A STRATEGY FOR EFFECTIVE TUBERCULOSIS CONTACT TRACING IN BOTSWANA

by

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DECLARATION

Student number: 448-919-11

I declare that **A STRATEGY FOR EFFECTIVE TUBERCULOSIS CONTACT TRACING IN BOTSWANA** is my own work and that all the sources that I have used or quoted have been indicated and acknowledged by means of complete references and that this work has not been submitted before for any other degree at any other institution.

July 20 2016

SIGNATURE **DATE**

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ABSTRACT

Botswana has witnessed highest TB rates in the southern African countries, ranking the fourth after South Africa, Swaziland and Zimbabwe. In 2012, the TB rate was on average 531/100 000 population. About 2 380 contacts out of a possible 8 110 (amounting to 29.30%) were traced nationally (Botswana 2011:8), indicating a possible gap of 5 730 which was yet to be traced in 2011. The TBCT strategies might be inadequate leading to absence of screening and treating TB contacts and reducing PTB related deaths. The purpose of this study was to describe utilisation of current TBCT and develop a strategy for a more effective TBCT in Botswana.

Data was collected through a quantitative cross-sectional research design. The study further described the association between TBCT strategies and practices and determined the gaps, challenges and needs in the TBCT. Results revealed under-tracing of contacts in the number of registered and enumerated TB contacts. The results further established the risk of mixing TB contacts and the general patients. The differences in the perceptions and knowledge of the cause of TB as well as poor utilisation of the current programmes by the PTB patients denotes the need for aggressive awareness raising and health promotion strategies.

The results were used to develop an alternative strategy, the IC-TBCT, which has a potential to trace all TB contacts. The strategy encourages participation, effective accountability and involvement of the beneficiaries in all efforts aiming at early contact identification and reducing the incidence of PTB.

KEY CONCEPTS

Integrated comprehensive tuberculosis contact tracing; pulmonary tuberculosis; tuberculosis contact; tuberculosis contact tracing.

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Dedication

To my mother, Pauline (R.I.P), father, Marcelly, my wife, Cate, my children, Joseph and Paulette for their inspiration and patience during my study.

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AIDS	Acquired immunodeficiency syndrome
ATB	Anti-tuberculosis
BIPAI	Baylor International Pediatric AIDS Initiative
BNTP	Botswana National Tuberculosis Programme
CAR	Central African Republic
CD	Cluster of differentiation
CDC	Centers for Disease Control and Prevention
CHW	Community health worker
CI	Confidence interval
DHMT	District Health Management Team
DOTS	Directly observed treatment short course
DRC	Democratic Republic of Congo
FGD	Focussed group discussion
FWEs	Family welfare educators
HBCs	High Burden Countries
HBM	Health Belief Model
HCW	Health care worker
HIV	Human immunodeficiency virus
HRDU	Health Research and Development Unit
IC-TBCT	Integrated comprehensive tuberculosis contact tracing
INH	Isoniazid
IRIS	Immune reconstitution inflammatory syndrome
KITSO	Knowledge, Innovation, Training Shall Overcome
LTBI	Latent tuberculosis infection
MDR	Multi-drug resistant
MOH	Ministry of Health
MS	Microsoft
MSF	Medesins sans Frontieres
MTB	Mycobacterium tuberculosis
N	Population
NNT	Number needed to trace
OPS	Objective Performance System
OR	Odds ratio
OSHA	Occupational safety and health administration
PHC	Primary health care
PPS	Probability proportional to size

PTB	Pulmonary tuberculosis
r	Pearson product moment correlation coefficient
R	Rifampicin
RNTCP	Revised National TB Control Programme
Sa	Sine anno
SD	Standard deviation
SDG	Sustainable development goal
SPSS	Statistical package for the social sciences
SSA	sub-Saharan Africa
T_1	First time
T_2	Second time
TB	Tuberculosis
TBCT	Tuberculosis contact tracing
TDR	Tuberculosis Digital Register
TST	Tuberculin skin test
UK	United Kingdom
UNISA	University of South Africa
USA	United States of America
USAID	United States Agency for International Development
WHO	World Health Organization
XDR	Extensively drug resistant
XXDR	Extremely drug-resistant

CHAPTER 1

ORIENTATION TO THE STUDY

1.1 INTRODUCTION AND BACKGROUND

Tuberculosis (TB) is the leading cause of mortality in the world, among the infectious diseases (World Health Organization [WHO] 2015:158–165). It is most prevalent in Africa (WHO 2015:131) with 1 387 929 cases, especially in sub-Saharan Africa (SSA) where the WHO (2015:158–165) ranks the TB as number one cause of morbidity and mortality in the region. According to the WHO (2015:5–7) the global mortality from TB in 2014 was 1 500 000 people where 1 100 000 people were human immunodeficiency virus (HIV) negative and 400 000 HIV positive). The mortality comprised 890 000 males, 480 000 females and 140 000 children. Mortality figures increased as the TB contacts fell ill thus increasing morbidity rates. As used in this study, 'contacts' refers to persons who have shared the same air space in a household, workplace or enclosed environments with a person diagnosed with infectious TB for a sufficient amount of time to allow possible infection with MTB (see section 1.11).

Morbidity is attributable to the incidence of TB that varies due to changes in the rate of TB infection, treatment defaulter rates, nutritional status, socio-economic and personal lifestyles, or the rate of HIV infection. For every TB patient, there is a risk of transmission of MTB to contacts. For instance, in 2012, 20.0% to 40.0% of contacts had latent TB infection (LTBI) due to lifestyle and one to two contacts had active TB in the United States of America (USA) and Canada (Langenskiold, Hermann, Luong, Rochat & Janssens 2008:81). According to the Centers for Disease Control and Prevention (CDC) (CDC 2012b:1311), two billion of the global population is infected and living with TB (Hirsch-Moverman, Shrestha-Kuwahara, Bethel, Blumberg, Venkatappa, Horsburgh & Colson 2015:31–38; WHO 2012f:11; Zumla, Raviglione, Hafner & Von Rein 2013:745). Of those, 10.0% will become ill with active TB (Botswana 2007:11; Hershkovitz, Donoghue, Minnikin, Besra, Lee, Gernaey, Galili, Eshed, Greenblatt, Lemma, Kahila Bar-Gal, Spigelman 2015: [2]) unless strategies such as effective TB contact tracing (TBCT) are used to accelerate reduction of these numbers and lowering mortality rates. The 'TBCT' in this context refers to tuberculosis contact tracing. That is the process of

finding and identifying a person who has been in close proximity with a PTB patient, screening him or her and treating if necessary. The WHO (2015:1–115) decries the fact that countries report only 25.60% of their TB cases mainly due to less effective TBCT strategies.

1.1.1 Status of tuberculosis globally

The estimated global number of deaths attributed to TB is more than 1 300 000 people per annum (WHO 2015:16–19). The TB causes morbidity among millions of people every year and ranks along the HIV as a leading cause of mortality globally, including 390 000 TB deaths among people who were HIV positive. The TB specific mortality was 1 200 000 in 2014. Although the TB incidence is falling in the European nations, the anticipated 50.0% reduction in prevalence and the 50.0% reduction in mortality rates by 2015 were not realised. For example China had a mortality rate of 2.9/100 000 population in the upper limit. In the Russian Federation, people with TB died at a rate of 11/100 000 that year (WHO 2015:26–28) despite the overall technological and economic advances in the two regions. This is unacceptably high. An effective TBCT, early diagnosis and correct prompt treatment will cure nearly all people with TB (WHO 2015:16–19).

1.1.1.1 Global prevalence of tuberculosis

The WHO (2010b:7) reports that there were 14 000 000 confirmed TB cases globally, a prevalence rate of 0.20%. The USA reported 11 545 TB cases at a rate of 3.8/100 000 population that year (CDC 2010:22; Winston, Navin, Becerra, Chen, Armstrong, Jeffries, Yelk Woodruff, Wing, Starks, Hales, Kammerer, Mac Kenzie, Mitruka, Miner, Price, Scavotto, Cronin, Griffin, LoBue & Castro 2011:846). In 2012, the USA recorded 9 951 new TB cases and an incidence of 3.2/100 000 populations (CDC 2012b:201). The burden of TB is highest in Asia and Africa (WHO 2012e:11). India with 2 500 000 (1 700 000–3 500 000, China with 1 200 000 (1 100 000–1 400 000),) and Indonesia with 8 707 cases accounted for 23.0%, 10.0% and 10.0% of global TB cases respectively (WHO 2015:129–132). The smear positive rate of TB in Cambodia in 2014 was 1 000 000 (8 700–1 200) of the persons aged over 15 years (WHO 2015:128). The syndemic infection with the HIV and its associated acquired immunodeficiency syndrome (AIDS) exacerbated the TB scourge. Of the 100 000 HIV positive new TB cases globally in

2010, 82.0% lived in Africa (WHO 2011:2). In 2014, 12.0% (1 200 000) of those who developed TB globally had HIV infection, 74.0% of that were in Africa region (WHO 2015:90). The HIV co-infection was the reason the TB morbidity worsened from 333/100 000 population in 1990 to 547/100 000 in 2008 and still a major co-morbidity today.

The WHO (2015:158–165) reports its regional TB status as follows: the Americas had 350 000 with a rate of 0.04% cases and a mortality of 6 000. For instance, the rate of death from the TB disease in the USA in 2010 was 0.2/100 000 (Wegner 2013:52). The Eastern Mediterranean region had 1 000 000 cases of pulmonary (P) TB with a rate of 0.16% and mortality of 3 000 cases. The European region had 440 000 with a rate of 0.05% and a mortality of 3 000 cases. The South East Asia had 5 400 000 with a rate of 0.29% and a mortality of 62 000 cases. For example, the annual mortality rate due to TB in India was 0.49%. The Western Pacific region had 2 100 000 with a rate of 0.12% and a mortality of 5 000 cases. Together, the South East Asia and the Western Pacific region accounts for 58.0% of the global TB cases in 2014 (WHO 2015:19).

The complications of TB such as multi-drug resistant (MDR) TB ensued (WHO 2010b:16). In 2008, there were 440 000 cases of MDR TB globally, of which 86.0% of these were in the 27 hardest hit countries; now 22 high burden countries (HBCs) according to WHO (2015:1–115), 15 of them in the European region. Georgia, in Europe, has a notification rate of 102/100 000 populations (WHO 2012d:1–74). The largest estimated numbers of MDR TB in absolute terms are in China, India, the Russian Federation and South Africa in that order (WHO 2010b:16). By 2010, 58 countries had reported at least one case of extensively drug resistant (XDR) TB. Such complications increased global mortality due to TB exponentially (WHO 2010b:16). The global death rate from TB reached 1 500 000 annually (Gouzy, Nigou, Gilleron, Neyrolles, Tailleux & Gordon 2012:270–280) and that of the high burden countries combined reached 1 200 000 per annum. The WHO (2015:47–49) notes with concern that only 123 000 of the 480 000 MDR TB cases were detected and documented with the highest burden in China (Zhao, Xu, Wang, Chin, Wang, Jiang, Xia, Zhou, Li, Qu, Pang, Song, Zhao, Zhang, He, Guo & Wang 2012:2161–2170), India and Russia. In 2012, 1 300 000 people globally died of TB. There were 940 000 deaths among people who were HIV negative and 320 000 among people who were HIV positive as the MDR TB situation worsened. Among those deaths, there were an estimated 170 000 from MDR TB (WHO 2012a:6). The WHO (2013a:6; WHO 2012e:1–74) reports that out of

450 000 people who developed MDR TB in 2012, 9.60% progressed to XDR TB. It reports further that out of 480 000 people who developed MDR TB In 2014, 190 000 MDR TB cases died, a case fatality rate of 40.0% (WHO 2015:1–115).

1.1.1.2 Global incidence of tuberculosis

In 2010 the number of new cases of TB globally was 9 400 000 (Gouzy et al 2012:270–280; WHO 2010a:7; WHO 2014:349) with an increase rate of 0.14% or 137/100 000 (Ahmad 2011:2). The annual number of new cases reached 9 800 000 in 2011 (Lawn & Zumla 2011:57–72; Schmidt, Korb, Howard, Dias, Blundell & Abell 2012:54–58). In 2012, the WHO (2012:6) reports, there were 8 600 000 new cases of TB globally. The incidence ebbed in 2015 to 9 600 000 (WHO 2015:1) but the current annual incidence is still unacceptably high. Of these new infections, 55.0% occurred in Asia, 35.0% in Africa, 7.0% in the Eastern Mediterranean Region, 4.0% in Europe and 3.0% in the Americas. India and China had 21.0% and 14.0% respectively.

Currently, as the WHO (2015:1–7) transits from millennium development goals (MDGs) to sustainable development goals (SDGs), it reports 9 600 000 new TB cases worldwide (5 400 000 males and 3 200 000 females). The WHO (2015:158–165) further reports the regional new cases of TB on average as follows: the Americas had 280 000 new cases of PTB including HIV with a rate of 0.03% or 28/100 000 population; the Eastern Mediterranean region had 740 000 new cases and a rate of 0.12% or 117/100 000 population. The European region had 340 000 new cases with a rate of 0.04% or 37/100 000 population. South East Asia had 4 000 000 cases with a rate of 0.20% or 211/100 000 population; the Western Pacific region had 1 600 000 with a rate of 0.10% or 85/100 000 population and a mortality of 5 000 cases per annum. The Africa region had 3 200 000 new cases with a rate of 0.33% or 330/100 000 population and a mortality of between 350 000 to 560 000 in 2014.

1.1.2 Status of tuberculosis in sub-Saharan Africa

1.1.2.1 Prevalence of tuberculosis in sub-Saharan Africa

This section presents the total number of persons infected with TB (prevalence) in various countries in sub-Saharan Africa. The WHO (2015:13) estimates that more than

33.0% of people in sub-Saharan Africa (SSA) have the TB infection. By 2012, 64.0% of the global TB prevalent cases were in the SSA (Binnu, Shapiro, Salimi, Ebrahim, Chaisson, Rakgokong, Golub, Moodley & Martinson 2012:1114). By 2014, the prevalent cases in the SSA were 28.0% of the global incidence (WHO 2015:19–46). The WHO (2015:89–93) estimates further that the TB and HIV co-infected three to five million people in the SSA. In the WHO member states, there are 3 200 000 cases with a rate of 330/100 000 (WHO 2015:158–165) and a mortality of 310 000 annual cases. The worst hit countries are in eastern, central and southern Africa.

Regionally, Ethiopia leads in eastern Africa with 190 000 cases. It also ranks seventh globally among 22 high prevalent countries (WHO 2015:131–142). A TB cross-sectional survey in Ethiopia reported a burden of 0.20% (WHO 2012b:82) in institutions and the public (Moges, Amare, Asfaw, Tesfaye, Tiruneh, Belyhun, Mulu & Kassu 2012: [5]). Kenya (120 000 cases or 266/100 000), Uganda (60 000 cases or 159/100 000) and United Republic of Tanzania (270 000 cases or 528/100 000) combined had 10.0% or 953/100 000 population. In central Africa, the Central African Republic (CAR) had 0.44% or 435/100 000 population, the Democratic Republic of Congo (DRC) had 0.53% or 532/100 000 and Congo, 0.46% or 46/100 000 population (WHO 2015:1). In western Africa, Burkina Faso had a prevalence of 0.08% or 81/100 000 population, Cote d'Ivoire, 0.22% or 215/100 000, Ghana, 0.28% or 282/100 000 and Nigeria had the highest of 0.33% or 330/100 000 population (WHO 2015:148).

In southern Africa, the prevalence of TB in 2014 was 0.48% or 480/100 000 for males and 0.15% or 146/100 000 for females. Malawi had a prevalence of 4.9/100 000 population (WHO 2015:11). Swaziland had 21.50%, the highest prevalence of the total TB burden in the region followed by South Africa and the Democratic Republic of Congo each with 690 000 (15.50%). The reports in the Medesins Sans Frontieres (MSF 2010) and in the WHO (2010) show the prevalence of TB among household contacts in Zimbabwe as 12.0% or 150 000 population. The prevalence of TB in South Africa was 6.08% or 6 075 /100 000 populations (Binnu et al 2012:1110–1116; Mulder, Klinkernberg, Manissero 2011:137).

The WHO (2010:20–22) reports that the TB mortality rate in the SSA was 90/100 000 population in 2008 and by 2014 it was 32/100 000 population (WHO 2015:160). The high TB mortality countries for 2014 include eastern, central and southern African

regions. In eastern Africa, Ethiopia had a TB mortality of 43 000 or 44/100 000 populations in the upper limit while Uganda had 6 400 or 16/100 000 populations in 2014 (WHO 2015:134–157). Burundi had a mortality of 23/100 000 population. Kenya had 12 000 or 28/100 000 population in the upper limit and United Republic of Tanzania had 54 000 (WHO 2015:25). According to the WHO (2015:1–115), the mortality rate in the WHO Africa region in 2014 was 450 000 with a rate of 0.05% or 46/100 000 population. In Central Africa region, the CAR had 48/100 000 population deaths, and Congo, 46/100 000 population. In Western Africa region, Nigeria was leading with a TB mortality rate of 280 000 in the upper limit in 2014. Burkina Faso had a mortality of 9.1/100 000 population, Cote d'Ivoire, 22/100 000, Ghana, 36/100 000 and Nigeria had 97/100 000 population. In southern Africa, Angola had a mortality of 52/100 000 population, the Democratic Republic of Congo (DRC) had 6 300 deaths or 8.4/100 000 (WHO 2015:141). Lesotho, 64/100 000, Madagascar, 51/100 000, Mozambique, 26 000 or 96/100 000 population, Namibia, 63/100 000, South Africa, 26 000, Swaziland, 51/100 000 deaths, Zambia, 32/100 000 and Zimbabwe had 15/100 000 population deaths.

1.1.2.2 Incidence of tuberculosis in sub-Saharan Africa

Incidence of TB refers to the number of new cases of the disease in a population at risk of it in any given time. In the SSA, the TB incidence increased from 0.16% to 0.36% or 162/100 000 to 363/100 000 population per annum between 1990 and 2007. By the end of 2008, the incidence of TB in the SSA was 0.71% or 710/100 000 population. Eastern Africa and southern Africa have the highest number of TB cases in the SSA. Ethiopia has an incidence of 0.34% or 341/100,000 and Kenya, Uganda and Tanzania combined had an incidence of 0.30% or 296/100 000 population (WHO 2010b:16) with Kenya mostly affected. According to the WHO (2015:131–144), the numbers ebbed and Ethiopia had 200 000 cases of TB with HIV, a rate of 0.21% or 207/100 000 (168–250) in 2014. Kenya had 120 000 cases, a rate of 0.27% or 266/100 000 (142–427); Tanzania had 170 000 cases, a rate of 0.33% or 327/100 000 (155–561) and Uganda had 60 000 cases, a rate of 0.16% or 161/100 000 (141–183).

The countries in southern Africa together have an annual TB incidence of over 2.30% or 2 300/100 000 (WHO 2011:15). The incidence of TB in South Africa was 590 0000 in 2010 with 3.0% of its incident TB accounting for MDR TB cases in 2013 (Schnippel,

Rosen, Shearer, Martinson, Long, Sanne & Variava. 2013:109–116). The WHO (2015:16) reports that by 2014, the incidence of TB in South Africa was 0.80% or 80/100 000 population. The Democratic Republic of Congo had 300 000 absolute number of cases in 2010 and remained unchanged by 2014. Lesotho had 0.64% or 640/100 000 in 2010 and in 0.85% or 850/100 000 population, one of the highest in the SSA and in the world. Swaziland had 0.72% or 720/100 000 population in 2014. Namibia had 0.56% or 555/100 000 population and Mozambique had 0.50% or 500/100 000 population (WHO 2015:16).

1.1.3 Status of tuberculosis in Botswana

1.1.3.1 Prevalence of tuberculosis in Botswana

In 2011, Botswana had 9 200 TB cases. There has been a gender difference in infection rate in the last decade. The gender rates of TB cases in Botswana were 560/100 000 population for males and 172/100 000 population for females in 2008. During 2012, the number of TB cases in Botswana was, on average, 531/100 000 population, one of the highest in the world and ranking fourth in the southern African countries after South Africa, Swaziland and Zimbabwe. The HIV prevalence was 17.60% according to Schwartz, Tamuhla, Steenhoff, Nkakana, Letlhogile, Chadborn, Kestler, Zetola, Ravimohan and Bisson (2013:1298–1303). Out of those, a large number (8 400) of persons were suffering from TB (WHO 2012a:1–97).The most affected age group is 25 to 34 year-olds, one of the most mobile and productive age groups (United States Agency for International Development [USAID] 2013; WHO 2010a:20–22). By 2014, the WHO (2015:1–115) reports, Botswana had 7 900 cases of TB and HIV at a rate of 354/100 000 population.

1.1.3.2 Incidence of tuberculosis in Botswana

The number of new cases is still high at between 0.30% and 0.50% in 2014 (WHO 2015:18). The TB case detection rate in Botswana under directly observed treatment (DOTS) in 2007 was 52.70%, slightly above 47.01% for Africa. The national status of new TB cases was 11.19% on average in 2009 (MSF 2010; USAID 2013; WHO 2010a:20–22). It had an annual incidence of 0.5% (WHO 2012f:11), and remained one of the highest incidences in the SSA. In 2010, 88.6% of 9 155 were new TB cases

(Botswana 2011a:8; WHOa 2010:78). The country recorded 5 865 new TB case notifications that year with a TB specific mortality rate of 0.02% or 24/100 000 population. In addition, there were 738 relapse cases. By 2012, the WHO (2013a:1–97) reports that the country had an incidence rate of 0.41% or 414/100 000 population. According to the WHO (2015:1–115), the country had a total PTB case notification of 3 137 (1 819 clinically confirmed and 2 218 bacteriologically confirmed), the total cases notified being 6 019 in 2014 with a relapse of 439 for bacteriologic and 413 clinical cases.

1.1.3.3 Status of tuberculosis and human immunodeficiency virus in Botswana

The co-morbidity with HIV threatened the efforts to control the TB as the syndemic worsened the morbidity and caused MDR TB in some of those who were infected. The high (>50.0%) prevalence of HIV in all new TB cases (WHO 2015:18) is a serious co-infection that can easily reverse the gains against TB if efforts to control the dual epidemic are not strengthened. In 2014, the MDR TB cases were 100 (61–140) with an average retreatment of 56 (20–90). Earlier, the MDR TB cases among new PTB cases were 120 (2.45%) of which 57 (6.56%) were retreatment cases (WHO 2012f:10–21) indicating a need for improved innovation in case finding measures such as a more effective TBCT (Shapiro, Variava, Rakgokong, Moodley, Luke, Salimi, Chaisson, Golub & Martinson 2012:1110). By 2014, the WHO (2015:1–115) reports, the country had 8 500 new cases with a static incidence of 0.39% or 385/100 000 including TB and HIV despite the efforts to reduce it.

1.1.3.4 Status of tuberculosis related deaths in Botswana

Despite the country emerging out of the list of 22 high burden countries (HBCs), the countries with the highest number of TB cases globally, TB is still a killer disease in Botswana (Habib 2016:147–155). Currently, the TB mortality rate is 1 000/100 000 population (2015:1–115). The HIV related mortality is 40.0% (Schwartz et al 2013:1298–1303). That calls for the health authorities strengthen efforts to maintain reduction of morbidity and mortality. The TB disease is responsible for 13.0% of all adult deaths and 40.0% of deaths among people with HIV/AIDS (Dagnra, Adjoh, Tchaptchet, Patassi, Sadzo, Awokou & Tidjani 2011:342–346).

1.1.4 Transmission of the mycobacterium tuberculosis

TB disease is primarily a droplet infection transmitted from an infected person to a susceptible host (Amhad & Triccas 2011:1–17; Axelsson-Robertson, Magalhaes, Parida, Zumla & Maeurer 2012:301–315). The mycobacterium tuberculosis (MTB) is in suspense in tiny airborne particles called droplet nuclei measuring 1–5 microns in diameter. The MTB droplet nuclei are generated when a person with pulmonary or laryngeal TB disease sneezes, coughs, sings or spits out sputum (Axelsson-Robertson et al 2012:301–315; CDC 2013:21–26; Jones-Lopez, Namugga, Mumbowa, Ssebidandi, Mbabazi, Moine, Mboowa, Fox, Reilly, Ayakaka, Kim, Okwera, Joloba & Fennelly 2013:1007–1015). Transmission occurs when a susceptible person inhales the droplet nuclei containing MTB, and the nuclei traverses the mouth or nasal cavities, upper respiratory tract through to the bronchi and to alveoli of the lungs (Axelsson-Robertson et al 2012:301–315; CDC 2013:21–26). However, 70% of persons exposed to MTB infected airborne particles may not suffer, depending on the intensity and duration of MTB exposure (Amhad & Triccas 2011:1–17). Only 10% of those originally exposed develop primary TB.

The factors that increase the transmissibility of MTB nuclei are mainly environmental. They include exposure in small and enclosed households and workplaces with concentration of infectious droplet nuclei. In the households and workplaces, the physical proximity, duration and frequency of exposure to an infectious person (Axelsson-Robertson et al 2012:301–315; CDC 2013:21–26) enhances transmission. In workplaces, the inadequate local or general ventilation often result in insufficient dilution or removal of droplet nuclei and recirculation of air containing MTB droplet nuclei. In health facilities, for instance, the improper handling of specimen procedures and positive air pressure in a TB patient's room often cause the MTB droplet nuclei to flow to other areas.

1.1.5 Risk factors for tuberculosis and contact tracing

Risk factors for transmission of TB include crowded residential and social areas. Often, in such areas people share space in close proximity (Amhad & Triccas 2011:2) and the shared living quarters muddle the TBCT. Tobacco smoking and shared abuse of alcohol consumption (Chi-Pang, Ta-Chien, Hu-Ting, Min-Kwang & Ting-Yuang 2010; WHO

2011:20) have been documented as risk factors. That is mainly due to close human social interaction associated with weakening of personal behaviour control. Contact tracing is not possible in such areas. Poor socio-economic status such as seen among miners (Stuckler, Basu, McKee & Lurie 2011:524–530) and homelessness are compounding risk factors due to associated poor nutrition, overcrowding and close contact with people with active TB. It also makes contact tracing difficult for lack of fixed abode. The anti-TB (ATB) treatment interruptions by defaulters and the risk of re-infection related to fatigue with prolonged treatment times are risk factors. Treatment defaulters often default in the TBCT as well. Other risks are distance from health facility and associated stigma (Abebe, Deribew, Apers, Woldemichael, Shiffa, Abdissa, Deribie, Jira, Bezabih, Aseffa, Duchateau and Colebunders 2010: [4]); Courtwright & Turner 2010:36; Kizito, Dunkley, Kingori & Reid 2011:52–57). Distance poses challenges in TBCT and household or workplace environmental assessments especially where means of transport is an added challenge. Aging diminishes the efficacy of the immune system (Donoghue 2011:826), making the elderly more susceptible to TB infection. In addition, since adults are more likely to have contracted TB during their lifetime, they are more likely to have dormant MTB. An advanced age also introduces less agility and interest in active TBCT.

Persons who work or live in enclosed premises such as nursing homes, military camps and prisons are at risk of exposure because of the prolonged proximity with TB patients (Claassens, Sismanidis, Lawrence, Godfrey-Faussett, Ayles, Enarson & Beyers 2010:1576–1581).

The MDR TB risk factors include previous ATB therapy, poor follow-up of TB patients and their contacts (Kizito et al 2011:52–57). It includes non-adherence to treatment for reasons such as fear of medication side-effects (Nader, de Mattos, Picon, Bassanesi, De Mattos & Pineiro 2010:70–74), alcohol and drug abuse (Mathew 2009:516–517) are common risk factors that lead to the development of MDR TB. In occupational risks, nurses and doctors have suffered and died from MDR TB and XDR TB, for example in South Africa, having been infected by the patients for whom they cared (Baussano, Nunn, Williams, Pivetta, Bugiani & Scano 2011:488–494; Claassens et al 2010:1576–1581; Kranzer, Bekker, Van Schaik, Thebus, Dawson, Caldwell, Hausler, Grant & Wood 2010:224–226). Out of these risks, previous TB therapy is the main risk factor for

progression to more complicated MDR TB and XDR TB, an indication to strengthen contact tracing as a useful strategy for early screening and treatment.

Rarely do people who inhale the mycobacterium tuberculosis (MTB) actually develop TB disease (Amhad & Triccas 2011:1–17; WHO 2013b:104). When MTB bacteria enter into the alveoli of the lungs, they multiply and spread in the pulmonary macrophages as PTB infection. Depending on the body's immune system, the MTB may cause tissue destruction. The tissue destruction causes the characteristic x-ray picture of minute mesh 'holes' in the lobes, especially at the apex of the lungs, associated with the accumulation of CD_{27} (low) IFN-γ (+) cell levels in the lungs (Nikitina, Kondratuk, Koskmiadi, Amansahedov, Vasilyeva, Ganusov & Lyadova 2012:[2]) which provide a means to TB activity, tissue destruction and lung repair. TB infection may affect the nervous system, lymph nodes and other body organs (Mazza-Stalder, Nicod & Janssens 2012:566–578), and be identified or known as extra-pulmonary (EP) TB. When MTB is in the lungs, it multiplies and causes tissue destruction. This process triggers the immune system to fight back the bacteria and the macrophages surround the tubercle in a process called *ghon's* complex or primary complex (Bynum 2012:163; Mason, Roy, Spillane & Singh 2016:206–232; Mazza-Stalder et al 2012:566–578; Ronald & Nancy 2012:48–50). A ghon focus is an area of consolidation that most commonly occurs in the mid and lower lung zones. A ghon (primary) complex is the addition of hilar adenopathy to a ghon focus (Curvo-Semedo, Teixeira & Caseiro-Alves 2005:158–172). Most primary complexes heal spontaneously with time only when the immune system is not weak. Some of the bacteria may remain alive in the lungs (latent TB) for a long time, not causing TB while the immune system remains strong enough to prevent the development of TB. If immunity declines, for example during HIV infection, the latent mycobacteria may be activated to cause TB disease (Amhad & Triccas 2011:2). This accounts for the high incidence of TB in countries with a high prevalence of HIV such as Botswana according to the Botswana National Tuberculosis Programme Manual (Botswana 2007:12) and the WHO (2011:2). An HIV positive person has a 10 times greater annual risk of suffering from TB than an HIV negative person (Botswana 2008:6; Gao, Zhou, Li & Jin 2010).

1.2 STATEMENT OF THE PROBLEM

The problem under investigation is mainly TBCT strategies that do not trace, screen, treat all the TB contacts and significantly reduce incidence of tuberculosis (WHO 2015:19). Despite reduction of TB incidence at a rate of 1.50% per year since 2000 and that the mortality rate in 2015 was 47.0% lower than in 1990, Africa region, especially the SSA, did not meet the target of the 50.0% reduction compared to the baseline of 1990 which was over 0.35% annually and prevalence of 0.40% (WHO 2015:34–37). The decline is too slow to realise the goal of 1/1000 000 TB cases by 2050 (WHO 2015:6) as high incidences of TB incidence rates are still witnessed in the SSA.

Tuberculosis continues to be one of the major killers in Botswana, indicating slow progress in curbing the TB infection rates. More males than females suffer from TB with a ratio of 3:1. The most affected age groups are 25–29; 30–34; 35–39; 40–44 and 45–49 years with a peak in the 25–29 and 30–34 year age groups.

In 2011, 2 380 contacts out of a possible 8 110 (amounting to 29.30%) were traced nationally (Botswana 2011a:8), thus a possible gap of 5 730 which was yet to be traced. The added problem of the HIV epidemic and the TB co-infection threatens to reverse the enviable political and socio-economic gains that Botswana had made since independence. Due to the problem of HIV epidemic, the country had a low healthy life expectancy of 36 and 35 years for males and females respectively. There was a TB relapse rate of 85.24% or 738/100 000 (WHO 2011:1; WHO 2012f:11) attributable to HIV infection and various factors such as relocations and less effective tracing. The HIV related TB mortality makes it a reason for the need for a more effective TBCT. The risk for re-infection becomes high if the TB patient does not adhere to treatment due to ineffective follow-up efforts by the HCWs (Gust, Mosimaneotsile, Mathebula, Chingapane, Gaul, Sherri & Samandari 2011:5). Moreover, such a patient could spread MDR TB or even XDR TB, with potentially fatal outcomes for his or her household members, working colleagues, health care personnel and community (Gandhi et al 2010:1830–1843). The strategies used by the HCWs do not exhaustively trace such persons (Botswana 2011a:13). Despite the training of the HCWs in TBCT, there is disparity in knowledge of the process. Moreover, not all HCWs follow the stipulated TBCT policy. The community TBCT awareness must improve the education of the TB patients and their contacts about the importance of TBCT for the individual, the

community and the nation. As such, the community members have little knowledge about the TBCT. Besides, the community TBCT structures that link the community and the health facilities are either weak or non-existent. It is, therefore, evident that the need is rife to strengthen the TBCT (WHO 2012c:1–70) and reduce re-infections through prompt diagnosis and treatment.

While the HCWs at the TB clinics should combine active and passive case finding strategies in the tracing of the TB contacts, little is done about active household and workplace follow-up (Botswana 2011a:12–13). Workplace TB contacts are as much at risk as are household TB contacts yet both have not benefited much from TB care services) partly due to ineffective monitoring and evaluation.

One of the compounding factors is the minimal active involvement of the TB patients and their contacts as beneficiaries in the TBCT process in planning, implementation and follow-up, evaluation and even in operational research (WHO 2015:105). The programmatic planning for tracing the TB patients' contacts is one such strategy that largely ignores inputs of patients yet its implementation depends on the co-operation of the patients and their contacts (Duarte, Neto, Carvalho & Barros 2012:56). For instance, once a health care worker (HCW) in the TB clinic issues a contact tracing form to a TB patient, he or she does little to tracing until the patient or TB contact subsequently returns to the TB clinic (Shapiro et al 2012:1110). This may aggravate the problem of loss of the TB contacts (Kizito et al 2011:52–57) that may continue to infect other persons.

The country's ATB treatment success rate is 65.0%, which is a little below the national target of 71.0%. Notwithstanding availability of ATB treatment, the disease still kills many people in Botswana. Attributable to this claim is the rate of transmission of the MTB amid poor implementation of the TB programmes such as the TBCT.

The TB programmes recognise the important role TBCT contributes to early case identification and prompt treatment, the reduction of transmissibility of MTB and mortality rates. Most, if not all, of the TB programmes, for instance the End TB Strategy and Sustainable Development Goals, rely on effective TBCT for their successful implementation. However, the existing TBCT strategies that most of the implementers currently use do not facilitate production of effective TB programmes hence in the

opinion of the researcher does address all the essential elements of effective TBCT and will not contribute to a decline in the levels of tuberculosis infection in Botswana. The current strategies are silent on the transmissibility of the MTB, which the TBCT implementers need to understand as this is essential for discerning potential areas of disrupting transmission. The problem is that the current TBCT strategies are not effective in ensuring that all the TB contacts are traced, tested and, if need be, treated. An effective strategy and developed programmes should facilitate understanding of the risk factors to contracting TB in order reduce the vulnerability to exposure and being infected as a result of ineffective contact tracing.

The central research problem that guides this study is, therefore, finding a strategy for effective TBCT in Botswana. Such strategy needs the support of development of new innovative tools and enabling timely and effective utilisation (WHO 2015:17). Moreover, the strategy must embrace involvement of the TBCT planners, implementers and the beneficiaries (WHO 2015:17).

1.3 CONTEXT OF THE RESEARCH PROBLEM

This section focuses on historical background of TBCT. It also sheds light on contemporary developments of the TBCT in Botswana. It will conclude with the research assumptions.

1.3.1 Historical background of tuberculosis contact tracing globally

One of the early methods of contact tracing was actively searching and putting the TB patients in *sanatoria*. The sanatoria were isolation facilities where the TB patients rest, get better nutrition and recover (Bryder, Condrau & Worboys 2010:3–23; Bynum 2012:127; Cengiz Çavuşoğlu 2014:171; Condrau & Worboys 2010:14). That provided prevention of TB transmission. A form of contact tracing was used to identify homes with sick patients who were separated from their families to prevent the spread of TB (Condrau & Worboys 2010:14; Dodor, Kelly & Neal 2012:211–218). Karel Styblo (Wegner 2013:57), considered the father of TB epidemiology, asserted that TB can be prevented and controlled under any socio-economic conditions because the infectious agent is usually simple and inexpensive to treat.

Later in the 1950s, Hochbaum, Rosenstock and Kegels developed a form of a TBCT and screening model (Janz & Becker 1984:2; Rosenstock 1966:94–127). They developed the model in response to a study pertaining to a failed self-report (Burke 2013a:2) TB screening program. Rosenstock, Stretcher and Becker (1988:175–183) developed further the HBM in the 1970s and 1980s. What was not known was the fact that the model was to later become one of the most utilised theories in health strategies, especially in TBCT and screening. As development of health care evolved globally, so did the use of the HBM in contact tracing. However, not much of contact tracing took place in the SSA. The historical development of health care in Botswana is similar to what was happening in the SSA where little contact tracing existed.

In the early times, the TB patients in Botswana suffered in isolation due to the stigma associated with TB. People associated the disease with witchcraft, curse, sin and divine punishment (Moagi, Personal communication, 7th February, 2016). As such many TB patients were either scorned at, were left to fend for themselves, or were treated in isolation by traditional doctors. The traditional doctors had isolated makeshift structures where TB patients stayed until they recovered or died. For example, a dwelling house was used as a clinic in Selebi Phikwe, south east of the city of Francistown before 1970 when the government started a hospital there (Botswana 2011b:[1]).

The advent of modern hospitalisation systems brought about by the missionaries resulted in better understanding of TB. The early mission hospitals included Debora Retief Memorial hospital in Mochudi which was started by the Dutch Reformed Church in 1932 (Botswana 2011b: [1]). It was dedicated to Miss Debora Retief who dedicated her life to the Bakgatla Ba Ga Kgafela. Bamalete Lutheran Hospital was started in Ramotswa and the Scottish Livingston Hospital in Molepolole was started in 1933-1934 with 20 beds by Dr Shepherd as its first doctor. Kanye Seventh Day Adventist in Kanye was started by the missionaries in the colonial era. The government started Athlone Hospital as its first hospital in 1929 (Botswana 2011b: [1]).

The health care takers in those mission hospitals began to use isolation rooms for infectious diseases. Among the diseases that needed isolation were TB and leprosy. The contact tracing hardly existed then. Hence, the TB patients presented themselves when the disease was advanced and were placed in rudimentary isolation structures. The care takers had basic training and practised a passive form of TBCT in which

health education was used in the clinic and church. The main purpose was to encourage persons with cough to visit the hospital for health assessment and treatment. Free medication was used to encourage TB sufferers into the hospitals. With time schools developed and better training of nursing auxiliaries improved the understanding of TB and the need for TBCT. They would do home visits, not only to identify those who had cough but also to spread the gospel. As the TB killed more and more people in the 1980's and 1990's, the nurse training became more and more a felt need and the usefulness of TBCT became real. In the meantime the TB reached epidemic proportions after the 1990's.

1.3.2 Contemporary developments on tuberculosis contact tracing in Botswana

Bearing in mind the problem under investigation, this section is about the developments on the TBCT in Botswana. The existing TBCT in Botswana developed as a result of the increasing pressure of the prevalence and mortality due to TB disease in addition to that of the need and calls to save the population. The country had a TB prevalence rate of over 0.50% (WHO 2010a:78) in 2010. Over 9 155 were TB sufferers (Botswana 2011a:8) of which 88.60% were new cases. More males than females suffered from TB at a ratio of 3:1. The most affected age groups are 25–29; 30–34; 35–39; 40–44 and 45–49 years with a peak in the 25–29 and 30–34 year age groups. It is clear that the Botswana government, through the MOH is committed to the WHO (2015) calls for more effective strategies for reducing those rates. One of the strategies is early identification and treatment of the TB contacts through the TBCT programme. In 2011, 2 380 contacts out of a possible 8 110 (amounting to 29.31%) were traced nationally (Botswana 2011a:8), thus a possible gap of 5 730 which was yet to be traced. This is mainly attributable to the slow pace of TBCT. The process does not follow immediately after a positive identification of a TB patient (Kabongo & Mash 2010:1–6; Kovarik 2010; Mutsvangwa, Millington, Chaka & Mavhudzi 2010).

The added problem of the HIV epidemic and the TB co-infection threatens to reverse the enviable political and socio-economic gains that Botswana had made since independence. With that, there was a TB relapse rate of 85.24% or 738/100 000 population (WHO 2011:1; WHO 2012d:1–74) attributable to HIV infection and various factors such as relocations amid passive and less effective TBCT strategies. Due to

this, the country had a healthy life expectancy of 36 and 35 years for males and females respectively.

Driven by the high rate of TB infection and the call by WHO (Inform'Action 2011) to utilise contact tracing, Botswana government put in place guidelines and mechanisms for the TBCT and subsequent screening (Inform'Action 2011; Omotowo, Ekwueme & Aghaji 2012:451–456). The guidelines contained relevant information for rationale for contact tracing, when to incorporate contact tracing, identification, assessment and management of contacts. Community TB volunteers and family welfare educators (FWEs) were recruited and trained (Ospina, Orcau, Millet, Sanchez, Casals & Cayla 2012:158). This strategy conforms to the WHO primary health care (PHC) elements. From the base of the clinics in Botswana, the HCWs, mainly nurses, co-ordinate the supervision of the FWEs who carry out follow-up in community.

In Botswana today, the TBCT is the procedure whereby the HCWs examine individuals who had been in contact with mostly a smear positive PTB patient to detect LTBI or TB disease as secondary cases (Zellweger 2010:1–25). The HCWs contact trace and screen individuals who are at risk of TB. Those at risk are mainly close relatives, workplace contacts and those who share the same environment during prolonged (up to 8 hours) periods of time. Because the TBCT in the country is still developing, the HCWs in Botswana currently utilise any of the TBCT strategies depending on who is exercising a given specific action.

While the HCWs at the TB clinic combine active and passive case finding strategies in the tracing of the TB contacts, little is done about household and workplace follow-up (Botswana 2011:12–13). Merely treating a PTB patient, without testing (and treating if necessary) all his or her household and work contacts, does not address the TB problem in Botswana and reflects poor implementation of the TBCT and overall TB services (Botswana 2011:18).

The regulations of Botswana Ministry of Health state that contact screening must be started and completed within a week of diagnosis of the index case (Botswana 2011:12; Botswana 2009:7), meaning that the TBCT should have preceded this action (Zellweger 2010:1–25). The HCWs commonly use facility-based TBCT by interviewing the PTB suspects who present themselves at the clinic, with signs and symptoms of PTB or for any other health care needs (Binnu et al 2012:1114; Botswana 2011:12). In this case, a

PTB suspect who does not present himself or herself in the clinic becomes not only a missed opportunity but continues to transmit the tubercles to TB contacts and worsening their health condition. In this case, Cook, Shah, Gardy and Bourgeois (2012:302) point out that TBCT programme coordination challenges are common and need addressing. The WHO (2008:1–10) advocates for active involvement of implementers and the beneficiaries in contact tracing.

1.4 RESEARCH QUESTIONS

The research questions for the study are:

1. Are organisational factors related to the utilisation/implementation of TBCT programme?
2. What is the basic TBCT knowledge of the HCWs about implementation of the TBCT programme?
3. How do the actions of the HCWs regarding implementation of contact tracing relate to PTB patient reception, initiation of the TBCT, TB record keeping, TBCT planned events and mobile phone user perceptions?
4. What perceptions do the TB patients have about the utilisation of the TBCT programme?
5. Are the socio-economic factors of TB patients related to utilisation of TBCT?

1.5 RESEARCH ASSUMPTIONS

The assumptions of the study are:

1. The TB clinic organisational factors including utility space, TBCT policy, TB-trained nurse staffing pattern and community TBCT structures enhance utilisation of the TBCT.
2. The HCWs' basic knowledge of the TBCT and their case identification rates improve the utilisation of the TBCT.
3. The HCWs' actions regarding the PTB patient reception, initiation of TBCT, TB record keeping, TBCT planned events and mobile phone user perceptions improve the utilisation of the TBCT.

4. The perceptions including knowledge of TB and TBCT, stigma, fear of TB medication procedures and health seeking behaviour of the PTB patients are barriers of the TBCT.
5. Socio-economic factors such as household income, physical housing and workplace environments of TB patients affect utilisation of TBCT.

1.6 RESEARCH PURPOSE

The main purpose was to describe utilisation of current TBCT and develop a strategy for a more effective TBCT in Botswana. The study aimed to do this by describing the utilisation of the current TBCT and determine the gaps, challenges and needs. The developed strategy aimed to enhance prompt identification, diagnosis and early treatment in such a way that would further reduce TB infection and mortality rates.

1.7 OBJECTIVES

The research objectives for the study are to:

1. Identify and describe the TB clinic organisational factors affecting the utilisation/implementation of the TBCT strategy.
2. Determine the basic TBCT knowledge of the HCWs about implementation of the TBCT programmes
3. Determine the HCWs' actions in relation to implementation of the current TBCT programme with specific reference to PTB patient reception, initiation of the TBCT programme, TB record keeping, TBCT planned events and mobile phone user perception in the TBCT programme
4. Identify the perceptions of the TB patients about the TBCT programme.
5. Study and critically analyse different strategies describing TBCT and strategies for reducing TB infection rates.
6. Construct an alternative strategy that links TB clinic organisational factors, TBCT knowledge and actions of the HCWs and participation of the TB patients in the development of the TBCT strategy. Such a strategy must be context based and needs based.

1.8 SIGNIFICANCE OF THE STUDY

The results from the study provided information for recommendations for improving the TBCT in the study sites and potentially in Botswana (Gerbeding et al 2012:4; Kabongo & Mash 2010:1–6). The study results provided potential for minimising the TB transmission by documenting perceptions and critical risk factors, types and actions used during TBCT follow-up and rates of case identification (Mulder et al 2011:137). The results also recommended the formulation of more effective actions in the early identification of the PTB patients. The subsequent early screening (and possibly treatment of cases) was emphasised as one of the cost-effective preventive strategies suitable for public health. Early identification and treatment of TB contacts would save the country's economic resources that it would otherwise spend on hospitalisations and expensive treatments for MDR TB and XXDR TB treatments (Kranzer, Afnan-Holmes, Tomlin, Golub, Shapiro, Schaap, Corbett, Lonnroth & Glynn 2013:441). The TB disease morbidity would be reduced and there would be fewer people on sick leave or not able to work in socioeconomic sectors, hence ensuring a healthier and more productive workforce. The mortality rates of TB, and of MDR TB and XXDR TB, would consequently decrease.

The health policy makers in Botswana might find the results and recommendations of this study useful in modification of the existing TB health policies or in the formulation of new ones. The study results pointed to other innovations for future operational research on the TBCT.

1.9 RATIONALE OF THE STUDY

The morbidity and mortality rates arising from the TB epidemic are still a major public health threat in Botswana. There is still an unacceptable gap of TB contacts (Botswana 2011a:8) that needs TBCT. However, the slow pace of the TBCT does not effectively reduce the TB. Further, when the TBCT commences, it does not always consider the suspected TB contact as the new case (where screening is positive) whose contacts the HCWs must also trace anew. As the slow pace continues, the TB morbidity and mortality takes its toll on the population. The need for the study came about because the researcher, during his public health teaching practice, was vexed by the less effective TB contact tracing strategies despite high TB incidence in the community. The

researcher wanted to understand the factors that made it difficult for the PTB patients to utilise TBCT services. One would interrogate themselves on why there was no TBCT strategy that could bring all TB contacts for screening. The TB programme policy enforcers, too, wanted to understand what could improve the TBCT. What factors explained the status quo of contact tracing? It is a general knowledge that many HCWs and the TB patients did not accord TBCT the seriousness it deserved (Botswana 2011a:12). Hence, the researcher sought to understand the factors that determined the utilisation of TBCT. A more effective strategy in TBCT is, thus, a felt and actual need. The understanding is that the implementing HCWs will internalise and adhere to the commitment of the government to reduce the TB transmission.

The researcher believes that the HCWs can empathise with the PTB patients and feel that they can actively intervene to prevent TB transmission among the TB contacts. They will also have a positive expectation of using a more effective TBCT in order to reduce morbidity and mortality of the TB. The HCWs must cultivate confidence in a successful implementation of a more effective TBCT.

On the other hand, the TB patients and the TB contacts must be health educated to feel that they can avoid the transmission of the TB. A more effective TBCT programme should enable them to have a positive expectation that they can avert the TB transmission in households and in workplaces. Furthermore, the TBCT programme should motivate them to see the benefits of a successful participation in the TBCT programme.

In summary, the rationale for the study lies in three problems. There are still unacceptable morbidity and mortality rates of the TB in the country despite the government's commitment to support the efforts to reduce them. The HCWs can change their TBCT strategies using actions that are more effective. The immediate beneficiaries including the PTB patients and the TB contacts can change behaviour and reduce transmission of the TB.

1.10 THE RESEARCH APPROACH

The study used quantitative research approach (Creswell 2014:200–229). It used descriptive methods with semi-structured instruments. Further, it used interview

techniques to gather information, perceptions about the TBCT and actions of the PTB patients and the TB contacts. The study also gathered information about the TBCT from the HCWs. The research was conducted in three phases.

1.10.1 Phase I: Observation of the clinic and enrolment of study participants

This phase involved administration of the document checklist for the observation of the TB clinic. The observation included design, spatial needs such as interviewing room for the PTB patients, the availability of the TBCT policies, plans and schedules. The checklist used the TB registers to identify the target PTB patients for tracing, their demographics, clinical diagnoses, residential locations and relevant social habits. The study extracted the gender, age and relationships of the household and workplace TB contacts that the HCWs documented in the TB registers. The study also enrolled the participants including the PTB patients, the TB contacts and the HCWs.

1.10.2 Phase II: Interview of the pulmonary tuberculosis patients

This second phase employed quantitative methods that encompassed follow-up interviews of the PTB patients. It also interviewed age-eligible TB contacts. Interviews were carried out at the place and time convenience of the participants in the clinic, households or workplace. Interviewers used research instruments developed in line with the HBM concepts (Champion 1984:73–85). The study compared the information generated about the TB contacts with the information the HCWs provided in the TB registers.

1.10.3 Phase III: Interview of the health care workers

This phase involved interviewing of the HCWs in the TB clinics. Interviewer used the HBM based quantitative methods (Champion 1984:73–85). The interviews generated data about the TB contacts and were compared with those that the PTB patients provided in Phase II. Any gap in the information showed missed opportunities of the TBCT.

1.11 DEFINITION OF KEY TERMS

The objective of this section is to present the definition of key terms as used in the text. They encompass conceptual and operational definitions.

1.11.1 Conceptual definitions

1.11.1.1 Community tuberculosis volunteer

A volunteer is a person who works for a community primarily because he or she chooses to do so freely. A volunteer is “one who renders a service or takes part in a transaction while having no legal concern or interest or to choose to act in recognition of a need, with an attitude of social responsibility and without concern for monetary profit, going beyond one's basic obligations” (Merriam-Webster’s Dictionary 2003). The person is a community member or family member of a PTB patient (Kuteesa 2009:525–527) who accepts to freely offer support during treatment; one who is responsible for observing home-based care and directly observed treatment (DOT) for TB patient (Kabongo & Mash 2010:1–6).

1.11.1.2 Exposure period

Exposure is defined as vulnerability, subjection, susceptibility, laying open to the action or influence of something (Merriam-Webster’s Dictionary 2003:1595–1605). It is also defined as contact, experience, introduction, acquaintance or revelation (*Roget’s International Thesaurus* 2011). With reference to the threat of the TB, exposure period is when the following two events overlap: the time the contact shares the same air space with the TB source patient and the infectious period of the source patient (CDC 2010:4; Mulder et al 2011:137). This information is critical for the TBCT programme as it offers potential for developing a preventive strategy.

1.11.1.3 Multidrug-resistant tuberculosis

The MDR TB is the TB disease caused by MTB organisms that are resistant to at least isoniazid (INH) and rifampicin (Gandhi et al 2010:1830–1843; Migliori, Sotgiu, Gandhi,

Falzon, DeRiemer, Centis, Hollm-Delgado, Palmero, Pérez-Guzmán, Vargas, Ambrosio, Spanevello, Bauer, Chan, Schaaf, Keshavjee, Holtz & Menzie 2013:169–179)

1.11.1.4 Mycobacterium tuberculosis

This is a rod-shaped pathogenic bacterial species in the family of mycobacteriaceae and the causative agent of most cases of TB. It has an unusual, waxy coating on its cell surface (mycolic acid), which makes the cells impervious to gram staining. Instead, the acid-fast detection techniques are more useful. Its physiology is highly aerobic and requires high levels of oxygen. It is primarily a pathogen of mammalian respiratory system and is the common tubercle bacterium that causes the LTBI and TB disease. (Botswana 2007:10; CDC 2010:1). The understanding of the aerobic nature of the mycobacterium offers a potential for designing specific strategies for prevention of transmission in households and workplaces.

1.11.1.5 Pulmonary tuberculosis case index

A PTB case index is a TB source patient with clinical symptoms of TB and who is the original source of infection for secondary cases or contacts (Kabongo & Mash 2010:1–6; Kovarik 2010; Mulder et al 2011:137). It is the initially identified case of new or recurrent TB in a person of any age in a specific household, workplace or other comparable setting in which others may have been exposed (WHO 2012c:28).

An index case is the case around which is the centre of a contact investigation. Because the investigation generally focuses on a defined group of potentially exposed people in which one may find other (secondary) cases, the index case is generally the case identified initially, although he or she may not be the source case. Contact investigation may centre on secondary cases if the exposed group differs from that exposed to the original index case.

1.11.1.6 Tuberculosis

A medical definition of tuberculosis is a usually chronic and highly variable disease that a bacterium of the genus mycobacterium (MTB) causes (Merriam-Webster's Dictionary 2003). This includes the related mycobacterium bovis (M. bovis), usually communicated

by inhalation of the airborne causative agent, and affects especially the lungs but may spread to areas (as the kidney or spinal column) from local lesions or by way of the lymph or blood vessels. The signs and symptoms include fever, cough, difficulty in breathing, inflammatory infiltrations, formation of tubercles, caseation, pleural effusions and fibrosis.

1.11.1.7 Tuberculosis contact

A TB contact is a person who has shared the same air space in a household, workplace or enclosed environments with a person diagnosed with infectious TB for a sufficient amount of time (about eight hours daily) to allow possible infection with MTB (Kabongo & Mash 2010:1–6; Kovarik 2010; Mulder et al 2011:137).

A household TB contact is a person who shared the same enclosed living space for one or more nights or for frequent or extended periods during the day with the index case during the 3 months before commencement of the current treatment episode (WHO 2012d:28). For this study, a workplace TB contact is a person who shared the same enclosed working space, for four hours or for frequent or extended periods during the working day, with the index case during the three months before commencement of the current treatment episode (WHO 2012c:28).

1.11.1.8 Tuberculosis transmission

The TB transmission refers to the spread of MTB from one person to another. The likelihood of transmission of an infectious agent directly relates to the duration and intensity of exposure (Mulder et al 2011:137).

1.11.2 Operational definitions

1.11.2.1 Health care worker

The term ‘health care worker’ in this context refers to the personnel who work in the TB clinic. They include the nurses who interview the TB suspects and initiate the contact tracing process. It also includes the family welfare educators who identify the TB contacts in the community and link them up with the TB clinic.

1.11.2.2 Tuberculosis contact tracing and screening

1.11.2.2.1 Tracing

Tracing refers to the act of tracking, finding, locating, following, trailing or hunting down (*Roget's International Thesaurus* 2011). It means seeking out, capturing or getting hold of someone.

In the case of TBCT in this study, tracing refers to following up the PTB patients with the expectation of identifying and screening contacts at risk of contracting TB (Contact tracing 2012:2; Kabongo & Mash 2010:1–6; Kovarik 2010; Mutsvangwa, Millington, Chaka & Mavhudzi 2010). This process follows immediately after identification of a TB case index (source patient) usually through smear positive results (Kabongo & Mash 2010:1–6; Kovarik 2010; Mutsvangwa, Millington, Chaka & Mavhudzi 2010). Contact tracing serves several functions (Mulder et al 2011:137):

- It identifies persons with TB disease or LTBI among the contacts of a PTB patient and provides potential for prompt and adequate follow-up and treatment (Zellweger 2010:1–25).
- It also traces and identifies the contacts of contacts. That is acknowledging that the new PTB patients also have contacts that must be found and tested.
- It reduces further TB transmission in the household and workplace.
- It reduces morbidity and mortality due to TB among the newly infected persons.

1.11.2.2.2 Screening

Screening is defined as selection, inspection, assessment, investigation, examination or testing (*Roget's International Thesaurus* 2011). Screening also means studying, researching, scrutinising, analysing or reviewing something.

In the context of the TBCT programme, contact screening is the process of finding, testing, treating and notifying persons who might have latent TB infection (LTBI) or TB disease as a result of recent contact with a person diagnosed with the disease (Mulder

et al 2011:137; Zellweger 2010:1–25). After the diagnosis of the PTB, the HCWs must institute screening of the contact(s) within the earliest time and fastest means.

1.12 ORGANISATION OF THE THESIS

The organisation of the thesis begins with the introductory chapter one and the literature review in chapter two. It proceeded with the implementation in chapter three and chapter four. Chapter five followed with discussion and chapter six concluded the study.

1.12.1 Chapter 1: Introduction and background

This chapter forms the introduction and includes the background. It states the status of the TB globally, the status of the TB in sub-Saharan Africa and the status of the TB in Botswana. It also includes the transmission of the MTB and the pathophysiology of the TB. Also covered is the research problem, the theoretical framework that is the basis of this study and the rationale of the research. The chapter concludes by defining the key words underpinning the study, the operational definitions, research design, scope of the study, ethical considerations, organisation of the study and summary of the chapter.

1.12.2 Chapter 2. Literature review

This chapter focuses on the literature review. The chapter reviews related literature and reminds the reader of the global use of the HBM in studies including the TBCT. The researcher used the context of the TBCT in the HBM theoretical framework to organise literature review. The literature review describes the TBCT in relation to the six HBM constructs: effects of susceptibility, effects of the severity, barriers and challenges of TBCT, modifying variables affecting intention to participate in the TBCT, cues to participation and self-efficacy in the TBCT. It also describes demographic factors and individual perceptions associated with intentions to participate in the TBCT. It then contextualised the literature review within the HBM and provided a summary of the chapter.

1.12.3 Chapter 3: Methodology

In this chapter, the researcher discusses the methodology in respect of the research design, quality, sampling techniques, data sources, data collection techniques, issues of reliability and validity. The chapter also details data management including analyses and interpretation, ethical considerations as well as the pre-testing of data-generating instruments. The researcher discusses the significance of the study, scope and limitations.

1.12.4 Chapter 4: Analysis, presentation and description of research findings

The chapter presents the results of the study. It analyses the findings relative to the objectives, questions and research instruments. It used descriptive and inferential analyses and presents results in contingency tables, graphs and textual presentations.

1.12.5 Chapter 5: Study discussion

This chapter presents a summary of the findings in relation to the stated research objectives. The chapter discusses the findings presented in chapter four. The findings are discussed relative to the research assumptions and the research questions. It also discusses the conclusion of the research based on the findings and the discussions. The discussion links literature review with study findings.

1.12.6 Chapter 6: Proposed strategy for tuberculosis contact tracing

This chapter presents IC-TBCT for would-be research consumers. The chapter constructs an alternative strategy that links organisational factors, the HCWs and TB patients in the development of the integrated comprehensive TBCT (IC-TBCT) strategy. It also clarifies policy and programme implications of the IC-TBCT. It provides operational guidelines for integration and implementation of the IC-TBCT.

The chapter also presents recommendations and conclusions of the study. It covers the utilisation of the strategy, strengths and contribution of research, limitations and implications of the findings for the nursing practice.

1.13 CONCLUSION

The present chapter gave the study orientation and discussed the context of the study problem in detail. The problem statement has also been presented together with justification of the study. The purpose, objectives and the research questions have been discussed in this chapter. The significance, rationale and chosen quantitative research approach in the study have been laid out. Key concepts have been defined and so is the outline of the chapters that follow. Finally, the chapter has provided a summary of the organisation of the thesis.

CHAPTER 2

LITERATURE REVIEW

2.1 INTRODUCTION

This chapter presents the literature on the context of TBCT in Health Belief Model (HBM), the theoretical framework on which this study is based. It also presents review on factors associated with intention to participate in in TBCT in relation to the HBM.

2.2 THE CONTEXT OF TUBERCULOSIS CONTACT TRACING IN HEALTH BELIEF MODEL

In this section, focus is on the framework and studies that have been done in relation to the TBCT. Those include reports on strengths, gaps, challenges and lessons learned in the implementation of TBCT globally. The review includes perceptions and barriers in utilisation of TBCT. It also includes modifying variables, cues and self-efficacy in TBCT.

The objective of Hochbaum, Rosenstock and Kegels who developed the HBM (Ayers, De Visser 2011:100-103) was to understand the reasons for the failure of a free, preventive TB screening program. The HBM is a psycho-social model used to explain and predict the lack of use of screening and preventive services. It was further developed to study and promote the uptake of health services. As such, it is fit for the detection and early treatment of asymptomatic diseases such as LTBI. According to Parvanta, Nelson, Parvanta and Harner (2011:152), the model is also useful for explaining the variance of individual's intentions to take health action and related actual behaviour that follows. For instance, Lubkin and Larsen (2013:442) assert that a person's intention to take a TBCT slip and visit a TB clinic is an immediate precursor of that specific self-reporting action for screening. Intentions, in turn, originate from certain beliefs related to the action.

As the HBM model states, one's beliefs are associated with one's knowledge; health knowledge according to Carpenter (2010:661–669) impacts on the person's perceived susceptibility, perceived severity, perceived benefits, perceived barriers, and perceived

self-efficacy. A review of research studies involving the HBM has shown the predictability of the model concerning the variance in TB related health behaviour intentions and factors that act as personal barriers to participating in TB prevention processes (Johari, Eslami, Alahverdipoor, Hasanzade & Farid 2014:25–26). The studies in Johari et al (2014:25–26), shows connections between the HBM variables and TB identification behaviours related to adopting healthy actions. This provides a valuable theoretical framework for investigating and identifying factors that contribute to poor utilisation of TB preventive services. In this study, the HBM avers that a feeling of being vulnerable to TB, and perceiving it as being a serious health problem, is a motivational factor that increases the likelihood that the person will take part in the TBCT process towards early identification and treatment of TB. The model further states that an individual will take such an action if he or she gets cues to participating in it (Carpenter 2010:661–669). Alternatively, he or she may take the action if the anticipated benefits of the TBCT outweigh barriers to that action. It is possible to influence positively the individuals who have such perceptions to plan to participate in the TBCT process (Cook et al 2012:298; Ekwueme, Omotowo & Agwuna 2014:1175; Omotowo et al 2012:451–456). It is also possible to predict the adoption and maintenance of that participation. Hence, it is possible to apply the HBM to include TB preventive health actions, which incorporate health promotion activities and health risk behaviours. The factors associated with an individual's participation in the TBCT processes are individual perceptions of TB (susceptibility, severity, benefits, barriers) modifying factors (demographic, socio-psychological and structural) and the likelihood of taking the TB screening action (self-efficacy, cues to actions) to contribute toward attainment of TB diagnosis and treatment if possible.

The health behaviour change concerning TB is an area that has been widely studied using various models including HBM, but the depth of the TBCT studied is little due, according to Nissen, Rose, Kimaro, Bygbjerg, Mfinanga and Ravin (2012:40183), to dynamic human behaviour and the MTB. The HBM contends that an individual's knowledge concerning TB and state of wellness is associated with his or her intended and actual preventive actions such as the TBCT and screening. The current research will frame the factors associated with the strategy for effective tracing of TB patients' contacts in Botswana within the context of the HBM.

According to the postulations of the HBM (Janz & Becker 1984:18; Rosenstock 1966:94–127), there is a likelihood that the TB patient's contacts would agree to participate in the TBCT process with the perception that participation in the process would be more effective for early diagnosis and treatment (if necessary), thereby further reducing transmission rates of TB to themselves and others. The research will discuss the TBCT process in the context of the HBM tenets.

2.2.1 Effect of susceptibility to tuberculosis on tuberculosis contact tracing

This section reviews studies on the TB contacts' perceptions of themselves to be at risk of contracting TB. It will further review the association of those perceptions with the TBCT as a control strategy.

Kane, Korn, Saukkonen, McDonald, Walsh, Waters. McLaughlin and Keane (2013:200–204) conducted a cross sectional study on the attitude towards the TBCT and treatment at St. James Hospital, Dublin. The study sought to determine the reasons for utilising TBCT services, Kane et al (2013:200–204) stated that 85.0% of the 150 respondents feared death due to activation to TB and 90.0% believed that cure is possible and available upon getting tested (Coleman, Selgelid, Reis, Reichman & Jaramillo 2012:1057–1059). As such, Chesca, Dogariu and Rogozea (2010:202) support the premise that in order to participate in preventive action such as the TBCT and utilise screening services, an individual must believe that he or she can contract TB and suffer from it, even without having the associated symptoms. While conducting TB focused group discussions for a community based participatory research in the USA in 2010, Wieland, Weis, Yawn, Sullivan, Millington, Smith, Bertram, Nigon and Sia (2012:14–22) documented a variety of misperceptions about transmission of TB, and a lack of knowledge about latent TB. These findings were reiterated in Amo-Adjei and Kumi-Kyereme (2013:1–8) in Ghana. In a study to determine knowledge, attitude and health seeking behaviour in Uganda, Buregyeya, Kulane, Colebunders, Wajja, Kiguli, Mayanja, Musoke, Pariyo and Michell (2011:938–942), reported that the feelings and perceptions related to TB, and which may determine how TBCT should be carried out, included secrecy, shame, fear, isolation and poverty. The examples of the common findings in Buregyeya et al (2011:939–940) are: "... we segregate them because we know TB does not cure... so we run away from them" and "The problem with follow-up ... is lack of money to complete the treatment ...". These claims were supported in a cross-sectional

study conducted in Dhaka, Bangladesh in Tasnim, Rahman and Hoque (2012:[2]) where 46.60% of respondents mentioned discrimination of separate utensils for food or drink, 50.50% expressed increased sadness, 39.80% had fear of loss of jobs and 21.40% felt socially neglected. Therefore the TB contacts are more likely to choose to participate in the TBCT as a way to prevent the fears (Wieland et al 2012:14–22). More studies have shown that people have varied expressions of how susceptible to TB they feel and making this the main reason for voluntary participation in the TBCT mostly in areas with high prevalence such as India (Sreeramareddy, Harsha Kumar & Arokiasamy 2013:16). A cross sectional study to assess the awareness, attitude, and treatment seeking behaviour regarding TB in rural Tamil Nadu, India, Kar and Logaraj (2010:226–229) found that out of 1 985 people interviewed, 56.0% had heard of TB, and perceiving susceptibility to TB disease, 54.0% sought treatment for cough lasting over two weeks. Kar and Logaraj (2011:50) reiterated this level of susceptibility to TB. Related this finding is the prospective study that Colson, Hirsch-Moverman, Bethel, Vempaty, Salcedo, Wall, Miranda, Collins and Horsburgh (2013:473–479) conducted to determine the likelihood of TB patients to participate in the TBCT and treatment. The study shows that 89.50% of respondents said that they did so because, "... I believe I can spread the TB germs ..." The TB contacts with such a perception are more likely to embrace the TBCT strategies.

In Ekiti State in Nigeria, Oluwadare and Bosede (2010:194) reported that knowing the severity of an illness determines the course of action, including the TBCT, for prevention or treatment of the illness. In an explorative study to determine the TB patients' knowledge of TB and health seeking behaviour, Oluwadare and Bosede (2010:191–194) participants said that TB was a cough that persists for more than a month (100.0%), feeling tired all the time (83.0%), weight loss (73.0%), cough blood (98.0%), loss of appetite (32.0%), night sweat (45.0%), and fever (20.0%). Such knowledge portrays how susceptible to TB the respondents feel and that may further facilitate acceptance of the TBCT.

Esmael, Ali, Agonafir, Desale, Yaregal and Desta (2013:786) used a cross-sectional study to determine the knowledge of behaviour and actions that respondents in Amhara, Ethiopia believed was the cause TB. Esmael et al (2013:786) report that 79.0% mentioned droplet infection, 30.10% eating food with an infected person, 44.80% drinking raw milk, 65.40% exposure to dust and 62.60% exposure to cold. Esmael et al

(2013:786) found that 66.60% of the respondents said that the main prevention of the TB infection was covering the mouth and nose. Viney, Johnson, Tagaro, Fanai, Linh, Kelly, Harley and Sleigh (2014: [1]) conducted a study using qualitative and quantitative methods to enquire about the cause of TB in the South Pacific island of Vanuatu. The descriptive study reports that 94.0% of the participants associated TB to alcohol, cigarette smoking, contaminated food, sharing eating utensils. They also associated TB with "kastom" (local term for the traditional way of life and for sorcery). Thus, Burke's (2013a:2) perceived susceptibility to TB determines individual's opinions about his or her readiness to participate in the TB control and prevention strategies such as the TBCT. The readiness to participate in the TBCT efforts, therefore, may also arise from various factors such as knowledge about the TB infection, caring for a TB infected household member or workplace colleague, working in the mining industries or living in overcrowded areas.

In a study on personal beliefs about illness, Green, Ottoson, García, Hiatt and Roditis (2014: [4]) state that individual beliefs about his or her health and vulnerability to a disease influence planning and engagement in utilisation of screening services for asymptomatic diseases such as TB. In order to utilise the TBCT, a person must believe that he or she can have TB, even without having the associated symptoms. In a prospective cohort study in USA and Canada, Colson et al (2013:475) found that of 89.90% of the participants enrolled in 2007/2008 accepted the TB follow-up and LTBI treatment mainly for fear of spreading the TB. Colson et al (2013:475) reiterate that the knowledge of threat of the TB effects on an individual and his or her level of awareness of the TB disease increases his or her tendency to participate in the TBCT. It also influenced their acceptance of the TB treatment. The findings showed that perceived susceptibility was highly associated with their intentions to return the TBCT form for TB screening. According to Colson et al (2013:475), it was more likely to enrol in the TBCT for those who perceived themselves as highly susceptible to the TB infection. Colson et al (2013:475) add that they had better knowledge scores about TB or LTBI than non-acceptors. Similar to this study, Omotowo et al (2012:451–456) found that 32.20% of respondents in Southeast Nigeria knew that the TBCT involved bringing for screening all household members in contact with the TB patients although only 23.60% of them took their contacts for screening. The study (Omotowo et al 2012:451–456) however added that 67.80% of the respondents did not know about the TBCT.

In a cross sectional study of knowledge, attitudes, practices in Gambella, Southwest Ethiopia, Bati, Legesse and Medhin (2012:734) found that female participants were less likely to have good level of knowledge, (0.33%) less likely to have favourable attitude (0.23%) and less likely to have good practices (0.37%) compared to male counterparts. The report reflects a gender difference in knowledge of the TB.

On the other hand, a study in Kanjee, Catterick, Moll, Amico and Friedland (2011:333–338) evaluating knowledge, attitudes and practices about the TB infection control including contact tracing and screening among the HCWs of a rural South African hospital in 2007 found that 41.50% of respondents had not been screened for HIV or TB and 42.90% believed that they were vulnerable to TB owing to the on-going TB/MDR-TB/XDR-TB deaths. This study demonstrates that the HCWs perceive themselves as vulnerable to TB and, consequently, may have intentions to embrace the TBCT, screening and possibly treatment.

Although the human population is remarkably resistant to MTB (Amhad & Triccas 2011:1–17; WHO 2013b:104), "... women seem to be even more resistant to the bacillus than men," according to Neyrolles and Quintana-Murci (2009: [1]). Available evidence suggests that 5–10% of people exposed to the MTB develop TB disease, and Neyrolles et al (2009: [1]) add that up to 70.0% of those who do develop TB are males, showing that gender difference is a factor in TB infection (Hershkovitz et al 2015: [2]). In a prospective study carried out in Taiwan in Feng, Huang, Ting, Chen, Lin, Huang, Lin, Hwang, Lee, Yu, Yu, Lee and Su (2012:333) found that male TB patients were associated with higher 6-month mortality (17.20% vs 10.80%) and higher overall on-treatment mortality (21.10% vs 12.10%) than females. Feng et al (2012:332) concluded that there is gender difference in the TB infection, the clarification of which "... provides important information for public health strategies against TB ..." including the TBCT.

Studies have shown that nurses are at higher risk of TB than other HCWs. In a study conducted in Christopher and Balamugesh (2013:150) in India, the prevalence of the LTBI in nurses was 1.30% to 35.60% higher than other HCWs. In the SSA, the HCWs, mainly nurses, generally perceive the TBCT activities as the onus of the employer or those in need, that is, the contacts themselves. For example, Kanjee et al (2011:333–338) reported that 49.10% of the rural South African hospital HCWs felt that the hospital did not care about them and or was not working to prevent staff from the TB infections.

In a 2010/2011qualitative study in Uganda, Buregyeya, Nuwaha, Verver, Criel, Colebunders, Wanyenze, Kalyango, Katamba and Mitchell (2013:360) assessed the HCWs' views as regards TBCT and screening and recorded responses such as "... you just hear somebody coughing when you are here in the room, when you get out, you can't even know who has been coughing ...". The HCWs with such perception wait for the contacts to present themselves in the TB clinic as seen in Botswana (2011:13). Such a mind-set has far-reaching ramifications as far as TB control is concerned. Case detection rates will be low as reported in Botswana's BNTP (Botswana 2008:16), Kabongo & Mash (2010:1–6) and in WHO (2010a). Given this stance, the CDC (2011:174) and the WHO (2010a:78) fear that the national guidelines on the TBCT may not translate into effective actions that programmes can evaluate. Worse still, the incidence of TB will continue to rise due to ineffective follow-up of TB indices and their contacts. With emphasis and support, Gust et al (2011:5) documented this concern.

In Botswana, (Botswana 2011a:12) contacts of TB patients within households and workplace expectedly take up contact tracing forms and present themselves at the nearest TB clinics for screening as is the practice in many parts of the SSA. However, it is noteworthy that their perceived threat of TB might not be sufficient motivation to exercise self-report, especially when they have no signs and symptoms. This puts to test the HBM theory that motivation to seek health care occurs when threat is experienced (Carpenter 2010:661–669; Glanz, Barbara, Rimer & Viswanath 2015:75–94; Glanz & Bishop 2010:399–418). This has far reaching effects in the TB control including the TBCT actions whose approach strategies are dynamic and yet to be fully understood. The Botswana Ministry of Health (MOH 2011:12–13) acknowledges that workplace peers often associate closely with colleagues who have TB. It worries about the assumption that transmission of the mycobacterium may not occur in the workplace as it does in the household. The assumption is rife despite the fact that the HCWs spend up to 8 hours daily for 5 to 6 days a week in close contact. Buregyeya (2013:360) reiterates that in the study in Uganda where one participant HCW said, "... We have worked here for years treating TB patients and none of us has ever got TB."

2.2.2 Effect of the severity of tuberculosis on tuberculosis contact tracing

This section reviews various studies about the effects of TB on individuals. It also reviews how their knowledge of the TB aetiology could be associated with intentions to participate in the TBCT. The basis of severity of TB is influenced by the magnitude of the disease as reported in the WHO (2014:83) that in 2013 there was a 13.0% prevalence of the TBHIV globally, and that 78.0% of these were in Africa, mainly the SSA, with four fifths of the TB persons co-infected with HIV. The indicators of the severity of the TB infection include resultant effects such as morbidity and mortality and co morbidity with opportunistic infections, for instance the HIV. The studies carried out in the CDC (2012a:1311), Hirsch-Moverman, Shrestha-Kuwahara, Bethel, Blumberg, Venkatappa, Horsburgh and Colson (2015:31–38) and in Zumla et al (2013:745) affirm that the TB disease is the leading communicable disease with morbidity and mortality globally.

Studies about people's expression of the effects of the TB around the world indicate varying responses depending on their experiences, feelings and beliefs about it. The effects of TB on the individual may be biophysical, psychosocial and economic. The biophysical effects of TB on an individual's body according to Serafino (2013:10–12) include respiratory disorders, loss of body weight, skin lustre, prolonged coughing for more than two weeks, the symptoms of which in turn reduce his or her ability to keep up with the TBCT actions. A 2008 qualitative study in Buregyeya, Kulane et al (2011:939) captured the words of one participant who complained of "... feeling pain in the chest, I make a wheezing sound when it is cold, I feel pain in the lungs ..." This is corroborated in Kayshap and Solanki (2014: [2]) who report that wheeze and stridor are the presenting symptoms of broncho stenosis that has an incidence rate of 68.0% in the initial 4 to 6 months of infection with the TB. Those, coupled with opportunistic conditions such as HIV, fungal infections and pneumonias intensify the TB severity that may alter the person's perceptions about TB and its cause depending on the individual's belief system. Thus, it behoves the individual to seek health care and thus participate in the TBCT. Personal beliefs about the TB inheritance in Uganda were noted in Buregyeya et al (2011:939) as a participant who believed that if there was a TB patient "… in your lineage, then you can get it through inheritance". These studies have shown that such perceptions often prompt the infected individuals to engage in various health seeking behaviours and actions that may reduce time for productive work and end up

losing jobs. Their households may suffer loss of income and the communities and nations may experience reduced economically productive populations while spending some resources on the treatment of sick citizens.

The Uganda study in Buregyeya et al (2011:939) described the severity of TB in the words of a worried participant as "… breathing is not the usual one, one can breathe like a pussy cat". Buregyeya et al (2011:939) reports that fear of the severity of TB and little knowledge of it might cause household TB contacts to practice informal isolation including segregation "... because we know TB does not cure ... so we run away from them". Such a practice may lead to neglect of the TB patient and jeopardising TB preventive services. Such fears might also lead to neglect of a TB patient or affect the manner in which household members provide or seek care for their sick members and, further, how they take up contact tracing activities. The neglect of the TB patients by adult household contacts might result in child dependence when a TB patient is under the care of a child with little regard to possible transmission. In such a child-care-provider scenario, the TBCT actions and strategies may not be effective.

The SSA experiences the worst effects of the TB. The WHO (2012:11) confirms that three to five million people suffering from the co-morbidity of TB and HIV; are in the SSA. In a study aimed at household tracing and screening of HIV in Kenya in 2008, Dalal, Feikin, Amolloh, Ransom, Burke, Lugalia, Ouma, Laserson, Mermin, Breiman and Bunnell (2013:47–54) report that 81.70% (19,966/24,450) of respondents accepted it. This implies that, given the syndemic HIVTB relationship (CDC 2012a:1311–1317; Kwan & Ernst 2011:351–376; Singer, Herring, Littleton & Rock 2011:13); household TBCT could have a similar acceptance rate. The fact that Dalai et al (2013:48) report that 65.40% of the participants were taking the screening for the first time indicate the serious lack of contact tracing, not only in Kenya but also in the SSA. In a prevalence study in Kenya, Van't Hoog, Laserson, Githui, Meme, Agaya, Odeny, Muchiri, Marston, DeCock and Borgdorff (2011:1245–1253) report that the TB prevalence among HIV infected persons in 2011 was 51.0%, indicating a serious syndemic co-infection of the two epidemics. Similarly using an active household contact tracing study in South Africa, Thind, Charalambous, Tongman, Churchyard and Grant (2012a:1643–1648) show that there were 67.10% HIV positive contacts of 732 index TB cases. A study in Bekker and Wood (2010:208–214) reported that the high adult HIV infection (23.0%) in Cape Town, South Africa, escalated TB infections citing that the high risk of HIV/TB co-

epidemic was propelled by unrecognised infections – and hence the need for integrated comprehensive TBCT – coupled with intense social interaction and overcrowding. One such comprehensive TBCT was reported in Harare, Zimbabwe in Corbett, Bandason, Duong, Dauya, Makamure, Churchyard, Williams, Munyati, Butterworth, Mason, Mungofa and Hayes (2010:1244–1253). During the 2.5-year intervention, Corbett et al (2010:1247) compare two active contact tracing strategies, door-to-door enquiry for chronic cough in the household and use of mobile van with loudspeakers. In that randomised trial, Corbett et al (2010:1247) report a substantial reduction from the previous 41.0% to between 15.0% and 25.0% of undiagnosed TB at each intervention.

According to the CDC (2012) reports, Botswana has reduced the prevalence of TB since 2009. However, it still has one of the highest number of TB cases (5 785) in the SSA with a notification rate of 0.47% in 2012. The number of cases is slightly less than that which is in the WHO (2010:78). A possible explanation of that reduction is either the mortality rate or cure rate. The WHO (2014) report that the country had an average TBHIV prevalence of 0.35% in 2013. The health information for Botswana (2010:1) shows that in 2009 it had a TBHIV co-infection rate of 68.0% with a prevalence of 11.21%. In the same period Botswana (2011:6–7) registered an annual inpatient mortality rate of 5.10% from the syndemic of HIV and TB. On the current co infection with HIV, the WHO (2011:1) report that Botswana has an overall rate of 17.60% HIV prevalence, females having a higher rate (20.40%) than males (14.30%). The Botswana study in Kandala, Campbell, Rakgoasi, Madi-Segwagwe and Fako (2012:97) confirms the WHO report further. Kandala et al (2012:97) indicate gender status as a possible risk factor, and emphasise the need for a more effective utilisation of the TBCT to reduce the syndemic impact. The CDC (2012:1311–1317), Kwan and Ernst (2011:351–376) and Singer et al (2011:13) corroborate the findings and urge for the need for effective TBCT to help reduce the co-infection of the TB and HIV. While conducting a TB case finding in Francistown, Botswana, Boss, Makombe, Kip, Smit, Chirenda, Gammino, Creek and Oeltmann (2012:1030) made similar reports of co-infection of TB patients with HIV (70.0%) in Botswana. The Botswana MOH (Botswana 2011a:12–13) confirms the finding.

Despite the fact that Botswana MOH (Botswana 2007:16–17) has a policy for immediate initiation of the TBCT and screening within three days, it frequently faces delays. Hence, there is need to assess the gaps in the TBCT process. Some of the gaps causing

delays according to Finnie, Khoza, van den Borne, Mabunda, Abotchie, Mullen (2011:397) include consultation with traditional healers first before going to a health facility. It also includes travel time taken to a health facility. Finnie et al (2011:397) conducted a systematic review of the TB detection among patients who were aged 15 years and above. The notable finding was 3.45% patient delays. The delays were mainly attributable to the patients who first visited traditional healers before visiting health facility. In addition, distance to health facility was consistently associated with 2.0% system delay.

Putting the foregoing review within the context of the HBM, Burke (2013:2) documents that it is necessary to assess how serious TB is to susceptible contacts both in households and in workplace, thus lending an indication for the need to explore the TBCT actions utilised. Further, Buregyeya et al (2011:941) indicate that it is also imperative to determine the opinions of HCWs about the severity of TB among the populations they serve and to themselves as health workers. That may also enhance awareness of how severe the TB is in the community. That would facilitate the potential for increasing the likelihood of participating in the TBCT, identifying TB contacts early and effecting prompt treatment measures to prevent severe outcomes of the TB infection.

2.2.3 The benefits of tuberculosis contact tracing

One may experience the benefits of the TBCT in several ways: The increase in the number of TB contacts screened accrues when individuals adopt utilisation of the TBCT. As Begun, Newall, Marks and Wood (2013:21) state, increased detection rates translate to "... aggregation into an increased treatment rate ..." One of the findings in the Dublin study in Kane et al (2013:200–204) was that TB contacts' perception of the degree of risk of developing the TB can influence their decisions to accept follow-up, be screened and treated if possible. However, Deery, Hanrahan, Selibas, Bassett, Sanne and Van Rie (2014:534–535) in their household TBCT study in South Africa in 2012 report that only 35.0% households were successfully traced. During the study, Deery et al (2014:535) offered TB contacts a home based TB symptom screening and report that the number needed to trace (NNT) in order to locate one individual was 4.8. Similarly, Marks, Murrill, Sanchez, Liu, Finlayson and Guilin (2008:1068–1073), using a convenience study of prevalence of TB in a small community in New York, report that

397 self-reporting TB patients' close contacts who received a TST yielded a rate of 4.0% of the TB infection. According to Marks et al (2008:1071), the rate is high for the small community that had a 16.0% prevalence of HIV. The study reiterates that HIV remains the greatest risk factor for the progression of LTBI to TB specifically among those in small communities with low level of education. In the study, 62.0% were males and 12.0% were females. It is an indication to strengthen passive TBCT and, as Deery et al (2014:539) suggest, there is need to find a more effective and cost-effective TBCT. The suggestion finds support in Shapiro et al (2012:1110–1116).

According to the CDC (2012:1316), self-reporting at the clinic for the TB screening is a reflection of perceived positive and beneficial action taken for possible early treatment against the threat of the TB. However, as of itself, it may not be reliable to use to achieve the set targets (Fox, Nhung, Sy, Lien, Cuong, Britton & Marks 2012:[1]). In a prospective TB contact investigation in Vietnam, Fox et al (2012: [1]) report that most of the existing TB control strategies are about symptomatic patients attending health services for investigation. The study warns that the approach "... has not resulted in substantial reductions in the prevalence of tuberculosis disease ..." despite the National Tuberculosis Program achieving high treatment completion rates.

In a cross-sectional study based on the HBM to investigate factors associated with adopting health behaviours by 196 TB patients, Johari et al (2014:25–26) report a statistically significant association between the perception of benefits in adopting healthy behaviours such as adopting the TBCT. The understanding of one's perception of the benefits of TB treatment, Burke (2013a:2) and Johari et al (2014:25–26) assert, is helpful in defining his or her belief system in the efficacy of the TBCT. It also helps in understanding that guidance by the HCWs is necessary for identifying their readiness to participate in the programme to reduce incidence and the risk or seriousness of impact of the TB infection. Besides, the perceived and actual benefits of the TBCT, passive or active, according to Kranzer et al (2013:437–438) are helpful for explaining people's awareness of how and where to carry out the TBCT, the participants in the TBCT process, and in the clarification of the desired outcomes expected of the exercise.

Such actual and perceived benefits would motivate the TB contact to participate in the TBCT. The cues such as health education talks, clinic announcements and medical information through various communication media may reinforce motivation.

Alvarez, Van Dyk, Aaron, Cameron, Davies, Stephen, Mallick, Momoli, Moreau, Obed, Baikie and Osborne (2014: [2]) conducted a door-to-door TBCT and testing campaign in Nunavut, Canada in 2011. The study showed that, of 389 consenting households, 162 (42.0%) participated in the TBCT. The study increased TB awareness and knowledge among 444 individuals in the households (Alvarez et al 2014: [5]).

In the SSA, studies show experiences in the benefits of the TBCT efforts according to Thind, Charalambous, Tongman, Churchyard and Grant (2013b:426). Thind et al (2013b:426) report that household active case finding in a high TB and HIV prevalence peri-urban setting in North West Province of South Africa obtained high yields of tracing TB cases. Among 3 627 household contacts in Thind et al (2013b:426), 20.40% were smear-positive of whom 76.30% were culture-positive. The findings reflect a high number of contact participation in the TBCT.

Earlier in 2007, the Botswana MOH (Botswana 2009:21) urged the TB contacts with symptoms of TB to voluntarily report to the public health facilities. In a bid to strengthen the TBCT, Botswana (2009:7) once again reiterate the national call, probably encouraged by improved national notification of the TB cases. It is also probable that the benefits of voluntary TBCT experienced in other countries such as South Africa (Thind et al 2013b:426) encouraged it. In a study using 163 paediatric TB patients in Puryear, Seropola, Ho-Foster, Arscott-Mills, Mazhani, Firth, Goldfarb, Ncube, Bisson and Steenhoff (2013:1049–1055) in Gaborone, Botswana, 548 contacts were screened whereby 2.20% of the contacts were new TB cases. The finding prompted Puryear et al (2013:1049–1055) to suggest that to find one new TB case, the number needed to contact trace (index cases/new cases) was 13.6, and the number needed to screen (contacts/new cases) was 46. It is, therefore, necessary to attribute any success rate in the country to the TBCT strategies used. As such, the current study, explores potential contribution of TBCT in further improving the benefits on the TB control.

This section has demonstrated the use of the HBM model in understanding how individual beliefs are associated with his or her health actions. It has also demonstrated that the perceptions of susceptibility to TB affect the utilisation of contact tracing. Further the severity of TB is closely associated with the intention to utilise TBCT.

2.2.4 Barriers and challenges in tuberculosis contact tracing

With reference to the research question on TB patient perceptions and socio-economic factors that affect utilisation of TBCT, this section seeks to review individual barriers, housing, HIV syndemic and resource mobilisation.

The barriers to TB elimination strategies abound in all efforts and at individual, household, community and resource mobilisation levels. Various studies indicate that the barriers to TBCT are varied and are inherent in all facets of the programme: policy formulation, supervision of implementation and monitoring and evaluation.

2.2.4.1 Individual barriers and challenges

Demographic factors such as sex, age, level of education, race, ethnicity, genetic predisposition and socio-economic, belief system and lifestyle factors can cause an individual to be more at risk or safer from the TB infection and determine the utilisation of the TBCT. Hence, the individual may become more or less intent to participate in the TBCT and screening activities. Similarly, stigma and discrimination are major barriers to the TBCT and screening services.

A study conducted in South Africa in Johnstone-Robertson, Mark, Morrow, Middelkoop, Chiswell, Aquino, Bekker and Wood (2011:1246–1255) report some individual factors that act as barriers to the TBCT. The factors include alcohol consumption and smoking patterns causing poor adherence and increased defaulter rates. Between 2005–2006, Godoy, Cayla, Carmona, Camps, Alvarez, Alseda, Minguell, Rodes, Altet, Pina, Barrabeig, Orcau, Parron, March, Follia, Sabater and Dominguez (2013:776) conducted a study to assess prevalence of TB among 7 673 contacts of 1 079 TB patients who smoke cigarettes in Catalina, Spain. The study identified 13.0% of the contacts with TB. Moreover, Godoy et al (2013:773) note that the proportion with TB was higher among contacts of smoking patients, that is, 1.60%, than non-smoking TB patients who made 1.0% of the sample. The study reports further that the prevalence of LTBI among contacts was 29.70%. The prevalence was 35.30% among contacts of smoking TB patients, again higher than the 25.70% of contacts of non-smoking TB patients. This was further associated with the TB patients' attributes among which was alcohol consumption together with the TB contact. In a peer-reviewed literature focusing on the

association between TB and smoking in Van Zyl-Smit, Brunet, Pai and Yew (2010:693–703), the study identifies excess TB deaths among smokers, as compared with non-smokers, among both women (3.0%) and men (2.30%). In addition, the study reports that a case-control study from India shows that those who both smoked cigarettes and drank alcohol had considerably higher active TB incidence rates than those who did not, suggesting a clear link between smoking and increased risk to TB infection. Appropriate TBCT strategies, therefore, need to consider smoking patterns in the population.

Factors such as illiteracy may result in poor knowledge of the importance of the TB and contact tracing needs. It may also result in personal superstitious beliefs that interfere with the TB facts. They also include personal default for various reasons such as illness, poverty, nutritional deficiencies and costs of transportation hindering an individual from accessing TB services. For example, in a study to compare challenges in active and passive TBCT in Arkhangelsk region of Russia, Kuznetsov, Grjibovski, Mariandyshev, Johansson, Bjune (2014:4–6) found that 57.0% (*n*=258) of the participants were unemployed and had secondary school education level of literacy. It is therefore difficult for such participants to afford finances that are necessary for linking up with the TBCT processes. In support of this, a prospective TB follow-up study done in Muheza District, Tanzania in 2010, Nissen et al (2012:40183) found that lack of transport to a TB clinic due to financial problems was more complicated when a TB patient's caretaker lives alone or is widowed. Nissen et al (2012:40183) quote a respondent single mother who mentioned that she had to work first in order to get bus fare to get to the hospital "… then you say that I don't want to be treated, we want, but the transport is a big problem". Similarly, in a 2008 health access barriers survey of 4 668 households in South Africa, Harris, Goudge, Ataguba, McIntyre, Nxumalo, Jikwana and Chersich (2011:105–107) found that transportation costs and travel distance were key access barriers. The study indicates that the barriers were severe especially for Africans, the poor and rural residents as 37.0% of participants walked to clinics. The study shows that transportation costs and distance could affect the TBCT activities.

In a qualitative study in rural Bangladesh, gender difference and age were cited in Karim, Johansson, Diwan and Kulane (2011:84–89) as important factors that influence the TB and TBCT. In the study, Karim et al (2011:84–89) found that women were culturally frowned upon for coughing up sputum (Mason et al 2016:206–232). The culture resulted in their suffering in silence and that may deter the TB patients from

seeking health care on time and or shying away from the TBCT activities. In support of this, Kurspahic-Mujcic, Hasanovic and Sivic (2013:274), in a prospective study of the TB related stigma and delay in seeking treatment in Sarajevo, found that 50.0% of the patients with TBHIV in 18–24 year age group perceived the TB as socially stigmatising. That compared with 12.30% of those in 65–75 year age group who had similar perceptions. In addition, the study reports that 24.70% of the 77 males testing positive for TB perceived the TB as stigmatising. In the same study, 39.70% of the 73 female counterparts considered TB as socially stigmatising. In the same light, Dodor et al 2012:214–215) reported in a qualitative study in Ghana that PTB patients were isolated and shunned and would not want to participate in TBCT until the conditions were worse. In Tamale, Ghana, Yahiya (2013:53–65) also found stigma as a major barrier in TB control. The studies find support in Nhamoyebonde and Leslie (2014:100–106) and Van Lunzen and Altfeld (2014:79–80) who report that men are more susceptible to tuberculosis than women are. The studies attribute the cause of the gender susceptibility difference to epidemiological factors that need exploration.

The WHO (2014:349) warns that alcohol is a psychoactive substance with dependence-producing properties that many cultures have used for centuries and causes 5.90% (3.3 million) of annual global deaths. The use of alcohol may affect TB control strategies such as the TBCT. With regard to the studies in Narasimhan, Wood, McIntyre and Mathai (2013:4–5), Hayden (2014:31–36) and Polit and Beck (2006:160), alcohol is known to weaken an individual's self-control mechanisms. Narasimhan et al 2013:4–5) warn that alcohol makes the consumer to fear less, care less and hence do not perceive the TB threat as serious problem. Consequently, he or she may not perceive the TBCT as a necessity for identification of the TB and early treatment. In a study on the TBCT in Arkhangelsk in Russia, Kuztetsov et al (2014:4–6) reported that 90.0% of the participants used alcohol, 80.0% were smokers, most of them having been imprisoned due to wanton behaviour that put them at high risk for TB infection. Further, Narasimhan et al (2013:4–5) compiled online databases for known risk factors for TB and did a systematic review of 3 cohort and 18 case control studies. The study reports that the risk of active TB is substantially 2.94% among individuals who consume 40.0 grams or more of alcohol per day. Narasimhan et al (2013:4–5) add that one of the reasons for increased risk include specific alteration of the signalling molecules that are responsible for cytokine production in the immune system.

A case-control study in Muture, Keraka, Kimuu, Kabiru, Ombeka and Oguya (2011:696) associated alcohol consumption with 16.73% defaulter rate in the TB treatment of 5 659 study participants in Nairobi, Kenya in 2008. The study notes that alcohol consumption can disrupt contact tracing efforts. Abebe et al (2010: [4]) reiterate that report. A cross-sectional study in Kuznetsov et al (2014) in Russia revealed 36.30% of active case finding patients as alcohol abusers (as opposed to only 26.20% of passive case finding patients. Moreover, alcohol abusers used self-treatment more often than did passive case finding patients. Such behaviour, Kuznetsov et al (2014) warn, could as well interfere with the TBCT process. The WHO (2011:1) reports that uncontrolled alcohol consumption by a TB contact without TB symptoms may take up most of his or her time (WHO 2014:349). Thus, it gives more time to the mycobacteria to spread and cause more complications that require difficult and expensive treatments.

A systematic literature review of three cohort and 18 case-control studies conducted in Lonnroth, Williams, Stadlin, Jaramillo and Dye (2008:289) found an average relative risk of 3.50 for consumption of alcohol. The review used an exposure cut-off level of ≥40 grammes of alcohol per day. Lonnroth et al (2008:289) conclude that the risk of TB increases in individuals who consume ≥40 grammes of alcohol per day, and or have an alcohol use disorder. The study associated alcohol consumption with increased risk of infection related to specific social mixing patterns associated with it. Besides, the report warns of the influence of alcohol and related conditions on the immune system. Such TB cases are more difficult to trace owing to the dynamic movements of the alcohol consumers. It is necessary to understand the reasons for the increased risk. Studying associated peer factors such as informal social interactions including shared alcohol consumption and time missed for TB protocols may provide reasons as potential avenues for effective TBCT. In this situation, the individuals who spend most of the time together consuming alcohol due to peer pressure may lack time for TBCT. The WHO (2011:1) further reports that alcohol use, especially beer since it is mostly consumed in Botswana, is the main risk factor of the TB relapse rate of 738/100 000 and can affect the TBCT activities. The study finds support, in Muture et al (2011:696) who used a multivariate analysis in a case-control study in Nairobi, Kenya. Muture et al (2011:696) report that the 22.70% of participants who defaulted in the first month of intensive TB treatment was attributable to non-adherence to the TB protocols due to various reasons, notably use of alcohol. In Botswana, Kabongo and Mash (2010:1–6) report one

frustrated community TB volunteer who complained that *"... It is discouraging to look after patients who ... still take alcohol,"* during TBCT and treatment.

In Waako, Verver, Wajja, Ssengooba, Joloba, Colebunders, Musoke and Mayanja-Kizza (2013:349) and Kar and Logaraj (2011:50), illiteracy and poor knowledge of TB are barriers to health seeking behaviour. The barriers also affect the ability to read health messages regarding the TBCT. A cohort study to determine prevalence of TB in Iganga/Mayuga, Uganda in Waako et al (2013:349) found that among 5 000 consenting participants, 21.70% were TB suspects during follow-up. Out of the 21.70%, 18.50% were TB positive. The study reports further that 85.0% of those with a higher incidence of TB had less than 7 years of education compared with only 13.90% who had over 7 years of education. Besides, the study found that TB was seven times more prevalent (6.84%) in participants who were out of school than those in school. In a cross-sectional TB awareness study in India, Kar and Logaraj (2010:226–229) found that 80.0% of rural participants were not aware of the cause and mode of its spread of the TB. In Nairobi, Kenya, Muture et al (2011:696) list inadequate knowledge on the TB (8.67%) among the TB treatment defaulters in 2008. Such is the situation in Vanuatu, a Pacific Island country, where 94.0% of the study participants had little knowledge of the cause of TB, Viney et al (2014: [6]) add, due to illiteracy. According to Chang and Cataldo (2014:168–173) most parts of the SSA including Botswana have similar findings among the PTB patients who have little knowledge about TB and the TBCT.

Many communicable diseases such as TB and the HIV/AIDS are associated with stigma and discrimination (Courtwright & Turner 2010:34–42). Stigma is a label that begins when a particular characteristic of an individual (or group) is identified as being undesirable or disvalued (Courtwright & Turner 2010:34–42). A study to assess pathways of TB interventions in Courtwright & Turner (2010:34–42) reports that the stigmatisation of TB prevented people from participating in selling goods in Ghana markets, thus affected the economy. In Brazil, Freitas, Crispin, Pinto, Villa, Brunello, Pinto and Arcencio (2012:646) report that 43.70% of respondents perceived that sharing dishes, contaminated water and food were the cause of TB. Further, the study shows that 56.30% of families of participants expressed fear and sadness of living with a TB patient. In the study, Freitas et al (2012:647) found that a further 50.0% of the participants reported that their relative was ashamed of them [TB patients] having the TB. In a 2010 case-control study to determine the relation between socio-demographic

characteristics and TB stigma among 425 TB patients and their 850 controls in Gezira, Sudan, Ahmed Suleiman, Sahal, Sodemann, El Sony and Aro (2013:388–393), found that stigma affected treatment adherence and, in reference, the TBCT. The study attributes this mainly to low levels of education and poor knowledge of TB. Ahmed Suleiman et al (2013:388–393) add that there was need to empower the TB patients, their contacts and communities. The study suggests enhancing knowledge of TB through education programmes in order to conduct effectively the TB control strategies such as the TBCT. Elsewhere, as reported in Abebe et al (2010:[4]), superstitious beliefs in Ethiopia prevented TB contacts from discerning causes of TB, its mode of transmission and science proven treatment options. While conducting a knowledge, attitude and practices study of the Maasai community in Kambiyaachoka, Lengasiti, and Loibor-siret in Simanjiro District, Tanzania, Haasnoot, Boeting, Kuney and Roosmalen (2010:902) found that the community had multiple scientifically unfounded health assumptions and beliefs about TB. Using semi-structured and structured interviews, Haasnoot et al (2010:903) report that 67.0% of the participants knew about TB, and that 80.0% knew the symptoms. Despite that level of knowledge, Haasnoot et al (2010:903) claims that they had misconceptions about the cause. In the study, Haasnoot et al (2010:903) report that 32.0% of the participants thought that divine punishment caused the TB. In support of the report, Bati et al (2012:734) found that, despite the fact that the mean score of 57.60% of the study participants had good knowledge of the TB in Ethiopia in 2012, only 40.80% had favourable attitude towards TB. Such findings may be attributable to misconceived TB health beliefs that may adversely affect TB control strategies including the TBCT.

In a systematic review of 1 268 international descriptive studies, Chang and Cataldo (2014:168–173) found that stigma antecedents included negative attitudes and misperceptions regarding the causes of TB. In Chang and Cataldo (2014:168–173), the stigma deters TB contacts from accessing screening services. The study explains that the TB contacts fear discouraging comments from the HCWs and others particularly those in their residential vicinity. Courtwright and Turner (2010:34–42) have similar findings about stigma. In support of the statements of Courtwright and Turner (2010:34–42), Freitas et al (2012:647) confirm that stigmatization and a feeling of embarrassment are major barriers to planning for a TBCT and screening since they [stigma and feeling of embarrassment] should be first considered.

Muture et al (2011:696) indicate personal default and poor adherence as the main reasons prevent individuals from participating in the TB programmes such as treatment and follow-up in Nairobi. The causes for that include 16.70% for ignorance, 12.50% for travelling away from site and 10.80% for side effects of treatment. Cherkaoui, Sabouni, Ghali, Kizub, Billioux, Bennani, Bourkadi, Bennmamoun, Lahlou, Aouad and Dooley (2014: [2]) report another instance of default in a case-control study in Morocco from 2010 to 2011. Cherkaoui et al (2014:[3]) reiterate that participating in the TBCT is as complex as treatment default and the PTB patient behaviour and actions, knowledge about TB and its treatment, social support and treatment organisation influence it. Cherkaoui et al (2014:[5]) further state that low literacy levels and health knowledge, low income and lack of money for transportation, migration for work or personal reasons, treatment protocols and schedules affected the TBCT. Naidoo, Yende-Zuma, Padayatchi, Naidoo, Jithoo, Nair, Bamber, Gengiah, El-Sadr, Friedland and Karim (2012:313–324) add other influencers of the TBCT. The study reports the factors such as not knowing the duration of treatment, side effects such as immune reconstitution inflammatory syndrome (IRIS), lack of TB education programmes, support systems and fear of stigma. Besides, it includes lack of staff for patient education due to shortage of the HCWs and community-level factors that varies by setting. That raises the need for interventions to improve the TBCT support mechanisms. The WHO (2012:39) report adds that such support systems must use appropriate, acceptable and affordable actions of involving communities in supportive training and supervision within the environmental and social milieu of the TB patients and their contacts, and using public reassurance and incentives in overcoming the barriers and conducting effective TBCT. Further, Cluver, Orkin, Moshabela, Kuo and Boyes (2013:748–755) carried out a follow-up study in South Africa to determine the TB transmission among children caring for TB infected adults. The study recommends community involvement and support in planning, implementing and evaluating programmes such as the TBCT.

Co-infection with diseases such as the HIV and diabetes is a challenge that complicates the TB control efforts including the TBCT due to the follow-up required by each disease. Pollock, Tam, Grass, Bowes, Cooke, Pareek, Montamat-Sicotte, Kapembwa, Taylor and Lalvani (2012: [1]) reiterate that HIV is the most important risk factor in the TB infection. Pollock et al (2012: [1]) used records review in London in 2010 to report that HIV enhanced the incidence of TB in the United Kingdom (UK) in the past 20 years. In addition, the study reports that there were 8 483 TB patients in 2010, 4.9% of which

were co-infected with HIV. According to Pollock et al (2012: [1]), most (67.50%) of the study participants were from sub-Saharan Africa. In a prospective study on co infection with TB, Narasimhan et al (2013:4–5) found that patients with TB and diabetes mellitus had a smear-positive culture rate of 22.20% at the end of treatment compared to only 6.90% of those without diabetes. The findings lend credence to the justification to improve the TBCT to include individuals with dual infections or other health conditions. Similarly, the study in Dooley and Chaisson (2009:737–746) states that poor past history of TB treatment, metabolic disorders such as diabetes mellitus, are risk factors for re-infection with TB. The consequences are that TB contacts may seek treatment in diabetes clinics and miss the TBCT strategy. From 2006 to 2008 Restrepo, Camerlin, Rahbar, Wang, Resptrepo, Zarate, Mora-Guzman, Crespo-Solis, Briggs, McCormick and Fisher-Hoch (2011:355) carried out a prospective cross sectional study of the contribution of diabetes to TB among 233 TB patients in South Texas and New Mexico. The study found that the prevalence of diabetes was 39.0% in South Texas and 36.0% in New Mexico. The study reports that diabetes contributed 25.0% of the TB cases. The investigators argue that though it remained controversial that TB induces a transient hyperglycaemia that would be classified as 'diabetes', the study data suggested that TB developed in patients who already had diabetes.

Household malnutrition often impedes or frustrates the TBCT efforts of individuals if they have to spend much time looking for food. The study in Narasimhan et al (2013:4) documents household malnutrition – both micro- and macro-deficiency – as a risk factor in the TB infection. An adequate and balanced diet enhances the body's immune system against TB. A potential relapse of TB occurs where household food lacks in vital nutrients such as vitamins that are necessary in the strengthening of the body's immune system, Narasimhan et al (2013:5) add. Malnutrition therefore becomes a threat to the TBCT when household members' focus on family nutritional needs is superior to that of the TBCT. A study in Nissen et al (2012:40183) evaluates challenges to follow-up of directly observed treatment of TB in Tanzania. The study reports that 38.80% of the household respondents had nutrition-based challenges of non-adherence. Further, Nissen et al (2012:40183) note that though some respondents were given money for bus fare to the clinic, they spent it on food as one respondent admitted, "I was given bus fare yes, then I spent the money". As such, there is little time left for TB control schedules such as the TBCT. Generally, poverty in the community put the individuals at

a higher risk of TB due to the inability to afford health care costs. It also increases their inability to enrol themselves in efforts such as TBCT to eliminate TB.

Studies show that gender as a risk factor in the TB transmission and hence determine control efforts. In a study that supports the claim, Ochieng-Ooko et al (2010:681–688) alert the TB control authorities that that may portray that male characteristics put them [males] at a higher risk of TB transmission than those of females. Furthermore, Babatunde, Elegbede, Ayodele, Fadare, Isinjaye, Ibirongbe and Akinyandenu (2013:216) did a cross-sectional study to determine the factors that affect the outcome of TB treatment among 78 participants in Ido-Ekiti, Nigeria in 2010. The study reports a gender distribution of 41.0% TB infected females against 59.0% for males. Hence, male characteristics pose a challenge to the TBCT actions. The WHO (2010:78) data show that the 88.60% of 9 155 new TB cases in Botswana had a male-female ratio of 1.3:1. In the MOH annual report, Botswana (Botswana 2011a:8) confirms the data, showing a greater gender risk of new TB disease or re-infection among men. The gender difference could therefore explain unknown facts about TBCT strategies that need exploration. This call has also been made in Karim et al (2011:84–89) in their study on gender difference in TB control strategies.

Age is a risk factor in the TB transmission and in the TBCT process. This is evident in Godoy et al (2013:773) on the prevalence of TB among contacts of TB patients who smoke in Spain. In the study, TB infection was higher among men, especially who smoke (50.70%), increased with age and was higher in the 15–44 year age group (41.30%) and 45–64 year age group (57.10%), and higher in contacts living with the TB patients (42.20%). In Botswana, the BNTP (Botswana 2008:7) reports, there is a peak in the 30–34 year age group among the most affected 25–49 year age group. For instance, in a prospective study in Hanoi, Vietnam, Fox et al (2012:[3]) found that 40.30% of the household TB contacts were males and their mean age group was 36.3 years. That is attributable to the fact that the age bracket is one of the most mobile and productive population groups. Therefore, for most of the time, the people in that age group are dynamic and often found in social places and outdoor areas rather than in households. In the Nigeria study, Babatunde et al (2013:212) report a statistically significant relationship between age and the TB infection. During the study, the sputum smear of patients with TB was positive in those who were 25 years or younger (81.80%) while a larger proportion of those above 50 years were negative (86.70%). As such, that

poses a challenge in the TBCT activities such as the TBCT that focus on households only. Botswana must harness the mobility pattern of this age group in planning a more effective TBCT strategy.

2.2.4.2 Housing environmental challenges and tuberculosis contact tracing

Living and working environments pose challenges in the TB control efforts and affects the TBCT. In Narasimhan et al (2013:2), household and workplace environment was a risk factor in incidence of the TB among TB patients and their proximal contacts. Furthermore, while comparing the socio-economic challenges active and passive TBCT in Arkhangelsk region of Russia between 2007 and 2011, Kuznetsov et al (2014:4–6) report that 11.0% of the participants had no housing and 36.0% of the patients were former prisoners and jobless. Such individuals often live in squalid housing conditions. Hargreaves, Boccia, Evans, Adato, Petticrew and Porter (2011:655) confirm that poor ventilation and overcrowding in households and workplaces increase the likelihood of exposure of uninfected individuals to TB infection. In the prospective household TBCT study in Hanoi, Vietnam, Fox et al (2012:[3]) found that 92.40% of TB contacts, had abnormal chest X-ray; households had a mean of 2.6 contacts per household room. The findings compare favourably with those of Gyawali, Gurung, Poudyal, Amatya, Niraula, Jha and Bhattacharya (2012:304). Gyawali et al (2012:304) carried out a cross-sectional study between 2009 and 2010 in Dharan, Nepal to determine the prevalence of TB among 802 household TB contacts of 184 TB index cases. In the study, Gyawali et al (2012:304) found a prevalence of TB at 1.60% adding that the TB infection was closely associated with household crowding. The study concludes that individuals living in a household of more than two persons in a room were 7.46% times more likely to contract TB infection. The study further reports that the 10.41% risk was greater in household TB contacts living in a house with less than two rooms and room size equal to or smaller than 10 x 10 feet with 4.05% risk.

Wingfield, Schumacher, Sandhu, Tovar, Zevallos, Baldwin, Montoya, Ramos, Jongkaewattana, Lewis, Gilman, Friedland and Evans (2014:779) did a cohort study to investigate risk factors for incident TB amongst 3 589 household TB contacts in 2006 in a peri-urban area of Ventanilla, Peru. The study setting has a high TB rate of 162/100 000 population and poverty. Wingfield et al (2014:779) found that during the 6 months with most crowding, the proportion of crowded households was 13.0% higher than the

rest of the year. The study reports further that 14.0% more contacts had TB symptoms during the overcrowding periods than the rest of the year. Wingfield et al (2014:778) further state that the randomly selected subgroup of 56.90% TB contacts with replete vitamin D were more likely to be poor and have more crowding than the entire cohort of TB contacts. Wingfield et al (2014:780) explain that vitamin D deficiency, linked to poverty, is a plausible risk factor for TB because it suppresses immune responses specific to TB. The argument concurs with the findings in Martineau, Nhamoyebonde, Oni, Rangaka, Marais, Tsekela, Bashe, de Asevedo, Caldwell, Venton, Timms, Wilkinson and Wilkinson (2011:19013–19037). Martineau et al (2011:19013–19037) state that vitamin D deficiency is epidemiologically associated with TB disease. It is important to note, here, that the active metabolite of vitamin D (1, 25-dihydroxyvitmain D) regulates the cellular vitamin D receptor to inhibit the growth of TB mycobacterium.

In Sumpter and Chandramohan (2013:104–105) was a systematic meta-analysis of 11 case-control and two cross-sectional studies investigating the link between TB and indoor air pollution (IAP) in India, China, Nepal, Mexico, Malawi and Benin. Sumpter and Chandramohan (2013:104–105) found that TB cases are 1.30% more likely to be exposed to indoor pollution from stove smoke, than healthy controls. The cross-sectional studies according to Sumpter and Chandramohan (2013:104–105) portrayed a 2.53% stronger association between indoor air pollution and TB. The statements find support in Bahera and Aggarwal (2010:139–143), Kolappan and Subramani (2009:705–708) and Pokhrel, Bates, Verma, Joshi, Sreeramareddy and Smith (2010:558–564). In contrast to other reports of males being at higher risk of TB infection than females, Sumpter and Chandramohan (2013:105) report that the odds of exposure to indoor air pollution linked to TB incidence were 1.70% higher among females. The Sumpter and Chandramohan (2013:107) analysis indicates that the African continent suffers a greater burden of indoor air pollution than any other region. That is because African countries have an average of 81.0% reliance on solid fuel for cooking and other heating needs indoors. In support, Gyawali et al (2012:304) found that the 5.96% use of firewood for household cooking in Nepal was a 3.07% risk factor among TB contacts owing to indoor pollution and close proximity with TB case patients. Such risk factors may need specifically designed TBCT strategies in order to be effective in TB control.

In Low, Lai, Tse, Tsui, Lee and Hui (2013:77–83) environmental factors such as poorly constructed and crowded housing and working environments add to the threats against

the TBCT efforts owing to the frequency of TB re-infections. The study urges for counter measures that are more innovative as the option. In a 2009 study to determine the relationship between housing and TB outcome among 1 787 participants in a densely populated Kowloon West area in Hong Kong, Low et al (2013:77–83) reveal that more TB cases were residing significantly in public as opposed to private or other types of housing. Similarly, Buregyeya et al (2013:360) state overcrowding and poor ventilation as structural challenges associated with TB infection control in Mukono and Wakiso districts in Uganda. The study states further that the structural challenges facilitated transmission of TB where workers with TB spent long hours in close contact. Buregyeya et al (2013:360) quote one FGD participant saying that separation of TB suspects was not possible because "... we don't have enough space ...". In such environments, there is need to design innovative and more effective strategies to enhance the workplace TBCT and minimise TB transmission. Dharmadhikari Mphahlele, Stoltz, Venter, Mathebula, Masotla, Lubbe, Pagano, First, Jensen, Van der Walt and Nardell (2012:1104–1109) conducted a case-control study in South Africa in 2010 to determine use of appropriate masks. In Dharmadhikari et al (2012:1104–1109), there were 40.0% infections in the intervention group and 76.60% infections in the control group. Hence, the innovation provided a 56.0% risk reduction in TB incidence. Dharmadhikari et al (2012:1108) urge for strengthening of innovative strategies such as comprehensive TBCT (Gyawali et al 2012:306) in developing countries with overcrowding constraints. The study lays emphasis especially in congregate settings such as the households and workplaces such as health facilities and prisons.

Countries must provide innovative strategies and policy enforcement references for lung protection. In the developed countries, for example the USA, such reference as USA 2008:s1910, paragraph 134 (f) section (2) is a respiratory protection programme under occupational safety and health administration act (OSHA). The reference enforces activities for prevention of risks and upsurge of respiratory hazards including TB in the workplace. Many developing countries have no such enforcement regulations. The modern public health facilities in Botswana have structural cough-environments for the TB patients and suspects; however, the facilities have low enforcement for their use. In support of this statement, a study conducted in Francistown, Botswana in Bloss, Makombe, Kip, Smit, Chirenda, Gammino, Creek and Oeltmann (2012:1030–1032) attests to the findings. Among 11 779 TB screenings at intake, the study reports, 926 were positive and 19 had TB. This indicates, Boss et al (2012:1030–1032) conclude,

that a more effective strategy of routine TBCT and screening at intake was feasible despite low yield.

2.2.4.3 The challenges of tuberculosis and human immunodeficiency virus syndemic in tuberculosis contact tracing

According to CDC (2011:1311–1317) and Kwan and Ernst (2011:357), the syndemic co-infection of the TBHIV poses challenges in the TB control efforts (Adeira, Abba & Okpapi 2016:1–14). Challenges are evident where two or more therapeautic programmes affecting one individual need to run simultaneously. For instance, the competing follow-up challenges pose threats to the TBCT process. A cross-sectional study in Adane, Alene, Koye and Zeleke (2013: [2]) assessed the TB treatment adherence among 280 participants in Northwest Ethiopia in 2013. The study indicates a non-adherence to TB treatment of between 10.0% and 13.60%. In addition, the study reports that the non-adherence was 4.06% higher if the patient had a co-infection with HIV, a fact that would equally affect the TBCT efforts. The risk factors for non-adherence to any one of the program's schedules are apparent where attendance time differs and frustrates the TB patients and their contacts.

Another challenge is the treatment of the dual syndemic. For example in the Ethiopian study, Adane et al (2013:[4]) report that 75.0% of respondents complained of unpleasant side effects that antiretroviral and anti-TB drugs produce. The findings are in tandem with those in Nezenega, Gacho and Tafere (2013:110). In a cross-sectional study in Sidama, South Ethiopia, Nezenega et al (2013:110) determined patient satisfaction with the TB treatment adherence. The study reports that 6.80% found it too hard to take so many pills and 5.10% feared for the effects of drug interaction with antiretroviral medication. In a similar study, Muture et al (2011:696) found that 10.80% of the TBHIV patients in Nairobi Kenya were lost to TBCT follow-up due to side effects. The studies show that the treatment of the syndemic TBHIV diseases endanger the TBCT efforts, hence there is need for a more effective strategy. The competing interests in treating both diseases may be overwhelming to an individual patient: as Govender and Mash (2009:513) report, though 63.0% believed in an association of TBHIV syndemic, and that 90.0% believed that TB was curable with medication, 30.0% were not expecting to complete their TB treatment. That may further mean that the TB patients and their contacts may not complete the requirements for the TBCT strategies.

Some of the difficulties that may seep in include availing time and resources for travelling between home and clinic in the contact tracing process, especially if the HCWs do not offer motivation (Maswanganyi, Lebese, Mashau & Khoza 2014:1–8). In the South African study, Govender and Mash (2009:513) reported 79.0% as accessing hospital by taxi and only 20.0% could access hospital while walking. In a retrospective study covering 2005 to 2010 in Gaborone, Botswana, Schwartz et al (2013:1298–1303) found the TB as the most reported cause of death in 40.0% of the HIV positive patients, a phenomenon that may complicate the TBCT process. That implies that the factors need clear understanding and planning in the design of the TBCT strategy where there is the TB and HIV co-infection (Govender & Mash 2009:513).

In yet another study to determine reasons for non-adherence to TB control measures in South Africa, Govender and Mash (2009:513) report that the relationship with the TB nurse was a 2.6% significant reason for the 34.0% non-adherents. The workload of the HCW affected the relationship between TB patients and the HCW. In Govender and Mash (2009:513), the South African study clinic registered 30–40 TB patients per month and experiences stress due to multiple tasks, patient numbers and shortage of the HCWs. However, when the HCWs improve their services, patient adherence to the TB control efforts such as adherence to the TBCT improves. In support the study conducted in Nezenega et al (2013:110) found that 90.0% of the TB patients in Ethiopia were satisfied with TB treatment, and that can encourage and facilitate positive intentions to the TBCT efforts despite the co-infection with HIV and its resultant syndemic effects.

2.2.4.4 Resource mobilisation barriers and challenges to tuberculosis contact tracing

The resources discussed in this section include TB control policy, policy implementation, logistics and how they are harnessed and health system delays.

The studies conducted in Buregyeya et al (2013:360), in Wilson, Chadha, Beyers, Claasens and Naidoo (2011:853), and in Squire, Ramsay, Van den Hof, Millington, Langley, Bello, Kritski, Detjen, Thomson, Cobelens and Mann (2011:862–870) link the challenges of poor resource mobilisation. The studies aver that poor resource mobilisation affect the TBCT strategies in the manner in which they are used. While

assessing the implementation of the TB control policies in Mukono and Wakiso districts in Uganda, Buregyeya et al (2013:360) found that a dismal 31.0% of the facilities had a TB control plan. Furthermore, “some clinicians don’t comply ... They don’t appreciate why TB patients should be triaged …," one HCW complained. An observational study in Kanjee et al (2011:333–338) notes poor human resource mobilisation in the TB control implementation in a rural South African hospital. In the study, 49.10% of HCWs felt that hospital authorities were not working to prevent staff TB infections. Kanjee et al (2011:333–338) warn that despite appointment of a TB control officer, “... the facility lacked a TB IC policy, the patient TB screening process was inadequate, and 41.50% of respondents were unaware of their ... status”. From the inference of the findings, such hospitals may, therefore, not plan nor implement the TBCT actions. The problem was still evident in Kanjee, Amico, Li, Mbolekwa, Moll and Friedland (2012:67–81). In support of the claims, Chiang, Weezenbeek, Mori and Enarson (2013:598) report that an incomprehensively formulated or lack of a TB policy becomes a source of poor implementation of TB control strategies including TBCT as the HCWs become complacent. Thus, increased HCW complacency in information of TB has led to poor implementation of the TBCT. Besides, Buregyeya et al (2013:359) report complacency among the HCWs in a qualitative arm of TBCT screening in Uganda. The study quotes one FGD participant who wondered why the health authorities were worried about their HCWs getting increasingly at risk of TB infection from patients, adding “... We have worked here for years treating TB patients and none of us has ever got TB. Why the fuss now?” Such complacency affected the TB control strategies including TBCT since the HCWs with similar perceptions portray limited knowledge of the TB infection and might not conceive of the need for effective TBCT.

Time is one of the most important resources that the HCWs poorly manage in the implementation of the TBCT activities in households and workplaces. Time constraints may emanate from the TB patients or the HCWs (Nezenega et al 2013:110). The study conducted in Nezenega et al (2013:110) in Sidama, South Ethiopia, report clinic time constraints. In the study, 5.10% of the respondents stated that they had other appointments that made them miss follow-up for treatment. That provides potential for missed opportunities in the TBCT. In a related instance, Chiang et al (2013:598) report that facility-specific organisational challenges include simple lack of or inappropriate allocation of specific tasks to specific TB clinic HCWs. It reports further the failure to keep appointments with the TB patients. With the foregoing, the HCWs often ignore

their organisation of clinic activities and staff punctuality as affecting the TBCT. More examples in Glanz, Rimer and Lewis (2002:44) include competing patient care activities, for instance, timing of clinic visits and time restrictions for opening and closing the TB clinics, clinic activities such as routine conduct of health education talks for all patients before commencing services. The HCWs often design local strategies that they themselves are comfortable with when carrying out the TBCT (Ekwueme et al 2014:1175). They ignore the TB patients' perspective and fail to discern anything wrong with their timing and organisation of clinic activities and indeed the TBCT. The MOH (Botswana 2011a:12–13) concurs that the TB clinic HCWs hardly schedule time with the TB patients for the TBCT, especially in the workplace where the BNTP (Botswana 2008:2) found that the TB contacts are as much at risk as are the household TB contacts in Botswana.

In this regard, an observational part of the study in Buregyeya et al (2013:360) found that the HCWs did not give priority to follow-up coughing patients in 90.0% of outpatient departments in health facilities in Uganda. The study reports further that the patients were in queues with non-coughing patients for long hours without facemasks. The TB contacts might be uncomfortable with those scenarios, and may strive to avoid, not only them but also the TBCT follow-up. Such factors, Chiang et al (2013:596–604) found, could influence the TB patients' contacts to stay away from the clinics until they are sick. In that way, the HCWs actions defeat the purpose of the TBCT for early screening and prompt treatment and further worsening the problems of delayed diagnosis and immediate initiation of the TBCT. In relation to that, Makwakwa, Sheu, Chiang, Lin and Chang (2014:132) did a cross-sectional study about time delay in providing health care to 588 participants in Blantyre, Malawi in 2011. The study reports that the public health system contributed 70.0% (median of 80 days) of total delay in diagnosis and initiation of treatment.

In the SSA, the study done in Mukono and Wakiso districts of Uganda in Buregyeya et al (2013:360) found that resource challenges included low capacity of the TB clinics and inadequate space for patient privacy during history taking and interviews. The study reports one participant who said, "It is not possible here [patient separation] because we don't have enough space. We don't have a place where to put them". The study conducted in Buregyeya et al (2013:360) in Wakiso, Uganda reported insufficiency of appropriate logistics such as funds for TB control strategies as an FGD participant

decried, *"*... But they didn't carry it out; ... it wasn't done because of funds". In a study conducted in 2010 in South Africa, Bristow, Podewils, Bronner, Bantubani, Van de Walt, Peters and Mametja (2013:1–8) found that logistics support, including use of mobile phone calls to the TB patients' families, plays a vital component in the TBCT programme. In this light, this study hopes to find which technology is affordable and acceptable for use in the TBCT process. According to Ndlovu, Littman-Quinn, Park, Dikai and Kovarik (2014:275) there is hope of harnessing mobile phone telecommunication to improve public health strategies such as the TBCT, citing an example of mobile telemedicine solution, known locally as "*kgonafalo*" in Botswana. This is reiterated further in Littman-Quinn, Mibenge, Antwi, Chandra and Kovarik (2013:120–125) that this could be achieved through health education to the general population. In a systematic study on the use of electronic communication to strengthen disease control such as the TBCT, Brinkel, Kramer, Krumkamp, May and Fobil (2013:11559–11582) report that mobile phone is now being utilised in some parts of the SSA. For example Cameron, with a population of 20 million in 2012, 70.0% literacy rate, and 50.0% of the population using mobile phones, Bisong, Asonganyi, Gontarenko, Semenov and Veijalainen (2013:69) suggest that it was time the country used mobile phones to enhance health strategies. In a qualitative study on health information needs in Senegal in Sylla, Robinson, Raney and Seck (2012:47), it emerged from 75 key informants and two focus groups, that there was need to close the gap of health 'information poverty' that continue to bedevil the country, and indeed the SSA, despite increased internet connectivity and the ubiquity of mobile phone subscriptions.

The MOH (Botswana 2011a:12) has a TB control policy that includes the TBCT. However, the CDC (2011:174) reports that the implementation of the TBCT measures in Botswana often faces organisational, human and resource challenges that might lead to ineffective monitoring and evaluation of the TBCT. The report is in tandem with the earlier BNTP (Botswana 2008:16) findings. Resource mobilisation for effective TBCT in the country, Botswana (2011:13) concedes, is a challenge within the TB clinics and implementing authorities. The experience in Botswana (2011:12), where the national TB control policy exists, is that the implementation of the TBCT actions faces the need to concur with national TBCT guidelines. As reported in Bloss et al (2012:1032), most of the actions that the TB patients, their contacts and the HCWs adopt are health facility based. The study decries the actions as reactive and encourage self-report TBCT, a strategy known to have low yields in Thanh, Ngoc, Viet, Van, Horby, Cobelens and

Wertheim (2014:[2]). Similarly in Thind et al (2012a:1643) in Matlosana in Northwest South Africa, the study reports a low of 10.0% of household contacts with active TB.

Studies conducted in Buregyeya et al (2013:360) in Mukono, Uganda and in Govender and Mash (2009:513) cite high HCW-patient ratio. The studies found the ratio of between one HCW to 30 TB patients and 1:40 per month. The studies warn that the ratio, coupled with multiple other tasks, might contribute to staff burnout, and hence impede effective TBCT activities. The BNTP (Botswana 2008:18) is aware that less experienced and appropriately trained HCWs in the TB clinics are a risk factor for effective TBCT. In order to reduce the resource constraint, the BNTP conducts on-the-job training on TB control to update the HCWs. However, the similarities in the study findings in the CDC (2011:174) and in the earlier BNTP (Botswana 2008:16) not only portray little improvement in the TBCT; but also indicate that the supervisory support of the TBCT programme faces HCWs resource challenges. That might mean further that the TBCT training component is inadequate. Besides, the success in achieving annual target of 85.0% of the TBCT is in question. That presents a vital challenge that Botswana (2011:12) promises to solve and must strive to improve the effectiveness of the TBCT. Earlier, the BNTP (Botswana 2008:12) indicates, the HCWs in the country rarely allocate time for more effective follow-up. Botswana (2011:12–13) emphasises that this scenario is especially severe in the workplace where the TB contacts are as much at risk as are household TB contacts in Botswana.

The study findings confirm the current concerns of the government of Botswana (2011:12) as it was in 2008 (Botswana 2008:7). The concerns are that the HCWs hardly implement the TBCT services according to the expectations of national guidelines of TBCT. According to BNTP (Botswana 2008:18), that is attributable to various challenges pertinent to the TB clinic specific organisation of work schedules. The challenges may result in poor implementation of the TBCT services. Puryear et al (2013:1049) conducted a home visit follow-up of 548 TB contacts of 163 TB patients in Gaborone, Botswana in 2009. Puryear et al (2013:1049) found that in order to get one new TB case, the number needed to contact-trace (index cases/new cases) was 13.6, and the number needed to screen (contacts/new cases) was 46. The finding had the support of the study conducted in Jeena (2015:19). Puryear et al 2013:1055) conclude that by improving the TBCT strategy, that is the proportion of symptomatic contacts evaluated, the yield of contact tracing process may increase, a conclusion that Thind et

al (2012b:426) made earlier in a similar study in South Africa. In support of this, Jeena (2015:19) reiterates the findings in Puryear et al (2013:1049–1055) that passive TBCT alone in Botswana is an inadequate strategy to control the tuberculosis epidemic and needs a more innovative and effective strategy.

Furthermore, Pia (2011:26) describes HCWs themselves as assuming passive roles in the TB clinics as they wait for the TB contacts who self-report. In congruence with this is the study to determine the TB control measures in Uganda in Buregyeya, Nuwaha et al (2013:360). The study reports that the HCWs remained passive and complacent in public health facilities. The study quotes a participant's comment about fellow HCWs that "Some clinicians don't comply...," with the TB control measures. In yet another study to assess attitudes and health-seeking behaviour in Uganda, Buregyeya, Kulane et al (2011:941) document that the HCWs may even discriminate against the TB patients. Buregyeya et al (2011:941) report an FGD participant who lamented, *"*... when the health workers find that you have TB, they treat you with fear ...*"*. Such an attitude by the HCWs, Gust et al (2011:5) conclude, often results in ineffective contact tracing of the TB patients, poor community TBCT awareness campaigns and weak adherence to the TB treatment. That may cause further risk of relapse of TB and possible spread. In a retrospective study on the TBCT practices in Vietnam, Thanh et al (2014:[1]) report that there were no data about the TBCT screening despite their importance in the control of TB. In the study, Thanh et al (2014:[3]) found that of the 4 118 household contacts of 1 091 TB patients, only 11.50% self-reported for screening yet the proportion of this screening was only 5.50%. The complacency and inability of the HCWs to interpret TBCT adequately to the TB patients and their contacts often lead to less reliable TBCT information in the community. When the TBCT is not immediately initiated, Gandhi et al (2010:1830–1843) warn, the MDR TB and the XDR TB may potentially arise in households, workplaces and in the contact communities.

In conclusion, it is necessary to note that knowing the barriers to the TBCT efforts presents an avenue for improving the TBCT. The knowledge also provides the need to find appropriate means of providing focused health education with appropriate content targeted at individual TB patient's at community level and the HCWs at health facility level. In support of this view, Wood, Lawn, Johnstone-Robertson and Bekker (2011:112) portray that the understanding of the TB challenges provides insights into the gaps of existing strategies and permits the development of additional, rational interventions to

regain TB control. Hence, it assists in planning how to carry out suitable practices of more effective TBCT actions.

2.2.5 Modifying variables affecting intentions to take up tuberculosis contact tracing

This section reviews literature on the modifying variables that influence the intention to participate in the TBCT. Modifying variables in this context refer to factors that influence the decision of TB patients as regards utilisation of TBCT. They include personal demographic characteristics such as gender, age, socio-economic status, beliefs, literacy level and knowledge of the TB and TBCT.

2.2.5.1 Age and intention to participate in tuberculosis contact tracing

Studies show, as Rosenstock (1974:328–335) aptly describes, how individual demographic, psychosocial characteristics and structural variables may affect individual's perceptions. The perceptions consequently determine whether to participate in the TBCT actions. Studies indicate further that the productive age group is associated with increased risk for TB infection. In a prospective descriptive study of TB among HCWs in Ibadan, Nigeria, Kehinde, Baba, Bakare, Ige, Gbadeyanka and Adebiyi (2011:613–617) note that age was a factor in screening of TB. In the study, Kehinde et al (2011:613–617) found that 90.0% of respondents testing positive TB were from the age bracket of 20–60 years. That is worrisome, as the age group constitutes the economic vibrant group of the population. TB infection affecting the vibrant work force may further aggravate shortage of the HCWs, which may cripple delivery of health care systems including the TBCT in the country.

2.2.5.2 Gender and intention to participate in tuberculosis contact tracing

According to Bati et al (2013:734), females in Ethiopia were 0.33% less likely to have good level of knowledge at indicating a gender factor in understanding TB. Similarly, the study carried out in Tanzania in Haasnoot et al (2010:903) shows that Maasai males made health decisions for their female spouses. Such community beliefs and practices affect the health seeking behaviour of females and may further act as barriers to the TBCT.

2.2.5.3 Educational level and intention to participate in tuberculosis contact tracing

Higher education among the TB contacts is associated with favourable perception about the causes of TB and its transmission. The claim finds support in Haasnoot et al (2010:903–904) in Tanzania where only 0.25% of the target population had some schooling and had a better understanding of the TB. The educated TB contacts are more likely to take up contact tracing activities for they can discern benefits to themselves and their household members. While assessing social support needs of the TB patients in a qualitative study in Lima, Peru, in 2005, Paz-Soldan, Alban, Jones and Oberhelman (2013:290) documented literacy concerns. The study reports that many community members who were less educated about TB perpetuated stigma. In substantiation, the study cites a religious leader who banished a church member, whose child had TB. The leader told the church member to abstain from attending church until the child healed. Such instances may psychologically discourage the TB patients from participating in the TBCT activities as well. They may discourage their close contacts and not refer them to the clinic.

The structural determinants such as knowledge about TB, enhanced by literacy, improve the capability of an individual to adopt the TBCT actions by understanding its benefits (Paz-Soldan et al 2013:290). In the cross-sectional study about awareness and treatment seeking behaviour for TB among rural communities of Tamil Nadu, India, Kar and Logaraj (2010:226–229) report that 56.0% of the participants had prior knowledge of TB. The study compares favourably with the findings in Abebe et al (2010:[3]) who report that 83.0% of the TB contacts knew about TB in Southwest Ethiopia. Abebe et al (2010:[4]) found that the literate participants were more likely to be aware about TB and more likely to know that a microorganism caused TB than non-educated TB contacts. These structural factors have an impact on the understanding of TB and the TBCT. The studies support the HBM theory (Rosenstock 1974:328–335) that knowledge affects perceived susceptibility and seriousness to TB, the ability to discern benefits of prevention and hence intention to participate in the TBCT. Therefore, health education about the TB, its cause, transmission and prevention in communities are a felt need. Besides, a more effective TBCT in health facilities is necessary to improve TB detection rates (Ekwueme et al 2014:1175). It is imperative to find cost-effective strategies of the TBCT (Deery et al 2014:539). In line with this, Bloss et al (2012:1032), Jeena (2015:19)

and Puryear et al (2013:1049–1055) suggest that there is need for health education on more effective strategies in the TBCT in Botswana.

2.2.5.4 Socio-economic status and intention to participate in tuberculosis contact tracing

Together with knowledge of TB, a higher socio-economic status enables an individual TB patient to afford costs of transport to a health facility and better likelihood of the TB treatment. Such variables can modify positively the TB contacts' health behaviours intrinsically by affecting their perceived seriousness and susceptibility to TB infection. They also encourage positive perception of the benefits of the TBCT and barriers preventing them to participate in the TBCT efforts. In that state, the individual is more likely to participate in the TBCT activities. However, true is the opposite where the TB patient has a low socio-economic status. The myriad problems inherent in low socio-economic status prevent the individual from participating in the TBCT services.

2.2.6 Modifying factors in implementation of tuberculosis contact tracing

This section reviews literature focusing on factors that influence implementation of the TBCT actions and resulting in varied forms of impact. Using explanations in Burke (2013:2), the modifying factors may be intrinsic or extrinsic. Intrinsic factors include personal demographic characteristics such as gender, age, socio-economic status, level of education, literacy and knowledge influence. Extrinsic or external factors include organisational challenges, logistics and other factors.

2.2.6.1 Gender and participation in tuberculosis contact tracing

The WHO (2010) reports that throughout the world, the greater impact of the TBCT largely depends on more self-reporting females than males with symptoms of TB. However, according to Omotowo et al (2012:451–456), TB affects males more often that it affects females in 60.0% to 70.0%. Omotowo et al (2012:451–456) attribute the higher prevalence to differences in social habits including environmental hazards. In reiteration, Onifade, Bayer, Montoya, Haro, Alva, Franco, Sosa, Valiente, Valera, Ford, Acosta and Evans (2010:381) confirm in their study about the gender factors that influence TB control including the TBCT. In a household survey on screening practices

on 4 118 contacts of TB patients in Vietnam in 2008, Thanh et al (2014:[3]) report that 27 secondary household contacts with LTBI were diagnosed at a rate of 0.70% and only 13 of them were males. That indicates gender influence in the TBCT participation. In a retrospective quasi-experimental study to determine the yield of TBCT from the close contacts who shared an enclosed space with a TB patient for four or more hours a week in Rio de Janeiro, Loredo, Cailleaux-Cezar, Efron, De Mello and Conde (2014:1–133) found that 62.50% were infected. The study, however, showed gender differences during the evaluation period with males being 58.40% and 41.60% were females. Further, Omotowo et al (2012:451–456) in a descriptive cross-sectional study involving 380 participants in Ebonyi State of Nigeria found that females (51.10%) were slightly more than males (48.90%).

However, some studies show that the contrary is true. A case-control study in Nigeria attests to gender difference in the TBCT uptake. In the study group of the case control study, Ekwueme et al (2014:1175) found that females were 58.10% before health education intervention and decreased to 43.50% post-intervention. The control group had 53.80% females during pre-intervention and 52.60% at post-intervention. This compared to 41.90% males in the pre-intervention baseline and 56.90% at post intervention. This compared to male control group who had a baseline of 46.20% at pre-intervention and 47.40% post-intervention. Despite this fact, one deduction is that gender is a determinant factor and that females are more likely to accept to participate in health preventive measures like the TBCT than male counterparts are.

2.2.6.2 Age and participation in tuberculosis contact tracing

Aging is associated with increasing health risks. As an individual becomes older, the more likely he or she becomes more conscious of his or her wellness, and more likely to accept the TBCT follow-up. In a study conducted in Ijebu-Ode in Ogun State, in Nigeria, Abba, Jombo, Banjo, De-Kaa and Ojo (2013:260) report that the incidence of TB was highest at 35.10% among participants in 21–30 years age bracket, and 19.30% among those in 31–40 years age bracket. However, it did not reflect a clearly significant association with increasing ages. The findings concur with those in Kehinde et al (2011:613–617) who found that 90.0% of the respondents testing positive TB were from the age bracket 20–60 years. This report further corresponds with that in Freitas et al (2012:644), that the study participants had an average age of 53 years, the median

being 55 years and the most occurring age was 74 years in Ribeirao Preto-SP (5 health districts) in Brazil. The expectation was that the individuals in high-risk age would have better knowledge of TB and ready to participate in the TBCT activities. However, Paz-Soldan et al (2013:290) cite the socio-economic status as challenges while on TB programme conducted in Lima, Peru.

2.2.6.3 Socio-economic level and participation in tuberculosis contact tracing

The level of socio-economic status is closely associated with an individual's capacity to attain the requirements such as decision-making, time and finances to participate in the TBCT and early TB screening services. Paz-Soldan et al (2013:290) report that some participants stopped working or worked less. By so doing, they combined additional costs associated with the TB programme like availing time and transport fee for clinic visits. In that situation, the study reports that the availability of family support enabled 50.0% of the respondents to participate in the TB control efforts including the TBCT. Furthermore, Paz-Soldan et al (2013:290) report that some TB patients in the study suggested that they incorporate income-generating activities into the TB control programme. That way, the study reports, the participants could provide not only family income, but also socialisation among patients and improve their self-efficacy. They were also more likely to participate in utilising the TB services than those without incomes. In support of this, a cross-sectional study conducted among 410 participants in Somali Regional State of Ethiopia in Tolossa, Medhin and Legesse (2014:[3]) found income level as a facilitating factor in TB control strategies. The study reports that individuals with regular income were 3.89% more willing to participate in the TB control strategies compared to individuals with no definite income. On the contrary, a household TBCT study in Deery et al (2014:535), in South Africa found that people who lived in poor settlements and are unemployed, lived on less than $6.00 per day and did not have money for the next meal. In Botswana, an average monthly earnings for citizens is BWP 4 661.00 (Botswana 2015:37) or $14.10 per day. Therefore, a premise may run thus: socio-economic welfare such as a household income is a modifying factor in the TBCT process.

A study that was conducted among the Amhara community in Ethiopia cites a significant impact that TB had on social relations that could contribute to poor adherence. Such impact occurs when there is stigma, discrimination, and several misconceptions.

However, the social relations could improve control efforts if there is support (Esmael et al 2013:787). In support of this premise, Paz-Soldan et al (2013:290) found that participants described increased social isolation while on TB treatment in Lima, Peru. The study reports that the patients preferred to take medication where no one would see them. Despite the feelings of social isolation, Paz-Soldan et al (2013:290) state, 90.0% of adult TB patients expressed having made valuable new friendships with other patients with whom they could discuss their illness openly in their treatment program. The study reports, moreover, that the TB patients feel supported as one participant was delighted with everyone in the programme because "... we are already friends..., they greet me, ask me how I'm doing ...".

2.2.6.4 Literacy and participation in tuberculosis contact tracing

A literacy level study conducted in Ekwueme et al (2014:1175) found that health education on the TBCT improved the level of the need to participate in the TBCT in Nigeria. The study shows that there was an increase of participants in the study group with knowledge of screening TB contacts from 44.90% pre-intervention to 85.80% post-intervention. However, in the control group, the pre-study knowledge of the same was 19.20% and increased to only 20.90% post-intervention. The differences in the knowledge of the TBCT between the intervention and the control groups at baseline and post-intervention were statistically significant. It showed that health education is important in the TBCT participation and the HCWs must strengthen it with community-specific innovations. Adequate levels of literacy enhance health education. A comparative example in Freitas et al (2013:644–645) illustrates that low literacy levels correlated with less knowledge about TB and the TBCT. In turn, that can lead to less likelihood of participating in the TBCT programme.

In the qualitative study conducted in Freitas et al (2013: 645) in Brazil, 62.50% of the respondents were literate; from which 37.50%had only elementary education and could read and understand health messages. The other 37.50% were illiterate hence not expected to interpret health messages. Therefore, the higher literacy level an individual is, the more knowledgeable the individual may be, and the more likely he or she is to access better social privileges that might enable him or her to acquire the capacity to participate in the TBCT programme. In addition, the individual is more likely to gain the information to influence health related thoughts, plans and behaviours.

2.2.6.5 Knowledge of tuberculosis and participation in tuberculosis contact tracing

The individual's knowledge of TB positively influences his or her perceptions about it. Further, it influences his or her consequent preventive actions against the TB. As such, the likelihood of him or her participating in the TBCT is improved. In a qualitative study to determine knowledge of the TB among poor people in London, Craig, Jolly and Zumla (2014:1–9) assert that their (poor people) knowledge of TB included their definition and perceived meaning of the disease, its cause and origin, their susceptibility to it and effects on them. The study concludes that such knowledge affects their TBCT, treatment and prevention methods. The study findings in Omotowo et al (2012:451–456) in Nigeria concur with Craig et al (2014:1–9). The Maasai in Tanzania, Haasnoot et al (2010:903) report, had good knowledge of the TB. However, they had poor health assumptions about it. The study found that, although 67.0% knew about TB, 80.0% knew about symptoms and 67.0% knew that TB was treatable (Haasnoot et al 2010:903). Further, 32.0% thought it was punishment from God, or that it resulted in beliefs such as eating infected food, promiscuity, strong sun and global changes. Their belief in traditional medicine complicated their health seeking behaviour and the TBCT actions. For instance, one traditional healer in Uganda justified patronage of the TB patients to traditional healers because the cause is witchcraft (Buregyeya et al 2013:939).

However, Buregyeya (2013:939) notes that majority of participants had good knowledge of the TB infection and associated it with prolonged chest pain, loss of weight, haemoptysis and "... oluweero," the local term for wheezing and difficulty in breathing. Similarly, the study findings in Tolossa et al (2014:[4]) show high level of knowledge of the TB infection in persons up to grade 12 of school education compared to illiterate individuals. Therefore, good knowledge about TB disease by the TB patients and contacts may positively influence their perceptions about the TBCT actions. Consequently, the knowledge enhances the TBCT improvement at household level and in the workplace. It would be beneficial for the TB control programme planners to understand the modifying factors. The understanding facilitates informed techniques of improving the existing TBCT strategies. The aim is to have more effective TBCT in screening and subsequent early treatment.

2.2.6.6 Extrinsic influencers and participation in tuberculosis contact tracing

Extrinsic influencers, Bristow et al (2013:6) note, include availability of material and human resources such as the TBCT policy, training materials, communication equipment, contact tracing forms, stationery and appropriate registers and supervisory skills. In a study on the use of contact tracing paper slip in Johannesburg, South Africa, Mwansa-Kambafwile, McCarthy, Gharbaharan, Venter, Maitshotlo, Black (2014:[2]) issued 718 contact tracing slips eliciting a 26.0% rate of contact tracing. The study achieved 98.0% participant acceptance rate and 12.0% case detection rate. The researchers owe the success rate to supervisory support including logistics. Hence, the support of effective TBCT must include logistics such as provision of transport which Mwansa-Kambafwile et al (2014:[3]) assert, would mitigate the costs of follow-up. The human resource influencers include the HCW supervision, style of implementation of the national TB policy and use of socially acceptable TBCT strategies.

However, many a monitoring and evaluation agency in ministries of health does not ensure that the HCWs adhered exhaustively to the TBCT component of the TB control policy. A case for instance, is that which Tafuma, Burnett and Huis in't Veld (2014: [1]) report while carrying out a study to determine the use of national guidelines by clinicians in 2009 in Botswana. In the study, Tafuma et al (2014:[2]) found that the high proportions of smear negative TB diagnoses unsupported by laboratory investigation. Besides, the clinicians did not follow the national guidelines. That may relate to poor TBCT and weak implementation of the policies resulting in strategies and practices that vary from one health care facility to another. Moreover, as Mulder et al (2011:137) term, the strategies are not in congruence with the national TB policy. The concerns of the MOH (Botswana 2011a:12) that the implementation of the TBCT is incongruent with the national guidelines attest to the findings. In Botswana, it is evident in Kabongo and Mash (2010:1–6) and in Tafuma et al (2014:[4]) that the TB case identification does not always follow guidelines of the TBCT and treatment by the HCWs. This is in spite of Botswana (2011:12) and the WHO (2010a) stipulating succinctly the need to strengthen contact tracing policy. As per the provisions of the BNTP in Botswana (2008:16), the target of the TB case identification and treatment is 71.0%. However, the WHO (2010a) reported that the actual national implementation stands at 65.0%, largely attributable to passive self-reports of the TB contacts.

2.2.7 Cues to participating in tuberculosis contact tracing

This section covers literature related to cues to knowing TB, participating in the TBCT and TB identification services. Cues include the use of developed health education materials, TB information brochures, research findings and recommendations, TB counselling manuals for health care personnel, TB training manuals for community HCWs, TB educational charts and even TB volunteers. The findings in a cross-sectional study to assess TB knowledge and health-seeking behaviour among 422 participants of Ahmara Regional State, Ethiopia, in Esmael et al (2013:786) support the statements. In Esmael et al (2013:786), 66.60% of the participants had heard of TB from health professionals and 37.90% had heard of it from peers. In a similar study in India, Kar and Logaraj (2010:226) found that 45.0% of respondents reported that television was the main source of TB information. Although the findings in Esmael et al (2013:786) support that the media such as television (17.80%) and radio (23.90%) enhanced the TB information dissemination, 99.80% of the participants, felt that they were uninformed about TB. That puts to question the quality of TB information from the sources. However, individual intrinsic factors, their level of literacy and social status determine the individual's access to the media, and that in turn affects their intention to participate in the TBCT.

Through information brochures on TB, the WHO (2010:78) warns that the actual threat of the TB epidemic could reverse economic gains of a country. Such information in WHO (2010:78) and the perceived benefits of comprehensive TBCT are the cues to national TBCT policy formulation and or improvement. In Stapledon and Viney (2010:12) various countries and TB control programmes utilised research findings, recommendations and the rationale that citizens are susceptible to TB infection to formulate national TBCT guidelines. The worldwide research findings and recommendations on the TBCT provide cues to the need to improve the TBCT. In an active TBCT study in Portugal, Cook et al (2012:299) and Duarte et al (2012:55–59) report that the strategy of home and workplace visits identified more at risk TB contacts and increased rates of TB screening (84 for every TB patient). Duarte et al (2012:55–59) concludes that that could prevent more TB cases in the future, especially with comprehensive and more effective TBCT. In a related study, Stapledon and Viney (2010:2) report a possible yield of 4.50% active TB cases when one screens an average

of 4.4 household contacts in low and middle income countries. That implies that, for a programme to identify one case of active TB, it needs to screen contacts in 22.2 households. Therefore, a comprehensive TBCT exercise may improve such a low proportion of detection and achieve a more exhaustive TB identification. In support of this fact, Wood et al (2011:112) assert that the benefits of increased and prompt TBCT are significantly vital in high transmission settings such as Botswana and South Africa in order to reduce transmission rates. In the study, Wood et al (2011:113) contend that, for long-term control of TB, the effective contact number must be less than the number of individuals who could produce a single case of infectious TB in a lifetime. In a meta-analysis of 95 studies from low and middle-income countries to investigate TB contacts, Fox, Barry, Britton and Marks (2013:144) found that the prevalence of TB among household contacts was 3.10%. Furthermore, the WHO (2012:32) found that systematic reviews of published studies show that a pooled average of 3.50% to 5.50% of household members or other close contact with a TB patient are themselves found to have previously undiagnosed, active TB.

The presence of TB manuals for use by the HCWs to translate the TB policy at implementation level provides an important cue for the TBCT. For example in the current India's Revised National TB Control Programme (RNTCP), Sachdeva, Kumar, Dewan, Kumar and Satyanarayana (2012:693) point out that the policy protocol provides for follow-up of the TB patients through the strategy of the TBCT and screening at household level. This is a proven cue that other countries that have severe experience of TB such as Botswana can emulate. However, Sachdeva et al (2012:693) calls for an urgent need to put the HCWs on continuous education on the importance of the TBCT and to institute strategies for rigorous and effective monitoring and evaluation. The utilisation of the TBCT training manuals for the CHWs in the community and provision of simple TBCT techniques may help accomplish that. The study findings in Mwansa-Kambafwile et al (2013:[4]) determined the effectiveness and acceptability of contact tracing in South Africa. The study reports that a paper slip method facilitated the TBCT rate. During the study, Mwansa-Kambafwile et al (2013:[2]) state that 26.0% of the participants returned the slips and the case detection rate among contacts screened was 12.0%. In the passive household TB contact study in Vietnam, Thanh et al (2014:[3]) report that, of the 4,118 household contacts, 474 (11.50%) were passively screened. The study adds that the use of the current passive TBCT yielded low proportions of 10.0% of household contacts. That illustrates the limitations when a

programme relies solely on passive TBCT. In agreement, Deery et al (2014:535) report that a household contact tracing study in South Africa achieved a paltry 35.0% of household contacts. Deery et al (2014:535) urge that more effective and affordable TBCT methods needed exploration.

As a cue, Bloss et al (2012:1032) conducted a study based on routine facility TB screening in Botswana. The study reports a low yield of 8.02% of the TB cases. As such, the study urges for the need for HCWs in Botswana to participate actively in continuous education programme, hopefully for innovative and more effective TBCT.

The WHO (2010:78) reports that in the SSA, on average, the incidence of TB continues to remain high due to less effective TBCT strategies. The report urges member countries, including Botswana, to clarify the role of each type of TBCT methods. The WHO (2010:78) points to deficiencies in the TBCT. The pointer may translate to a cue to heed to in the region and indeed in Botswana. Although Botswana (2007:16–17) stipulates in its BNTP for improved TBCT, Pothukuchi, Nagaraja, Kelamane, Mail, Shashidhar, Babu, Dewan and Wares (2011:[3]) decry that the implementation of household TBCT under routine programmatic conditions is sub-minimal (Bloss et al 2012:1032). Besides, the workplace contact tracing needs improvement.

The cues to participating in the TBCT process apply similarly to effects of health education to individuals in households and workplaces. The HCWs, however, may unwittingly discourage the TB patients and their contacts in the manner in which they deliver routine health education activities. In a qualitative study, Paz-Soldan et al (2013:290) report a participant in Lima, Peru, who disliked the manner in which health education talks were organised in the clinic because, "… they give us talks that they should have given us at the start of treatment, like what tuberculosis is. Those who are starting should be separate from those of us who are finishing treatment". Such talks sound repetitive and bore a negative effect of not motivating participants in the TB control strategies.

When an individual realises the threat of the TB infection in the household or workplace, that [threat] prompts him or her to act in a way as to prevent it. According to studies done in Burke (2013a:2) and in Rosenstock, Stretcher and Becker (1988:175–183) the perception of susceptibility to TB motivates a TB contact to take the action of visiting a

health care facility and reporting their symptoms. In that way, the patient is thus participating in passive TBCT. In part, the media announcements and advertisements, most often from TB control programmes in ministries of health and other health organisations, play a role in prompting the realisation for the need for participating in the TBCT. They may be from friends, household and workplace members and they provide the individual with cues to action. Such cues, Burke (2013a:2) avers, and active involvement of individuals in all levels of community TB programmes: planning, implementation and evaluation would activate the individual's readiness to change attitude towards accepting to participate in the TBCT.

2.2.8 Self efficacy and likelihood to participating in tuberculosis contact tracing

2.2.8.1 Self efficacy of the individual in tuberculosis contact tracing

Once equipped with convincing information through cues, an individual becomes less complacent to risks of TB transmission (Johari et al 2014:25–26; Polit & Beck 2014:160). Further, his or her self-confidence, likelihood and ability to participate successfully in the TB control programmes such as TBCT, builds up. In a health-seeking behaviour study conducted in Esmael et al (2013:786), 12.30% of participants in Amhara Region, Ethiopia, accepted the TBCT. The study reports that the acceptance followed their searching and acquiring knowledge about the transmission of the TB from one person to another. Ospina et al (2012:158) report similar findings in a quasi-experimental study in Barcelona, Spain. According to the study, the positive change in attitude occurred following the provision of the TB innovation. The study sought to compare a pre-intervention period (2000–2002). The public health nurses carried out the TBCT in pre-intervention. An addition of community health workers (CHWs) improved the TBCT in the intervention period (2003– 2005). The study reports that the CHWs worked with 79.40% of the 388 participants in intervention population and increased the TBCT coverage from 55.40% in the pre-intervention period to 66.20% in the intervention period. The achievement is attributable to change of attitude by the TB patients and their contacts after receiving improved knowledge and support of the CHWs. The CHWs supported the public health nurses in active TBCT, health education sessions and community mobilisation. Consequently, the programme achieved the desired change in participant population attitude towards embracing the TBCT. Sometimes, however, the attitude and behaviour are unchanged after the individual

becomes aware of risks of the TB transmission and its adverse effects. In that case, it is important to weigh the benefits and barriers to see if they are worth participating in preventive measures such as the TBCT.

One may liken the benefits of participating in the TBCT for an individual to the correlation results of participating in a six-month follow-up treatment that Johari et al (2014:25–26) conducted in Iran. The study resulted in large-scale benefits. In the study, the correlation shows that there was a 0.35% significant association between the perceived benefits of the TB patients and their adopting healthy behaviours. Therefore, the training in the TBCT that portrays its benefits as outweighing perceived barriers enables the TB contact to see the worth of participating in the screening and possible treatment. It is the onus of the HCWs to portray to the community members, through awareness creation, the worth of the TBCT in order to envisage success in the programme.

Because of perceiving the benefits of knowledge of TB, the Project HOPE (2011) in Malawi reports that 63 000 community members participated in health education on TB, with 400 volunteers trained on the TBCT. Consequently, the TB treatment success rate in Mlanje and Phalombe districts increased from 60.0% to 86.0% in a five-year span and case fatality rate decreased from 20.0% to 11.0% during that time. This finding attests to the fact that the benefits of health education accrue with community involvement (WHO 2011:15–20).

It is encouraging to note that the collaboration of Baylor International Pediatric Aids Initiative (BIPAI) (BIPAI 2011) and Botswana MOH have trained more than188 HCWs through *KITSO* (Setswana word for knowledge). The *KITSO* is also an acronym for “Knowledge, Innovation, Training Shall Overcome” meaning that knowledge, innovation and training shall overcome the syndemic scourge of the TBHIV. From this cohort, 7.45% HCWs begun training others. They were mainly nurses (*n*=85), auxiliaries (*n*=30) and physicians (*n*=20). They had an added task of routine sputum inductions in their respective hospitals as part of their routine work. The BNTP, together with collaborators, regularly produce 15,000 pamphlets and 10,000 posters on TBHIV, written in Setswana and English, for free distribution in health centres in the country. The country may be harness such support mechanisms to incorporate the TBCT programme.

2.2.8.2 Self-efficacy in utilisation of household tuberculosis contact tracing

The knowledge of TB by the TB patients and their contacts may enhance or frustrate the TBCT efforts. Study findings in Golub and Dowdy (2013:856), Ospina et al (2012:158) and in Thind et al (2012a:1643) show that an infected, asymptomatic household TB contact (WHO 2012c:28) with little knowledge of TB may hardly see the need to visit a health facility for TB screening. Where there is no active TBCT, this may indicate a gap in the household TBCT. In a follow-up of contacts of smear positive PTB patients in the Netherlands, Kouw, Keizer, Mensen, Deutekom and Schim van der Loeff (2010:181) found that the prevalence of LTBI among contacts was 62.70%, and 68.40% of them had active TB. Furthermore, Abebe, Doherty, Wassie, Demissie, Mihret, Engers and Aseffa (2012:50) conducted a three-year prospective follow-up study of the TB contacts in Ethiopia. The study findings support the need for a shift from reliance on passive case finding. The shift is possible with planned and focused health education. By increasing the awareness of the TB during the study, it was possible to treat 13.80% of the household contacts with active TB at Butajira Hospital. That laid laying credence to the need to improve the TBCT actions utilised (Bloss et al 2012:1032). The study findings in Marks et al (2008:1069) show the experience with self-reporting TB contacts of a House Ballroom community in New York, USA. The study reports that with a 16.0% HIV prevalence, the number of self-reporting TB contacts who had TB was 1.40%. Similarly, a study on activity-based costing approach of contact tracing in Malaysia in Atif Sulaiman, Shafie, Ali and Asif (2012:40) found that the yield of passive TBCT was low at 0.50% in 2011. While urging for the need for improvement of the TBCT, Atif et al (2012:40) attribute the low yield to a passive self-reporting process of the TBCT. The report confirms the earlier findings in Sumeet, Kanchan and Sonal (2010). Using a cross-sectional study in Lao People's Democratic Republic, Nguyen, Odermatt, Slesak and Barennes (2009:5) found a 1.80% rate of new cases of adult household TB contacts needing treatment. Furthermore, Jones-Lopez et al (2013:1007–1015) report a similar experience among minority groups. The study found that, though cough aerosols of a minority 44.80% of 96 TB patients may produce MTB in aerosols, it still had a high prediction of TB transmission in the household. The study recommended its use in improving cost effective TB control programmes; thus justifying the need to strengthen household TBCT with more effective strategies.

Studies conducted in the SSA report similar research findings. In a prospective household contact tracing study of 2 700 contacts of 713 TB patients in Matlosana, South Africa, 88.0% were asymptomatic, Thind et al (2012a:1643) report, but there was a 10.0% yield of active TB. In a retrospective TBCT study in a rural South African community to determine the TB yield among household TB contacts, Thind et al (2013b:426) found that the household TBCT had a 3.10% TB yield out of 3 029 with 20.40% being smear positive and 76.30% being culture positive. In a similar study in South Africa, Shapiro et al (2012:1110–1116) reported in a community based TBCT that at least a case of undiagnosed TB was found in 19.0% of 727 contacts versus 1.0% of 312 control households, further showing the proportional value of planned and improved TBCT strategy.

Therefore, both studies show a rationale for the need to strengthen the TBCT in households and workplaces (WHO 2012c:29) alike. The household TBCT study in Botswana in Puryear et al (2013:1055) and that in Jeena (2015:20) have similar calls to use specific health education to improve the TBCT strategies.

Ekwueme et al (2014:1175) conducted a case control study to determine awareness and utilisation of the TBCT among 380 participants in Enugu, Nigeria. The study reports that the awareness of TBCT before intervention was 18.20% and rose to 85.20% post-intervention for the study group. In comparison, the awareness of TBCT for the control group was 18.40% at baseline and rose to only 26.0% at the end of the study. The study further found that the knowledge that the TBCT involved taking household TB contacts for screening was 44.90% for the study group and 19.20% for the control group at pre-intervention period. That increased to 85.80% and 20.90% for the study group and control group respectively at post-intervention. In a similar manner, 2.80% of the study and 3.50% of the control group brought two or more contacts for screening at pre-study. Hence, the percentages rose to 64.80% for the study group and 5.20% for the control group respectively. The study concluded with an improved awareness, self-efficacy and participation in the TBCT after planned health education was utilised. It is clear, therefore, that self-efficacy may improve with intensified health education for a more effective TBCT. In summary, the self-efficacy of individuals in the household TBCT depends on improved factors such as health education, knowledge and greater awareness.

2.2.8.3 Self efficacy in utilisation of workplace tuberculosis contact tracing

Various studies report the efficacy of workplace TBCT. Further, they suggest that its utilisation in the workplace could improve the TB control efforts. However, seldom do individuals utilise the workplace TBCT technique for various reasons.

In the study carried out in Vila Nova de Gaia, Portugal, Duarte et al (2012:55–59) found that active workplace TBCT identified more at risk contacts (8.4 per index patient) than interview (2.5 per index patient). It also improved uptake from 67.60% to 87.30% of identified workplace TB contacts. Thus showing that more contacts with active TB and LTBI were detected (1.4 per index patient compared with 0.75 per index patient previously). That is possible due to improved TB knowledge that enhanced self-efficacy among individuals who were contact traced.

Some parts of the SSA occasionally use the workplace TBCT. However, it is mainly in studies and projects in which the HCWs in TB control programmes conduct regular health visits to TB patients' workplace. The HCWs carry out the TBCT and screening with an aim to improve self-efficacy of workplace TB contacts. While discussing the risk of TB and resource availability, Golub and Dowdy (2013:858) state that the TBCT and screening is likely to have a great impact at individual level when targeted at risk groups. The risk groups include high-prevalence subpopulations such as contacts of active cases in health care settings like hospitals and congregate workplaces like prisons. In the discussion, Golub and Dowdy (2013:856–865) report that the enhanced contact tracing arm of the ZAMSTAR (Zambia/South Africa TB and AIDS Reduction) strategy in Zambia and South Africa was not as more effective as door-to-door contact tracing campaign. It probably failed to improve the self-efficacy among targeted participants. However, such innovations provide learning advances for improved strategies and individual self-efficacy in participating in the TBCT. While conducting active TBCT strategies in their studies in Zambia and South Africa, Corbett et al (2010:1244–1253) and Ayles, Muvoveta, Du Toit, Schaap, Floyd, Simwinga, Shanaube, Chishinga, Bond, Dunbar, De Haas, Analet, Gey van Pittius, Claassens, Fielding, Fenty, Sismanidis, Hayes, Beyers and Godfrey-Faussett (2013:1183–1194) had similar calls. Similarly, Buregyeya et al (2013:360), in a qualitative study on the attitude of the HCWs towards the TB control practices in Uganda, report a participant as saying "... it is not

possible here ...," citing environmental and spatial constraints and thus portraying lack of self-efficacy in strategies such as the TBCT.

In South Africa, Mwansa-Kambafwile et al (2013:[3]) report a successful implementation of the TBCT using paper slip. It further reported that, despite the 11.0% initial doubts, 98.0% of the contacts said that the strategy was a good way to inform the TB contacts. That was more useful especially in situations where home visits were not possible. It, therefore, may improve the efficacy of using the innovation in the workplace TBCT. This success, gives credence to the need to innovate the current TBCT strategy in order to reduce incidence of TB in Botswana.

With the high prevalence of TB in Botswana, Zafar, Huque, Husain, Akter, Akter and Newell (2012:1637–1642) call for the workplace TBCT that needs formalisation within the TB control programme. The study further reports that only do workers receive TB screening when they self-report at the health facilities seeking treatment of some occupational or other disease. In addition, Burke (2013a:2) and Rosenstock, Stretcher and Becker (1988:175-183) state that the HCWs might voluntarily go for screening when perceived threats of TB infection among other co-workers motivate them. As Burke (2013b:31–32) substantiates further, it reflects the passive TBCT process in which TB screening is often missed where a HCW in contact with a susceptible worker fails to carry out TB screening as well. The studies conducted in Golub and Dowdy (2013:856–865) and in Zafar et al (2012:1637–1642) evidently show that proactive identification and screening of workplace individuals with frequent and prolonged interactions (up to eight hours daily) with the TB co-workers is still as a felt need in many countries as indeed in Botswana.

2.2.8.4 Self-efficacy in utilisation of health facility tuberculosis

The knowledge of TB and ability to utilise it in the TBCT process varies in communities depending on age, knowledge and socio-economic factors. In Laxman and Torgal (2014:14), the findings of a cross-sectional study conducted in Belgaum District Hospital, India in 2013 attests to that. The study reports that among 400 participants: 60.50% males and 39.50% females, the level of knowledge of TB was almost similar in all age categories. Eighteen per cent of the participants in the age group 21–30 years had poor TB knowledge, 18.0% had average knowledge and 64.0% had good

knowledge. Further, Laxman and Torgal (2014:14–15) found that 30.10% of the participants had poor practice and 69.90% had average practice regarding the TB. The study shows a varying efficacy in TB knowledge as affected by age difference. Like in other studies, the investigators recommended innovative strategies to improve knowledge and awareness among TB contacts (Laxman & Torgal 2014:17). Such kind of insufficient knowledge of TB among individuals may achieve little success in utilising the TBCT strategies. Hence, there may be little data for evaluation and basis of advancement in TB control programmes. For example, while conducting a systematic review of studies to determine the effect of active TBCT, Fox, Dobler and Marks (2014:[1]) found that in one randomised controlled study, there was no sufficient data to evaluate a separate effect of active TBCT among TB contacts. That is due to the inclusion of other arms such as screening for LTBI and treatment of contacts in the study (Fox et al 2014:[1]).

Studies in the SSA show varied strategies of TBCT, often termed as TB follow-up. A cross sectional study in Ospina et al (2012:158) reports that the HCWs in the SSA, including Botswana, often utilised the health facility based TBCT, in the process of screening for TB among individuals who seek health care in the general outpatient clinic. In their studies, Golub and Dowdy (2013:856–865) and Jeena (2015:230) support this report.

As may be the case with the community members, the TB knowledge of the HCWs in the clinics may be similarly insufficient to implement effective TBCT. Study findings in Haasnoot et al (2010:903) in Tanzania report that adult Maasai had poorer TB knowledge compared to their youth. For example, the belief that TB was punishment from God by 32.0% of the study participants, is a factor that interferes with self-efficacy in health seeking behaviour, the TBCT and treatment: Haasnoot et al (2010:904) report that the belief and use of traditional medicine to cure TB the among the Maasai complicates their health seeking behaviour. The HCWs with little knowledge on TB often enhance such beliefs and practice. Consequently, that may lead to the traditional healers taking the key role of providing primary diagnosis among the TB patients yet they have no scientific knowledge about TB. This also shows lack of self-efficacy in the TB control efforts by the HCWs who have inadequate TB knowledge. The WHO (2013a:1–97) recommends that the screening of TB contact should include a thorough history, clinical examination, tuberculin test and or chest X-ray. Ekwueme et al

(2014:1175) emphasises the recommendations stating the improvement of health education to ensure self-efficacy. In a quasi-experimental study on the TBCT in Enugu, East Nigeria, Ekwueme et al (2014:1175) report a 15.84% significant difference in awareness of the TBCT in the study group pre-and-post health education intervention compared with the 3.31% of the control group with no health education component. The TB patients, too, Kigozi, Heunis, Wouters and Van den Berg (2012:[6]) add, would prefer to have the TB awareness improved. In 2008, a cross-sectional study in 61 primary health care facilities in the Free State, South Africa, in Kigozi et al (2012:[6]) report that 46.10% of TB patient participants expressed a need for increased dissemination of the TBHIV information by the HCWs to improve the self-efficacy in the TBCT activities. The report finds support in Omotowo et al (2012:451–456) that 67.80% of participants had not heard of the TBCT. However, 32.2% knew that contact tracing involved bringing for screening the household TB contacts. Consequently, 25.0% of the TB contacts brought for screening had contracted TB. The study further reported that the number was epidemiologically significant considering that one undetected case would infect 10–15 other persons per annum. The study further lends credence to the fact that knowledge of TB and strengthening of awareness with intensified health education influences self-efficacy in undertaking the TBCT (Ekwueme et al 2014:1175). Strengthening that awareness must focus on the TB patients, the TB contacts and the HCWS. A report in Cook et al (2012:293–298) describes HCWs who often focus on concentric-circle approach to contact tracing in which HCWs, routinely and passively record presenting symptoms of individual TB patients during interview process in clinics, which they posit is no longer recommended. In concurrence to the need to improve the TBCT techniques, Cook et al (2012:298) state that an interviewer with self-efficacy must be respectful and sensitive to patient concerns and beliefs about TB. The report states further that the comprehensive TBCT should incorporate education about TB and emphasise the confidentiality of the TBCT and investigations.

The instance of classic type of TBCT described in Cook et al (2012:298) is that the HCWs wait in health facilities for the clients. The HCWs might pick up signs and symptoms of TB in the ensuing health facility interviews (Botswana 2009:21). In the process, the HCWs may enrol the patient for further TB investigations. In Botswana (2011:12), one finds similar findings of the overly reliant stance on facility TBCT strategy, despite low yields. One example is in Bloss et al (2013:1031), the study conducted in Botswana in 2009.The study found a yield of only 0.18% of TB positive

screenings from 10 853 participants in public health facilities. The study and recommends innovative TBCT strategies that are more effective. Similarly, in Puryear et al (2013:1055) a follow-up of TB patients in Gaborone, Botswana recommends improvement in the TBCT, and hence self-efficacy, by the HCWs.

The studies suggest that an improved system of TBCT has a direct link with associated increased knowledge about TB in the general population. Moreover, that the individual self-efficacy in the workplace TBCT can improve is fact. The studies also show a possibility of significant levels of undetected LTBI among household and workplace TB contacts. That further justifies the need to review the TBCT policies for the HCWs to improve their self-efficacy in active and passive household and workplace TBCT. Puryear et al (2013:1055) add that the report increases the understanding of TB among the TB patients and their contacts in order to embrace the TBCT strategies with confidence. Such self-efficacy may enable the HCWs to realise the priority pillar in the new WHO (2015:18) focus of sustainable development goals (SDGs): systematic TBCT for early diagnosis and treatment (WHO 2015:18). The WHO (2015:12) is concerned that only 63.0% of new TB cases were recorded in 2014, and that 37.0% of the 9 600 000 patients were undiagnosed or not reported, casting doubts on the quality of care the TB patients received.

2.3 FACTORS ASSOCIATED WITH INTENTION TO PARTICIPATE IN TUBERCULOSIS CONTACT TRACING IN RELATION TO HEALTH BELIEF MODEL

The factors associated with intentions to participate in the TBCT include demographic and psychosocial, structural information about the programme, perceptions towards it, barriers and benefits.

2.3.1 Demographic, psychosocial and structural factors associated with intentions to participate in tuberculosis contact tracing

2.3.1.1 Demographic factors associated with intentions to participate in tuberculosis contact tracing

Demographic factors such as gender, living conditions and socio-economic status differently determine individual's intention to participate in the TBCT activities.

Family spokespersons vary from community to community, could be either males or females whose power controls sensitive household information and decisions. A HCW may encounter such factors may during the TBCT activities. A cross-sectional study conducted to determine TB risk factors in Nepal in Gyawali et al (2012:304) found that being an immediate relative to a TB patient was a 4.85% risk factor for the TB infection among contacts since they depended on relatives who determined their intentions to participate in the TBCT. In some communities, males do not allow their spouses to make decisions. For instance, Haasnoot et al (2010:903) report that in Tanzania, East Africa, the Maasai men play a dominant role over women and make decisions concerning the family. Subsequently, males are the only ones who speak to strangers such as interviewers in TBCT. In another study to determine factors leading to following TB treatment in Dar es Salaam, Nissen et al (2012:40183) quoted a participant as saying, "... others tell us that their husbands don't like them to come here, and others refuse consent due to the problem, that their husband is not here ...". However, the opposite is the norm in some communities where females take the lead in health decision-making for the family. For instance, Oluwadare and Bosede (2010:195) reported that for men in Ekiti, Nigeria, their respective spouses have significant voice in decision-making; for women, their respective parents and in-laws have a significant dominance in decision-making. In support, Hargreaves et al (2011:655) argue that some social opportunities have created gender partnerships characterised by power inequalities between male and female partners. Such power inequalities may determine the type of TBCT practice to use.

Living conditions and environments such as slum dwellings, feeding of families and socio-economic status determine the effectiveness of TBCT. The TB patients in low socio-economic status, for example, face time and financial constraints that prevent them from participating in the TBCT process. A simple explanation is that most of the time is spent catering for family livelihood leaving no time for the TBCT activities. For instance, Gyawali et al (2012:304) found that in Nepal slum dwelling was 4.56% risk factor of TB contacts and that affected TB control strategies including contact tracing. Further to this, Hargreaves et al (2011:655) documented conditions that facilitate unequal distributions of important social determinants of TB, including poor housing and living environmental conditions, food insecurity and malnutrition, financial and cultural challenges that deter individuals to participating in TB control strategies such as TBCT. On the contrary, individuals with regular income are better able to participate in TB

control strategies. Thus, socio-economic status is closely associated with intentions to participate in TB control such as the TBCT. Such factors need consideration in designing TBCT strategies that are more effective.

In summary, many demographic factors that are associated with individual's intentions to utilise the TBCT services are cited in the literature. These factors include family socio-economic status and decision making, education and literacy levels, housing and living environments, distance from TB clinics, and experience of having personal contact with friends or relatives with TB, marital status, and cultural beliefs. A more effective TBCT strategy must take into cognisance such factors in order to reduce further the morbidity and mortality rates of TB.

2.3.1.2 Psychosocial factors associated with intention to participate in tuberculosis contact tracing

The psychosocial milieu of TB patients and their contacts determine their lifestyle in the community. This is due to the interaction with fellow community members and their influence on opinion about health and the actions and strategies they use to respond to tuberculosis infection. The effect of such interaction, Courtwright and Turner (2010:35–36) explain, is attitude towards TB and TB control efforts such as contact tracing. The attitude that the community approves may negate or support the TBCT activities.

Studies have shown that a poor provider attitude, such as scolding a TB patient for missing opportunities results in non-adherence. For example, Hargreaves et al (2011:655–656) explain that individuals with TB symptoms like persistent cough often face psychosocial barriers, including fear of stigma, that may discourage them from participating in TB control measures. Poor guidance such as authoritative, confrontational HCWs (Govender & Mash 2009:516) may exacerbate the barrier which may only increase resistance and reduce the motivation to participate in TB control strategies. One TB patient in Vanuatu, Viney et al (2014:[7]) report, commented of a defaulter fellow TB patient who went home upon feeling better before completing treatment, "... If you go home and feel worse, then come back to the hospital for treatment, what will you say to the nurses?" This pertains to the scolding attitude of some HCWs. In South Africa, Govender and Mash (2009:515) found that depression scored a mean 7.14% among non-adherents than those who adhered with a mean

score of 2.55%. Courtwright & Turner (2010:36) report that the TB stigma in Ghana led to prohibition of TB infected patients from selling goods in public markets and attending community events. The study notes that stigma results in a sense of shame, guilt and self-isolation as the individual internalises their community's negative judgements about TB. In Vanuatu, Viney et al (2014:[9]) quoted one of the 74.0% stigmatised study participants as saying, "When I was sick, I didn't go to "nakamal" [traditional meeting place in Vanuatu Island in the Pacific] meetings and church because of my cough". The tendency to isolate oneself is corroborated further in Courtwright & Turner (2010:37) and in Freitas et al (2012:647) who report that the thought of TB lead many individuals to defer their visit to TB clinics for fear of diagnosis, negative representation of TB in the community and the fear to be labelled as "TB patient" by the HCWs.

In Govender and Mash (2009:516), eliciting, acknowledging and discussing patient's beliefs, health status and concerns, can significantly improve acceptance of the TBCT programmes. In this regard, Hargreaves et al (2011:654) state further that the circumstances under which TB patients and their contacts grow, live, work and age are enabling factors that needed action. When such circumstances are improved, there is an improvement in acceptance of the TBCT efforts. The relationship of the TB contact with HCWs, Govender and Mash (2009:515) add, that utilises a holistic approach recognises that TB patients have personal and contextual issues in addition to clinical concerns. In addition, Paz-Soldan et al (2013:290) quoted a study participant, as saying of a nurse, "... [Name withheld] is a very happy nurse, youthful, gives you the feeling you can ask her anything ... she asks you how you have been ... gets more involved in your life ..."

2.3.1.3 Structural factors associated with intention to participate in tuberculosis contact tracing

The knowledge about TB disease, its cause, transmission, prevention to include contact tracing can improve intentions to participate in the TBCT. In a case-control study to evaluate knowledge of TBCT in Nigeria, Ekwueme et al (2014:1175) found that 43.20% of the study group and 32.0% of the control group did not know that a mycobacterium caused TB. However, 44.90% of the study group and 19.20% of the control group knew that they should bring their household members to the clinic for screening. This shows the need and importance of health education to improve the TBCT. This report concurs

with that of a similar study in South Eastern Nigeria in Omotowo et al (2012:451–456) who report that 37.60% of the participants knew that bacteria caused TB and 37.90% knew that mode of transmission of TB is airborne. However, 27.90% believed that the consumption of infected cow milk caused TB and 55.20% stated that transmission was through contact with a TB patient. The knowledge about routes of TB transmission may not only contribute to dispelling the TB stigma (Courtwright & Turner 2010:36) but also facilitates acceptance and demand for control and preventive measures such as the TBCT. A case in point is in Viney et al (2014:[7]) in Vanuatu where a participants said, "... if there is awareness about TB people will know and be proud that TB can be treated". Another participant, while recommending health education to improve the TBCT, Paz-Soldan et al (2013:290) add, suggested involvement of the patients with experience of TB infection because "... former patient knows what the patients feels like. They know better than anyone ...". Such opinions are vital for informing health care systems in formulating socially acceptable TBCT policy structures and strategies. Besides, Ekwueme et al (2014:1175) decry the fact that in practice, the TBCT health education is minimal and unplanned. Sporadic dissemination of health information to patients with little documentation of patient's educational progress suffer lack of effective enforcement, coordination and largely depends on the whims and inclinations of each specific team of the HCWs on shift of duty. This portends fragmentation of the TBCT services and subsequent failure. The contrary is true of a planned, supported and supervised TBCT implementation and evaluation.

In Hargreaves et al (2011:655), a country's national TB control guidelines must provide for policy structures with guidelines that implement component 5 of the WHO (2015:17): empowerment of people with TB and communities through partnership especially in harnessing their opinions about health programmes, in this case, the TBCT. Once the HCWs understand a policy and the community accepts it, there will be a feeling of intention to implement a TBCT process or strengthen existing processes with the aim of enabling the TB patients and their contacts to utilise it. This would enable them to acquire knowledge and accurate information about TB and the TBCT and build the skills needed to motivate them to participate in the TBCT.

Consequently, out of demand, the intention to design and construct a TB facility or modify the existing TB structures that accommodate the TBCT programmes will arise

from the community, thus creating linkage of communities with the TB programme for mutual understanding in the TBCT activities.

2.3.1.4 Knowledge of tuberculosis contact tracing

This section presents literature review on the TB patents' knowledge about the TBCT. The knowledge includes perception of its implementation, how it would influence the perception and intention of the individual' to participate in it.

As defined in Ekwueme et al (2014:1175) the TBCT is the identification and screening of a person who has been in contact with a PTB patient. It can be active TBCT in that the HCW would visit the family of the TB patient and keep a contact register. Conversely, in passive TBCT the HCW gives health education to each TB patient with an aim of motivating him or her to bring his or her contacts to the health facility. The basic knowledge of the TBCT increases an individual's intention to participate in the TBCT. The level of education influences knowledge of the TBCT and is positively associated with intentions to participate in TB preventive and control programmes such as the TBCT.

The knowledge and understanding of the TBCT varies from different TB patients and their contacts to the HCWs. In a TBCT study in Nigeria, Ekwueme et al (2014:1175) attribute the low awareness of observed contact tracing to inadequate routine TB health education, differences in prior exposures and experiences. In the study, the intervention group had a statistically significant (65.30%) difference in the knowledge of TBCT at baseline, 79 individuals and 151 after health education intervention.

The experience of TB infection and effects of illness may influence the knowledge of the TB patients about TBCT. Their experience with the TB infection offers a more meaningful understanding of the importance and purpose of the TBCT for their overall recovery and welfare. Their understanding might, however, be marred by stigma. For example, Mwansa-Kambafwile et al (2013:[3]) report of the paper slip form of contact tracing in South Africa that 11.0% of the TB contacts were annoyed when they first received the paper slips. This could be due to little knowledge of it as one participant said he was shocked when, "… I was asked to take slips. It was as if I was asked to announce to the whole world. The whole thing was too scary". Such misconceptions

might demotivate the individuals a little from participating in the TBCT efforts. However, the attitude changed to positive after health education and an experience of screening. Consequently, as Mwansa-Kambafwile et al (2013:[3]) state, the uptake was 98.0%, as the TB contacts understood the TBCT from the point of view of information received from other TB patients and the HCWs. The finding lends its support in Meidany, Radebe, Ganie, Yose, Fynn, Mdabe, Behle, Rahmani, Makhaye and Carter (2011:26). Meidany et al (2011:16) report a TBCT success rate of 22.30% after 3 542 TBCT slips were issued to the contacts of 1 499 TB patients. Meidany et al (2011:26) report further that 791 TB contacts were contact traced and screened for TB.

On the other hand, the HCWs must understand the TBCT from implementation of the national TB programme policy and scientific knowledge as professionals. However, as Bristow et al (2013:6), in a TB tracer team study in South Africa, found that a range of 50.0% to 59.30% of HCWs was knowledgeable about TB prevention processes including contact tracing. It clearly shows that 40.70% to 50.0% of HCWs need this education themselves. In Botswana, Tlale, Molefi, Masupe, Kgosiesele, Tshikuka and Steenhoff (2015:10–15), in a study of knowledge and perception of TBCT among the HCWs in Kweneng District found that 60.0% of them had been trained. However, Tlale et al noted that 54% of them did not know the TBCT policy and recommended that further study was a felt need in Botswana.

2.3.2 Perceived impact of tuberculosis contact tracing

This section reviews literature on the depth of involvement in the TBCT by the HCWs, the TB patients and TB contacts. It also reviews the effectiveness of their actions on TBCT. In addition, it reviews the impact of the TB case identification rate attributable to active and passive TBCT actions and the level of involvement in planning, implementation and evaluation of the programme where it exists. The indicators of the TBCT include the rates of identification and assessment of contacts by specific contact tracing strategy by the HCWs, TB patients and their contacts.

2.3.2.1 Knowledge about the role of tuberculosis contact tracing in detection of latent tuberculosis infection

The WHO (2014) underscores the TBCT as cheap, affordable and acceptable preventive measure in identification of the LTBI and urges countries to adopt it. It is common knowledge that adequate knowledge about the cause of TB and its transmission are an impetus to favourable attitude and prevention behaviour among TB patients and contacts. Lack of this knowledge, therefore, hinders appropriate prevention practices. In the Ekwueme et al (2014:1175) study, the TB patients and contacts had poor knowledge of causes and transmission of TB: evils spirits and food poisoning, leading to inappropriate and delayed health seeking behaviour.

2.3.2.2 Implementation of tuberculosis contact tracing

Not many settings use the TBCT measure in the standard required. In attestation to this claim, Ekwueme et al (2014:1175) in the study on TBCT, report that where the programme is implemented, it is haphazard, lacks standardised protocols and at the whims of the implementing teams. It reflects the poor knowledge of it, lack of support and logistics and monitoring and evaluation by implementing HCWs. Consequently, the programmes cannot effectively evaluate it since its indicators may not be statistically attributable to its implementation.

In a study on household door-to-door TBCT campaign in Nunavut, Alvarez et al (2014:[4]) found an overall yield of TB among contacts as 18.80%. The yield had a 34.0% relative increase in the Iqaluit community, implying an initial low knowledge. In Vietnam, Jeena (2015:19) reports that the TBCT and symptomatic screening yielded an incidence of 0.18% and a prevalence of 0.70%; while in Botswana, 548 contacts of 163 TB patients were screened resulting in TB rate of 2.20%, the number needed to contact trace being 13.6 for one TB patient. Although WHO (2014) recommends a simple TBCT strategy at primary level, the study suggests the use of molecular tool especially for children. The study assessed the efficacy of point-of-care Xpert MTB/RIF screening at primary health facilities in southern Africa in a bid to strengthen efforts of the TBCT, Theron, Zijenah, Chanda, Clowes, Rachow, Lesosky, Bara, Mungofa, Pai, Hoelscher, Dowdy, Pym, Mwaba, Mason, Peter and Dhedan (2014:434) support this finding

because it is quick and highly reliable. This may portray that the seriousness of TB is at a stage that needed a quick-fix strategy.

In summary, there is low knowledge of the TBCT, especially in developing countries. For effectiveness of the programme, there is need for the HCWs to health educate the TB patients and their contacts about the TBCT. In support, Alvarez et al (2014:[4]) recommends innovative awareness through health education, while contact tracing remained a cornerstone of TB prevention.

2.3.3 Perceived benefits of tuberculosis contact tracing

This section reviews the individual and programme benefits of the TBCT, as they would translate into household and community benefits. The perception of benefits of TB contacts tracing to individuals, households, the community, workplace and the nation is important. The perception provides the impetus for maintaining the TBCT programme.

2.3.3.1 Benefits of tuberculosis contact tracing and screening

When an individual TB contact perceives of the benefits of the TBCT programme as early identification of the newly infected persons he or she would readily participate in the TBCT. Hence, the person would potentially receive early treatment and have good prognosis. The TBCT offers early identification of the TB patients or contacts that may benefit from prompt treatment, and who might otherwise continue to transmit infection in the community and worsen the disease morbidity. For example in South Africa, the report in Mwansa-Kambafwile et al (2013:[5]) show that active TBCT by both door-to-door visits and community screening using mobile van showed reduction in the prevalence of TB from 0.67% for adults to 0.38%. The study findings in Kenya in Van't Hoog et al (2011:1245–1253) corroborate the results. In the study, Van’t Hoog et al (2011:1245–1253) found 64.0% of undiagnosed, untreated TB patients in Western Kenya and warned that those patients could transmit TB to many other people if they were not effectively traced and treated.

Since TBCT mainly targets the asymptomatic LTBI contacts, a more effective TBCT and rapid access to treatment may shorten the TB transmission period (Mwansa-Kambafwile et al 2013:[5]). The TBCT also motivates individuals to identify early their

TB patients by the cardinal symptoms and promptly take them to health facilities for treatment. When the household members know the benefits of the TBCT to include reduced transmissibility of MTB, and the saved time that one could spent in illness, the household individuals would most likely encourage one another to participate in preventive strategies such as the TBCT. Nissen et al (2012:40183) report a case in point while assessing TB treatment adherence in Tanzania. The study quotes one of the participants who confessed, *"… what motivated me to take her is her chest... and since they are doing tests, I had to take her ..."*.

In the course of conducting TBCT, the HCWS may also pass health education messages alongside it through face-to-face talks with the TB patients and their contacts. This may provide an opportunity to the close contacts of TB patients to ask pertinent questions and receive responses in their immediate environment. However, Mwansa-Kambafwile et al (2013:[4]) argue that a TBCT that uses home visits to trace contacts may be unpopular due to the discomfort the visits cause to the TB patients at home. Therefore, it is necessary to exercise caution to ensure institution of a socially acceptable TBCT program. That may be better facilitated by the HCWs who themselves must improve their perception of the benefits of the TBCT in planning, implementation and evaluation.

2.3.4 Perceived barriers to tuberculosis contact tracing

The barriers to the TBCT may be intrinsic or extrinsic. The literacy rates and individual beliefs and attitude often mar intrinsic factors. The health care systems, socio-economic and environmental challenges often cause the extrinsic ones. Little participation in the TBCT among TB patients causes weak linkage between the HCWs and the community. That may lead to weak TBCT actions. For instance, Nissen et al (2012:40183) report challenges to follow-up in Tanzania. The study notes the sentiments of one participant who *"… simply didn't understand ... why they did not give me an appointment date for going back there ..."*. Poor communication strategies such as this may cause failure in programmes like the TBCT.

Low literacy levels may contribute to poor discernment of health messages related to importance of the TBCT and thus lead to low uptake among TB patients and their contacts. In Nepal, for example, Gyawali et al (2012:304) link illiteracy to incidence of

TB among the household TB patients and their household TB contacts 5.77% of the time.

Socio-economic factors such as joblessness and poverty and may make it difficult for the TB patients and their contacts to give time for the TBCT activities. They spent most of the time in livelihood endeavours. During the TBCT study in KwaZulu-Natal, Mwansa-Kambafwile et al (2013:[4]) noted a participant who lamented, "... I told my partner and gave him the paper slip, he didn't go to the clinic, saying he was too busy to go during the week, and clinics are closed on weekends". In support of this statement, Hargreaves et al (2011:655) report "... lack of hope for the future, driven by poverty ..." as undermining the TB control measures including the TBCT.

Confinement such as imprisonment is a barrier, owing to strict separation of prisoners and difficult accessibility, for any TBCT exercises. In a study to determine the effectiveness of TB control measures such as contact tracing in Cameroon, Noeske, Ndi, Amogou Elo and Mfondih (2014:209–211) report that among 3 219 prisoners traced, 1.20% (40) new TB contacts were missed by prison TB control programme. The missed opportunity was positively associated with severe overcrowding and previous TB treatment (O'Grady, Hoelscher, Atun, Bates, Mwaba, Kabata, Ferrara, Maeurer, Zumla 2011:173–178). However, in a prospective study Noeske et al (2014:209–211) warn that even a substantial increase in TB detection and treatment rates has little effect on the overall reduction of TB incidence as long as prisons continue to be congregate centres of TB transmission. That is indicative of the need to design more innovative ways of the TBCT.

High mobility related to work and social commitments among TB patients may lead to loss of trace, thus weakening the TBCT activities. One example of this statement is the report in Nissen et al (2012:40183) that 77.0% of participants travelled at the time they were traced in the village, thus defaulting treatment due to feeling well. That further validates the need to expand and enhance the use of modern communication technology such as mobile phones. The strategy takes care of the individuals who travel during the TBCT process and be enlisted in the nearest TBCT programme (Ndlovu et al 2014:275; Sylla et al 2012:46–63). In summary, the HCWs need to understand better and plan for the challenges of barriers in the TBCT strategies.

2.3.4.1 Stigma, embarrassment and fear in tuberculosis contact tracing

Stigma and a feeling of embarrassment pose a major barrier to the TBCT and may lead TB patients to hide their TB status from their families. In a meta-analysis of TB stigma, Courtwright and Turner (2010:36) aver that it often result in guilt feelings or shame, leading to self-isolation. Paz-Soldan et al (2013:290) found that participants in Lima, Peru described increased social isolation while on TB treatment. In relation to this, Mwansa-Kambafwile et al (2013:[4]) quotes a participant who felt stigmatised to participate in the TBCT slips because, *"*... I didn't want people to know my illness. I even wanted to come and take my medicine from the clinic so that people won't see ...*".* Such feelings deter TB contacts from accessing screening services because they might fear discouraging comments from HCWs and others particularly those in their residential vicinity.

Stigma, as stated in Courtwright and Turner (2010:757) reduces the bearer from a usual person to a tainted, discounted one. In this regard, stigma commonly results from a transformation of the body, blemish of the individual character, or membership of a despised group. Many communicable diseases, Courtwright and Turner (2010:38) explain, such as TB and HIV/AIDS, are associated with stigma and discrimination. The study adds that the commonest cause of TB stigma is the perceived risk of contracting the disease from a TB-infected individual in a susceptible community. Consequently, the TBCT programme is fraught with feelings of stigma, embarrassment and fear among the TB patients, their contacts and even HCWs. Qualitative studies, Courtwright and Turner (2010:37) state, have recorded examples of such feelings. According to the study in Mwansa-Kambafwile (2013:[4]), a participant confessed, *"*I threw away some slips after my housemates told me that I should not involve them and should deal with my illness alone. So I didn't even take slips to most other people I spend time with". Consequently, Dodor et al (2012:211–218) warn that the TB patients and their contacts may exhibit feelings of being exposed to the public to be looked down upon with disdain that goes with TB stigma in certain communities. The presence of myths and traditional beliefs surrounding TB may reinforce such a feeling. The stigma on TB disease, and hence on TB patients, may extend to those in the TBCT as well, Dodor et al (2012:211–218) postulates. The indicators for such stigma, Courtwright and Turner (2010:35) add, include social isolation, reduced frequency of interaction with community members (Mwansa-Kambafwile et al 2013:[4]), exclusion from consultative community meetings,

and denial of certain public services for fear of risk of transmission (Viney et al 2014:[7]).

The ramifications of stigma are fear and poor or no TBCT activities that will be carried out in a community. Therefore, the national TBCT policy might risk implementation frustrations; high costs of implementation, ineffectiveness and consequential failure.

2.3.4.2 Socio-economic barriers in tuberculosis contact tracing

Socio-economic and employment status continue to be a barrier in utilisation of health services, including the TBCT. The TB patients and their contacts in low socio-economic status find it difficult to participate in the TBCT if they have to spend much time eking out a living. That is because their livelihood takes precedence of any other work. In a study conducted in Deery et al (2014:535) in South Africa, the reasons why 65.0% of households were not traceable included 508 of households in which no one was home. The study reports that it was partly due to the 19.50% of TB patient having moved or migrated and partly due to 27.40% of household members being at work eking out a living. Several socio-economic challenges in Govender and Mash (2009:513) include 37.0% household members with no income. The study points out that the main reason was that 80.0% of them were unemployed. Thus, food insecurity was a problem for 42.0%. The study reports that transport to hospital was a challenge for 79.0% of the participants who used taxi and for 20.0% of those who walked. Courtwright and Turner (2010:36) add that the fear of loss of jobs and reduced income may prompt TB patients not to participate in the TBCT; hence, they do not seek treatment. Instead, the individuals spend most of the time fending for household income and food security even when the TB symptoms like persistent coughing are obvious. As Hargreaves et al (2011:655) put it; individuals with persistent cough often face socio-economic barriers like difficulties in transport to health facilities and fear of stigma. Hence, that stigma delays their contact with the HCWs.

If the TBCT programme must remain strong, the planners must cater for the basic economic needs of the participants to a level they can spare time for the programme. O'Mara, Marrero-Guillamon, Jamal, Lehmann, Cooper and Lorenc (2010:76) did a systematic study of qualitative evidence on the factors that affect the uptake of TBCT. The study reports a 53 year old male participant who was afraid to go for screening

saying, "I was thinking about may be not going … like hide or, you know, just not going ...". That explains that there was an unmet need that made the participant to hesitate and it needed a sufficient mitigation. A TB follow-up programme in Dar es Salaam, Tanzania identified transport costs as a challenge among participants. The programme tried to mitigate the transport challenge by providing fare for transport but it was reportedly insufficient as one participant said: "There was fuel hike and bus fare was raised. That is why I did not go back ....". That thus provides a pointer to macro-economic barriers that need to be addressed at national policy level. That would create enablers for individuals to participate in such prevention and control programmes as the TBCT, screening and treatment.

On the national scale, the WHO (2014) cautions that adequate budgetary lines are among the measures that determine the success or failure of any TB control strategies like the TBCT. When the national TBCT budget is insufficient, Shrivastava (2014:1) adds, a cascade of logistic barriers seep into the programme. The items and services that depend on logistics may experience operational difficulties that slow down the implementation of the programme. For example, the training of the HCWs in the TBCT may be insufficient or non-existent where the human resource development budget is inadequate. Where little training exists, Stapledon and Viney (2010:13) warns, there would be little knowledge in implementation of processes that are necessary for effective TBCT; and where finances are limited, logistics for follow-up would be an implementation barrier. For example in Uganda, Buregyeya et al (2013:360) observed that 90.0% of the health facilities did not perform TB contact screening, mainly attributable to insufficient HCWs training and logistic support. Similarly, in a cross-sectional study on TB management modalities in India Yadav, Gag, Chopra, Bapai, Bano, Jain and Kumar (2013:161–163) found that 56.50% of private physicians in Meerut had not had education on new national TB policy guidelines and only 33.10% were aware of the International Standards of Tuberculosis care to include the TBCT and treatment.

2.3.4.3 Private and traditional health care providers and tuberculosis contact tracing

According to the HBM, an individual's perception about health influences his or her intentions to act relative to those perceptions (Champion & Skinner 2008:45–65). One

of the long-standing barriers of the TBCT is the perception that private practitioners and traditional medicine offer better health care services. Sometimes TB patients and their contacts enrol with a private health system for follow-up and treatment of TB. The private practitioners may not follow national guidelines for the TBCT (Tafuma et al 2014:[4]; Yadav et al 2013:161–163). They cite various reasons such as risk of losing follow-up of the patient. That may result in loss to TBCT and worsening the illness. Similarly, for traditional medicine programmes, an informal pattern of follow-up strategy is set up with the traditional healer whose programme competes with the national TBCT guidelines. In a cross-sectional study in rural India, Satyanarayana, Nair, Chadha, Shivashankar, Sharma, Yadav, Mohanty, Kamineni, Wilson, Harries and Dewan (2011:[4]) found that over 50.0% of patients were accessing TB care services outside of registered TB outlets. Buregyeya et al (2011:940) conducted a study to seek data that may inform design of appropriate communication and social mobilisation of TB control strategies, such as the TBCT, in 2008 in Iganga/Mayuge, Uganda. The assessment found that TB contacts with threatening TB symptoms preferred to seek treatment from traditional healers because, as one participant put it, "traditional healers handle patients in a friendly manner, unlike government facilities". Another participant reasoned that some people visit the traditional healers because they, "*...* prefer their medicine. In the health facility they can give a TB patient a total dose of 2000 tablets or 1000 injections ... so some people would prefer to go to traditional healers*".* That, according to HBM, most likely happens when the person's perceptions and myths about TB seem to convince the individual more than the formal TBCT does (Champion & Skinner 2008:45–65). It also happens when it is easier to follow-up with the traditional healer's prescriptions of activities than those of the HCWs in the TB clinics. The time allocated to such a pattern competes with the time required of the TB patient to participate in formal and scientifically tested TBCT enshrined in the national TB policy. At times, a TBCT participant may try to follow both systems and ends up with no success in any. There is, therefore, lack of a continued comprehensive TBCT health education that brings together HCWs in public and private TB programmes and traditional healers (Yadav et al 2013:161–163).

2.3.5 Cues to participating in tuberculosis contact tracing

This section reviews various cues to participating in the TBCT. The review will include knowledge of TB, perception of obstacles in the TBCT, costs involved, previous effects and treatment of TB and intentions to seek TB treatment.

In a study on factors associated with intentions to seek health care for TB symptoms among 1 137 high school learners in South Africa, Naidoo and Taylor (2013:[3]) found that participants who knew that TB was transmitted when an individual coughs were significantly (1.56%) more likely to take their contacts with TB symptoms for screening. Similarly, the participants who knew that coughing for more than three weeks (2.33%) and night sweats (3.12%) were TB symptoms were significantly more likely to intend to take a family member to a health facility if they had TB symptoms. This underlines the importance of knowledge of TB in enhancing the probability that an individual would take action, including the TBCT.

The perception of obstacles in the TBCT gauges the individual's probability of taking the action of participating in its process. One of the considerations to weigh is the cost involved in the TBCT and treatment. That may include finances for transport to a health facility, or attend TBCT meetings, the time it may take and the opportunity cost of not going to work in order to avail time for the TBCT. A few examples are pointers to the costs involved. While conducting a household TBCT study in India, Satyanarayan et al (2011:4) found that 80.0% of TB patients were from households with a total income of less than Indian Rupees (INR) 4 000 ($89.00) per month. Such meagre incomes were mainly to cater for the households' food security with little left for any other functions including transport to health facilities. In Lima, Peru, Paz-Soldan et al (2013:290) show economic hindrances such as transportation costs that compete with participating in TB control strategies. Yet in another study to evaluate household TBCT among 1 850 participants in South Africa in 2012, Deery et al (2014:535) report that it was not possible to contact trace 778 patients due to failure to locate their address due to 30.70% of them moving and 65.30% not being home during working hours. The study adds that most of the participants lived in humble housing and 68.50% were unemployed, 81.0% lacked money for food and 48.30% of them lived on less than $6.00 per day.

Previous hospitalisation and treatment of the TB patients and contacts provides a cue for individual judgement as to whether the TBCT and early treatment is a better option than hospitalisation. One example of this need is in Paz-Soldan et al (2013:290) who found that several participants suggested asking people who were previous sufferers of TB to work as peer health educators. The objective was so that they could build positive relationships with patients and teach them from the point of view of their own TB experiences.

The manner in which individuals seek professional help for self if TB is suspected or for a suspected TB sufferer is suggestive of the probability of intentions and actual behaviour of participating in any of the TBCT strategies. In this regard, Nissen et al (2012:40183) in a qualitative study in Tanzania cite a participant who was motivated to take her TB infected child for screening because, *"*... I will get to know my child's health status ...*"*. Further, it also involves willingness to refer or supervise the treatment of a TB recidivist. In support of this, Nissen et al (2012:40183) report the usefulness of the CHWs who aided in referral of the TB suspects. According to Nissen et al (2011:40183), one mother of a sick child confirmed, *"*... that lady who is our village health worker came here and took the child ... for tests ...*"*. Such probability to participate in the TBCT includes the intention not to conceal the TB infection under any circumstances.

The individual knowledge of TB and the symptoms and transmission enhance the cue to action. Health education and awareness creation about TB are avenues for achieving that. The aim is to improve the skills that the individuals who required motivation to bring their TB contacts for screening and treatment if possible. In the study on the TBCT in Enugu, Nigeria, Ekwueme et al (2014:1175) add that the cue to participate in the TBCT may be achievable through a planned health education programme. The authors argue further that the cue to participation requires changing personal factors and value system re-orientation. The personal factors such as self-efficacy (perceived ability/competency), attitude (beliefs and values about the outcome of behaviour) and social norms are examples.

Furthermore, the WHO recommends that TBCT guidelines must be written down (WHO. 2012:40) and availed to CHWs so as to promote intentions to implement them (Kliner, Knight, Elston, Humphreys, Mamvura, Wright & Walley 2013:299–303). The CHWs' staff training and development (WHO. 2012:42) is envisaged to strengthen the TBCT

process whose content, Ekwueme et al (2014:1175) suggest, could include meaning and importance of TB, risk factors, signs and symptoms of TB. Further, it should include modes of transmission, spread and control, benefits of early detection, diagnosis and treatment, dangers of untreated cases of TB, fallacies associated with TB, the TBCT and the framework for attitudinal and behavioural changes towards community health and TB patients.

In the TBCT awareness, the passing of knowledge through interdisciplinary and consultative meetings, community based seminars and conferences, focused media advertisements and involvement may prompt concerted TBCT actions between the HCWs on the one hand, and the TB patients and their contacts on the other. Appropriate and adequate information sharing about TBCT is still little and operational research is a necessity. Among the objectives of the research is to inform policy and strengthen cues to action. The study in Hargreaves et al (2011:660) decries the fact that currently, *"*... little evidence is available ... We believe now is the time for a rapid scale up of innovation, action ... in this area ...*"*.

2.4 SUMMARY

The literature review takes cognisance of the TB contacts tracing processes and activities of TB patients and their contacts alongside of the HBM. The review also takes cognisance of the activities of the HCWs. In addition, it has espoused the activities of the TBCT in line with the components of the HBM.

2.4.1 Perceptions with regard to the tuberculosis contact tracing

The literature reviewed perceptions about the TBCT from the perspective of the TB patients and their contacts. The perceptions vary according to differences in their understanding of the meaning of TB, cause, its transmission, the strategies of prevention and treatment (Haasnoot et al 2010:903), and in their sources of knowing (Buregyeya et al 2011:939). The literature shows further the effects of the perceptions in their actions and seriousness pertaining to the TB and TBCT process.

2.4.2 Modifying factors and resources in tuberculosis contact tracing

The literature review showed various factors that affect the TBCT strategy in TB control efforts. It also shows that communication strategies, knowledge and literacy level, and socio-economic status of the TB patients and their contacts are critical in the TBCT process. Moreover, the literature portrays supportive health systems, HCWs, health education and guidelines as modifying factors in adoption of positive behaviour change and beliefs for proactive TBCT.

Enhanced TB patient tracing for the identification of contacts is not yet a priority screening strategy in Botswana. For instance, the use of cellular phones (Botswana 2009:10; Botswana 2011a:13) is not fully utilised as one of the feasible ways of harnessing tracing resources (Botswana 2011a:13; Ndlovu et al 2014:275) in the TBCT. The mobile network, however, has 90.0% nationwide use in households and workplace. As such Ha, Littman-Quinn, Antwi, Seropola, Green, Tesfalul, Ho-Foster, Luberti, Holmes, Steenhoff and Kovarik (2013:1188) and Ndlovu et al (2014:275) suggest that cellular phones could prove useful in the TBCT in Botswana where the CHWs could transmit data to health facilities. This may provide an opportunity to suggest for its formalisation and use. The factors portray clearly as determinants of the perceptions and actions of the TB patients, their contacts and the HCWs about the TBCT processes.

The literature further shows the cues to participating in the TBCT process as response of the TB patients, the TB contacts and the HCWs to the perceived threat of the TB scourge. It also shows that the cues include past TB infection experiences, living with a TB infected individual. Besides, literacy and effective health education about the TB disease, its symptoms, prevention and referral for treatment are cues to TBCT participation. The literature review shows further that various TBCT strategy guidelines are available. It also indicates that innovative TBCT strategies (Ekwueme et al 2014:1175) and cost-effective technologies such as cellular phones are useful (Brinkel et al 2013:11565; Ndlovu et al 2014:275).

2.4.3 Likelihood of action for the tuberculosis contact tracing

The literature further still expounds that among the important perceived benefits of the TBCT are screening and possible early diagnosis and treatment of the TB. The

perceived benefits are, therefore, motivators of participating in the TBCT. Literature review indicates that a focused health education about TB imparts knowledge and skills to enable the TB patients to bring their contacts for the TB screening and treatment if possible.

The barriers to adopting and carrying out the TBCT militate against the benefits. Nonetheless, that depends on which of the two is more important to the individual. The result is that the change of behaviour could mean success or failure of contact tracing take place.

In conclusion, literature on the global, regional and local studies has been reviewed. It expounded the methodology and effectiveness of TBCT in the perspective of the components of the HBM. It included knowledge and perceptions of the TB patients, their contacts and the HCWs about TBCT. Further, it includes discussion on actions used in the TBCT, organisational and structural challenges of implementation. It also reviewed case identification rates of TB in various regions and risk factors for the TBCT. It notes the increasing use of innovative technology such as mobile phones to enhance the convenience of improved tracing and earlier identification of contacts.

CHAPTER 3

METHODOLOGY

3.1 INTRODUCTION

The main purpose of this study was to develop a strategy for a more effective TBCT to reduce further the transmission of TB and mortality rates in Botswana. This is in relation to the TBCT strategies that do not trace, screen, treat all the TB contacts and significantly reduce incidence (WHO 2015:19).

This chapter presents the research methodology used in the study. Topics covered in the chapter include the research design, research paradigm, population and sample selection, data collection, data collection tools and procedures. The reliability and validity of the research instrument is discussed as well. The chapter also discussed ethical considerations and research methods preferred for data collection.

3.2 RESEARCH DESIGN

Research design refers to a strategy or structured approach followed by researchers to answer a particular research question (Burns & Grove 2012:252). The research design involves a plan, structure and strategy of the study. These three research design concepts guide a researcher in writing the research questions, conducting the project, and in analysing and evaluating the data (Burns & Grove 2012:252; Creswell 2014:209).

The current study employed a quantitative, cross-sectional design as it was found to be most appropriate and convenient for investigation of TBCT in Botswana. The design was chosen because it was economical and the data generated from this design are helpful in assessing the health care needs of the TB contacts. It is useful for investigating variables that are fixed characteristics of individuals such as gender, age, socio-economic status, education level and how they affect a phenomenon. The design was chosen to describe the association between these variables and TBCT and determine the gaps, challenges and needs. It described the perceptions and knowledge of TB and TBCT. It also described utilisation of TBCT by the PTB patients and the

HCWs. Further, it described the interrelationships between TBCT strategies and practices and the risk of contracting PTB infection and related mortality.

However, when using cross-sectional design, it is not easy to assess the reasons for the association between the characteristics under study.

3.3 RESEARCH METHODOLOGY

Research methodology refers to the researcher's general approach to the research study (Polit & Beck 2014:12). It describes the steps, procedures and strategies for gathering and analysing the data (Polit & Beck 2014:12). This section discusses the study setting, population and sample selection.

3.3.1 Study setting and context

Figure 3.1 shows the map of Botswana where the study was conducted. Botswana is a landlocked country in southern Africa with a total land area of 582,000 km^2. The country shares borders with Zambia, Namibia, South Africa, and Zimbabwe.

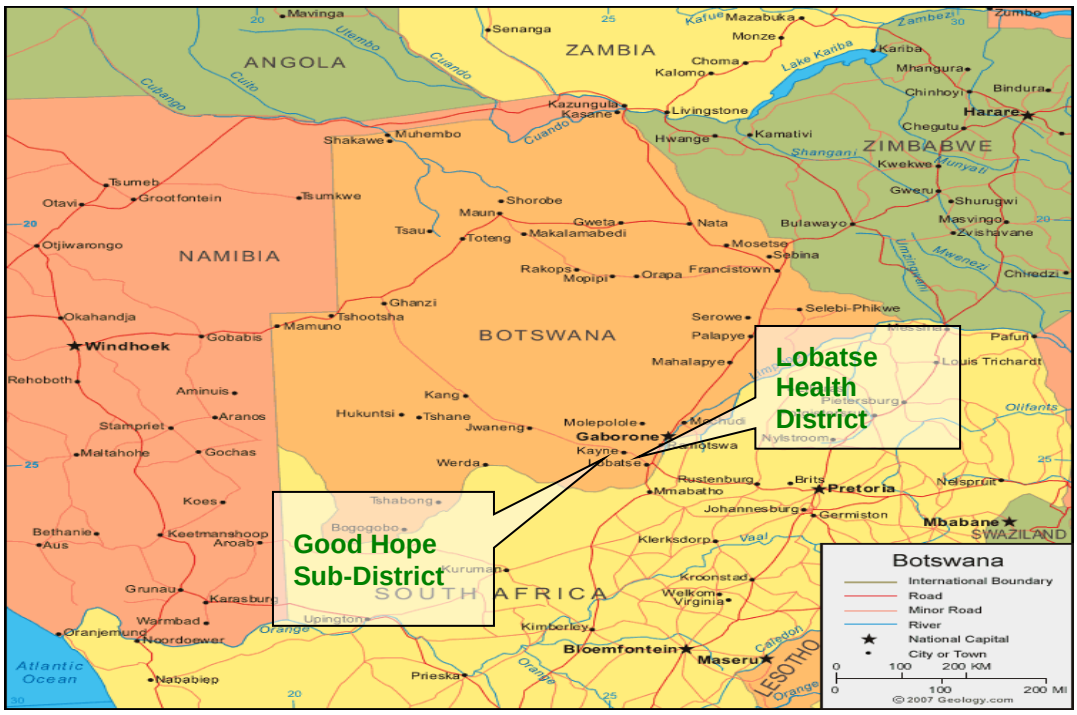


Figure 3.1: Map of Botswana showing location of Lobatse and Good Hope districts

(Source: http://geology.com/world/botswana-satellite-image.shtml)

More than two-thirds of the land mass in semiarid and arid with the Kalahari Desert dominating the Southern and Western parts of the country. At the time of the study, the country had seven towns and two cities that made up urban areas and 27 small and large villages that comprised rural areas.

Botswana has 2 200 000 people (WHO 2015:1–115) of whom 49.0% were males and 51.0% were females. The majority (57.0%) of the people lived in urban areas situated mainly along the eastern border of the country. The country is among the most sparsely populated areas in the SSA with an average national population density of 3/km^2 and 8.5/km^2 to 22.5/km^2 for the study area (Botswana 2015:33).

The exact location of where the study was conducted is Good Hope Sub District and the Lobatse Health District. The reasons for selecting the sites were the ease of access by the researcher and the availability of the PTB patients for sample selection. In addition, the two districts were among the high TB prevalence areas. The advantage of this technique was the cost-effectiveness and that it ensured a wide coverage. According to the report in the WHO (2013a:1–97), the incidence rate of 0.04% and above was considered a high incidence. The number of new TBHIV cases was 16 000 as of 2014. In absolute numbers, it ranged from 14 000 to 17 000 TBHIV cases.

3.3.2 Study population

3.3.2.1 Pulmonary tuberculosis patients, tuberculosis contacts and health care workers

A study population is an aggregate of elements sharing some common set of criteria (Grove, Grey & Burns 2014:366). The population is described in terms of the target population, inclusion criteria, and sampling method. The target population in this study was the PTB patients and the TB contacts. In order to get to the PTB patients and their contacts the researcher audited files in the selected TB clinics to identify PTB patients, their contacts and other characteristics such as age and gender and place of residence and the time they have been on TB treatment. They also provided information concerning the number, age and relationship with their household and workplace TB contacts. This also allowed the researcher to get to the possible contact persons who

provided information on whether they have been contact-traced. Health care workers working in the Good Hope and Lobatse districts in the respective TB clinics also formed part of the population. They provided information on the type of the TBCT strategies used in each TB clinic. Besides, they provided information regarding the TB contacts.

3.3.3 Sample size, sampling and sampling procedure

This section presents the sample size and the sampling process. In addition, it presents the sampling procedures.

3.3.3.1 Sample size

3.3.3.1.1 Sample size for tuberculosis patients and tuberculosis contacts

A study sample is a subset of the eligible target population (Polit & Beck 2014). Thus, the first step in selecting a sample is to define the population of interest. In this study, the population of interest was the PTB patients and eligible contacts. According to Fitzner and Heckinger (2010:701-707), calculation of the sample size is pivotal to producing scientifically valid results that are generalizable to the population from which it was drawn. Conversely, an inadequate sample size can result in Type I and Type II errors, which can subsequently result in rejecting or accepting the assumption when the opposite is true (Kadam & Bhalerao 2010).

There are several approaches to determining sample size. One can use a census for a small population, replicating the sample size of prior research studies, using published sample size tables, applying any one of the several formulae or using statistical software. Most of the population-based surveys often determine the sample size using the estimated prevalence of the variable of interest, the desired level of confidence and the acceptable margin of error.

The study used a single population proportion formula to determine the sample size with the following considerations. It determined the sample size using the proportion of the PTB patients in the Good Hope Sub District and Lobatse Health District with a 95% confidence interval (CI) and the acceptable margin of error (0.05). It applied probability sampling using the following formula:

The sample size, $\mathrm{n} = \frac{\mathrm{z}^2\ \mathrm{p}\ \mathrm{q}\ \mathrm{D}}{\mathrm{d}^2}$

Where:

n=sample size

z=standard normal deviate (1.96) which corresponded to 95% confidence level

p=proportion of sputum smear positive patients eligible for the TBCT

q=1 – p

d=degree of accuracy or level of statistical significance set (*α*)=0.05

D=design effect=1.5

The design effect is a constant that takes into account the extent of the departure from the variance of sampling (Bierrenbach 2016:7–8; Design effect 2014:[1]; Salganik 2006:104–108). For demographic surveys, the estimated design effect for sample size of 1.5 to 2 is effective in eliminating errors (Pettersson & Do Nascimento Silva 2013:127). The researcher used 1.5.

The proportion of PTB patients eligible for TBCT in the study sites was estimated at 50.0% (0.5) aiming at the maximum value. Using the formula above, the sample size was determined as follows:

$$\mathrm{n} = \frac{1.96^2 * 0.5\ (1.5\ \mathrm{p}) * 1.5}{0.05^2}$$

$$\mathrm{n} = \frac{3.842 * 0.5 * (0.5) * 1.5}{0.0025}$$

$$\mathrm{n} = \frac{0.96 * 1.5}{0.0025}$$

$$\mathrm{n} = 576$$

Since the target population served in the districts was 3 668, the final sample was determined using the following formula:

$$\mathrm{n}f = \frac{\mathrm{n}}{1 + \frac{\mathrm{n}}{N}}$$

Where $\mathrm{n}f$ was the final sample and *N* was the target population or *N*=3 668.

Thus:

$$\mathrm{n}f = \frac{576}{1 + \frac{576}{3\ 668}} \text{ or } = \frac{576}{1.157}$$

$$\mathrm{n}f = 497.8 \approx 498$$

However, the researcher used a sample of 500 in order to enhance the 95% CI. The sample size was further divided by the number of clusters (*N*=6) of health facilities. That provided an average of 83.3 or 83 PTB patients per cluster. When the probability proportional to size (pps) of cumulative number of the PTB patients in the health facilities was used to determine the sub-samples for each site, the sample was almost the same. The study calculated the average from the cumulative number of the PTB patients in the cluster health facilities in order to obtain the sample size for each cluster. The total number of the PTB patients for the study sites was 430 with an average of 72 per health facility and it almost concurs with the sample size. Therefore, the sample size ensured 95% CI. The study generalised the results to the expansive districts.

The design effect was included in order to minimise the effects of loss of questionnaires, incomplete questionnaires and attrition through withdrawal, migration or deaths. The researcher added a further 10.0% in order to cater for the attrition. Hence, the sample size was 91.3 or 91 for each cluster and the total was 547.8 or 548 PTB patients. For each PTB patient, one eligible contact was included.

In summary, the sample size was 548 PTB patients and 548 TB contacts in the Good Hope Sub District and the Lobatse Health District. That gave a total 1 096 participants in the two districts. However, the actual participants were 427 PTB patients and 427 contacts.

3.3.3.1.2 Sample size for health care workers

The sample size for the HCWs was 16. This represented all the HCWs who were present on duty during the data collection period in the TB clinics.

3.3.3.2 Sampling

Sampling is a process of selecting a portion of the designated population to represent the entire population (Polit & Beck 2014:339). Similarly, a sample is a subset of people or objects from a population often referred to as elements. An element is the most basic unit about which information is collected (Burns & Grove 2012:545)

3.3.3.2.1 Sampling of pulmonary tuberculosis patients and tuberculosis contacts

The study used systematic sampling technique (Berzofsky, Williams & Biemer 2013:270; Polit & Beck 2011:340) to select the PTB patients who participated in the study. The study used the TB clinic registers in the participating clinics to extract identification numbers of the PTB patients. A checklist was used to identify relevant information needed by the researcher.

3.3.3.2.2 Sample frame for pulmonary tuberculosis patients

The TB clinics and the TB registers provided the sample frame for the PTB patients. Through a written and verbal communication, the researcher formally requested the TB clinic site authorities for permission to peruse the TB register. Its quality was that, through direct element sampling, it enabled the identification and follow-up of the PTB patients and contacts to be included in the sample. The names of the PTB patients, their personal characteristics and addresses, TB diagnosis, type and phase of treatment, contact information and tracing addresses and other relevant information were expected to be available in the register. In some study sites, the TB register had entry errors such as incomplete data for the PTB patient. Most of the errors included missing information for the TB contacts. Some clinics had illegible information.

3.3.3.2.3 Inclusion criteria

This section discusses inclusion criteria. That means inclusion of the PTB patients and the TB contacts who qualify in terms of legal status and ethics as units of analysis.

- The PTB patients and selected contacts aged 21 years and above in the Good Hope Sub District and the Lobatse Health District. In Botswana, only people aged 21 years and older can give sole, legal consent.
- The PTB patients and contacts who gave informed consent, thus ensuring autonomy, in the Good Hope Sub District and the Lobatse Health District.
- The PTB patients and contacts with had no diagnosis of mental illness were included since they were able to provide competent information through informed consent.

- Ambulant PTB patients and TB contacts that travelled to and from the TB clinics.
- The PTB patients in the TB clinic register who resided in the study sites. The study determined their addresses and the TBCT actions.
- All the HCWs who worked fulltime in the TB clinics in the Good Hope Sub District, and the Lobatse Health District were included. Their consistent presence in the TB clinics potentially ensured the reliability of information they had about the TBCT activities in their areas of coverage.
- The study extracted and analysed the complete information from the TB registers and the PTB patients' contact tracing forms. However, it noted information on the incomplete records in the analysis.

3.3.3.2.4 Exclusion criteria

This section discusses exclusion criteria. That means exclusion of the PTB patients and the TB contacts who do not qualify in terms of legal status, health status and ethics as units of analysis.

- The PTB patients and contacts aged below 21 years. In Botswana, the persons younger than 21 years did not give legal consent by themselves.
- The PTB patients and selected contacts who were unwilling to give informed consent were not included. This ensured freedom of choice and autonomy of the PTB patients.
- The study excluded the PTB patients and TB contacts with mental illness. They would not provide competent informed consent.
- The PTB registers and PTB patients' forms whose information were illegible or with incomplete or no patient information were not scrutinised. The data from such records might introduce subjectivity and unreliability in data collection. However, the study noted them in order to inform the data analysis.
- The non-ambulant PTB patients who were hospitalised and not able to give competent consent to participate in the study were excluded.
- The PTB patients and the contacts whose names were in the TB records in the research clinics and resided outside of the research area.

3.3.3.2.5 Sampling of health care workers

The study used non-random sampling approach (Berzofsky et al 2013:270) in this phase to select the HCWs. Non-random sampling is a technique in which not every element has a chance of being selected in the sample. It refers to limited sample representativeness and can be used where probability sampling techniques are not suitable. For this study, the focus is the HCWs who work in the TB clinic and have had experience in TBCT. Hence, purposive sampling was used. Within this technique, the expert sub-case sampling technique was used. Battaglia (2011:524) defines expert sampling technique as the section of research participants based on their expertise on the subject of interest. The researcher used this technique since it involved the assembling of the HCWs with demonstrable experience and expertise in the TBCT. One of the reasons for using expert sampling was to best elicit the views of the HCWs with expertise in conducting the TBCT for at least one month. With such an experience, the HCWs were able to define the TBCT and commented on its appropriateness in the TB control programme. The study purposively selected the TB clinic HCWs who were involved in the care of the PTB patients in the Lobatse Health District and the Good Hope Sub District. It used structured interview schedules to interview them. The interview technique used techniques that were convenient, less complex, clear and easy to administer.

The HCWs on temporary assignment in TB clinic and those who were relieving other HCWs were not included. The reason is that they did not meet the criterion of expert sampling and had no adequate exposure to TBCT strategies in the clinic to be able to provide reliable information.

3.3.3.3 Sampling procedures

For this study the multistage sampling technique was used. Multistage sampling is a form of cluster sampling which involves dividing the population into groups (Polit & Beck 2008:347). It further involves repetition of two basic steps: listing and sampling.

3.3.3.3.1 List of districts and major health facilities in Botswana

The following districts of Botswana, with their respective major health facilities, are listed in alphabetical order:

Table 3.1: List of districts showing major health facilities

District	Major health facility	Location
Barolong	Good Hope District Hospital	Good Hope
Central Serowe	Sekgoma Hospital	Serowe Town
Central Bobonong		
Central Tutume		
Central Mahalapye	Mahalapye Hospital	Mahalapye
Central Boteti		
Chobe		
Kgalagadi North		
Kgalagadi South		
Kgatleng	Debora Retief Memorial Hospital	Mochudi
Francistown	Nyangabwe Hospital	Francistown City
Gaborone	Princess Marina Referral Hospital	Gaborone City
	Gaborone Private Hospital	Gaborone City
Ghanzi		
Jwaneng	Jwaneng Mines Hospital	Jwaneng
Kweneng East	Bokamoso Hospital	Mopane
Kweneng West	Scottish Livingstone Hospital	Molepolole
Lobatse	Athlone Hospital	Lobatse
Ngamiland East		
Ngamiland West		
Ngwaketse West	Seventh Day Adventist Hospital	Kanye
North East		
Orapa	Orapa Mines Hospital	Orapa
Selebi Phikwe		
South East	Bamalete Lutheran Hospital	Ramotswa
Southern		
Sowa		

Source: (BAIS III 2009)

The first stage selection conveniently comprised the cluster of two districts as follows: the South East District with a population of 276 319 had the villages of Ramotswa, Otse, Lesetlhane, Sepitswane, Mogobane and the Lobatse Health District, which was a major stand-alone town, and which was included in the cluster for the purpose of this study. The Southern District had a population of 186 831 and consisted of Moshupa,

Ngwaketse and Good Hope sub districts. The population figures were reported according to the 2011 census.

3.3.3.3.2 Site target population and accessible sites

Table 3.2: Target health units showing number of new PTB patients in Lobatse Health District (N=169)

Health facility	New pulmonary tuberculosis patients (2014)	
	F	**%**
Athlone Hospital	13	7.69
BMCI Clinic	4	2.37
Bofwa Clinic	0	0.00
Motswedi	13	7.69
Peleng Central Clinic	28	16.57
Peleng East Clinic	23	13.61
Prisons Clinic	1	0.59
Sbrana Psychiatric Hospital	8	4.73
Tsopeng Clinic	34	20.12
Woodhall Clinic	45	26.63
Total	**169**	100.00

F – Frequency

Source: Quarterly TB Report (Lobatse Health District)

The total number of the health posts and clinics was 42 and the hospitals were three. The accessible sites were listed in Table 3.2 and Table 3.3 showing the number of PTB patients registered in 2014. The clinics had 354 new PTB patients and the hospitals had 58, a total of 412.

Table 3.3: Target health units showing number of new PTB patients in Good Hope Sub District (*N*=261)

New pulmonary tuberculosis patients (2014)						
Good Hope Sub District	**F**	**%**		**Good Hope Sub District**	**F**	**%**
Cwagare Health Post	1	0.38		Mmathethe Clinic	37	14.18
Digawana Clinic	12	4.60		Mogojogojwe Health Post	5	1.92
Dikhukhung Health Post	0	0.00		Mokatako Health Post	2	0.77
Ditlharapeng Health Post	2	0.77		Mokgomane Health Post	2	0.77
Gathwane Health Post	7	2.68		Motsentshe Health Post	1	0.38
Good Hope Clinic	15	5.75		Papatlo Health Post	1	0.38
Good Hope Primary Hospital	45	17.24		Phihetswane Health Post	3	1.15
Hebron Clinic	2	0.77		Phitshane Molopo Clinic	5	1.92
Kanngwe Health Post	0	0.00		Phitshane Potlokwe Health Post	1	0.38
Kgoro Health Post	5	1.92		Pitsane Clinic	26	9.96
Leporung Health Post	11	4.21		Rakhuna Health Post	8	3.07
Lorwana Clinic	2	0.77		Ramatlabama Clinic	9	3.45
Mabule Clinic	8	3.07		Sedibeng Health Post	6	2.30
Magoriapitse Health Post	5	1.92		Sekhutlane Health Post	4	1.53
Majaalela Health Post	3	1.15		Sheep Farm Health Post	5	1.92
Metlobo Clinic	10	3.83		Tlhareseleele Health Post	2	0.77
Metlojane Health Post	8	3.07		Tshidilamolomo Clinic	3	1.15
Mmakgori Health Post	5	1.92		**Total**	**261**	**100.00**

F – Frequency

Source: Quarterly TB Report (Good Hope District)

The health facilities in the study site were within an average within 15 km of medical personnel, x-ray equipment and sufficiently equipped laboratory for specimen screening for PTB. Each health facility had either a resident doctor or scheduled regular visits by a doctor who evaluated the PTB patients and their contacts. The District Health Management Team (DHMT) in each district was the line of authority that facilitated accessibility and permission to conduct the research and information sharing.

3.3.3.3.3 Site sampling

The public health facilities were available as clusters of the two districts. The study used a single stage cluster sampling and conveniently selected them.

Cluster sampling is a selection technique in which groups (called *clusters*) of *sampling* units, and not individual unit, are selected from a population for analysis. Convenience sampling is a non-probability sampling technique where subjects are selected because of their convenient accessibility and proximity to the researcher. The main reasons for using cluster sampling were (1) to save on financial costs, (2) to save on time and (3) that the population was wieldy in the two districts. The other advantage was that the PTB patients in the clusters were similar to one another as they shared geographical area, language, culture and socio-economic activities.

The Good Hope Sub District had 35 facilities: 1 hospital and 34 health posts/clinics with 261 PTB patient load whereas the Lobatse Health District had two hospitals and eight clinics with a PTB patient load of 169. The study sampled health posts with high PTB patient volumes and clustered them. As such, the study purposively selected three clinics in the Good Hope District and eight clinics in Lobatse district (Table 3.2). The Sbrana Psychiatric Hospital was not included due to its uniqueness as a mental health facility and that the PTB patients might not provide competent consent.

The practice regarding a new PTB diagnosis in the study hospitals was that the HCWs admitted the PTB patients and commenced them on the ATB treatment for the duration of the initial infective phase of 14 days. Thereafter, the HCWs discharged patients through their nearest clinic to continue with the DOT for PTB for the remaining time of the initial phase treatment (2NHRZE) and into the continuation phase of 4NIHRE. The hospital HCWs then transferred records of the patients to the clinic HCWs who enrolled them [patients] in their community TB programmes and administered the DOT.

For this reason, the study avoided potential duplication of enrolling the hospital PTB patients into the study and re-enrolling them through the clinics. In order to avoid this, the study clustered the clinics. Thereafter, the study, using the TB registers, systematically recruited the PTB patients and their contacts until it obtained required

sample size. For every PTB patient, the study randomly selected one contact with a criterion of at least 21 years old to respond to the item seeking to determine his or her TBCT status. They followed them as study participants through the DOT-administering TB clinics, in their households and workplace.

The study determined the site sample from the 45 health posts and the two hospitals in the two districts (Table 3.2 and Table 3.3). Table 3.4 shows the clinics that were included. In Good Hope Sub District, the sites were Good Hope Clinic, Good Hope Primary Hospital, Mmathethe and Pitsane. In Lobatse Health District, the sites were Athlone Hospital, Motswedi Clinic, Peleng Central Clinic, Peleng East Clinic, Tsopeng and Wood Hall clinics.

Table 3.4: Selected health units showing number of new PTB patients in selected study sites in 2014

Selected sites	F	%
Good Hope Clinic	15	4.63
Good Hope P. Hospital	45	13.89
Mmathethe Clinic	37	11.42
Pitsane Clinic	26	8.02
Athlone Hospital	13	4.01
Molapowabujang Clinic	45	13.89
Motswedi Clinic	13	4.01
Peleng Central Clinic	28	8.64
Peleng East Clinic	23	7.10
Tsopeng Clinic	34	10.49
Wood Hall Clinic	45	13.89
Total	**324**	**100.00**

F - Frequency

3.3.3.3.4 Cluster sampling of the clinics

The study selected clinics using single stage cluster sampling technique, which means that a simple random sample of clustered clinics was selected. This technique enabled each clinic in the two districts to have an equal, independent chance of inclusion and bore representative characteristics (Berzofsky et al 2013:270; Polit & Beck 2011:340). They included the clinics listed in Table 3:5. Cluster 1 (C_1) for Athlone Hospital and Wood Hall clinic, Cluster 2 (C_2) for Peleng Central and Tsopeng clinics, Cluster 3 (C_3) for Motswedi and Peleng East clinics, Cluster 4 (C_4) for Mmathethe and Molapowabujang clinics, Cluster 5 (C_5) for Good Hope Primary Hospital and Good Hope clinic and Cluster 6 (C_6) for Pitsane clinic respectively. That allowed data to be collected from every clinic in the sampled clusters.

The study checked each clinic in the cluster for the presence of space for receiving and interviewing the PTB patients and TB suspects. It also checked the availability and display of the TBCT policy document.

Table 3.5: Cluster sampling of tuberculosis clinics (*N*=11)

Cluster (C)	**Clinics**
Cluster 1 (C_1)	Athlone Hospital Woodhall Clinic
Cluster 2 (C_2)	Peleng Central Clinic Tsopeng Clinic
Cluster 3 (C_3)	Motswedi Clinic Peleng East Clinic
Cluster 4 (C_4)	Mmathethe Clinic Molapowabujang Clinic
Cluster 5 (C_5)	Good Hope Primary Hospital Good Hope Clinic
Cluster 6 (C_6)	Pitsane Clinic

In the second stage, the site population was the PTB patients and their contacts in those districts. The estimated population of the Good Hope Sub District was 48 104 and that of Lobatse Health District was 29 082, giving a total of 77 186. Children 0 – 14 years made up an estimated 40.0% in the country (Mookodi, Ntshebe & Taylor 2013:89). That was applied in determining the population of persons 15 years and above in the districts, that is 77 186 less 30 874.4 or 46 312.

The crude TB prevalence was 24.0%, hence, the proportion of the PTB patients eligible for TBCT was 0.24 (77 186) or 18 525. The crude prevalence is the proportion of people in a population who have a particular disease, in this case the PTB patients, at a specified point in time. The TB prevalence in the study sites was an estimated 19.80% or 0.198 (Botswana 2009:7). In those sites, the proportion of the PTB patients eligible for TBCT was 19.80% of 18 525 or 3 668.

The study consecutively selected the PTB patients and TB contacts for the study. That is mainly owing to the similar cultural, habitat and socio-economic characteristics that they shared. No other sampling took place.

In a similar manner, the researcher consecutively interviewed the HCWs who were conveniently available and worked fulltime at the participating study sites. No other sampling took place.

The foregoing is linked to the research objectives in a number of ways, including identifying and describing organisational factors affecting the utilisation of TBCT. It is also linked to the objective to determine TBCT knowledge and actions of the HCWs and that of identifying perceptions of PTB patients about TBCT programme.

3.4 DATA COLLECTION AND DATA COLLECTION INSTRUMENTS

3.4.1 Data collection

In this section, discussion centres on data collection and data collection instruments. Data collection for this study was in three phases.

3.4.1.1 Phase I: Generation of quantitative data: observation of the clinic and extraction of information

In this phase a checklist was used to audit registers of patients in the TB clinics. The researcher extracted the information of the PTB patients from the TB registers. The information included the diagnosis, type of treatment, the TB contacts, tracing addresses and PTB patients' personal characteristics (Annex H).

3.4.1.2 Phase II: Interview schedule for pulmonary tuberculosis patients

The interviewers used a self-designed structured interview schedule for interviewing the PTB patients (Annex I). A qualified translator transcribed the questionnaire items into Setswana, a national language for Botswana spoken by all nationals. That produced a Setswana version (Annex J) of the questionnaire. The translation minimised the potential for loss of meaning before data collection (Kabongo & Mash 2010:1–6). The bilingual expert translated the Setswana version back into English and compared it with the original English version. That also prevented loss of meaning during the translations. The researcher discussed with the bilingual expert any discrepancies and mutually accepted the best possible versions.

3.4.1.3 Phase III: Interview schedule for health care workers

The researcher administered the structured interview schedule in the TB clinic to obtain information from the HCWs about their perceptions and practices of the PTB patients' contact tracing actions. The researcher collected information using English language (Annex K).

3.4.2 The research instruments

There were three instruments for data collection, namely (1) the document checklist, (2) the interview schedule for the PTB patients and (3) the interview schedule for the HCWs. The interview schedule for the PTB patients had 50 items and that of the HCWs had 36 items. The instruments portrayed the quality of this study as measured by their internal and external validity. As such, the items of the questionnaires yielded knowledge, perceptions and utilisation of the TBCT, strategies, actions and their impact on the uptake of the TB screening. The procedures reflected instrument reliability and validity, the vital components of the quality of quantitative research.

3.4.3 Reliability of the research instrument

3.4.3.1 Instrument reliability

There are two types of reliability: internal and external reliability. Internal reliability assesses the consistency of results across items within an instrument or test. External reliability refers to the extent to which a measure varies from one use to another.

The reliability of the interview schedule in this study was attained in its stability, dependability and predictability in obtaining similar TBCT results (Burns & Grove 2012:462; Drost 2011:108; Jekayinfa 2007:4). It was able to measure consistently the TBCT characteristics (Jaroonkhongdach, Todd, Hall & Keyuravong 2013:100; Polit & Beck 2011:452) as noted from the similarity of the responses.

3.4.3.2 Internal reliability

The study used Pearson correlation coefficient (r) to determine the internal reliability of the TBCT interview schedule. In this case, the researcher carried out a test-retest reliability pilot study in Cwaanyaneng Health Post in the first week of September 2015. The second data collection followed in the third week, time short enough to minimise introduction of confounders. The study correlated the results of the first data collection (T_1) with those of the second (T_2). The pilot study provided r=0.7, which is close to the proposed $r \geq 0.8$. It showed that the results were consistent and reliable.

The researcher made further corrections on the instruments and began data collection within a week after the pilot study. Thus, it minimised potential confounders in the main study. Therefore, the data collection and analysis in this research consistently ensured acceptable degree of reliability (Jaroonkhongdach et al 2013:100) and that reproducing the study elsewhere would potentially obtain similar results.

3.4.3.3 External reliability

External reliability was obtained through pretesting of the instrument. This means that the researcher carried out a pilot study in a different facility, Cwaanyaneng Health Post,

which was not one of the study clinics and was far from the study area. The results obtained reflected more or less similar attributes of the results in the greater study areas: the Lobatse Health District and the Good Hope sub District. As in Jaroonkhongdach et al (2013:100) and in Mitchell and Jolley (2013:161), the further use of the results of this research elsewhere may obtain similar findings, thus ensuring external reliability of the study.

3.4.3.3.1 Pre-testing of the instrument

The reliability of a study instrument may be determined through one of the following test techniques: alternative form technique, a split-half technique and a test-re-test technique. This study used test-retest technique (Drost 2011:108; Jaroonkhongdach et al 2013:100) to test for instrument reliability. Test-retest reliability is a statistical technique used to estimate components of measurement error by repeating the measurement [interview] process on the same subjects. The researcher administered the interview schedule at interval times to the same PTB participants in Cwaanyaneng Health Post Clinic. The participants were not part of the selected sample. This showed how the PTB patients reacted to the interviews. The pilot study results showed items that needed modification in the instruments before its use in the research areas. The researcher made those corrections until it achieved an acceptable coefficient alpha of 0.7. This ensured internal consistency and reliability (McBurney & White 2010:44). The researcher ensured that the items on the schedule measured the stated TBCT objectives (Mitchell & Jolley 2013:6).

In summary, the researcher analysed the data from the pilot study. The results were the basis to accept the proposed methods of data analysis as suitable.

3.4.4 Validity of the research instrument

This section states the quality of the interview schedule using content validity, face validity, and the threats to instrument validity. It also states the strategies that reduced the threats of instrument validity. The extent to which an instrument actually reflects the abstracts, examines defines and its validity as in Burns and Grove (2012:409) and in Jaroonkhongdach et al (2013:100). In this study, the ability of the questions in the

interview schedule to measure TBCT practices (Jekayinfa 2007:5) in the research areas determined the validity of the instrument.

3.4.4.1 Content and face validity of the instrument used in collecting data from tuberculosis patients

3.4.4.1.1 Content validity of the instrument

Content validity refers to how accurately an assessment or measurement tool, in this case, the questionnaire, taps into the various aspects of the specific construct in question. It is also called logical validity in psychometrics and it refers to the extent to which a measure represents all facets of a given social construct. It is the extent to which a measuring device measures what it intends or purports to measure. According to the report in Drost (2011:118), content validity portrayed a reference that clarified the domain of the concept and the analyst judging whether the measures fully represented the domain. In this study, a Setswana-English bilingual expert in the University of Botswana and UNISA reviewed the interview schedules prior to their administration. As such, the items determined content validity (Burns & Grove 2012:381) of the interview schedule. Besides, a panel of experts in the UNISA assessed the coverage of the items in the interview schedule.

3.4.4.1.2 Face validity of the instruments

Face validity is the extent to which a test is subjectively seen as covering the concept it purports to measure. It refers to the transparency or relevance of a test as it appears to test participants. It refers to the degree to which an assessment or test subjectively appears to measure the variable or construct that it is supposed to measure. In other words, face validity is when an assessment or test appears to do what it claims to do. In this study, face validity (Burns & Grove 2012:380) was determined by ensuring that each question related to specific aspects of the TBCT practices. In order to achieve this, the researcher constructed the instrument items in the way that they were able to elicit responses that related to the practices and actions of the TBCT. The study generated adequate items that ensured the overall coverage of the TBCT perceptions, risk factors and practices.

3.4.4.1.3 Internal validity

Internal validity refers to how well a test is done, particularly if it evades confounding variables. The less chance for confounding in a study, the higher its internal validity is. The current study consistently applied quantitative research practice of data collection concerning the TBCT to all the health facilities (Jaroonkhongdach et al 2013:100). The type of TBCT was the independent variable and case identification and uptake in screening was the observed variable. It also described the different strategies and actions that each facility used in carrying out the TBCT.

The threats to internal validity included attrition of PTB patients by death, patient-transfer or out-migration (Burns & Grove 2012:380; Gerbeding et al 2012:4). About four PTB patients died during the study. Some PTB patients had migrated within the study area and others out-migrated to other districts. However, their original addresses were unchanged in the active TB registers. The study established communication and tracing using the mobile telephone number for those who were within the study area, thus minimising attrition. To minimise attrition further, the demographic details that the study collected included names, relationships, residential and email addresses.

The study did not experience the expected threat that some of the HCWs might view the study as an exposure of their TBCT practice. Hence, nothing prompted them to change their actions (Michel & Jolley 2013:143; Polit & Beck 2011:296). Nevertheless, the researcher maintained confidentiality of information, respect and the anonymity of the HCWs (Pera & Van Tonder 2011:331) and constantly reminded them that their honesty and objective responses would provide the necessary information for improved utilisation of the TBCT process in Botswana.

3.4.4.1.4 External validity

External validity is the extent to which the results of a study can be generalised to other situations and to other people. The results showed the perceptions and attributes of the PTB patients regarding the TBCT. Similarly, the results showed the health facility organisational structures, the knowledge, actions and services of the HCWs that relate to the TBCT in the study areas within Lobatse and the Good Hope Sub districts. As far as the external validity of the TBCT instruments is concerned, the study deemed the

results applicable to the entire study districts. However, the generalisability of the findings is subject to further research.

The feared threat to external validity: interaction between relationships and people (Drost 2011:120; Polit & Beck 2011:301), did not affect this study since the PTB patients resided in the same community. They lived in communities with common social environment and language (*Setswana*). They shared TBCT services from the same public health facilities that had similar administrative and organisational structures. The HCWs in those facilities used the same policies and regulations that commonly influenced their TBCT activities. Hence, the study found the potential of using the recommendations to improve TBCT in a wider perspective (Mitchell & Jolley 2013:54). Certain threats to external validity of this study included testing and instrumentation.

3.4.5 Testing and instrumentation

Testing threats may occur when participants' performance on a test at the end of a study differ from an initial testing or when the researcher carry out subsequent interviews on the PTB patients who had participated in pilot study. In this study, this threat was reduced when the pilot study was done on similar but different PTB patients in a non-participating clinic – the Cwaanyaneng Health Post. In addition, the researcher was able to identify, by using the serial numbers, any PTB patient who might have in-migrated to the participating clinic.

Instrumentation refers to a component of measurements that involves application of specific rules to develop a tool such as the interview schedule in TBCT (Burns & Grove 2012:70). Some undesirable effects that occur to participants' responses may not be due to understanding the questions in the schedule but due to changes introduced by interviewers into the interviewing process. The instruments used to interview participants may change over time – instrumentation threats – as interviewers become bored or tired, and thus cause changes in participants' responses (Burns & Grove 2012:222). Those changes are not due to the items but to changes in the interview schedule used to measure contact tracing practices.

In order to reduce the threat of instrumentation (Burns & Grove 2012:254; Polit & Beck 2011:297), the researcher trained the field workers on interviewing skills and how to

ensure consistency in administering interview schedules (McBurney & White 2010:33). Moreover, the researcher and the field workers met for one hour every day during the data collection to share experiences and clarifications on how to ask questions consistently.

In order to ensure similarity of items and prevent potential modifications in the instruments, the researcher consistently administered photocopies of the instruments. Further, the field workers administered the interviews at similar times (0800 to 1600 hours) and that minimised the effects of time variation. They also gathered the same information from each patient in a pre-arranged style and which style they rehearsed at the end of each data collection day. The average duration of each interview was 35 to 40 minutes and that minimised time variations and boredom that risked introducing fatigue and affecting the objectivity of the responses.

In summary, this section discussed data collection which was in three phases. It focussed on reliability and validity requirements of the data collection instruments. It also spelt out how the threats of reliability and validity were prevented.

3.5 DATA COLLECTION PROCEDURE

In this section, discussion focusses on data collection procedure. This involves the respondent population and administration of data collection instruments in each phase.

3.5.1 Accessible participants for data collection

The accessible participants were the PTB patients and TB contacts that were entered in the TB registers and resided in the study sites at the time of the study. Interviews took place at the TB clinic, household or workplace. In addition, the researcher interviewed the HCWs, including the TB coordinators, nurses and the CHWs or FWEs, who worked fulltime and were available in the TB clinics at the health facilities

3.5.2 Administering the data collection instruments

3.5.2.1 Phase I: Observation of the tuberculosis clinic and extraction of information

The study initially used the checklist during the observation of space availability in the TB clinic. The observation included space for reception and interview rooms for the new PTB patients and TB suspects. The study determined availability of the TBCT policies. Thereafter, the study extracted secondary TB information from the TB registers and contact tracing forms. It identified the PTB patients from the TB records and assigned pre-generated serial numbers to enrol them into the study. It extracted information about diagnosis and treatment of the PTB patients, and gender, age and relationship of the household and workplace TB contacts. The information provided a basis for comparison with the data that the study obtained during the interviews of the PTB patients and the HCWs. Their comparison pointed out gaps in documentation that mighty influence the TBCT strategies

Several factors influenced the quality of secondary data. They included incomplete entry, missing values and illegibility of information entered. In order to maintain quality of the information, the checklist clearly stated the information abstracted from the TB records and sieved out the illegible ones. The study self-generated a serial number for each document checklist and placed it in the right top corner of the instrument. The study used that serial number to link the information in the PTB patients' interview schedule responses with those that were in the document checklist.

3.5.2.2 Phase II. Interview process for pulmonary tuberculosis patients

This phase involved administering the structured interview schedules on the PTB patients and determined household and workplace. Seven (7) research assistants were engaged and trained as field workers. Each one of them interviewed the PTB patients in each TB clinic and its catchment area. They communicated either in English language (Annex I) or in Setswana language (Annex J). In order not to disrupt the clinic activities, the field workers approached the PTB patients who had received health care services. They informed them about the study objectives, and requested them for consent

(Annexes L & M) to respond to the interview items in the questionnaire. They also interviewed the PTB patients and their contacts in their households and workplaces. The researcher ensured that the interviews took place at the convenience of the participant. The field workers maintained consistency by asking each of the PTB patients the same information in the same sequence (McBurney & White 2010:44) between 08:00 and 16:00 hours each interview day. That reduced possible confounders related to time and style.

The researcher gathered personal information from the PTB patients who were the primary sources of the TBCT data. The information included demographic characteristics, socio-economic characteristics, perceptions about TB, roles and actions in the TBCT process. Moreover, the study determined their perceived threat of TB and the perceived benefits of the TBCT. One eligible TB contact responded to the questionnaire item concerning participation status in the TBCT. The researcher asked the TB contacts whether they had been contact-traced. The collected narrative information was derived from the original Setswana language narratives (transcripts of interviews) into English language.

In order to prevent meaning being lost in translation, the study selected research assistants who were fluent in both English and Setswana languages (Kabongo & Mash 2010:1–6). The assistants were from the same area as the PTB patients and TB contacts. The researcher trained the research assistants in structured interviewing skills and in how to determine if the PTB patients had understood the questions (McBurney & White 2010:33) before they left the interview scene.

At the end of each data collection day, the researcher and the field workers met for one hour. During the meeting, they correlated information in the filled interview schedules with those in the PTB patients' records. In addition, they corrected entry errors and placed the instruments in the appropriate folders for storage. The TB registers and TBCT forms were perused and information about TB contacts, their addresses and other related information were recorded (Annex H). The researcher correlated specific patient's records with his or her completed interview schedule using serial numbers at the top right corner of the data collection instruments (Annexes I & J). The study purposively generated specific serial numbers for each facility that eased audit during

data analysis. That provided a link between the PTB patients' responses and their various data in patient files. It also ensured anonymity.

The responses from the PTB patient questionnaire provided perceptions, knowledge of actions used in the TBCT and an avenue for improving the TBCT.

3.5.2.3 Phase III: Interview process for health care workers

This phase involved administration of the structured interview schedule for the HCWs (Annex K). During the interview, the researcher established the type of the household and workplace TBCT actions. The interviewer approached each HCW after he or she had completed his or her tasks. That ensured no distraction between them and their clients. They were informed about the objectives of the study and requested for consent to participate (Annex N). The researcher collected similar information from each HCW in as a comparable, pre-specified way as to maintain consistency (McBurney & White 2010:44). The variables included demographic information relevant to the TBCT, their understanding, utilisation and uptake of the types of TBCT, and their opinion for the improvement of the TBCT. It compared the percent coverage of the household and workplace TBCT (Mulder et al 2011:137). Further, the study compared the contact tracing actions of the HCWs and those of the PTB patients and their contacts, with those specified in the policies of Botswana MOH. It also compared the outcomes of the TBCT with those of the current contact tracing rates and the national annual target. Their comparison offered the HCWs a potential for new insights into improving the TBCT.

The HCWs expressed the need for the use of mobile phone hotlines specifically for communication between them and the PTB patients and their contacts. This strategy offered potential for enhancing early case identification, improved screening rate, early diagnosis and possibly treatment of the TB contacts.

3.6 ETHICAL CONSIDERATION

This section discusses ethical considerations which mean adhering to the protection of dignity of participants and the publication of the information in research (Fouka & Mantzorou 2011:3–14). They include ethical clearance to carry out the study. It also

includes informed consent that provided autonomy in decision making (Atif, Javaid, Farooqui & Sarwar 2016:[4]; Butts & Rich 2008:48; Duguet, Wu, Altavilla & Man 2013:983). Further, it includes maintenance of privacy and anonymity that provides confidentiality (Beauchamp & Childress 2009:38–39). Besides, it considers the consent to carry out the study (Beauchamp & Childress 2009:152–153).

3.6.1 Ethical clearance and consent to do the study

The researcher sought and obtained ethical clearance from the Higher Degrees Committee of UNISA in order to proceed with the study (Annex A). Subsequently, permission to conduct the study in the Good Hope Sub District and the Lobatse Health District was formally requested from the HRDU in the Botswana MOH (Annexes B & C). That included permission to peruse the TB registers, the TBCT forms and records (Polit & Beck 2011:178). Consequently, permission was obtained from the Good Hope DHMT (Annex D) and the Lobatse DHMT (Annex E) to carry out the study in the TB clinics. Further, the researcher formally requested the Good Hope Primary Hospital (Annex F) and the Athlone Hospital (Annex G) to conduct the study.

Besides, the researcher formally requested permission to interview the HCWs and the PTB patients and contacts in the TB clinics (Annexes L, M & N), the households and workplaces.

3.6.2 Informed consent

The researcher designed the informed consent process in a manner that provided research participants with full disclosure about research risks, benefits and an opportunity to ask questions before deciding whether to participate. In order to ensure autonomy of the participants (Adams 2013; Burns & Grove 2012:196; Duguet, Wu, Altavilla & Man 2013:983), the researcher used a written consent form (Annexes L & M) to document the informed consent process in which the PTB patient, or his or her authorised representative, read, signed (optional) and entered the date of interview. The interviewer, who obtained the PTB patient's consent also signed and entered the date of the interview. Since the research interview began on the same day of obtaining informed consent, the interviewer recorded the time and date of consent in order to

document evidence of administering informed consent prior to any study-related procedures.

The minimum age of the intended human data sources was 21 years and older. The age limit ensured that the participant provided legal informed consent. In Phase I, the interviewer approached the respondent PTB patients at the TB clinics after receiving the health care. That approach ensured minimal disruption of health services. The participant was informed about research purpose and objectives, risks and benefits and subject selection and thereafter asked to participate voluntarily by reading the informed consent form and giving verbal consent (Polit & Beck 2011:177; Annexes L & M). The participant was informed that he or she was free to decline participation or opt out during the study if he or she so wished without incurring any risks to their care and medication. Participants were accorded privacy and comfort at a separate room or private space after finishing services at the TB clinic, and the risks such as prolonged interviews and stigma were minimised (Gupta, Dandu, Packel, Rutherford, Leiter, Phaladze, De Korte, Lacopino & Weiser 2010:[2]). However, interviewers were trained to exercise courtesy and respect towards respondents (Pera & Van Tonder 2011:331) and avoid possible sources of stigma by treating PTB patients in as similar a manner as other patients without TB (Polit & Beck 2011:177).

3.6.3 Maintaining privacy and anonymity

3.6.3.1 Privacy and confidentiality

The interviewer conducted the structured interviews in privacy (Holloway & Wheeler 2013:1–351) in an area that was separate from the service area and promised confidentiality (Adams 2013) of the information that the respondent provided. The interviewer also conducted interviews in the utmost care to protect the rights of the participants (Holloway & Wheeler 2013:1–351). To achieve anonymity (Adams 2013), the interviewers conducted interviews in secure, comfortable and quiet rooms that enhanced privacy and confidentiality of information and the utmost interest of the participants (Pera & Van Tonder 2011:331). At the end of each day, the researcher received the completed interview schedules and locked them in a cabinet that was accessible to only the researcher. That action further assured the respondents of confidentiality and safety of their information (Duguet, Wu, Altavilla & Man 2013:983).

The study relied on this gesture to have reflected research integrity and improved their [participants] honesty and objectivity in responding to the interview items.

3.6.3.2 Autonomy

Autonomy refers to the right of an individual to determine what activities he or she will or will not participate in (Adams 2013). The study granted the participants with full autonomy and ensured that the individual PTB patients understood what the interviewers asked them to do in the process. That enabled them to make a reasoned judgment. For instance, the PTB patients needed to know about what was involved in being required to take the role of identifying and referring their contacts to the nearest TB clinic. The PTB patients and the HCWs were also informed that it was their right and not a requirement to choose to participate in the research (Burns & Grove 2012:196; Duguet, Wu, Altavilla & Man 2013:983). That allowed for freedom of choice and opinion, confidentiality and privacy, respect and dignity. Furthermore, the interviewers offered the consent forms (Duguet, Wu, Altavilla & Man 2013:983) to the respondents to read and get information about the research. The interview process gave an opportunity for the participants to ask questions regarding the research and the interviewer responded to concerns that the participants expressed (Holloway & Wheeler 2013:1–351). The informed consent forms, duly read by the PTB patients and HCWs indicated respect for their free will to participate in the study without coercion (Adams 2013).

3.6.3.3 Confidentiality in participants' data treatment

The researcher maintained the confidentiality of documentation, data and all other information that each participant provided by locking the filled interview schedules in a cabinet in the Institute of Health Sciences, Lobatse, prior to data analysis. A serial number at the top right hand corner of the interview schedule was the only link to specific participant's data in the document checklist. That assured the participant that there was no identifying information and confidentiality was achieved. Only authorised persons accessed the documents with written approval of the researcher. The authorised persons included the data analyst and the research assistants. The researcher kept separate the interview schedules and checklists of the PTB patients from the interview schedules of the participant HCWs.

The researcher entered all the information from the interview schedules in the computer MS-excel 2013 software spread sheets with passwords accessible to only the researcher and the data analyst and were confidential.

3.7 DATA ENTRY AND ANALYSIS

This section presents data entry and analysis. The data included the information received from the TB clinics, the PTB patients, TB contacts and the HCWs during the field interviews. Besides, it included the descriptive and inferential statistics that were used during data analysis.

3.7.1 Data entry

Prior to entry, the data were cleaned and checked for completeness and accuracy. They were then logged and entered into the computer. The data presentation included transforming them, developing a database structure that integrated the necessary measures for further analysis. The researcher entered the quantitative data in the MS-excel 2013 software spread sheet, validated them and sought the assistance of a statistician in performing data analysis.

3.7.2 Data analysis

The researcher used the SPSS Version 20 (Pinheiro & McNeill 2014:129) to analyse data. The analysis involved the use of descriptive statistics for the baseline information and the inferential statistics to deduce their meaning

3.7.2.1 Descriptive statistics

Through the use of descriptive statistics, the researcher summarised the descriptions of the TB clinic design and space availability, the TBCT policy and HCWs TBCT plans. The analysis also included knowledge of TB among the PTB patients, definition, perceptions and utilisation of TBCT among the PTB patients and the HCWs. The researcher used frequencies, means, medians and standard deviations to present baseline socio-demographic variables of participants in tables and graphs. Descriptive statistics were also used to analyse the basic features of the sample in the context of

the TBCT. They provided simple demographic measures and the summaries about the sample. The researcher did simple graphic analysis of the data as a basis of further quantitative analysis. The researcher analysed the categorical data using counts and percentages to portray comparison of types of the TBCT and their 95%CI. The study described the extent of utilisation of the four types of TBCT and compared (1) the outcome of active TBCT with that of passive TBCT, and (2) the outcome of the household TBCT with that of the workplace TBCT.

3.7.2.2 Inferential statistics

The study used inferential statistics to deduce from the sample data the TBCT perceptions and actions of the PTB patients and the HCWs in the research sites. The analysis linked the inferential analyses to the research questions.

The researcher analysed the following indicators: the TB clinic design and space availability, the TBCT policy and TBCT plans. The analysis also included knowledge of TB among the PTB patients, definition, perceptions and utilisation of TBCT among the PTB patients and the HCWs. Besides, the analysis showed coverage of each type of TBCT, proportion of contacts per PTB patient in household and workplace and number of investigated contacts per index case (contacts-index case ratio) (Mulder et al 2011:137). That presented the comparative potential for case identification and efficacy of each type of TBCT. The data analysis used the Pearson chi-square contingency tables (Hosmer & Lemeshow 2013:145; Motulsky 2010:296) for possible outcomes. The analysis presented continuous data as mean, median and standard deviation (SD) with 95% CI for the mean. It performed bivariate analyses using Chi-square statistic to determine relationship between demographic (age and gender), socioeconomic (education and employment status) and the utilisation of the TBCT. It also calculated odds ratio (OR) using contingency tables.

It used the Hosmer and Lemeshaw (2013:144–147) test to assess the goodness-of-fit to estimate significance of relationship between variables at 95% CI. The test (Hosmer & Lemeshow 2013:147) assesses whether or not the observed event rates match expected event rates in subgroups of the population.

The researcher interpreted the results and presented them in contingency tables and graphs. Consequently, the researcher discussed the results and drew conclusions and recommendations. The contribution of the study emerged as the IC-TBCT. The implication of the IC-TBCT to the TB policy and programme were outlined.

The link of this section to the research problem is that the analysed data shows the significance of association between variables and the TBCT. The strength of association shows the level of utilisation of TBCT. It also points at gaps in the implementation of TBCT.

3.8 CONCLUSION

In conclusion, the chapter presented the design approach and methods that were used to carry out the study. It also showed study setting and the population of study. The sampling plans and data collection procedures were stated. In addition, the ethical procedures and analysis of data were stated.

The results from the current study were expected to provide description of the TB clinics and information on the availability status of the TBCT policy and plans. A description of the PTB patients, their contacts and their knowledge and perceptions about TB and the TBCT were expected. In addition, the results would show the characteristics of the HCWs as regards knowledge, perceptions and utilisation of the TBCT. Moreover, the findings were expected to provide potential avenues for minimising the TB transmission by documenting perceptions and critical risk factors, types and actions used for the TBCT and rates of case identification (Mulder et al 2011:137).The suggestions by the participants for the improvement of TBCT practice were also expected. In that way, the results would set a basis for recommendations for the need for more effective strategies for improving the TBCT in the study sites and potentially in Botswana (Gerbeding et al 2012:4; Kabongo & Mash 2010:1–6; Kranzer et al 2013:441).

The health policy makers in Botswana may find the results and recommendations of this study useful in modification of the existing TB health policies or in the formulation of new ones. The next chapter presents the study results that would point to other innovations for future operational research on the TBCT.

CHAPTER 4

ANALYSIS, PRESENTATION AND DESCRIPTION OF RESEARCH RESULTS

4.1 INTRODUCTION

This chapter presents and discusses the results of the TBCT study. The purpose of this quantitative descriptive study was to investigate the organisational factors that affected the tracing of TB contacts. They included the TB clinic design with respect to space availability for reception, interviewing of the PTB patients and the TB suspects, presence of the TB policy, the TB register, the TBCT forms and the clinic schedules for TBCT. The results about the perceptions of the PTB patients concerning the TB and the TBCT are also presented. Included in the chapter are the actions of the PTB patients and the HCWs in the utilisation of the types of TBCT. Moreover, it presents a conclusion of results that suggest the need for a more effective TBCT programme.

4.1.1 Research objectives

The research objectives for the study were:

1. To identify and describe the TB clinic organisational factors affecting the utilisation/implementation of the TBCT strategy.
2. To determine the basic TBCT knowledge of the HCWs about implementation of the TBCT programmes
3. To determine the HCWs' actions in relation to implementation of the current TBCT programme with specific reference to PTB patient reception, initiation of the TBCT programme, TB record keeping, TBCT planned events and mobile phone user perception in the TBCT programme
4. To identify the perceptions of the TB patients about the TBCT programme.
5. Study and critically analyse different strategies describing TBCT and strategies for reducing TB infection rates.
6. Construct an alternative strategy that links TB clinic organisational factors, TBCT knowledge and actions of the HCWs and participation of the TB patients in the

development of the TBCT strategy. Such a strategy must be context based and needs based.

4.2 DATA MANAGEMENT AND ANALYSIS

This section presents data management and analysis. It involves data preparation and presentation. It also presents the overall results of the analyses.

4.2.1 Data management: preparation and presentation

The researcher checked data for completeness and accuracy prior to entering into MS-excel 2013 software for processing. The data were analysed using SPSS v.20 software. The assistance of a statistician was sought during data analysis. The analysis was organised by objectives and phases of the study. The research questions and assumptions were cited during analysis. The results were presented in tables, graphs and text.

4.3 RESEARCH RESULTS

The results comprise of organisational factors. Under organisational factors are reception and interview areas, the policy document for TBCT and the community structures that link with the TB clinic.

The analysis also includes sample characteristics of PTB patients and the TB contacts. Under that will be demographic information, end-diagnostic plans, educational level, socio-economic information, knowledge and perceptions of TB. The characteristics of the TB contacts include gender and population, number per PTB index case, relationship to the PTB patient, contact-case index ratio and number needed to trace. The number needed to trace (NNT) is an epidemiological measure used in communicating the effectiveness of a health-care intervention, in this case TBCT. A positive *number needed to trace, and hence screen* implies that screening prevented a death, and a negative *number* implies that screening increased mortality.

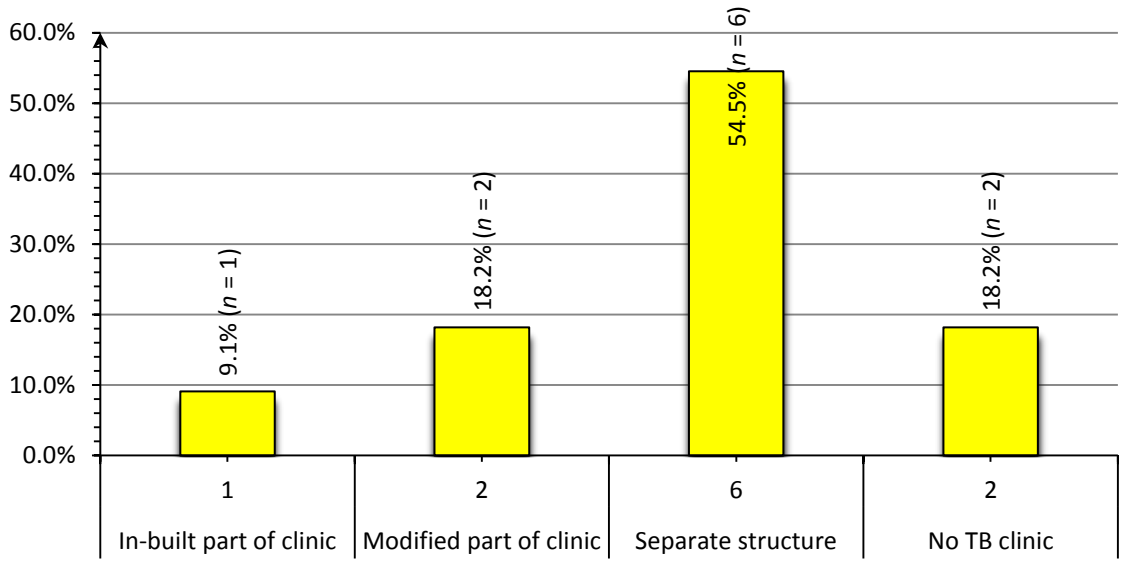
The characteristics of the HCWs include educational and staffing pattern, TBCT training and knowledge, adherence to TBCT policy, perceptions of TBCT.

Further, the analysis includes utilisation of TBCT. Under the utilisation of TBCT are PTB patients' knowledge, perceptions and participation in TBCT. It also includes utilisation of the types of TBCT.

4.3.1 Clinic factors that affect utilisation of tuberculosis contact tracing

4.3.1.1 Tuberculosis clinic spatial characteristics

This section presents the analysis of the TB clinic organisational factors that affect the utilisation of the TBCT. In particular, it presents analysis of the availability of areas for receiving and interviewing new PTB patients and TB contacts. Besides, it presents the analysis of availability of the TB policy, TB registers and the TBCT forms and schedules. The study observed a total of eleven clinics in the study sites. The study sites referred to the TB clinics in Botswana. They were organised in Figure 4.1 and Table 4.1 as follows:



% - percent; (f) - frequency

Figure 4.1: Eleven tuberculosis clinics in the study sites (*N*=11)

Only one (9.1%) of the eleven TB clinics in Figure 4.1 above had a reception area (in-built part of the clinic) already planned during construction. Two (18.2%) of the TB clinics had temporary cubicles (modified part of the clinic) that served as reception areas where TB patients are received and procedures explained to them. Six (54.5%) of

the TB clinics had separate structures that isolated PTB patients from the general patients while 45.5% (*n*=5) had a reception area where the PTB patients mixed with other patients. The other 18.2% (*n*=2) of the clinics did not have specific areas for TB patients, the implication being that contact tracing might have been compromised.

Table 4.1 below shows that 63.6% (*n*=7) of the clinics had a separate interviewing room for the PTB patients, and 36.4% (*n*=4) had a room where PTB patients mixed with other patients. This had implication on the process of contact tracing. The clinics that received the new PTB patients in an area separate from that of other patients were more likely to interview them in a separate space with no other activity than those that received the PTB patients mixed with others.

Table 4.1: Distribution of utility areas in tuberculosis clinics (*N*=11)

UTILITY AREAS	CHARACTERISTIC	TUBERCULOSIS CLINICS (%)
Reception Area	Separate from that of other patients	54.5
	Mixed with other patients	45.5
	Total	**100.0**
Interviewing Room	Separate room	63.6
	Room/space with other patients	36.4
	Total	**100.0**

4.3.1.2 Policy and instruments for contact tracing in Botswana

The study aimed at finding whether the study sites had kept the policy and TBCT instruments for application in their clinics. Table 4.2 shows the results. Although majority of the clinics separated the PTB patients, there are still some that mix all patients at reception and interviewing.

Table 4.2: Distribution of tuberculosis contact tracing policy and instruments in tuberculosis clinics (*N*=11)

TBCT POLICY AND INSTRUMENTS		TUBERCULOSIS CLINICS (%)
TBCT policy	Available, displayed	18.2
	Available, not displayed	9.1
	Not available	72.7
	Total	**100.0**
TBCT instruments utilised	Use of TBCT forms only	81.8
	Use of TB register only	9.1
	Use of TBCT forms and TB register	9.1
	Total	**100.0**

The TB clinics that had kept and displayed the TBCT policy were 18.2% (*n*=2). Those which had it but not displayed were 9.1% (*n*=1). Those that had no available TBCT policy were 72.7% (*n*=8). The clinics that used the TB register only were 9.1% (*n*=1).

The clinics that utilised the TBCT forms only as TBCT instrument were 81.8% (*n*=9). Those that utilised TB register only as the TBCT instrument were 9.1% (*n*=1). A further 9.1% (*n*=1) of the TB clinics utilised a combination of the TBCT forms and the register for TBCT instruments. This implies that the use of TBCT instruments is not standard. It is, therefore, the discretion of the clinic personnel on work shift to decide what to use.

4.3.1.3 Community tuberculosis contact tracing structures and contact tracing plans

The researcher asked the PTB participants to list the community TBCT structures that are linked to their nearest clinic. Table 4.3 presents the responses.

Table 4.3: Community tuberculosis contact tracing structure that is linked with tuberculosis clinic by gender of pulmonary tuberculosis patients (N=427)

Community tuberculosis contact tracing structure	GENDER OF PULMONARY TUBERCULOSIS PATIENTS (%)		Both
	Male	Female	
Community TBCT structure is available	4.20	3.8	8.0
No community TBCT structure	23.7	16.4	40.1
Do not know	26.7	17.8	44.5
Other structures	3.7	3.7	7.4
Total	**58.3**	**41.7**	**100.0**

Table 4.3 shows that 8.0% (*n*=34) of the participants thought that community TB programme was the TBCT structure that linked with the local clinic. Those who said that there was no community TBCT structure comprised 40.1% (*n*=171). The PTB patients who did not know of any existence of a TBCT structure linking with the local clinic were 44.5% (*n*=190). A further 7.4% (*n*=32) of the participants mentioned other structures such as development committees and health committees that they thought were linked to the TB clinic. The fact is that the majority of the participants did not know of the community TBCT structure. For those who knew it, the majority said that it was not available. This raises doubts as to the availability of it``. The Assumption 1 is not supported that organisational factors affect utilisation of TBCT (χ^2=1.575; df=3; p=0.665).

The researcher asked the HCWs whether the TBCT follow-up plans were available in the clinic. Table 4.4 shows the responses.

Table 4.4: Percentage distribution of tuberculosis contact tracing plans in clinic (N=16)

CLINIC HAS TBCT PLANS	GENDER OF HEALTH CARE WORKERS (%)		Both
	Male	Female	
Yes	6.3	6.3	12.6
No	31.2	56.2	87.4
Total	**37.5**	**62.5**	**100.0**

The participants who stated that the clinic had TBCT plans were 12.6% (*n*=2). These were equally distributed between males and females. Most of the HCWs, that is 87.4% (*n*=14), said that the clinic had neither household nor workplace contact tracing plans. The majority, that is 56.2% (*n*=9), of these were females. This implies that the clinics had no TBCT plans.

4.3.1.4 Availability of workplace tuberculosis contact tracing plans by health care workers

The researcher analysed workplace TBCT schedules in order to find the most active HCW in the TBCT visit plans. Participants were asked to indicate (1) if planned workplace TBCT visit are available, (2) there are no planned workplace TBCT visits and (3) do not know. Table 4.5 shows the responses.

Table 4.5: Percentage distribution of responses for availability of workplace tuberculosis contact tracing plans by health care workers (N=16)

WORKPLACE TBCT PLANS	HEALTH CARE WORKERS (%)			Total
	Nurse	FEW	Other HCW	
Workplace TBCT plans are available	12.5	6.25	0.0	18.75
Workplace TBCT plans are not available	50.0	12.5	0.0	62.5
Do not know	0.0	12.5	6.25	18.75
Total	**62.5**	**31.25**	**6.25**	**100.0**

Of the 16 health care workers who participated in the study, only 18.75% (*n*=3) indicated that there were planned workplace TBCT visits in the clinic and 62.5% (*n*=10) indicated that there were no planned workplace TBCT visits taking place. The participants who did not know about the planned workplace TBCT visits were 18.75% (*n*=3). In general, planned workplace TBCT visits existed in few clinics. The Assumption 1 was not supported (χ^2=11.307, df=6; *p*=0.051).

The researcher sought to determine the most active HCW in the workplace TBCT follow-up. Participants were asked to indicate any of the following variables: (1) nurse, (2) FWE and (3) other HCW.

Participants who indicated that the nurse was the most active HCWs in TBCT were 62.5% (*n*=10). They were followed by 31.25% (*n*=5) of those who indicated that the FWEs were the most active. Those who indicated that others were the most active were 6.25% (*n*=1). Others included the PTB patients, their relatives and the doctor. The results marginally supported alternative Assumption 3, that there was significant association of lack of planned schedules and the utilisation of TBCT.

4.3.1.5 Perceptions of suitability for tuberculosis contact tracing activities

The researcher followed up this question in Phase II in order to get the response opinions of the PTB patients. The participants were asked to indicate the individual who could best identify TB contacts during the TBCT follow-up. The variables were (1) do not know, (2) PTB patients, (3) nurses, (4) FWEs and (5) other.

The majority of the participants, that is 67.2% (*n*=287) indicated that nurses were best placed to carry out TBCT. Out of these, 57.5% (*n*=165) were males. The participants who listed the FWEs were 18.5% (*n*=79). Those who listed the PTB patients were 10.1% (*n*=43) and only 3.5% (*n*=15) listed others. The others included family members. Males were the majority in all of the responses. The perception of who was best placed to carry out the TBCT had no significance to the intention to participate in it (χ^2=1.714, df=4; *p*=0.808).

In summary, the responses for this item were similar for both the HCWs and the PTB patients. The nurse was not only indicated as the most active individual in TBCT, but was also perceived as the most suitable individual in carrying out TBCT.

4.3.2 Characteristics of the pulmonary tuberculosis patients

This section presents the demographic and socio-economic characteristics of the PTB patients relative to TBCT. They include demographic characteristics, end-diagnostic plans, diagnoses, treatment status and educational status. The socio-economic status includes occupation, employment, category of employer organisation, conditions describing their work environment and household income. It includes household characteristics about type of housing, number of household members and the hours spent together. Further, it includes frequency of TB infection and the risk factors such as the TBHIV syndemic and defaulter rate of ATB DOT. In addition, results include relationship between TBCT training and knowledge, and perceptions about TB and contact tracing.

4.3.2.1 Demographic characteristics of pulmonary tuberculosis patients

The results of demographic characteristics of the PTB patients include age group distribution, gender and marital status. It also includes end-diagnostic plans, TB diagnoses, treatment status and educational level.

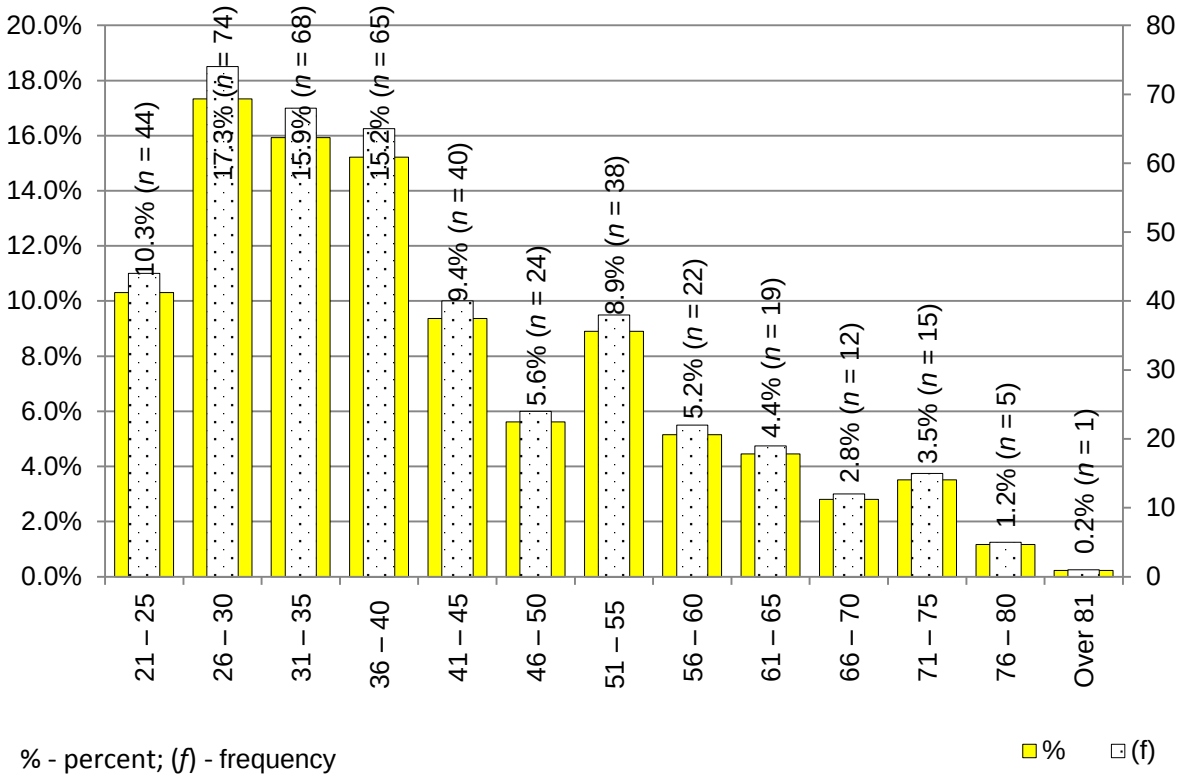


Figure 4.2: Age group of the pulmonary tuberculosis patients (N=427)

Figure 4.2 shows age distribution of the PTB patient participants. The participants who were in the age group of 26 – 30 years were 17.3% (*n*=74). Most of them, that is 4.4% (*n*=19), were aged 29 years. They were followed by 15.9% (*n*=68) of the participants who were in the age group of 31 to 35 years. Most of those in this age group, that is 4.0% (*n*=17), were aged 34 years. Those in the age group of 36 to 40 years were 15.2% (*n*=65). In this age group, 3.7% (*n*=16) were aged 37 years and were the majority. The participants in the age group of 21 to 25 years comprised 10.3% (*n*=44). Many of them, that is 48.0% (*n*=21) were aged 21 years.

The participants who were aged below 40 years were 58.7% (*n*=251) and they comprised majority of the PTB patients. The median age of the PTB patients was 37 years and the mean age 40.9 years respectively. It is evident that most of the participants in the population were youth.

4.3.2.1.1 Gender of pulmonary tuberculosis patients

Table 4.6 shows the gender of the PTB patients. From a sample of 427, 58.3% (*n*=249) of the participants were males and 41.7% (*n*=178) were females. The male-female ratio was 1:4.

Table 4.6: Percentage distribution of sample size by gender of pulmonary tuberculosis patients (N=427)

GENDER OF PTB PATIENTS	SIZE OF THE SAMPLE (%)	
	F	%
Male	249	58.3
Female	178	41.7
Total	**427**	**100.0**

F – Frequency

4.3.2.1.1. Marital status of pulmonary tuberculosis patients

The researcher analysed the marital status of the PTB patients in order to determine their demographic characteristics. Participants were asked to indicate any of the following variables: (1) married monogamous, (2) married polygamous, (3) single cohabiting, (4) single non-cohabiting, (5) divorced, (6) separated and (7) widowed. Table 4.7 shows the responses.

Table 4.7: Percentage distribution of marital status of pulmonary tuberculosis patients (*N*=427)

MARITAL STATUS	GENDER OF PULMONARY TUBERCULOSIS PATIENTS (%)		Both
	Male	Female	
Married monogamous	7.4	1.6	9
Married polygamous	0	0.3	0.3
Single non-cohabiting	23.9	16.6	40.5
Single cohabiting	23.9	20.1	44
Divorced	0.7	0.7	1.4
Separated	0.5	0.5	1
Widowed	1.9	1.9	3.8
Total	**58.3**	**41.7**	**100.0**

The participants who were married monogamous were 9.0% (*n*=39). Out of these, 7.4% (*n*=32) were males and the females were 1.6% (*n*=7). The participants who were married polygamous were 0.3% (*n*=1), the only one female. The participants who were single-non-cohabiting were 40.5% (*n*=173). Out of these, 23.9% (*n*=102) were males and females were 16.6% (*n*=71). The participants who were in single-cohabiting relationships were the majority with 44.0% (*n*=188). Out of these, 23.9% were males and 20.1% were females. Those who were divorced were 1.4% (*n*=6). Out of these, 0.7% (*n*=3) were male and a further were females 0.7% (*n*=3). The participants who were separated were 1.0% (*n*=4) with a similar male-female ratio of 1:1. Those who were widowed were 3.8% (*n*=16) with a male-female ratio of 1:1. The results show that the study population was generally mostly single, either cohabiting or non-cohabiting.

4.3.2.1.3 End-diagnostic plans, diagnoses and treatment status of pulmonary tuberculosis patients

- *End-diagnostic plans*

The researcher analysed end-diagnostic plans for the PTB patients in order to determine the commonest diagnoses as part of the medical procedures affecting TBCT.

The information was extracted from the TB registers using a checklist. They included TST, sputum smear microscopy, culture, chest x-ray and others. Table 4.8 shows the end-diagnostic plans for the PTB patients.

Table 4.8: Percentage distribution of end-diagnostic plans for pulmonary tuberculosis by gender (*N*=427)

END-DIAGNOSTIC PLAN FOR PULMONARY TUBERCULOSIS	GENDER OF PULMONARY TUBERCULOSIS PATIENT (%)		Both
	Male	Female	
Smear microscopy	2.8	2.4	5.2
Specimen culture	30.9	26.2	57.1
Chest X-ray	24.6	13.1	37.7
Total	**58.3**	**41.7**	**100.0**

The participants whose end-diagnostic plan was smear microscopy were 5.2% (*n*=22). Out of these, 2.8% (*n*=12) were for males and 2.3% (*n*=10) were for females. The end-diagnostic plans by specimen culture method were the majority with 57.1% (*n*=244). Out of these, 30.9% (*n*=132) were for males and 26.2% (*n*=112) were for females. The end-diagnostic plan by chest x-ray was second in numbers with 37.7% (*n*=161). Out of these, 24.6% (*n*=105) were for males and 13.1% (*n*=56) were for females. Negligible frequencies for TST end-diagnostic plan were not included. Specimen culture method of end-diagnosis was most commonly used. The end-diagnostic plan by specimen culture was the most common. The Assumption 4 is supported that the medical procedures are a barrier to TBCT (χ^2=5.069, df=2; *p*=0.081, 95% CI: 0.075 – 0.086).

- *Diagnoses for tuberculosis*

The researcher analysed the diagnoses for the PTB patients in order to determine common diagnoses as part of the medical procedures that affect TBCT. The variables used were categorised into (1) new PTB, (2) retreatment TB and (3) MDR TB. Table 4.9 shows the extracted information about diagnoses of the PTB patients by gender.

Table 4.9: Percentage distribution of diagnoses of pulmonary tuberculosis by gender (*N*=427)

DIAGNOSES OF PULMONARY TUBERCULOSIS	GENDER OF PULMONARY TUBERCULOSIS PATIENT (%)		Both
	Male	Female	
New PTB	45.9	36.5	82.4
Retreatment PTB	12.4	4.7	17.1
XDRTB	0	0.5	0.5
Total	**58.3**	**41.7**	**100.0**

Majority, that is 82.4% (*n*=352), of the participants were new PTB patients. Out of these, 45.9% (*n*=196) were males and 36.5% (*n*=156) were females. The participants who were in retreatment PTB category were 17.1% (*n*=73). Of these, 12.4% (*n*=52) and 4.7% (*n*=21) were males. The participants with XDRTB diagnosis were 0.5% (*n*=2), all female PTB patients. Most of the participants had new PTB diagnosis. This may indicate that the frequency of new infections was one of the medical problems that affected TBCT (χ^2=6.072, df=2; *p*=0.028, 95% CI: 0.012 – 0.044).

- *Treatment phase for tuberculosis*

The study analysed the treatment phases for PTB in order to find the prevalent status among the participants. The variables that were extracted included (1) initial phase PTB treatment, (2) continuation phase treatment, (3) retreatment, (4) completed treatment, (5) treatment failure and (6) other. Table 4.10 shows the treatment phases of the PTB patients.

Table 4.10: Percentage distribution of treatment phases of pulmonary tuberculosis patients by gender (*N*=427)

TREATMENT PHASES OF PULMONARY TUBERCULOSIS PATIENTS	GENDER OF PULMONARY TUBERCULOSIS PATIENT (%)		Both
	Male	Female	
Initial phase	9.1	7.5	16.6
Continuation phase	40.5	27.2	67.7
Retreatment phase	3.3	3.7	7.0
Completed treatment	5.2	2.8	8.0
Treatment failure	0.0	0.5	0.5
Other	0.2	0.0	0.2
Total	**58.3**	**41.7**	**100.0**

The participants who were in initial phase treatment PTB category were 16.6% (*n*=71). The males were 9.1% (*n*=39) of the study population and the females comprised 7.5% (*n*=32). Majority, that is 67.7% (*n*=289) of the participants were at continuation phase of PTB treatment. In this category, 40.5% (*n*=173) were males and the females were 27.2% (*n*=116) of the study population. The participants on retreatment phase were 7.0% (*n*=30). Of these, 3.3% (*n*=14) were males and the females in this category were 3.7% (*n*=16) of the study population. The participants who had completed PTB treatment were 8.0% (*n*=34). In this category, the males were 5.2% (*n*=22) and the females comprised 2.8% (*n*=12) of the study population. Participants in the category of treatment failure comprised 0.5% (*n*=2), all of them females in the study population. Most of the participants were in the continuation phase of treatment. This confirms that the majority were new PTB patients. The category of treatment phase had no association with TBCT (χ^2=6.378, df=5; *p*=0.215, 95% CI: 0.176 – 0.254).

4.3.2.1.4 Educational status of pulmonary tuberculosis patients

The study analysed the education status of PTB patients in order to relate it with their knowledge of TBCT. Participants were asked to indicate educational status by highest level of education they attained. The educational level ranged from no education to

tertiary level. The variables used were (1) no education, (2) primary education, (3) secondary education and (4) tertiary education. Table 4.11 shows the responses.

Table 4.11: Percentage distribution of education levels of pulmonary tuberculosis patient by gender (*N*=427)

EDUCATION LEVEL OF PULMONARY TUBERCULOSIS PATIENT	GENDER OF PULMONARY TUBERCULOSIS PATIENTS (%)		Both
	Male	Female	
No education	15.0	5.2	20.2
Primary education	22.5	12.4	34.9
Secondary education	18.9	19.7	38.6
Tertiary education	1.9	4.4	6.3
Total	**58.3**	**41.7**	**100.0**

Those who had no education were 20.1% (*n*=86). Of these, males were 15.0% (*n*=64 of the study population. The females in this category were 5.2% (*n*=22) of the study population. Those who had completed primary education followed with 34.9% (*n*=149). Of these, 22.5% (*n*=96) were males and 12.4% (*n*=53) were females. The participants who had completed secondary education were 38.6% (*n*=165). Of these, 18.9% (*n*=81) were males and 19.7% (*n*=84) were females. Those who had completed tertiary education were the least with 6.3% (*n*=27) of the participants. Of these, 1.9% (*n*=8) were males and 4.4% (*n*=19) were females in the study population. Most of the participants had completed between primary and secondary education levels. The education status would therefore enhance knowledge of TBCT (χ^2=26.381, df=3; *p*=0.000).

4.3.2.2 Socio-economic status of pulmonary tuberculosis patients

The socio-economic characteristics of the PTB patients include occupation, employment, category of employer organisation, conditions describing their work environment and household income.

4.3.2.2.1 Occupation status of pulmonary tuberculosis patients

he researcher analysed the occupation of the PTB patients in order to determine its association with TBCT. Participants were asked to indicate their occupation status by the variables (1) no occupation, (2) skilled, (3) unskilled labour, (4) college student and (5) other. Table 4.12 shows the responses.

Table 4.12: Percentage distribution of occupation status of pulmonary tuberculosis patients (*N*=427)

OCCUPATION STATUS OF PULMONARY TUBERCULOSIS PATIENTS	GENDER OF PULMONARY TUBERCULOSIS PATIENT (%)		Both
	Male	Female	
No occupation	35.1	26.9	62.0
Unskilled	12.6	7.5	20.1
Skilled	7.3	5.9	13.2
Student	2.8	1.4	4.2
Other	0.5	0.0	0.5
Total	**58.3**	**41.7**	**100.0**

The participants who had no occupation were the majority, that is 62.1% (*n*=265). Of these, 35.1% (*n*=150) were males and the females were 26.9% (*n*=115) of the study population. The participants with unskilled labour were 20.1% (*n*=86). Of these, 12.6% (*n*=54) were males and the females were 7.5% (*n*=32) of the study population. The participants with skilled labour were 13.2% (*n*=56). Out of these, 7.3% (*n*=31) were males and the females were 5.9% (*n*=25) of the study population. The participants who were students were 4.2% (*n*=18). Of these, 2.8% (*n*=12) were males and the females were 1.4% (*n*=6) of the study population. The others were 0.5% (*n*=2) and they were only males: a traditional medicine man and a pastor. The occupation status of the PTB patients was not significantly associated with participating in TBCT (χ^2=3.176, df=4; *p*=0.590).

4.3.2.2.2 Employment status of pulmonary tuberculosis patients

The researcher analysed the employment status of the PTB patients in order to assess its association with their participation in TBCT. The participants were asked to indicate employment status using the variables (1) no employment, (2) government employee, (3) private company employee, (4) self-employed and (5) other. Table 4.13 shows the results.

Table 4.13: Percentage distribution of employment status of pulmonary tuberculosis patients (*N*=427)

EMPLOYMENT STATUS OF PULMONARY TUBERCULOSIS PATIENT	GENDER OF PULMONARY TUBERCULOSIS PATIENT (%)		Both
	Male	Female	
Not employed	37.0	27.6	64.6
Government-employee	5.2	5.6	10.8
Private company employee	10.5	4.7	15.2
Self employed	5.6	2.1	7.7
Other	0.0	1.6	1.6
Total	**58.3**	**41.7**	**100.0**

The participants who were not employed were 64.6% (*n*=276). Out of these, 37.0% (*n*=158) were males and 27.6% (*n*=118) were females. Those who were government employees were 10.8% (*n*=46). Out of these, 5.2% (*n*=22) were males and 5.6% (*n*=24) were females who were the majority in this category. Those who were private company employees were 15.2% (*n*=65). The males in this category were 10.5% (*n*=45) and the females were 4.7% (*n*=20) of the study population. The participants who were self-employed were 7.7% (*n*=33). Males in this category were the majority with 5.6% (*n*=24) and the females were 2.1% (*n*=9). Others were 1.6% (*n*=7). All of them were females and included casual labourers and wage earners in what is commonly known as *piece jobs*.

In summary, the results showed that the majority of the participants were not employed. The employment status may affect the PTB patients' participation in TBCT mainly

because employment represents predictable income that preoccupy time usage of each individual ($\chi^{2=}$310.963, df=4; *p*=0.027, 95% CI: 0.022 – 0.028).

4.3.2.2.3. Category of employer organisation for pulmonary tuberculosis patients

The study analysed the category of employer organisation to assess the association with PTB patients' intention to participate in TBCT. Participants were asked to indicate the category using the variables (1) service industry, (2) manufacturing industry, (3) mining industry, (4) farming industry and (5) other industries. Table 4.14 displays the responses.

Table 4.14: Percentage distribution of categories of employer organisations for pulmonary tuberculosis patients (*N*=427)

CATEGORY OF EMPLOYER ORGANISATION	GENDER OF PULMONARY TUBERCULOSIS PATIENT (%)		Both
	Male	Female	
Service industry	11	9.6	20.6
Manufacturing industry	8	2.3	10.3
Mining industry	2.6	1.2	3.8
Farming industry	0.7	0.9	1.6
Other	0.5	1.6	2.1
Not applicable	35.5	26.1	61.6
Total	**58.3**	**41.7**	**100.0**

Table 4.14 shows that the participants who worked in the service industry were 20.6% (*n*=88). Out of these, males were 11.0% (*n*=47) and the females were 9.6% (*n*=41) of the study population. Those who worked in the manufacturing industry were 10.3% (*n*=44). Out of these, 8.0% (*n*=34) were males and the females were 2.3% (*n*=10) of the study population. Those who worked in the mining industry were 3.8% (*n*=16) of the participants. Out of these, 2.6% (*n*=11) were males and the females were 1.2% (*n*=5) of the study population. The participants who were in the farming industry were 1.6% (*n*=7). Out of these, 0.7% (*n*=3) were males and the females consisted 0.9% (*n*=4) of the study population for this category. Other participants constituted 0.1% (*n*=9). The

participants who did not fit in any of the industries were 61.6% (*n*=263) out of which 35.5% (*n*=152) were males and 26.1% (*n*=111) were females. These were treated as not applicable.

In summary, most of the employed participants were in the service industry. The analysis showed that there was association between the categories, especially service industry, with the PTB patients' participation in TBCT (χ^2=13.634, df=5; *p*=0.018, 95% CI: -2.274 – 0.023).

4.3.2.2.4 Conditions describing physical workplace for pulmonary tuberculosis patients

The researcher analysed the conditions that described physical workplace for the PTB patients in order to determine workplace factors that affect utilisation of TBCT. The participants were asked to indicate any of the following conditions: (1) closed and spacious, (2) closed and congested and (3) open and spacious. The participants who were eligible for response to this item were 41.7% (*n*=178). Based on these 178 participants, the researcher analysed the conditions that best described physical conditions of workplaces. Table 4.15 displays the results.

Table 4.15: Percentage distribution of conditions that best describe physical structures of workplace by gender (*N*=427)

CONDITIONS THAT BEST DESCRIBE PHYSICAL STRUCTURES OF WORKPLACE	GENDER OF PULMONARY TUBERCULOSIS PATIENT (%)		Both
	Male	Female	
Closed and spacious	11.5	8.4	19.9
Closed and congested	4.7	1.9	6.6
Open and spacious	9.6	5.6	15.2
Sub-total	25.8	15.9	41.7
Not applicable	32.5	25.8	58.3
Total	**58.3**	**41.7**	**100.0**

It is from these that 19.9% (*n*=85) of the participants indicated that the physical structures at workplaces were closed and spacious. Out of these, males were 11.5% (*n*=49) and the females were 8.4% (*n*=36). The participants who worked in closed and congested physical workplaces were 6.6% (*n*=28). Out of these, males were 4.7% (*n*=20) and females were 1.9% (*n*=8). Those who worked in open and spacious physical workplaces were 15.3% (*n*=65). Out of these, males were 9.6% (*n*=41) and females were 5.6% (*n*=24). The participants who were not applicable for this item were 58.3% (*n*=249) of the study population. The results in general show that out of the majority, that is 25.8% (*n*=110), of the participants who worked in closed and spacious structures, most were males (χ^2=11.153, df=4; *p*=0.009, 95% CI: 0.000 – 0.019).

The researcher also analysed conditions describing physical workplace by the type of industry for the PTB patients. The aim was to determine workplace factors by type of industry that affect utilisation of TBCT. The conditions are in relation to the category of employer organisation. The results are presented in Table 4.16.

Table 4.16: Percentage distribution of conditions that best describe physical workplace by category of employer organisation (*N*=427)

CONDITIONS THAT BEST DESCRIBE PHYSICAL WORKPLACE	CATEGORY OF EMPLOYER ORGANISATION (%)					Total
	Service industry	Manufacturing industry	Mining industry	Farming industry	Not applicable	
Closed and spacious	10.1	5.6	0.7	0.5	3.0	19.9
Closed and congested	2.2	1.9	0.9	0.9	0.7	6.6
Open and spacious	6.3	2.6	2.1	0.0	4.2	15.2
Not applicable	2.1	0.2	0,0	0.2	55.8	58.3
Total	**20.7**	**10.3**	**3.7**	**1.6**	**63.7**	**100.0**

The participants who worked in the service industry were 18.6% (*n*=79). This was followed by 10.1% (*n*=43) who worked in the manufacturing industry, 3.7% (*n*=16) who worked in mining industry and 1.4% (*n*=6) who worked in farming industry. Those that were not applicable were 7.9% (*n*=34). Among the participants who worked in the closed and spacious physical structures of service industry were 10.1% (*n*=43) and were the majority. They were followed by 5.6% (*n*=24) participants who worked in

closed and spacious physical structures of manufacturing industry, 0.7% (*n*=3) of mining industry and lastly, 0.5% (*n*=2) of the farming industry. Those who worked in closed and congested physical structures of service industry were 2.2% (*n*=9). They were followed by 1.9% (*n*=8) of manufacturing industry, 0.9% *(n*=4) each of mining and farming industries respectively.

The participants who worked in open and spacious physical structures of service industry were 6.3% (*n*=27). This was followed by 2.6% (*n*=11) participants who worked manufacturing industry, 2.1% (n=9) of mining industry and none of farming industry. The conditions that best describe work environment was associated with TB infection (χ^2=601.904, df=20; *p*=0.000, 95% CI: 0.000 – 0.007) and that may determine the participation of PTB patients in TBCT.

4.3.2.2.5 Household income for pulmonary tuberculosis patients

The researcher studied the household income to find the economic status of the PTB patients and its association with TBCT. The household income was measured using the local currency, Botswana Pula (BWP). The participants were asked to indicate any of the following variables: (1) no monthly income, (2) below BWP 500.00, (3) BWP 501.00 – BWP 1 500.00, (4) BWP 1 501.00 – BWP 2 500.00 and (5) over BWP 2 501.00. Table 4.17 shows the responses for household income per month for the PTB patients.

Table 4.17: Percentage distribution of household income per month for pulmonary tuberculosis patients (*N*=427)

HOUSEHOLD INCOME PER MONTH	GENDER OF PULMONARY TUBERCULOSIS PATIENTS (%)		Both
	Male	Female	
No monthly income	28.3	22.2	50.6
Below BWP 500.00	10.8	6.6	17.3
BWP 501.00 – 1 500.00	10.1	7.0	17.1
BWP 1 501.00 – 2 500.00	4.2	3.5	7.7
0ver BWP 2 501.00	4.9	2.3	7.3
Total	**58.3**	**41.7**	**100.0**

The participants who had no monthly income were 50.6% (*n*=216). This group constituted the majority. Out of these, males were 28.3% (*n*=121) and females were 22.2% (*n* 95). They were followed by 17.3% (*n*=74) of those who earned less than BWP 500.00. The participants who earned between BWP 501.00 and BWP 1 500.00 were 17.1% (*n*=73). Those who earned between BWP 1 501.00 and BWP 2 500.00 were 7.7% (*n*=33). Those who earned BWP 2 501.00 and above were 7.3% (*n*=31). This is much less than BWP 4 661.00 which is an average monthly earnings for citizens.

Of the participants who had no monthly household income, males were 28.3% (*n*=121) and females were 22.2% (*n*=95). They were the majority with 53.4% among all females in the study. The males who had an income of less than BWP 500.00 constituted 10.8% (*n*=46) of the study population. The females in this income bracket comprised 6.6% (*n*=28) of the study population. For those who had an income between BWP 501.00 and BWP 1 500.00, 10.1% (*n*=43) were males. The females in this income bracket comprised 7.0% (*n*=30) of the study population. The male participants who had an income between BWP 1 501.00 and BWP 2 500.00 comprised 4.2% (*n*=18) of the study population. The females in this income bracket comprised 3.5% (*n*=15) of the study population. Most of those who had an income over BWP 2 501.00 were males. They constituted 4.9% (*n*=21) of the study population. The females in this income bracket comprised 2.3% (*n*=10) of the study population.

In summary, the majority of the PTB patients had no income. Most of them were males. However, the economic status is not significantly associated with their participation in TBCT (χ^2=2.256, df=4; *p*=0.689; 95% CI: 0.654 – 0.741).

4.3.2.2.6 Household characteristics of pulmonary tuberculosis

The household characteristics were analysed in order to determine their relationship with TBCT. The characteristics were cross-tabulated with gender of the PTB patient. The variables included type of housing, number of rooms, number of household members and number of hours spent together with the TB contacts each day.

- *Housing pattern for pulmonary tuberculosis patient lived*

The housing patterns for the PTB patients were studied in particular to find if that had any relationship with their participation in TBCT. The variables used were (1) temporary, (2) semi-permanent, (3) permanent and (4) others. A temporary house was that which had neither concrete floor nor walls and had a grass-thatched roof. A semi-permanent house was that which has concrete floor, mud walls and iron-sheet roofing. A permanent house was described as that which has concrete floor, walls and roof tiles. Other housing included makeshift structures that were used as temporary shelters. The responses are displayed in Table 4.18.

Table 4.18: Percentage distribution of housing patterns for pulmonary tuberculosis patients (*N*=427)

TYPE OF HOUSEHOLD	NUMBER OF HOUSEHOLD ROOMS (%)					Total
	1 – 2.5 rooms	3 – 4.5 rooms	5 – 6.5 rooms	7 – 8.5 rooms	>9 rooms	
Temporary	2.8	0.7	0.2	0.0	0.0	3.7
Semi-permanent	2.8	4.0	0.0	0.0	0.0	6.8
Permanent	21.8	17.1	24.7	16.2	9.3	89.1
Other	0.0	0.2	0.2	0.0	0.0	0.4
Total	**27.4**	**22.0**	**25.1**	**16.2**	**9.3**	**100.0**

The participants whose house was temporary were 3.7% (*n*=16). Those whose house was semi-permanent were 6.8% (*n*=29). Those whose houses were of permanent physical structures were 89.1% (*n*=380). The Other housing structures were 0.4% (*n*=2).

The variable used for the number of rooms were (1) 1 to 2.5 rooms, (2) 3 to 4.5 rooms, (3) 5 to 6.5 rooms, (4) 7 to 8.5 rooms and (5) 9 or more rooms. The houses with 1 to 2.5 rooms were 27.4% (*n*=117). The houses with 3 to 4.5 rooms were 22.0% (*n*=94). Those with 5 to 6.5 rooms were 25.1% (*n*=107). The houses with 7 to 8.5 rooms were 16.2% (*n*=69) and those with 9 or more rooms were 9.3% (*n*=40). The results show that housing pattern had some association with the PTB patients' participation in TBCT (χ^2=74.414, df=33, *p*=0.014; 95% CI: 0.003 – 0.025).

- *Occupancy of households by pulmonary tuberculosis patients and contacts relative to number of rooms*

The household number of rooms and the number of household occupants was studied to assess occupancy status. Occupancy was defined as low, moderate and high. Low occupancy is that which had 1 to 4 household members. Moderate occupancy is one which had 5 to 9 household members and high occupancy had 10 household members and above. The variables for the number of rooms were (1) 1 to 2.5, (2) 3 to 4.5, (3) 5 to 6.5, (4) 7 to 8.5 and (5) over 9 rooms. The variables for the number of household members were (1) 1 to 4, (2) 5 to 9, (3) 10 to 14 and (4) over 15. Table 4.19 displays the responses.

Table 4.19: Percentage distribution of number of rooms per house by number of household occupants (*N*=427)

NUMBER OF ROOMS PER HOUSE	NUMBER OF HOUSEHOLD OCCUPANTS (%)				Total occupants
	1 – 4 occupants	5 – 9 occupants	10 – 14 occupants	>15 occupants	
1 – 2.5 rooms	4.2	12.2	5.6	5.4	27.4
3 – 4.5 rooms	2.8	10.1	4.4	4.7	22
5 – 6.5 rooms	1.8	13.3	6.3	3.6	25
7 – 8.5 rooms	0.5	10.5	3.3	1.9	16.2
> 9 rooms	0.5	6.6	0.7	1.6	9.4
Total	**9.8**	**52.7**	**20.3**	**17.2**	**100.0**

The houses with 1 to 4 occupants were 9.8% (*n*=42); those with 5 to 9 were 52.7% (*n*=225); those with 10 to 14 were 20.4% (*n*=87) and those with over 15 were 17.2% (*n*=73). The participants whose houses had 1 to 2.5 rooms were 27.4% (*n*=117). Those whose houses had 3 to 4.5 rooms were 22.0% (*n*=94). Those whose houses had 5 to 6.5 rooms were 25.0% (*n*=107). Those whose houses had 7 to 8.5 rooms were 16.2% (n=69) and those whose houses had 9 rooms and more were 9.4% n=40). The majority of household occupants in the houses ranged from 5 to 9.

In summary, the occupancy status of houses was high. That could be a risk for TB transmission and implications for the TBCT (χ^2=369.111; df=187; *p*=0.009, 95% CI: 0.000 – 0.019).

- *Duration of closeness of pulmonary tuberculosis patient and household contacts per day*

The number of hours spent in the household per day was analysed to find the duration of closeness by the PTB patients and the household TB contacts. Males were 57.0% (n=223) and females were 43.0% (n=168). The majority of the participants, that is 37.6% (n=147), were those who spent 24 hours together in a day. Most of them, that is 56.5% (n=83) were males. This was followed by 34.8% (n=136) of the participants who spent 12 hours per day together. Out of these 136, 60.3% (n=82) were males and 39.7% (n=54) were females. The duration of closeness was not significantly related to TBCT (χ2=14.798, df=12, p=0.245).

- *Household food normally served per day*

The type of food and the frequency of servings per day in the household was analysed in order to estimate the adequacy in amount. The foods included *raese* (rice), *nama* (beef meat) sorghum, *phaleche* (maize meal), *morogo* (vegetable), potatoes, *bogobe* (porridge) and other types of food. The variables were grouped in the combinations according to the participants' preferences. The combinations were (1) rice, meat, sorghum, (2) meat, maize meal, vegetable, (3) potatoes, rice, maize meal and (4) porridge, rice, maize meal.

The participants who indicated that their households normally served the combination of meat, maize meal and vegetable were 46.6% (*n*=199). They were the majority. However, 57.3% (*n*=114) of them served it twice a day. This may have an implication with their participation in TBCT (χ^2=32.079, df=12, *p*=0.001). About 31.4% (*n*=134) of the participants indicated that the food was adequate.

The participants who indicated that their households served the combination of rice, meat and sorghum were 40.7% (*n*=174). Out of these, 35.6% (*n*=62) served this food

type twice a day and only 33.0% (*n*=141) of them said it was adequate. Thus, on estimate, the amount of food normally served was not adequate. This may be associated with difficulty in finding time to participate in TBCT (χ^2=11.836, df=4, *p*=0.014).

4.3.2.3 Living or working with pulmonary tuberculosis patient

The PTB patients' history of living or working with someone infected with PTB prior to the present infection was analysed in order to deduce their participation in TBCT. Participants were asked if they lived/worked or had ever lived/worked with a person infected with PTB. The participants who indicated that they had never before lived or worked with a person infected with PTB were 58.1% (*n*=248). Out of these, males were 61.7% (*n*=153) and females were 38.3% (*n*=95). Those who had lived or worked with a PTB patient before were 21.1% (*n*=90). The majority, that is 62.2% (*n*=56) of them were males. The participants who indicated that they were still living or working with someone with PTB were 20.0% (*n*=89). The females were the majority with 55.1% (*n*=49). The history of living or working with someone with PTB was associated with their participation in TBCT (χ^2=8.276, df=2; *p*=0.014).

The researcher analysed the duration, by number of days, of close proximity with a person with PTB in the week prior to the interview in order to assess their intention to participate in TBCT. The participants were asked to indicate any of the following variables: (1) 1 to 2 days, (2) 3 to 4 days, (3) 5 to 6 days and (4) 7 days.

There were 22.5% (*n*=96) participants who had shared close proximity with a person with PTB in the week prior to the interview. Out of these, 43.6% (*n*=42) were males and 56.4% (*n*=54) were females. Of the 96 participants who had shared close proximity with a PTB patient in the last week, 65.6% (*n*=63) had spent 7 days. They comprised 14.8% of the study population. Most of them, that is 37.5% (*n*=36) were females who comprised 8.4% of the study population. The participants who had spent 1 to 2 days were 15.6% (*n*=15). They comprised 3.5% of the study population. Majority of them, that is 60.0% (*n*=9) were males. Those who had spent 3 to 4 days were 7.3% (*n*=7). They comprised 1.6% of the study population. The majority of them, that is 57.1% (*n*=4) were females. Only 3.2% (*n*=3) of the participants had spent 5 to 6 days in close proximity with a PTB patient. They comprised 0.7% of the study population.

The number of days the participants spent with a PTB patient was significantly associated with participating in TBCT. The closeness with a PTB patient is an influencing factor in the intention to participate in TBCT (χ^2=20.964, df=5; *p*=0.000). This is probably because the individual can see the seriousness of the TB disease and that may act as a cue to participate in TBCT.

The numbers of days shared with a PTB patient in the month prior to the interview were analysed in order to determine further the intention of the participant to participate in TBCT. The participants who had shared close proximity with a person with PTB in the month prior to the interview were 21.5% (*n*=92). From these, the male participants were 42.4% (*n*=39) and females were 57.6% (*n*=53). The number of days shared were grouped as (1) every day, (2) 8 to 15 days and (3) 16 to 21 days.

Of those who had shared close proximity with a PTB patient in the month prior to the interview, 88.0% (*n*=81) had shared close proximity in every day of the month. They comprised 19.0% (*n*=81) of the study population. Out of these, 48.9% (*n*=45) were females who comprised 10.5% of the study population. Those who had shared close proximity in 8 to 15 days were 5.4% (*n*=5). They comprised 1.2% of the study population. Out of these, 60.0% (*n*=3) were females. Those who had spent 16 to 21 days were 6.5% (*n*=6). They comprised 1.4% of the study population The majority of them, that is 83.6% (*n*=5) were females.

Sharing close proximity with a person with PTB in the month prior to the interview was significantly associated with the participant's intention to participate in TBCT (χ^2=14.016, df=3; *p*=0.002).

The number of workplace contacts in daily contact with the participant was analysed to find if that was associated with their intention to participate in TBCT. The variables were (1) none, (2) 1 to 4 workmates, (3) 5 to 9 workmates, (4) 10 to 14 workmates and (5) over 15 workmates. The valid cases were 99.3% (*n*=424) of the study population. Only 7.0% (*n*=3) were missing. This was applicable for the 47.2% (*n*=200) participant workmates.

The majority, that is 20.5% (*n*=41), of the participants had none. They comprised 63.4% (*n*=26) males and 36.6% (*n*=15) females. The participants who had 1 to 4 workmates were 7.0% (*n*=14). The majority, that is 64.3% (*n*=9) of this group were males. The participants who had 5 to 9 workmates were 42.0% (*n*=84). Out of these, 58.3% (*n*=49) were males and 41.7% (*n*=35) were females. The participants who had 10 to 14 workmates were 17.0% (*n*=35). Out of these, 65.7% (*n*=23) were males and 34.3% (*n*=12) were females. The participants who had over 15 workmates were 13.0% (*n*=26). Out of these, 53.8% (*n*=14) were males and 46.2% (*n*=12) were females. The number of workplace contacts in daily contact with the participant was not associated with their [PTB patients] intention to participate in TBCT (χ^2=22.164, df=18; *p*=0.187).

4.3.2.4 Perceptions of risk of tuberculosis infection

4.3.2.4.1 Perceptions of risk of contracting tuberculosis

The study analysed perception of risk of contracting TB by the participants at home and workplace in order to deduce their intention to participate in TBCT. The variables were (1) yes, (2) no, (3) do not know. The participants comprised 57.9% (*n*=216) males and 42.1% (*n*=157) females. The responses are as follows:

The participants did not know whether they were at risk of contracting TB were 35.4% (*n*=132). Out of these, 52.3% (*n*=69) were males and 47.7% (*n*=63) were females. The participants had various reasons for feeling or not feeling at risk of TB infection. The participants who felt at risk because a household member with a cough had not been tested were 14.7% (*n*=55). These included 60.0% (*n*=33) males and 40.0% (*n*=22) females. Those who stated that they felt at risk because a workmate with a cough had not been tested were 6.7% (*n*=25). Out of these, 52.0% (*n*=13) were males and 40.0% (*n*=12) were females.

The participants who indicated that they did not feel at risk because no workmate had a cough were 16.0% (*n*=59). These included 64.4% (*n*=38) males and 35.6% (*n*=21) females. Those who had other perceptions were 19.8% (*n*=74). Out of these, 63.5% (*n*=47) were males and 36.5% (*n*=27) were females. There was no association between the perception of feeling at risk of contracting TB and the intention to participate in TBCT (χ^2=4.159, df=5; *p*=0.538)

4.3.2.4.2 Perception of risk of transmitting tuberculosis

Conversely, the researcher analysed the perception of risk of transmitting TB to household and workplace contacts in order to know if that was associated with intention to participate in TBCT. The participants were asked whether they felt that someone was at risk of contracting TB from them. The response variables included (1) no, (2) yes and (3) do not know. There were 249 (58.3%) males and 178 (41.7%) females.

The participants who did not perceive that they risked transmitting TB to household and workplace contacts were 45.7% (*n*=195). Out of these participants, males were 65.6% (*n*=128). Those who felt that they risked transmitting TB only to household contacts were 44.7% (*n*=191). Out of these, males were 52.4% (*n*=100). Those who felt that they risked transmitting TB only to workplace contacts were 4.2% (*n*=18). Out of these, 50.0% (*n*=9) were males and 50.0% (*n*=9) were females. Those who did not know that they risked transmitting TB to contacts were 5.4% (*n*=23). Out of these, 52.2% (*n*=12) were males and 47.8% (*n*=11) were females.

In summary, the association of perceptions of feeling at risk of contracting or transmitting TB to contacts showed some significance to TBCT (χ^2=5.367, df=1; *p*=0.026). Although it is a weak association, the perception that one may risk contracting or transmitting to contacts is associated with the PTB patients' intention to participate in TBCT (χ^2=5.367, df=1; *p*=0.026).

4.3.2.4.3 Risk factors for tuberculosis and tuberculosis and contact tracing

The study analysed the risk factors for TB and contact tracing in order to determine their association with TBCT. They include TBHIV co-infection, alcohol consumption and smoking cigarettes. It also includes defaulter rate for ATB DOT and prescription medication.

4.3.2.4.4 Syndemic tuberculosis and human immunodeficiency virus

The study analysed the status of the TBHIV syndemic co-infection to determine its implication on TBCT. The researcher asked the participants whether they knew their HIV status. The response variables were (1) living with HIV, (2) not living with HIV, (3) no disclosure of HIV status and (4) do not know HIV status. Table 4.20 shows the responses.

Table 4.20: Percentage distribution of status of human immunodeficiency virus co-infection by gender of pulmonary tuberculosis patients (*N*=427)

STATUS OF HIV CO-INFECTION	GENDER OF PULMONARY TUBERCULOSIS PATIENTS		Both
	Male	Female	
Living with HIV	30.0	28.1	58.1
Not living with HIV	20.6	9.1	29.7
No disclosure of my HIV status	0.7	0.5	1.2
Do not know my HIV status	7.0	4.0	11.0
Total	**58.3**	**41.7**	**100.0**

The participants who indicated that they had HIV were 58.1% (*n*=248). They were the majority of the population. Out of these, 51.6% (*n*=128) were males who comprised 30.0% (*n*=128) of the study population. The females who had HIV were 28.1% (*n*=120) of the study population. Those who stated that they did not have HIV co-infection were 29.7% (*n*=127). Males, that is 69.3% (*n*=88), were twice as many as were females who comprised 30.7% (*n*=39). The participants who knew their HIV status and would not disclose were 1.2% (*n*=5). Out of these, males were 0.7% (*n*=3) and females were 0.5% (*n*=2). Those who did not know of their HIV status were 11.0% (*n*=47). Out of these, males were 7.0% (*n*=30) being the majority and were nearly twice as many as were the females who comprised 4.0% (*n*=17). Results showed that the co-infection of TBHIV was associated with the PTB patients' participation in TBCT (χ^2=11.471, df=3; *p*=0.012).

- *Smoking cigarettes as risk factor for tuberculosis and contact tracing*

The researcher sought to determine the association between cigarette smoking and contact tracing. From the assumption that the participants smoked cigarettes, the study aimed to know the type smoked. The response variables were (1) do not smoke, (2) manufactured cigarettes, (3) traditional cigarettes and (4) manufactured and traditional cigarettes. The responses are as follows:

The participants who did not smoke at the time of the study were the majority being 73.8% (*n*=315). Out of these, 50.8% (*n*=160) were males and 49.2% (*n*=155) were females. There was approximately a 1:1 ratio for males and females in this response. Those who smoked both manufactured and tradition cigarettes were 11.7% (*n*=50). Out of these, 90.0% (*n*=45) were males. They also comprised 10.5% of the study population. The participants who smoked only manufactured cigarettes were 9.0% (*n*=38). Out of these, 78.9% (*n*=30) were males who comprised 7.0% of the study population. Among the 5.6% (*n*=24) who smoked traditional cigarettes, 58.3% (*n*=13) were males and 41.7% (*n*=10) were females. In summary, smoking of cigarettes has an implication on the intention to participate in TBCT (χ^2=34.635, df=3; *p*=0.000).

When age was used as a control variable for smoking, the following were obtained: The majority of the participants that is 75.0% (*n*=33), in the age group of 21 – 25 years did not smoke cigarettes. The participants in this age group comprised 10.3% (*n*=44). Only 13.6% (*n*=6) of those who smoked cigarettes used both manufactured and traditional cigarettes.

Out of the 17.3% (*n*=74) of the participants in the age group 26 – 30 years, 81.1% (*n*=60) did not smoke cigarettes, 8.1% (*n*=6) smoked manufactured cigarettes only and the rest had negligible percentages. For the 15.9% (*n*=68) in the age group 31 – 35 years, 81.0% (*n*=55) did not smoke cigarettes. Only 7.4% (*n*=5) smoked manufactured cigarettes only and a further 7.4% (*n*=5) smoked both manufactured and traditional cigarettes. The majority, that is 64.6% (*n*=42), of the participants in the age group 36 – 40 years did not smoke cigarettes. The participants in this age group comprised 15.2% (*n*=65) of the study population. Out of these, 23.1% (*n*=15) smoked both manufactured and traditional cigarettes. The participants in the age group 41 – 45 years who did not smoke cigarettes were 75.6% (*n*=31). The participants in this age group comprised

96.0% (*n*=41) of the study population. In this age group, only 17.1% (*n*=7) of the participants smoked both manufactured and traditional cigarettes. The age of smoking shows further that smoking has implication on the PTB patients' participation in TBCT (χ^2=204.256, df=168; *p*=0.037).

The study analysed the number of cigarettes smoked per day for the 26.2% (*n*=112) who smoked cigarettes. The majority of the participants, that is 38.4% (*n*=43) smoked over 10 sticks of cigarettes per day. Out of these, males were 72.1% (*n*=31). That was followed by 23.2% (*n*=26) of those who smoked 1 to 3 cigarettes, mostly males, that is 80.8% (*n*=21). Those who smoked 4 to 5 cigarettes were 22.3% (*n*=25). Again, most of them were males, that is 88.0% (*n*=22). Those who smoked 7 to 9 cigarettes were 21.4% (*n*=24), mostly males, that is 70.8% (*n*=17). The number of cigarettes smoked per day had significant implication on the TBCT (χ^2=32.093, df=5; *p*=0.000).

The participants were asked how often they shared cigarette butts. The variables included (1) do not share, (2) sometimes share, (3) seldom share and (4) often share. This applied for the 26.2% (*n*=112) who smoked cigarettes.

The participants who sometimes shared cigarette butts were 54.5% (*n*=61) and were the majority. They were predominantly males, that is 82.0% (*n*=50). Those who seldom shared partly smoked cigarettes were 20.5% (*n*=23). Almost all, that is 95.7% (*n*=22), of them were males. The participants who often shared partly smoked cigarettes were 12.5% (*n*=14). Most of them, that is 85.7% (*n*=12), were males. Only 16.1% (*n*=18) of the participants never shared partly smoked cigarettes. In this percentage, there was a male-female ratio of 1:1. The sharing of partly smoked cigarettes by the participants had significant implication in their participation in TBCT (χ^2=38.816, df=4; *p*=0.000), probably due to peer pressure associated with the act of smoking.

- *Alcohol consumption as a risk for tuberculosis and contact tracing*

The researcher sought to determine the association between alcohol consumption and contact tracing. From the assumption that the participant consumed alcohol, the study aimed to know the type consumed. The response variables were (1) do not consume

alcohol, (2) consume manufactured alcohol, (3) consume traditional alcohol and (4) consume manufactured and traditional alcohol. The responses are as follows:

The participants who did not consume alcohol were 60.7% (*n*=259). Majority, that is 52.9% (*n*=137), were females. The participants who consumed alcohol were 39.3% (*n*=168). Out of these, 47.0% (*n*=79) participants consumed both manufactured and traditional beer. The participants who consumed only manufactured alcohol were 33.3% (*n*=56) and those who consumed only traditional beer were 19.6% (*n*=33). Alcohol consumption had implication on the PTB patients' participation in TBCT (χ^2=41.016, df=3; *p*=0.000). That is probably ascribable to the peer pressure associated with consumption of alcohol.

When age was used as control variable, majority, that is 20.0% (*n*=34), of those who consumed both manufactured and traditional beer were aged between 26 and 40 years Age and consumption of alcohol had implication on the TBCT (χ^2=218.452, df=168; *p*=0.014).

The study determined the risk of consuming alcohol while on ATB treatment. The majority of those who consumed alcohol, that is 36.3% (*n*=61), did so seven days per week. Out of these, males were 75.4% (*n*=46). Those who consumed alcohol five to six days in a week were 26.2% (*n*=44). Out of these, 88.6% (*n*=30) were males. Those who consumed it three to four days in a week were 21.4% (*n*=36). Out of these, 77.8% (*n*=28) were also males. There was 1:1 male-female ratio for the 15.5% (*n*=26) who consumed alcohol in one to two days per week. The frequency of alcohol consumption by the PTB patients was significantly associated with their participation in TBCT (χ^2=45.427, df=7; *p*=0.000).

4.3.2.4.5 Defaulter risks for anti-tuberculosis directly observed treatment and other medication

The researcher asked the participants to state the number of days per week that they went late or failed to go for DOT for TB. This was in order to assess defaulting medications as a risk for TBCT. The variables included (1) none, (2) 1 to 2 days, (3) 3 to 4 days and (4) 5 to 6 days. Table 4.21 displays the responses.

Table 4.21: Percentage of defaulter risks of anti-tuberculosis directly observed treatment and other medications by gender of pulmonary tuberculosis patients (*N*=427)

DEFAULTER RISKS OF ANTI-TUBERCULOSIS DIRECTLY OBSERVED TREATMENT AND OTHER MEDICATIONS	GENDER OF PULMONARY TUBERCULOSIS PATIENTS (%)		Both
	Male	Female	
Number of days late or failed DOT for TB			
None	46.2	39.1	85.3
1 – 2 days	4.9	0.7	5.6
3 – 4 days	4.4	1.2	5.6
5 – 6 days	2.8	0.7	3.5
Total	**58.3**	**41.7**	**100.0**
Number of days shared non-ATB medications			
None	45.9	37.7	83.6
1 – 2 days	10.8	3.3	14.1
3 – 4 days	1.2	0.7	1.9
5 – 6 days	0.5	0.0	0.5
Total	**58.3**	**41.7**	**100.0**
Number of days borrowed non-ATB medications			
None	46.6	37.9	84.5
1 – 2 days	10.3	3.0	13.3
3 – 4 days	1.4	0.7	2.1
Total	**58.3**	**41.7**	**100.0**

The participants who neither went late nor failed the ATB DOT were 85.3% (*n*=364). Out of these, 46.2% (*n*=197) were males and 39.1% (*n*=167) were females. The participants who had failed one to two days were 5.6% (*n*=24). Out of these, males were 4.9% (*n*=21) and females were 0.7% (*n*=3). A further 5.6% (*n*=24) had failed three to four days. Out of these, 4.4% (*n*=19) were males and females were 1.2% (*n*=5). Those who had failed five to six days were 3.5% (*n*=15). Most of them, that is 2.8% (*n*=12) were males and 0.7% (*n*=3) were females. The risk of defaulting ATB DOT and

other medicines was closely associated with failing to participate in TBCT (χ^2=18.238, df=3; *p*=0.000; 95% CI: 0.000 – 0.007).

Table 4.21 also shows the number of days that the participants shared their prescribed non-ATB medicines in the month prior to the interview. The researcher asked the participants to state the number of days by indicating either of the following variables: (1) none (2) 1 to 2 days, (3) 3 to 4 days and (4) 5 to 6 days. Results showed that the participants who indicated that they did not share ATB DOT nor any other medicines were 83.6% (*n*=357). They were the majority. Out of these, 45.9% (*n*=196) were males and 37.7% (*n*=161) were females. The participants who had shared prescribed medicines in one to two days were 14.1% (*n*=60). Out of these, males were 10.8% (*n*=46) and females were 3.3% (*n*=14). Those who had shared the medicines in three to four days were 1.9% (*n*=8). Out of these, 1.2% (*n*=5) were males and 0.7% (*n*=3) were females. All 0.5% (*n*=2) of the participants who had shared the medicines in five to six days were males. Results show that the sharing of prescribed medicines had implications on the TBCT (χ^2=6.072, df=2; *p*=0.028, 95% CI: 0.012 – 0.044). However, the majority of the participants did not share.

Further, the researcher asked the participants to state the number of days that they borrowed prescribed non-ATB medicines from a friend in the month preceding the interview. The variables included (1) none (2) one to two days and (3) three to four days. Table 4.21 portrays the responses. The participants who indicated that they did not borrow non-ATB medicines were 84.5% (*n*=361). Out of these, 45.9% (*n*=199) were males and 37.9% (*n*=162) were females. Those who borrowed the non-ATB medicines in one to two days were 13.3% (*n*=57). Out of these, males were 10.3% (*n*=44) and females were 3.0% (*n*=13). Those who borrowed three to four days were 2.1% (*n*=9). Out of these, 1.4% (*n*=6) were males and 0.7% (*n*=3) were females. The borrowing of non-ATB medicines had implications for a possibility of defaulting ATB treatment. Such default might have also led to default in TBCT follow-up (χ^2=10.126, df=2p=0.000, 95% CI: 0.000 – 0.007).

4.3.2.5 Frequency of tuberculosis infection and health seeking behaviour for pulmonary tuberculosis patients

4.3.2.5.1 Frequency of pulmonary tuberculosis infection

The study analysed the frequency of TB infection among the participants. This was in order to know their health seeking behaviour and participation in TBCT. The participants were asked to state their frequency of TB infection with the variables being (1) first time, (2) two times and (3) more than two times. Table 4.22 shows the responses.

Table 4.22: Percentage of frequency of pulmonary tuberculosis infection by gender of pulmonary tuberculosis patients (*N*=427)

FREQUENCY OF PTB INFECTION	GENDER OF PULMONARY TUBERCULOSIS PATIENTS (%)		Both
	Male	Female	
First time infection	35.4	25.8	61.2
Two times infection	16.6	12.4	29
More than two times infection	6.3	3.5	9.8
Total	**58.3**	**41.7**	**100**

The participants who had the TB infection for the first time were 61.0% (*n*=261). Out of these, 35.4% (*n*=151) were males and 25.8% (*n*=110) were females. The participants who had two times infection of TB were 29.0% (*n*=124). Out of these, 16.6% (*n*=71) were males and 12.4% (*n*=53) were females. Those who had PTB infection more than two times were 10.0% (*n*=42). Out of these, 6.3% (*n*=27) were males and the females were 3.5% (n=15). The frequency of TB infection was not associated with the intention of the PTB patients to participate in TBCT (χ^2=0.696, df=2; *p*=0.710; 95% CI: 0.667 – 0.753).

4.3.2.5.2 Participants' learning about pulmonary tuberculosis infection

The study analysed how the participants learned about their TB infection in order to determine health-seeking behaviour. They were asked to state how they learned of their

TB infection. The variables were (1) prolonged cough and chest pain, (2) self-suspicion, seeking care, (3) contact tracing by HCW, (4) diagnosed in clinic, (5) told by traditional doctor and (6) other.

The participants stated that they knew they were infected with TB through self-suspicion were 89.7% (*n*=383). They were the majority. Most of them, that is 60.8% (*n*=233) were males. The participants who learnt that they were infected with PTB when they had prolonged cough and chest pain were 4.0% (*n*=17). Most of them, that is 76.5% (*n*=13) were females. Those who learnt through TBCT by the HCWs that they had TB were 4.9% (*n*=21). Again, 61.9% (*n*=13) of them were females and were the majority. Those who learnt that they were infected with TB when they went to the clinic for other health seeking purposes were 1.2% (*n*=5). Out of these, 0.7% (*n*=3) were males and 0.2% (*n*=2) were females. One male, the only participant for this response, learnt that he was infected with PTB after consulting a traditional doctor. The results show that health seeking behaviour for TB care was associated with TBCT (χ^2=15.913, df=6; *p*=0.012).

4.3.2.5.3 Health seeking behaviour for tuberculosis care

In order to determine further the health seeking behaviour, the study analysed how the participants sought initial care for TB infection. The participants were asked where they sought initial TB care by indicating either of the following variables: (1) self-treatment, (2) public health facility, (3) traditional practitioner and (4) other.

The participants who sought initial TB care in a public health facility were 74.5% (*n*=318). They were the majority. Out of these, 57.9% (*n*=184) were males and 42.1% (*n*=134) were females. The males comprised 43.1% and the females comprised 31.4% respectively in the study population. Those who used self-treatment as the initial TB care were 13.6% (*n*=58). Out of these, 53.4% (*n*=31) were males who also comprised 7.3% of the entire population. The place where the participants sought initial TB care was not associated with TBCT (χ^2=2.522, df=3; *p*=0.487).

The study analysed the problems faced by the PTB patients while seeking TB care in order to determine factors that hinder TBCT. Participants were asked to state the problems by indicating either of the following variables (1) money for transport, (2)

stigma and discrimination, (3) personal perceptions of treatment, (4) clinic schedules, (5) distance to the clinic and (6) others. The responses are as follows:

Majority of the participants who indicated that they had no problems while seeking TB care were 58.1% (*n*=248). Most of them were males who comprised 35.8% (*n*=153) of the study population. This was followed by 18.3% (*n*=78) who indicated that they faced the problems of stigma and discrimination. Most of them were males who comprised 10.3% (*n*=44) of the study population. The participants who indicated the clinic schedules as the problems were 11.0% (*n*=47). Most of them were males who comprised 6.3% (*n*=27) of the total population. The participants who indicated personal perceptions of treatment and medical procedures as the problems were 6.1% (*n*=26). Most of them were females who comprised 3.3% (*n*=14) of the study population. Participants indicated distance to the clinic as a negligible problem. In general, the problems that the PTB patients encountered while seeking TB care were not significantly associated with TBCT (χ^2=8.986, df=6; *p*=0.183).

4.3.2.5.4 How the tuberculosis patients recovered from tuberculosis infection

The researcher sought to know how the PTB patients recovered the first time they were infected with TB. That would help to evaluate their perception about the importance of the TB care they received and would determine their intention to participation in TBCT. The variables about how the participants recovered from the previous TB infection were (1) treatment in public health facility, (2) treatment with traditional medicine, (3) combination of hospital and traditional medicine, and (4) other. There were 41.2% (*n*=176) valid cases and 58.8% (*n*=251) were not applicable for this item since they were among those who had TB infection for the first time. Males were 56.3% (*n*=99) and females were 43.7% (*n*=77).

The participants who were treated in public health facilities were in the majority with 95.5% (*n*=168). Out of these, males were 56.0% (*n*=94) and females were 44.0% (*n*=74). The males comprised 22.0% of the study population and females comprised 17.3% respectively. Those who combined hospital and traditional medicine were 0.5% (*n*=9). Others were also 0.5% (*n*=9) mainly in the private sector. Results indicate that the way the participants recovered from the previous TB infection has no implication on the current TBCT (χ^2=2.202, df=4; *p*=0.780).

4.3.2.6 Knowledge of tuberculosis and perceptions about tuberculosis contact tracing

The study analysed the PTB patients' knowledge and perceptions about TB in order to find their association [knowledge and perceptions] with TBCT. The knowledge of TB was by its cause. The perception of TBCT was by the definition.

4.3.2.6.1 Knowledge of the cause of tuberculosis

Participants were asked of the cause of TB by indicating either of the following variables: (1) eating bad food, (2) witchcraft, (3) germs, (4) divine punishment, (5) other and (6) do not know. Table 4.23 displays the responses.

Table 4.23: Percentage distribution of knowledge of the cause of tuberculosis by gender of pulmonary tuberculosis patients (*N*=427)

KNOWLEDGE OF THE CAUSE OF TUBERCULOSIS	GENDER OF PULMONARY TUBERCULOSIS PATIENTS (%)		Both
	Male	Female	
Eating bad food	4.2	5.6	9.8
Witchcraft	6.1	3.5	9.6
Germs	22.3	16.4	38.7
Divine punishment	8.9	5.2	14.1
Other causes	10.5	6.8	17.3
Do not know	6.3	4.2	10.5
Total	**58.3**	**41.7**	**100**

The participants who indicated that eating bad food caused TB were 9.8% (*n*=42), the majority of whom were females who comprised 5.6% (*n*=24). The male in who indicated this response were 4.2% (*n*=18). The participants who indicated that witchcraft caused TB were 9.6% (*n*=41). Out of these, males were 6.1% (*n*=26) and females were 3.5% (*n*=15). Those who indicated that germs caused TB were 38.6% (*n*=165). They were the majority. Out of these, 22.3% (*n*=95) were males and 16.4% (*n*=70) were females. The

participants who indicated that divine punishment caused TB were 14.1% (*n*=60). Out of these, 8.9% (*n*=38) were males and 5.2% (*n*=22) were females. Those who indicated other causes of TB were 17.3% (n=74). Out of these, 10.5% (*n*=45) were males and 6.8% (*n*=29) were females. Those who did not know of the cause of TB were 10.5% (*n*=45). Out of these, males were 6.3% (*n*=27) and females were 4.2% (*n*=18). The knowledge of the cause of TB was not associated with hindering the intention of participating in TBCT (χ^2=5.468, df=5; *p*=0.365; 95% CI: 0.320 – 0.411).

4.3.2.6.2 Perceptions of the meaning of tuberculosis contact tracing

The study determined the perceptions of the meaning of TBCT by asking the participants to define it. The researcher analysed the definition of TBCT per se by the PTB patients in order to determine any implications on utilisation of TBCT. Subsequently, the knowledge by definition was analysed in relation to education level of the PTB patients. Later, the definition was analysed in relation to the TBCT training the PTB patients received.

- *Definition of tuberculosis contact tracing by pulmonary tuberculosis patients*

The researcher analysed the definition of TBCT by the PTB patients in order to determine their knowledge of it. The participants were asked to indicate any of the following options: (1) HCW visits home of TB patient to assess welfare, (2) HCW visits home of TB patient to identify contacts at risk, (3) HCW visits workplace of TB patient to identify contacts at risk, (4) identify and screen contacts at risk of contracting TB from TB patient and (5) do not know. The following are the responses.

The majority of the participants, that is 49.9% (*n*=213), understood TBCT to mean that HCWs visit households of PTB patients to identify contacts at risk. Out of these, 55.9% (*n*=119) were males. Those who understood it to mean that HCWs visit the households of PTB patients to assess their welfare were 18.5% (*n*=79). Out of these, 57.0% (*n*=45) were males. Those who defined it as to identify and screen contacts at risk of contracting TB from a PTB patient were 12.4% (*n*=53). Out of these, 60.4% (*n*=32) were males. The participants who perceived TBCT to mean that HCWs visit workplace of PTB patients to identify contacts at risk were 6.1% (*n*=26). Those who did not know the definition of TBCT were 2.3% (*n*=10). Out of these, 1.4% (*n*=6) were males and 0.9%

(*n*=4) were females. Other definitions accounted for 10.8% (*n*=46). Results indicate that the PTB patients' perception of TBCT had no significant implications on TBCT (χ^2=2.358, df=5; *p*=0.799). Further, the researcher applied education status of the PTB patients to analyse definition of TBCT.

- *Definition of tuberculosis contact tracing by educational level of pulmonary tuberculosis patients*

The researcher analysed the definition of TBCT by the highest completed education of the PTB patients in order to assess the influence of education on their definition of TBCT. The participants were asked to indicate their education status by choosing any of the following levels: (1) none, (2) primary education, (3) secondary education and (4) tertiary education. Table 4.24 shows the responses.

Table 4.24: Percentage distribution of definition of tuberculosis contact tracing by education level of pulmonary tuberculosis patients (*N*=427)

DEFINITION OF CONTACT TRACING	EDUCATION LEVEL OF TUBERCULOSIS PATIENTS (%)				Total
	No education	Primary education	Secondary education	Tertiary education	
HCW visits home of TB patient to assess welfare	2.81	7.03	7.03	1.64	18.50
HCW visits home of TB patient to identify contacts at risk	9.13	18.97	18.50	3.28	49.88
HCW visits workplace of TB patient to identify contacts at risk	2.81	1.41	1.64	0.23	6.09
Identify and screen contacts at risk of contracting TB from TB patient	3.04	4.92	4.45	0.00	12.41
Do not know	2.34	2.58	7.03	1.17	13.11
Total	**20.14**	**34.89**	**38.64**	**6.32**	**100.00**

The participants defined TBCT as that the HCWs visit the homes of PTB patients to assess their welfare were 18.50% (*n*=79). The majority in this category were the participants who had completed primary and secondary levels of education, each with 7.03% (*n*=30). The majority of the participants, that is 49.88% (*n*=213), defined TBCT to mean that the HCWs visit homes of TB patients to identify contacts at risk. Out of these, 18.97% (*n*=81) had completed primary level of education and 18.50% (*n*=79) had

completed secondary level of education. Those who defined TBCT as the HCW visits workplace of TB patient to identify contacts at risk were 6.09% (*n*=26). Out of these, 2.81% (*n*=12) had no education, 1.41% (*n*=6) had primary educational qualification, 1.64% (*n*=7) had secondary education and 0.23% (*n*=1) had tertiary educational qualification. Those who defined TBCT as identify and screen contacts at risk of contracting TB from TB patient were 12.41% (*n*=53). Out of these, 3.04% (*n*=13) had no education, 4.92% (*n*=21) had primary educational qualification and 4.45% (*n*=19) had secondary educational qualification. Those who did not know the definition of TBCT were 13.11% (*n*=56). Out of these, 2.34% (*n*=10) had no education, 2.58% (*n*=11) had primary educational qualification, 7.03% (*n*=30) had secondary educational qualification and 1.17% (*n*=5) had tertiary educational qualification.

The researcher computed the odds ratio to determine the number of PTB patients with various definitions of TBCT. The number of incorrect definitions included those of the participants who did not know the definition of TBCT. Among the 172 participants with no education, 37.2% (*n*=64) defined TBCT correctly and 62.8% (*n*=108) did not (OR=7.66 $p < 0.05$). The participants who had correct definition of TBCT among those with primary education were 35.0% (*n*=22). Those who defined TBCT correctly in the secondary education were 87.5% (*n*=105). Those who defined TBCT correctly in the tertiary education were 83.3% (*n*=60). The participants who did not know the definition of TBCT among those in primary education were 65.0% (*n*=41), among those in secondary education were 12.5% (*n*=15) and among those in tertiary education were 16.7% (*n*=12) respectively (OR=2.19; $p < 0.05$).

- *Definition of tuberculosis contact tracing by duration of training of pulmonary tuberculosis patients*

Subsequently, the researcher analysed knowledge of definition of TBCT by the duration of the TBCT training that the PTB patient received. The researcher asked the PTB patients to indicate their definition of TBCT from any of the following: (1) the HCWs visit households of PTB patients to assess their welfare, (2) the HCWs visit households of PTB patients to identify contacts at risk, (3) the HCWs visit workplace of PTB patients to identify contacts at risk, (4) the HCWs identify and screen contacts at risk of contracting TB from PTB patient, (5) do not know and (6) other. The researcher reported only significant values. Table 4.25 shows the responses.

Table 4.25: Percentage distribution of definition of tuberculosis contact tracing and duration of training by pulmonary tuberculosis patients (*N*=427)

KNOWLEDGE OF DEFINITION OF TUBERCULOSIS CONTACT TRACING	DURATION OF TBCT TRAINING FOR PULMONARY TUBERCULOSIS PATIENTS (%)				Total
	None	1 – 2 days	3 – 4 days	Over 5 days	
HCW visits home of TB patient to assess welfare	3.0	9.4	5.4	0.7	18.5
HCW visits home of TB patient to identify contacts at risk	11.5	24.6	11.0	2.8	49.9
HCW visits workplace of TB patient to identify contacts at risk	1.4	2.6	2.1	0.0	6.1
Identify and screen contacts at risk of contracting TB from TB patient	8.4	3.5	0.5	0.0	12.4
Do not know	2.1	0.2	0.0	0.0	2.3
Other	1.9	6.3	2.6	0.0	10.8
Total	**28.3**	**46.6**	**21.5**	**3.5**	**100.0**

The participants who had no training in TBCT were 28.3% (*n*=121). Those who were trained for 1 to 2 days were 46.6% (*n*=199), being the majority. Those who were trained for 3 to 4 days were 21.5% (*n*=92). Those who had TBCT training for more than 5 days were 3.5% (*n*=15).

- *Relationship between knowledge of definition tuberculosis contact tracing and duration of training*

The majority of the participants, who defined TBCT as *HCW visits home of TB patient to assess welfare*, were trained 1 to 2 days. They were 9.4% (*n*=40) and comprised 50.6% of all those who had the same definition. The majority of those who defined TBCT as *HCW visits home of TB patient to identify contacts at risk*, that is 24.6% (*n*=105), were trained for 1 to 2 days. They comprised 49.3% of those who stated this definition. The majority of those who defined TBCT as *HCWs visit workplace of PTB patients to identify contacts at risk*, that is 2.6% (*n*=11), were trained for 1 to 2 days. They comprised 42.3% of those who had this definition. The majority of those who defined TBCT as *identify and screen contacts at risk of contracting TB from TB patient* had no training in TBCT. They were 8.4% (*n*=36) and comprised 67.9 % of those who had this definition.

The participants who did not know had not undergone any training except one who had one to two days training.

In summary, Table 4.24 and Table 4.25 show that knowledge of TBCT increased with training. There is significant association of the training received by the PTB patients with the knowledge of TBCT by definition (χ^2=81.558, df=15; *p*=0.000). Pearson goodness-of-fit was positive (χ^2=33.486; df=15; *p*=0.004). Hence, the results support Assumption 4 that knowledge and training in TBCT improves its utilisation.

4.3.3 Characteristics of the tuberculosis contacts

In this section the population of the household and workplace TB contacts by gender is analysed. It determined the relationship to the PTB case index and the TB contact - case-index ratio. There were two versions of the source of information for the TB contacts, (1) the TB register and (2) interviews of the PTB patients.

4.3.3.1 Gender and population of tuberculosis contacts

In Phase I, the researcher, using the checklist, obtained 600 male and 939 female TB contacts. The total contacts were 1 539 for 427 PTB patients. These are displayed in Table 4.26, Table 4.27 and Figure 4.3. During the interview in Phase II, 937 male and 1 407 female TB contacts were enumerated. The total contacts were 2 344 for 427 PTB patients. These are also portrayed in Table 4.26, Table 4.27 and Figure 4.3. The age distribution of the TB contacts as obtained in Phase I and in Phase II were summarised in Table 4.26.

Table 4.26: Age group distribution of tuberculosis contacts in Phase I (*N*=1 539)

AGE GROUP OF CONTACTS (YEARS)	PHASE I	
	F	%
0 – 0.9 yrs.	20	1.3
1 – 9 yrs.	69	4.5
10 – 19 yrs.	447	29.0
20 – 29 yrs.	313	20.3
30 – 39 yrs.	264	17.2
40 – 49 yrs.	178	11.6
50 – 59 yrs.	139	9.0
> 60 yrs.	109	7.1
Total	**1 539**	**100.0**

F – Frequency

The TB contacts in the age group 0 to 0.9 years were 1.3% (*n*=20) in Phase I. Those in the age group 1 to 9 years were 4.5% (*n*=69), those in the age group 10 to 19 years were 29.0% (*n*=447), those in the age group 20 to 29 were 20.3% (*n*=313) and those in the age group 30 to 39 years were 17.2% (*n*=264). These were the majority. The contacts in the age group 40 to 49 years were 11.6% (*n*=178), those in age group 50 to 59 years had 9.0% (*n*=139) and those who were above 60 years old were 7.1% (*n*=109) in Phase I.

Table 4.27: Age group distribution of tuberculosis contacts in Phase II (*N*=2 344)

AGE GROUP FOR CONTACTS (YEARS)	PHASE II	
	F	%
0 – 0.9 yrs.	37	1.6
1 – 9 yrs.	98	4.2
10 – 19 yrs.	532	22.7
20 – 29 yrs.	569	24.3
30 – 39 yrs.	493	21.0
40 – 49 yrs.	292	12.5
50 – 59 yrs.	191	8.1
> 60 yrs.	132	5.6
Total	**2 344**	**100.0**

F – Frequency

Table 4.27 shows that the TB contacts in the age group 0 to 0.9 years were 1.6% (*n*=37) in Phase II. Those in the age group 1 to 9 years were 4.2% (*n*=98), those in the age group 10 to 19 years were 22.7% (*n*=532), those in the age group 20 to 29 were 24.3% (*n*=569) and those in the age group 30 to 39 years were 21.0% (*n*=493). These were the majority. Those who were in the age group 40 to 49 years were 12.5% (*n*=292), those in the age group 50 to 59 years were 8.1% (*n*=191) and those who were above 60 years old were 5.6% (*n*=132).

From the population of 1 539 contacts in Phase I, the majority were aged below 39 years, that is 72.3% (*n*=1 113). From the population of 2 344 contacts in Phase II, the majority were similarly aged below 39 years, that is 73.8% (*n*=1 729). It is apparent that the majority of the TB contacts were youthful populations. This may influence the strategic planning of TBCT services that focus more on the youthful population.

From the total number of 1 539 TB contacts according to the TB records in Phase I, males were 39.0% (*n*=600) and the females were 61.0% (*n*=939). The mean number was 30 and the median was 11 for males. The mean number for females was 46.95 and the median was 16. That provides a case index-contact ratio of 1:4 for Phase I.

From the total number of 2 344 TB contacts according to the interviews in Phase II, males were 40.0% (*n*=937) and the females were 60.0% (*n*=1 407). The mean number of males was 46.85 and median was 18.5. The mean number for females was 70.35 and the median was 17.5. That provides a case index-contact ratio of 1:6 for Phase II. The difference in the number of contacts between Phase I and Phase II is 805.

Figure 4.3 shows visual frequency of the TB contacts by checklist during Phase I and that of the interviews during Phase II.

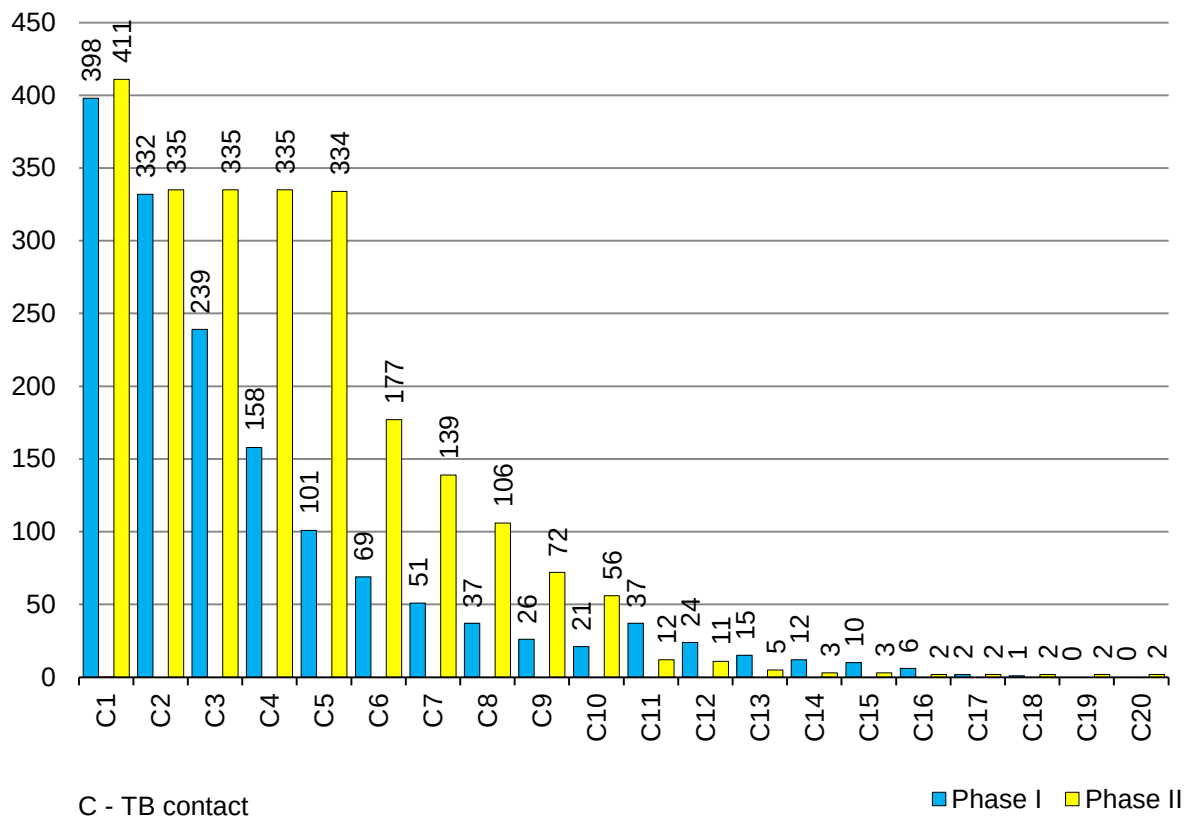


Figure 4.3: Population of the tuberculosis contacts in Phase I and Phase II

4.3.3.2 Number of tuberculosis contacts per pulmonary tuberculosis patient

The researcher asked the PTB patients to state the number of their TB contacts in order to find the TB contact-case index ratio. The number of contacts per PTB patient were grouped as (1) none, (2) 1 to 5 contacts, (3) 6 to 10 contacts, (4) 11 to 15 contacts and (5) over 21 contacts. Table 4.28 shows the responses.

Table 4.28: Percentage distribution of contacts per pulmonary tuberculosis patient in Phase II (*N*=427)

TYPE OF TUBERCULOSIS CONTACTS	GENDER OF HOUSEHOLD CONTACTS (%)		Both
	Male	Female	
Household TB contacts			
None	5.9	2.3	8.2
1 – 5 contacts	5.9	3.5	9.4
6 – 10 contacts	23.2	16.4	39.6
11 – 15 contacts	9.8	9.1	19.0
16 – 20 contacts	7.5	5.2	12.6
0ver 21 contacts	6.1	5.2	11.2
Total	**58.3**	**41.7**	**100.0**
Workplace TB contacts			
None	39.8	30.0	69.8
1 – 5 contacts	1.2	0.7	1.9
6 – 10 contacts	4.7	2.3	7.0
11 – 15 contacts	3.0	3.0	6.1
16 – 20 contacts	2.3	1.4	3.7
0ver 21 contacts	7.3	4.2	11.5
Total	**58.3**	**41.7**	**100.0**

4.3.3.2.1 Household tuberculosis contacts

The participants who had no household contacts were 8.2% (*n*=35). Out of these, males were 5.9% (*n*=25) and females were 2.3% (*n*=10). Those who had one to five TB contacts were 9.4% (*n*=40). Out of these, 5.9% (*n*=25) were males and 3.5% (*n*=15) were females. The participants who had six to ten household TB contacts were the majority with 39.6% (*n*=169). Out of these, 23.2% (*n*=99) were males who comprised the larger part of the study population. They were also 60.0% of all participants with six to ten contacts. The females were 16.4% (*n*=70). The participants with 11 to 15 contacts were 19.0% (*n*=81). Out of these, males were 9.8% (*n*=42) and females were 9.1%

(*n*=39). Those who had 16 to 20 contacts were 12.6% (*n*=54). Out of these, males were 7.5% (*n*=32) and females were 5.2% (*n*=22). Those who had over 21 contacts were 11.2% (*n*=48). Out of these, males were 6.1% (*n*=26) and females comprised 5.2% (*n*=22). The household TB contact-case index ratio was 5.4:1 in this Phase II (χ^2=13.459, df=5; *p*=0.665, 0.620 – 0.710).

4.3.3.2.2 Workplace tuberculosis contacts

The participants who did not have workplace contacts were 69.8% (*n*=298). Out of these, 39.8% (*n*=170) were males and 30.0% (*n*=128) were females. Those who had one to five TB contacts were 1.9% (*n*=8). Out of these, 1.2% (*n*=5) were males and 0.7% (*n*=3) were females. The participants who had six to ten TB contacts were 7.0% (*n*=30). Out of these, 4.7% (*n*=20) were males and the females were 2.3% (*n*=10). The participants with 11 to 15 contacts were 6.1% (*n*=26). Out of these, males were 3.0% (*n*=13) and females were equally 3.0% (*n*=13). Those who had 16 to 20 contacts were 3.7% (*n*=16). Out of these, males were 2.3% (*n*=10) and females were 1.4% (*n*=6). Those who had over 21 contacts were 11.5% (*n*=49). Out of these, males were 7.3% (*n*=31) and females comprised 4.2% (*n*=18). The workplace TB contact-case index ratio was 1.05:1 in this Phase II (χ^2=17.855, df=6; *p*=0.398, 95% CI: 0.377 – 0.402).

4.3.3.3 Relationship of tuberculosis contacts with pulmonary tuberculosis patients

Figure 4.4 shows the relationship of the PTB patient with the TB contact as per information obtained in Phase I. The majority of the TB contacts, that is 27.0% (*n*=412) were children. The mean number of children per PTB patient was 21. The relationship by sibling of the TB contact followed with 18.4% (*n*=283). The mean number of siblings per PTB patient was 14. The relationship by nephew/niece was 10.5% (*n*=161). The mean number for this was 8. The relationship by parent was 7.7% (*n*=118), mean being 6.

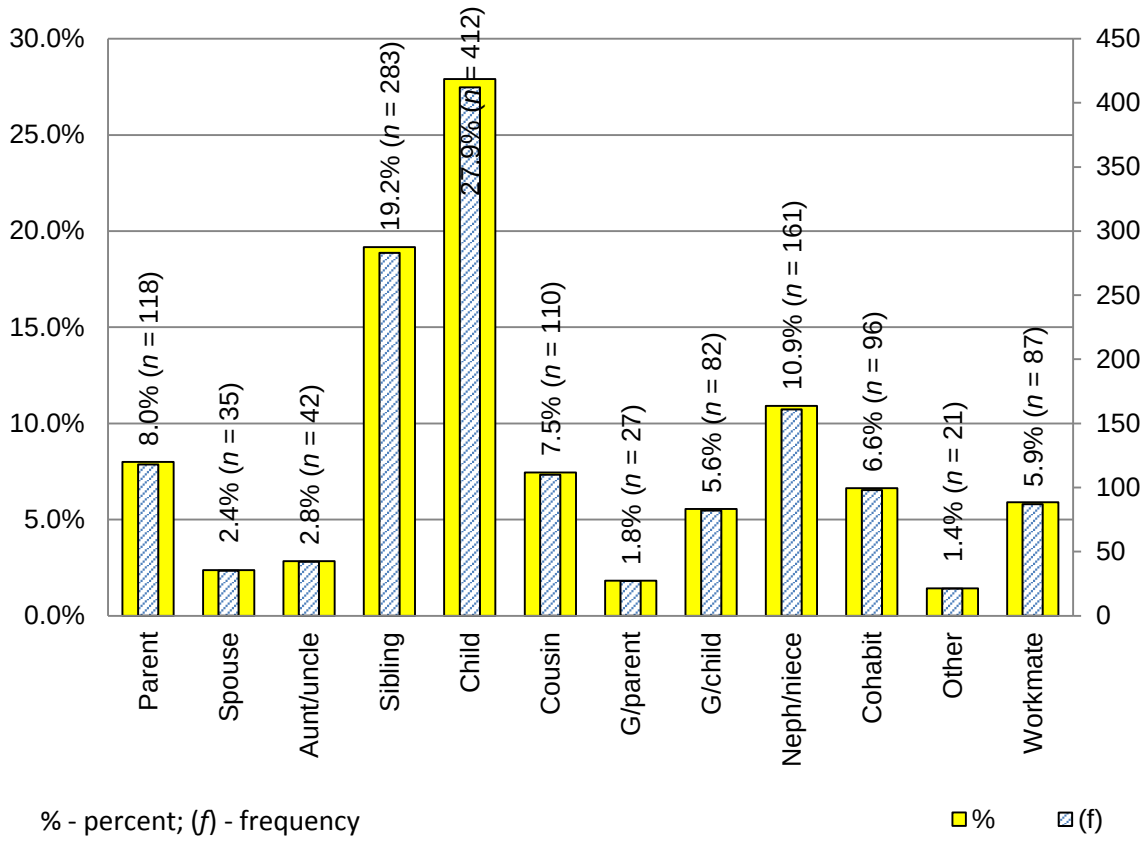


Figure 4.4: Relationship between pulmonary tuberculosis patients and tuberculosis contacts (Phase I)

Figure 4.4 shows children and siblings of the PTB index patients as the most of the TB contacts at risk. Those relationships have the highest number of TB contacts. Owing to the variance (*n*=805) between Phase I and Phase II populations of the TB contacts, Assumption 4 is supported that the strategies used have an implication on TBCT and case identification.

4.3.3.4 The tuberculosis contact-case index ratio and number needed to contact trace

4.3.3.4.1 Tuberculosis contact-case index ratio

The TB contact-case index ratio was analysed for household and workplace in order to assess the number needed to contact trace (NNT). The information from the register by the checklist in Phase I was compared to the information that was obtained through the interviews in Phase II. Table 4.29 shows the results.

Table 4.29: Percentage distribution of tuberculosis contact screening and outcome

SCREENING OF CONTACTS	OUTCOME OF SCREENING (%)				Total
	Screened	With TB	Without TB	Missed screening	
PHASE I (*N*=1 539)					
Household contacts	24.5	12.3	8.8	3.3	48.9
Workplace contacts	5.1	1.0	0.0	45.0	51.1
Total	**29.6**	**13.3**	**8.8**	**48.3**	**100.0**
PHASE II (*N*=2 344)					
Household contacts	17.4	8.2	28.3	0.8	54.7
Workplace contacts	5.5	0.7	26.4	12.8	45.3
Total	**22.9**	**8.9**	**54.7**	**13.6**	**100.0**

- *Outcome of tuberculosis screening in Phase I and tuberculosis contact-case index ratio*

From the 1 539 TB contacts in Phase I, 29.6% (*n*=455) TB contacts were screened. Those with TB were 13.3% (*n*=205), those without TB were 8.8% (*n*=136) and those who were missed were 48.3% (*n*=743).

From the 455 TB contacts who were screened, 24.5% (*n*=376) were household TB contacts and 5.1% (*n*=79) were workplace TB contacts. The household TB contacts with TB were 12.3% (*n*=189), 8.8% (*n*=136) were without TB and 3.3% (*n*=51) were missed in screening. The workplace TB contacts with TB were 1.0%% (*n*=16) and 45.0% (*n*=692) were missed in screening. According to the checklist information from the TB register in Phase I, the TB contact-case index ratio was 3.5:1 for the household and 0.19:1 for the workplace respectively.

- *Outcome of tuberculosis screening in Phase II and tuberculosis contact-case index ratio*

From the 2 344 TB contacts in Phase II, 22.9 (*n*=536) TB contacts were screened. Those with TB were 8.9% (*n*=208), those without TB were 54.7% (*n*=1 282) and those who were missed were 13.6% (*n*=318).

From the 536 TB contacts who were screened, 17.4% (*n*=408) were household TB contacts and 5.5% (*n*=128) were workplace TB contacts. The household TB contacts with TB were 8.2% (*n*=192), 28.3% (*n*=663) were without TB and 0.8% (*n*=19) were missed in screening. The workplace TB contacts with TB were 0.7% (*n*=16), those without TB were 26.4% (*n*=619) and 12.8% (*n*=299) were missed in screening. For Phase II, the TB contact-case index ratio was 5.4:1 for the household and 1.05:1 for the workplace respectively.

4.3.3.4.2 Number of tuberculosis contacts needed to contact trace

The number of tuberculosis contacts needed to contact trace (NNT) was analysed using the formula:

$$\text{NNT} = \frac{\text{PTB index cases}}{\text{New PTB cases}}$$

Given that in 2014 there were 412 new PTB patients in the study sites, the number needed to contact trace is discernible for both phases. According to the checklist in Phase I, 189 out of 376 contacts tested positive. Thus 189 provided a denominator for the 412 index cases. According to the interviews in Phase II, 192 out of 408 contacts tested positive. Therefore, the NNT for Phase I is 2.17 and 2.15 for Phase II.

4.3.4 Utilisation of tuberculosis contact tracing and screening uptake

This section presents the analysis of the utilisation of TBCT. It presents the perceptions and participation in TBCT activities. It also presents methods used and the screening uptake. They include the preferred follow-up methods and those utilised in the clinics.

The TBCT methods presented include the household visits, workplace visits, use of mobile phones, and others.

4.3.4.1 Perceptions of pulmonary tuberculosis patients and participation in tuberculosis contact tracing activities

4.3.4.1.1 The role of pulmonary tuberculosis patient in community tuberculosis contact tracing activities

The researcher analysed specific roles of the PTB patients in order to assess their utilisation of TBCT. The participants were asked to indicate their specific roles in the community TBCT using the following plausible responses: (1) no contact tracing role, (2) TBCT peer educator, (3) TBCT management team member, (4) community TBCT volunteer and (5) other roles. Table 4.30 shows the responses.

Table 4.30: Percentage distribution of roles in contact tracing by gender of pulmonary tuberculosis patients (*N*=427)

ROLE IN CONTACT TRACING	GENDER OF PULMONARY TUBERCULOSIS PATIENTS (%)		Both
	Male	Female	
No contact tracing role	47.5	30.0	77.5
TBCT peer educator	2.8	2.6	5.4
TBCT management team	0.5	0.0	0.5
Community TBCT volunteer	5.4	5.2	10.5
Other roles	2.1	4.0	6.1
Total	**58.3**	**41.7**	**100.0**

The participants who had no contact tracing role were 77.5% (*n*=331). They were the majority of the study population. Only 22.5% (*n*=96) of the participants had roles. Among those participants, the TBCT peer educators were 5.4% (*n*=23) of the study population. Out of these, 2.8% (*n*=12) were males and 2.6% (*n*=11) were females. Those in management team were only 0.2% (*n*=2) and were all males. The community TBCT volunteers were the majority with 10.5% (*n*=45) of the study population. Out of

these, 5.4% (*n*=23) were males and 5.2% (*n*=22) were females. Those in other roles were 6.1% (*n*=26) with females, 4.0% (*n*=17), nearly as twice as many as were males. The males in this category were 2.1% (*n*=9). There is some association between the roles and the utilisation of TBCT (χ^2=9.992, df=4; *p*=0.042).

The researcher analysed the support that the PTB patients received to perform TBCT activities in order to evaluate the utilisation of community TBCT. Participants were asked to indicate any of the following variables (1) no support, (2) financial, (3) supervisory, (4) transport and (5) contact tracing training. This item was applicable to 42.2% (*n*=180) of the participants. Table 4.31 portrays the responses.

Table 4.31: Percentage distribution of support received in contact tracing activities by gender of pulmonary tuberculosis patients (*N*=427)

SUPPORT RECEIVED IN CONTACT TRACING ACTIVITIES	GENDER OF PULMONARY TUBERCULOSIS PATIENTS (%)		Both
	Male	Female	
None	11.2	12.2	23.4
Financial	0.7	0.0	0.7
Supervisory	9.1	6.3	15.5
Transport	0.5	1.2	1.6
Contact tracing training	0.9	0.0	0.9
Not applicable	35.8	22.0	57.8
Total	**58.3**	**41.7**	**100.0**

The participants who indicated that they received no support of any kind were 23.4% (*n*=100). They were the majority of the study population. Out of these, males were 11.2% (*n*=48) and females were 12.2% (*n*=52). Those who received financial support were 0.7% (*n*=3), all of them males. The participants who received supervisory support were 15.5% (*n*=66). Out of these, males were 9.1% (*n*=39) and females were 6.3% (*n*=27). Those who received transport support were 1.6% (*n*=7), males being 0.5% (*n*=2) and females being 1.2% (*n*=5). Those who received contact tracing training were 0.9% (*n*=4), again all of them males. Results indicate that support to carry out TBCT was associated with the participants' utilisation of the TBCT (χ^2=13.282, df=5; *p*=0.021; 95% CI: 007 – 035).

4.3.4.1.2 Frequency of tuberculosis contact tracing activity by pulmonary tuberculosis patient and neighbour

The study analysed the frequency of doing a TBCT activity by the PTB patients in the month prior to the interview. Based on the incidence rate of TB, the study arbitrarily assumed that five days in a month was adequate time to portray active participation. The participants were asked to indicate any of the following variables: (1) no activity, (2) 1 to 2 days, (3) 3 to 4 days and (4) over 5 days. Table 4.32 shows the responses.

- *Number of days that pulmonary tuberculosis patient did a tuberculosis contact tracing activity*

Table 4.32 shows that the participants who did no TBCT activity in the previous month were 86.2% (*n*=368). They were the majority of the study population. Out of these, 50.8% (*n*=217) were males and 35.4% (*n*=151) were females. Those who had an activity in one to two days were 8.9% (*n*=38). Most of them, that is 52.6% (*n*=20), were males. The females were 4.2% (*n*=18). Those who had done a TBCT activity in three to four days were 1.9% (*n*=8). Similarly, most of them, that is 75.0% (*n*=6) were males. The females were 0.5% (*n*=2). Those who had an activity in over five days were 3.0% (*n*=13). The majority of them, that is 53.8% (*n*=7) were females. The males in this category were 1.4% (*n*=6). Results show that carrying out a TBCT activity in the month prior to the study was not significantly associated with TBCT (χ^2=2.276, df=3; *p*=0.520): 95% CI: 0.473 – 0.567).

Table 4.32: Percentage distribution of contact tracing activity in previous month by gender of pulmonary tuberculosis patient (*N*=427)

FREQUENCY OF CONTACT TRACING ACTIVITY IN PREVIOUS MONTH	GENDER OF PULMONARY TUBERCULOSIS PATIENTS (%)		Both
	Male	Female	
Number of days that PTB patient did a TBCT activity			
No activity	50.8	35.4	86.2
1 – 2 days	4.7	4.2	8.9
3 – 4 days	1.4	0.5	1.9
Over 5 days	1.4	1.6	3.0
Total	**58.3**	**41.7**	**100.0**
Number of days that a neighbour of PTB patient did a TBCT activity			
Do not know	41.9	25.3	67.2
1 – 2 days	4.9	8.0	12.9
3 – 4 days	3.0	2.3	5.4
Over 5 days	0.2	1.2	1.4
Not involved	8.2	4.9	13.1
Total	**58.3**	**41.7**	**100.0**

- *Number of days a neighbour of pulmonary tuberculosis patient did a tuberculosis contact tracing activity*

Further, the study analysed the frequency of a neighbour doing a TBCT activity in the month prior to the interview. The participants were asked to indicate any of the variables (1) no activity, (2) 1 to 2 days, (3) 3 to 4 days, (4) over 5 days and (5) not involved. Table 4.32 shows the responses.

The participants who did not know whether a neighbour did a TBCT activity were 67.2% (*n*=287). They were in the majority. Out of these, males were the majority with 62.4% (*n*=179). Those who knew that a neighbour was involved 1 to 2 days were 12.9% (*n*=55). Out of these, females were the majority with 8.0% (n=34) whereas males were 4.9% (*n*=21). Those who knew a neighbour who involved in 3 to 4 days were 5.4%

(*n*=23). The majority in this category were males with 3.0% (*n*=13) and females were 2.3% (*n*=10). Only 1.4% (*n*=6) knew of a neighbour who did a TBCT activity over 5 days in the previous month. The majority were females with 1.2% (*n*=5) and males were 0.2% (*n*=1). The participants who knew that a neighbour did not carry out any TBCT activity were 13.1% (*n*=56). The majority were males with 8.2% (*n*=35) and the females were 4.9% (*n*=21). The knowledge of a neighbour who was involved in TBCT activity was significantly associated with intention to participate in TBCT (χ^2=15.827, df=4; *p*=0.002; 95% CI: 0.000 – 0.007).

4.3.4.1.3 Perceptions of benefits of tuberculosis contact tracing

In order to understand the immediate benefits of TBCT to the PTB patients, the following response variables were analysed: (1) early screening and treatment of the TB contact, (2) reduce transmission of TB in the community, (3) better home-care for the PTB patient and (4) other. Table 4.33 presents the responses.

Table 4.33: Percentage distribution of perceived benefits of contact tracing by gender of pulmonary tuberculosis patients (*N*=427)

PERCEIVED BENEFITS OF CONTACT TRACING	GENDER OF PULMONARY TUBERCULOSIS PATIENTS (%)		Both
	Male	Female	
Early screening and treatment of TB contact	22.7	19.0	41.7
Reduce transmission of TB in community	23.4	10.3	33.7
Better home care for PTB patients	9.8	9.6	19.4
Other	2.3	2.8	5.2
Total	**58.3**	**41.7**	**100.0**

Most of the participants, that is 41.7% (*n*=178), indicated that TBCT provided early screening and treatment of the TB contacts. Out of these, males were 22.7% (*n*=97) and females were 19.0% (*n*=81). The participants who perceived the benefit as reducing transmission of TB in the community were 33.7% (*n*=144). Males in this category were 23.4% (*n*=100) and females were 10.3% (*n*=44). Those who perceived that the benefit of TBCT was better home care were 19.4% (*n*=83). There was almost a

1:1 gender ratio in this category as males were 9.8% (*n*=42) and females were 9.6% (*n*=41). Those who stated other perceived benefits were 5.2% (*n*=22). Out of this, males were 2.3% (*n*=10) and females were 2.8% (*n*=12). The others included reducing the number of TB treatment defaulters and that TBCT helped people and the clinics to work together. The perception of the benefits of tuberculosis was significantly associated with TBCT ($\chi^{2=}$11.934, df=4; *p*=0.009).

4.3.4.1.4 Pulmonary tuberculosis patient's education versus perceived benefit of contact tracing

The researcher analysed the perceived immediate benefit of TBCT by completed educational level in order to determine the association of their perceptions with education. The control variable was the highest completed education and the response variable was the perceived immediate benefit of TBCT to the individual. Educational levels included (1) none, (2) primary, (3) secondary and (4) tertiary level. The perceived immediate benefits included (1) early testing and treatment (if possible), (2) reduce transmission of TB in the community, (3) better home care for the PTB patients and 4) other. Table 4.34 presents the responses.

Table 4.34: Percentage distribution of immediate benefits of contact tracing by education of pulmonary tuberculosis patients (*N*=427)

PERCEIVED IMMEDIATE BENEFIT OF TBCT	EDUCATION LEVEL OF PULMONARY TUBERCULOSIS PATIENTS (%)				Total
	None	Primary	Secondary	Tertiary	
Early testing and treatment (if possible)	9.8	12.4	15.0	4.4	41.7
Reduce transmission of TB in the community	5.9	15.2	11.5	1.2	33.7
Better home care for PTB patients	4.0	5.2	9.6	0.7	19.4
Other	0.5	2.1	2.6	0.0	5.2
Total	**20.1**	**34.9**	**38.6**	**6.3**	**100.0**

The participants who reported that the benefit of the TBCT was early testing and treatment of a TB contact were 41.7% (*n*=178). Most of them, that is 15.0% (*n*=64), had completed secondary education, followed by 12.4% (*n*=53) of those who had completed

primary education, 9.8% (*n*=42) of those with no education and lastly 4.4% of those with tertiary education. The participants who indicated that the benefit of TBCT was to reduce transmission of the TB in the community were 33.7% (*n*=144). The majority of them, that is 15.2% (*n*=65), had completed primary education. They were followed by 11.5% (*n*=49) of those who had completed secondary education, 5.9% (*n*=25) of those who had no education and lastly by 1.2% (*n*=5) of those with tertiary education.

The participants who indicated that the benefits was better home care for the PTB patients were 19.4% (*n*=83). The majority of them, that is 9.6% (*n*=41), had completed secondary education. They were followed by 5.2% (*n*=22) of those who had completed primary education, 4.0% (*n*=17) of those who had no education and lastly by 0.7% (*n*=3) of those with tertiary education. The participants who indicated other benefits of TBCT were 5.2% (*n*=22). The majority of them, that is 2.6% (*n*=11), had completed secondary education. They were followed by 2.1% (*n*=9) of those who had completed primary education and 0.5% (*n*=2) of those who had no education. There was none for this category among those with tertiary education. The benefits of TBCT was more discernible for the participants who had completed secondary education and that was associated with intention to participate in TBCT (χ^2=24.395, df=9; *p*=0.004; 95% CI).

The researcher analysed the suggestions of the PTB patients about improving the contact tracing in order to obtain information for enhancing TBCT. The study asked the participants to state what they thought might best improve people's participation in the TBCT by indicating any of the following variables: (1) provision of transport for TB contacts, (2) improving TB contact identification procedures, (3) involving community TBCT volunteers, (4) creating TBCT awareness and (5) others. The results showed that creation of TBCT awareness was the commonest response among 43.2% (*n*=186). Most of them, that is 64.5% (*n*=120) were males. The participants who suggested improving TB contact identification procedures were 20.1% (*n*=86). Similarly, most of them, that is 59.3% (*n*=51) were males. The participants who suggested for the provision of transport for the TB contacts were 14.3% (*n*=61). For this response, the male-female ratio was near 1:1. There was no significant association between the participants suggestions and the TBCT (χ^2=7.272, df=4; *p*=0.136).

The study analysed the status of TBCT for the eligible contacts of the PTB patients in order to determine the TBCT coverage. The participants were asked to indicate any of

the following response variables: (1) at household level, (2) at workplace level and (3) not contact traced. Table 4.35 shows the responses.

Table 4.35: Percentage distribution of tuberculosis contacts traced by gender of pulmonary tuberculosis patients (*N*=427)

TUBERCULOSIS CONTACTS TRACED	GENDER OF PULMONARY TUBERCULOSIS PATIENTS (%)		Both
	Male	Female	
At household level	41.0	29.3	70.3
At workplace	1.9	0.9	2.8
Not contact traced	15.4	11.5	26.9
Total	**58.3**	**41.7**	**100.0**

The participants who indicated that they were contact traced at household level were 70.3% (*n*=300). Out of these, males were 41.0% (*n*=175 and females were 29.3% (*n*=125). The participants who indicated that they were contact traced at workplace were 2.8% (*n*=12). Out of these, males were 1.9% (*n*=8) and females were 0.9% (*n*=4). The participants who indicated that they were no contact traced were 26.9% (*n*=115). Out of these, males were 15.5% (*n*=66) and females were 11.5% (*n*=49).

4.3.4.2 Utilisation of the household tuberculosis contact tracing and screening uptake

4.3.4.2.1 Preferred and utilised tuberculosis contact tracing follow-up methods

The researcher analysed the most preferred communication method in TBCT follow-up in order to determine a suitable communication during follow-up. Participants were asked to indicate any of the following variables: (1) mobile phone, (2) home visit and (3) workplace visit. One case was missing. The results showed that majority of the participants, that is 46.5% (*n*=198) preferred home visit to other means of TBCT follow-up. Out of these, 56.6% (*n*=112) were males and 43.4% (*n*=86) were females. Those who preferred being called through the mobile phone were 51.4% (*n*=219). Out of these, 60.3% (*n*=132) were males and 39.7% (*n*=87) were females. Those who preferred workplace to other methods were 2.1% (*n*=9), mostly females, that is 55.6%

(*n*=5). The preferred method of communication in TBCT follow-up was not significantly associated with TBCT (χ^2=1.956, df=3; *p*=0.649).

4.3.4.2.2 Tuberculosis contact tracing follow-up method listed in the clinic

The researcher analysed the methods listed for TBCT follow-up of the PTB patients in the TB clinic. The participants were asked to indicate the method listed by indicating any of the following: (1) household address, (2) workplace address, (3) mobile phone number, (4) other and (5) none. Figure 4.5 shows the responses.

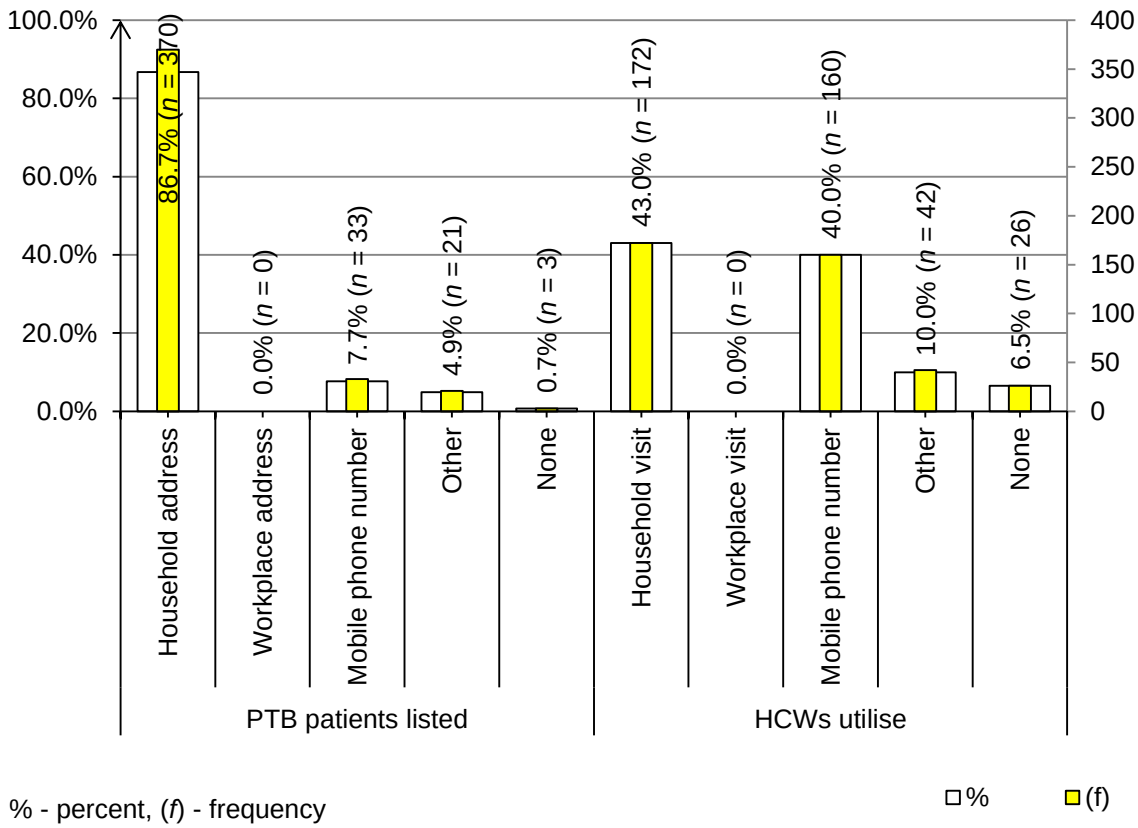


Figure 4.5: Methods listed and utilised by health care workers in tuberculosis contact tracing (*N*=427)

The participants who listed the household address were the majority with 86.7% (*n*=370). Out of these, 59.2% (*n*=219) were males and females were 40.8% (*n*=151). Those who listed the mobile phone were 7.7% (*n*=33). Out of these, 48.5% (*n*=16) were males and 51.5% (*n*=17) were females. Those with no contact address were 0.7% of the population. The others were 4.9% participants who listed landmark features such as churches, schools and water reservoirs. The method utilised for follow-up had no

association with intention to participate in TBCT (χ^2=1.526, df=3; *p*=0.639). Further, the participants were asked to state the methods the HCWs utilised during TBCT follow-up.

4.3.4.2.3 Tuberculosis contact tracing follow-up method utilised by health care workers

The participants were asked to indicate the method utilised by indicating any of the following: (1) household visit, (2) workplace visit, (3) mobile phone number, (4) other and (5) none. Figure 4.5 shows the responses. There were 94.0% (*n*=400) of the participants who provided information. The participants who indicated that the HCWs mostly utilised the household visit for the TBCT follow-up were 43.0% (*n*=172). This was not significantly associated with TBCT ($\chi 2$ =5.382, df=4; *p*=0.248). Those who listed the use of mobile phone were 40.0% (*n*=160) and those who listed other means were 10.5% (*n*=42). Those who listed none were 6.5% (*n*=26). The Wald chi-square statistic was significant about preferred and utilised method of household visit (χ^2=8.43; df=1; *p*=0.004).

4.3.4.2.4 Tuberculosis contact tracing and screening uptake

The researcher analysed the number of TB contacts screened per PTB patient in order to determine the uptake of screening. Participants were asked to indicate any of the following variables: (1) none, (2) 1 to 4 TB contacts,(3) 5 to 9 TB contacts, (4) 10 to 14 TB contacts and (5) over 15 TB contacts. The participants who had eligible TB contacts were 98.8% (*n*=422). Out of these, 57.6% (*n*=246) males and 41.2% (*n*=176) females. The participants who did not have eligible contacts were 1.2% (*n*=5), three males and two females. Table 4.36 shows the responses.

Table 4.36: Percentage distribution of household tuberculosis contacts screening and outcome by gender of pulmonary tuberculosis patients (*N*=427)

HOUSEHOLD TB CONTACTS SCREENING AND OUTCOME	GENDER OF PULMONARY TUBERCULOSIS PATIENTS (%)		Both
	Male	Female	
TB contacts screened			
None	34.9	20.6	55.5
1 – 4 contacts	6.8	12.4	19.2
5 – 9 contacts	11.0	5.2	16.2
10 – 14 contacts	3.0	2.1	5.2
Over 15 contacts	1.9	0.9	2.8
Not applicable	0.7	0.5	1.2
Total	**58.3**	**41.7**	**100.0**
TB contacts screening outcome			
Contacts testing negative	19.4	12.6	32.1
1 – 4 contacts testing positive	2.6	7.3	9.8
5 – 9 contacts testing positive	0.7	0.5	1.2
10 – 14 contacts testing positive	0.0	0.2	0.2
Not applicable	35.6	21.1	56.7
Total	**58.3**	**41.7**	**100.0**

- *Household tuberculosis contacts screening uptake*

The majority of the participants, that is (55.5% (*n*=237) had TB contacts who were unscreened. Out of these, 34.9% (*n*=149) were males and 20.6% (*n*=88) were females. Those who had 1 to 4 TB contacts screened were 19.2% (*n*=82). The majority, that is 12.4% (*n*=53) were females. The males in this category comprised 6.8% (*n*=29) of the study population. Those who had 5 to 9 TB contacts screened were 16.2% (*n*=69). Out of these, 11.0% (*n*=47) were males and the females were 5.2% (*n*=22) of the study population. Those who had 10 to 14 TB contacts screened were 5.2% (*n*=22). Out of these, 3.0% (*n*=13) were males and 2.1% (*n*=9) were females. Those who had more

than 15 TB contacts screened were 2.8% (*n*=12). Most of them, that is 1.9% (*n*=8) were males. The females in this category were 0.9% (*n*=4). The uptake of screening was significantly associated with TBCT (χ^2=38.326, df=16; *p*=0.000; 95% CI: 0.000 – 0.007).

- *Household tuberculosis contact screening outcome*

The participants who had their TB contacts who tested negative were 32.1% (*n*=137) of. Among these, 19.4% (*n*=83) were males and 12.6% (*n*=54) were females. Majority of the 9.8% (*n*=42) participants who had 1 to 4 of their contacts who tested positive for TB were females with 7.3%, (*n*=31). The males in this category were 2.6% (*n*=11). The participants with 5 to 9 TB contacts who tested positive for TB were 1.2% (*n*=5). Out of these, 0.7% (*n*=3) were males and 0.5% (*n*=2) were females. Only 0.2% (*n*=1) participants had ten to fourteen contacts that tested positive.

4.3.4.2.5 The frequency of immediate tuberculosis contact tracing of new pulmonary tuberculosis patient

The frequency of immediate household and workplace TBCT was analysed in order to determine utilisation of TBCT by the HCWs. The HCWs were asked to indicate any of the following variables (1) once in a week, (2) once in two weeks, (3) not frequent and (4) other. The frequency of immediate household TBCT was missing for the variable "once in a week" and the analysis did not compute it. Table 4.37 displays the responses.

Table 4.37: Distribution of immediate workplace and household tuberculosis contact tracing for new pulmonary tuberculosis patients (*N*=16)

WORKPLACE TUBERCULOSIS CONTACT TRACING FOR NEW PTB PATIENTS	HOUSEHOLD TUBERCULOSIS CONTACT TRACING FOR NEW PTB PATIENT (%)			Total
	Once in 1 week	Once in 2 weeks	Not frequent	
Once in 1 week	0.0	0.0	12.5	12.5
Once in 2 weeks	0.0	6.3	0.0	6.3
Not frequent	6.3	0.0	75.0	81.2
Total	**6.3**	**6.3**	**87.5**	**100.0**

- *Frequency of immediate household tuberculosis contact tracing*

The participants who indicated that household TBCT was carried out once in 1 week were 6.3% (*n*=1). Those who indicated once in 2 weeks were also 6.3% (*n*=1). Most of the participants, that is 87.5% (*n*=14), indicated that TBCT was not frequent.

- *Frequency of immediate workplace tuberculosis contact tracing*

Table 4.37 also shows the frequency of workplace TBCT. The participants who indicated that workplace TBCT was carried out once in 1 week were only 12.5% (*n*=2). Those who indicated that the TBCT was carried out once in 2 weeks were 6.3% (*n*=1). Those who indicated that the TBCT was not frequent were 81.2% (*n*=13). They were the majority of the study participants. The frequency of TBCT was associated with TBCT (χ^2=19.727, df=6; *p*=0.042). The results support alternative Assumption 3 that lack of frequent TBCT activities hinders implementation of TBCT.

4.3.4.3 Utilisation of workplace tuberculosis contact tracing and screening uptake

The researcher analysed the number of screened TB contacts in order to assess workplace TBCT uptake. The participants were asked to indicate any of the following variables (1) none, (2) 1 to 5, (3) 6 to 10, (4) 11 to 15 and (5) over 16. The males that did not have work contacts were 39.3% (*n*=168) and females were 30.7% (*n*=131). Table 4.38 shows the responses.

Table 4.38: Percentage distribution of workplace tuberculosis contacts screening and outcome by gender of pulmonary tuberculosis patients (*N*=427)

WORKPLACE TB CONTACT SCREENING AND OUTCOME	GENDER OF PULMONARY TUBERCULOSIS PATIENTS (%)		Both
	Male	Female	
TB contacts screened			
None	15.7	10.5	26.2
1 – 4 contacts	0.2	0.5	0.7
5 – 9 contacts	1.4	0.0	1.4
10 – 14 contacts	0.7	0.0	0.7
Over 15 contacts	0.9	0.0	0.9
Not applicable	39.3	30.7	70.0
Total	**58.3**	**41.7**	**100.0**
TB contacts screening outcome			
Contacts testing negative	2.6	0.5	3.1
1 contact testing positive	0.5)	0.0	0.5
2 contacts testing positive	0.2	0.0	0.2
Over 3 contacts testing positive	0.0	0.0	0.0
Not applicable	55.0	41.2	96.2
Total	**58.3**	**41.7**	**100.0**

- *Workplace tuberculosis contact screening uptake*

The participants whose contacts were unscreened were 26.2% (*n*=112). Out of these, 15.7% (*n*=67) were males and 10.5% (*n*=45) were females. The participants who indicated that they had 1 to 4 TB contacts who were screened were 0.7% (*n*=3). Out of these, males were 0.2% (*n*=1) and females were 0.5% (*n*=2). Those who indicated that they had 5 to 9 TB contacts who were screened were 1.4% (*n*=6). These participants were males. Those who indicated that they had 10 to 14 TB contacts who were screened were 0.7% (*n*=3), all of them males. Those who indicated that they had more than 15 TB contacts who were screened were 0.9% (*n*=4), all of them males. The

workplace screening had significance with the uptake of TBCT (χ^2=11.280, df=4; *p*=0.063). The results support alternative Assumption 3.

- *Workplace tuberculosis contact screening outcome*

The study analysed further the workplace screening outcome. The participants were asked to provide information of the screening outcome for their TB contacts by indicating any of the following variables: (1) negative, (2) one contact positive, (3) two contacts positive and (4) more than three contacts positive. They provided no more than two contacts positive. Table 4.38 further shows the responses.

The majority of those with the screening outcome, that is 87.5% (*n*=14) were males. The participants with negative screening outcome were 3.0% (*n*=13). They were predominantly males, that is 2.6% (*n*=11). The participants who had one contact testing positive were 0.5% (*n*=2), all males. Only 0.2% (*n*=1) of the participants had two workplace contacts testing positive. There were no participants who had 3 or more contacts testing positive.

The researcher further analysed information about the workplace where the HCWs mainly conduct TBCT in order to find the target areas of the HCWs. The participant HCWs were asked to indicate any of the following variables: (1) public workplaces, (2) no plan of workplace visits and (3) do not know. There were no frequencies for private workplaces.

The majority of the participants, that is 62.5% (*n*=10), indicated that there were no plan of visits for anywhere. Out of these, 70.0% (*n*=7) were females and 30.0% were males. Only 37.5% (*n*=6) indicated that there were occasional visits to government facilities. There was no association between the target areas and the TBCT (χ^2=1.351, df=2; *p*=0.757).

4.3.4.4 Utilisation of the self-reporting tuberculosis contacts and screening uptake

The researcher asked the HCWs to estimate the case identification rate of the self-reporting TB contacts in order to determine uptake of its utilisation. The variables were

(1) below 25.0%, 2) 26.0% to 50.0%, 3) 51.0% to 75.0%, 4) 76.0% to 100.0% and 5) do not know.

The majority of the participants, that is 37.5% (*n*=6), indicated that they did not know the rate of uptake. Out of these, 66.7% (*n*=4) were females and 33.3% (*n*=2) were males. The participants who indicated that there were no TBCT uptake records in the clinic were 25.0% (*n*=4). There was no association between self-reporting and TBCT (χ^2=7.467, df=4; *p*=0.095).

4.3.4.5 Health care workers utilisation of tuberculosis contact tracing

The strategy of TBCT used in the clinic was analysed in order to determine the utilisation of TBCT by the HCWs. The researcher asked the participants to indicate any of the pertaining to TBCT. They included (1) HCWs visit PTB patients at home to identify and screen contacts, (2) HCWs visit PTB patients at workplace to identify and screen contacts, (3) PTB patients send their relatives to clinic for screening and (4) other. Table 4.39 portrays the responses.

Table 4.39: Percentage distribution of strategies of tuberculosis contact tracing by gender health care workers (*N*=16)

STRATEGY OF TUBERCULOSIS CONTACT TRACING	GENDER OF HEALTH CARE WORKERS (%)		Both
	Male	Female	
HCWs visit PTB patients at home to identify and screen contacts	25.0	37.5	62.5
HCWs visit PTB patients at work to identify and screen contacts	6.25	0.0	6.25
PTB patients send their relatives to clinic for screening	6.25	12.5	18.75
Other HCWs	0.0	12.5	12.5
Total	**37.50%**	**62.5**	**100.0**

The majority of the participants, that is 62.5% (*n*=10) indicated that the HCWs in the TB clinic used the strategy of visiting the PTB patients at home to identify and screen contacts. Out of these, 25.0% (*n*=4) were males and 37.5% (*n*=6) were females. Only 6.3% (*n*=1) indicated that the HCWs visit PTB patients at work to identify and screen

contacts. The participants who indicated that the PTB patients send their relatives to the clinic for screening were 18.8% (*n*=3). Out of these, males were 6.3% (*n*=1) and females were 12.5% (*n*=2). A further 12.5% (*n*=2), all females, indicated other strategies. Other strategies included the use of mobile phone call and sending information through neighbours of the PTB patients. The strategies of the health care workers showed no association with their utilisation of TBCT (χ^2=2.916, df=3; *p*=0.558).

4.3.5 Characteristics of the health care workers

In this section, characteristics of the HCWs are discussed. They include their educational status, TBCT training, knowledge and perceptions of TBCT. Also included are the number of years worked, perception of PTB patients, adherence to TBCT policy and utilisation of TBCT. Further, the suggestions of the HCWs for the improvement of TBCT are discussed.

4.3.5.1 Education status and staffing pattern of the health care workers

The researcher analysed the education status of the HCWs in Phase III. They included the nurses and the FWEs. There were 16 eligible nurses in the study sites. They were available and were selected using expert technique. Educational level for the nurses was determined using (1) mid-level college (post-secondary training) and (2) tertiary level training. Figure 4.6 shows the responses.

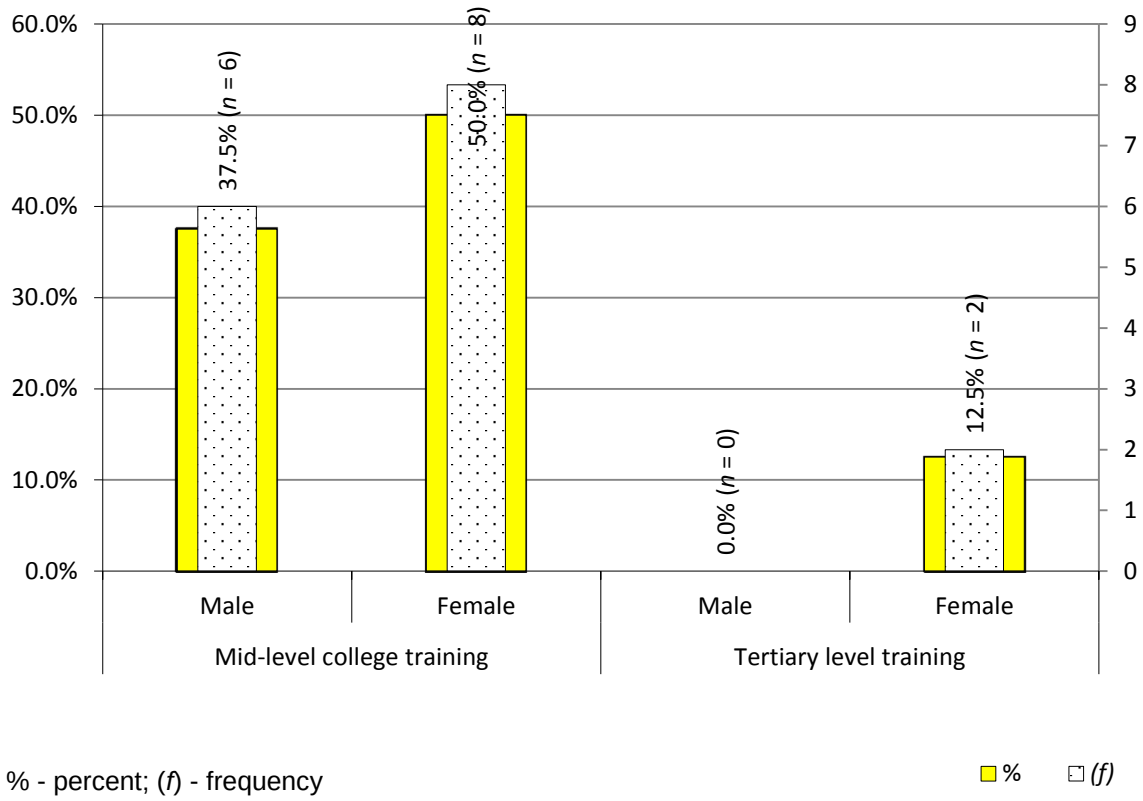


Figure 4.6: Educational status of nurses in tuberculosis clinics (*N*=16)

Males comprised 37.5% (*n*=6) and females were 62.5% (*n*=10). The participating HCWs who had completed tertiary level professional education were 12.5% (*n*=2). Those who had completed mid-level college education were 87.5% (*n*=14). Each clinic had one TB nurse focal person. The analyses of the HCWs were based on these.

4.3.5.2 Health care workers' tuberculosis contact tracing training, knowledge and perceptions

The researcher analysed the duration of the TBCT training for the HCWs with the number of years worked in the TB clinic in order to determine staffing pattern and experience in TBCT. Participants were asked to indicate any of the following response variables: (1) seminar (TBCT training of 3 to 5 days), (2) short course (introductory training of 7 to 14 days) and (3) no training. Table 4.40 shows the responses.

Table 4.40: Distribution of training and knowledge of tuberculosis contact tracing by number of years worked in tuberculosis clinic (*N*=16)

TRAINING AND KNOWLEDGE OF TBCT	NUMBER OF YEARS HCW WORKED IN TB CLINIC (%)			Total
	0 – 1 year	2 – 3 years	> 4 years	
TBCT training versus number of years worked				
Seminar	31.2	12.5	12.5	56.2
Short course	0.0	6.3	6.3	12.5
No training	18.8	12.5	0.0	31.3
Total	**50.0**	**31.3**	**18.8**	**100.0**
Knowledge of TBCT by definition versus number of years worked				
Home visits to assess patient's welfare	6.25	6.25	0.0	12.5
Home visits to identify contacts at risk	25.0	18.75	6.25	50.0
Workplace visits to identify contacts at risk	12.5	0.0	0.0	12.5
Identify and screen contacts at risk of contracting TB	6.25	6.25	12.5	25.0
Total	**50.0**	**31.25**	**18.75**	**100.0**

4.3.5.2.1 Number of years worked in tuberculosis clinic

Table 4.40 shows the duration worked in the clinic as ranging from (1) 0 to 1 year, (2) 2 to 3 years and (3) over 4 years. The participants who had worked in the clinic for 0 to 1 year were 50.0% (*n*=8). Those who had worked for 2 to 3 years were 31.3% (*n*=5) and those who had worked for more than 4 years were 18.8% (*n*=3). The work duration of showed no association with enhancing TBCT (χ^2=5.997, df=6; *p*=0.424, 95% CI: 0.382 – 0.695).

4.3.5.2.2 Training in tuberculosis contact tracing versus number of years worked

Table 4.40 also shows that most of the participants, that is 56.3% (*n*=9) had had seminar training. The majority among these, that is 55.6% (*n*=5), had worked less than 1 year, 22.2% (*n*=2) had worked for 2 to 3 years and a further 22.2% (n=2) had worked for more than 4 years. The participants who had had short course TBCT training were

12.5% (*n*=2). Between them, 6.3% (*n*=1) had worked for 2 to 3 years and a further 6.3% (*n*=1) had worked for more than 4 years. The participants who had no training in TBCT were 31.3% (*n*=5). Out of these, 18.3% (*n*=3) had worked for 0 to 1 year and 12.5% (*n*=2) had worked for 2 to 3 years. The training in TBCT and the number of years worked showed no association with enhancing TBCT (χ^2=6.857, df=9; *p*=0.769, 95% CI: 0.637 – 0.901).

4.3.5.2.3 Knowledge of tuberculosis contact tracing by definition versus number of years worked

Table 4.40 shows further the definitions of TBCT by the HCWs versus the number of years worked. The participants who defined the TBCT as conducting home visits to assess patients' welfare were 12.5% (*n*=2). Out of these, 6.3% (*n*=1) had worked for 0 to 1 year and a further 6.3% (*n*=1) had worked for 2 to 3 years. Those who defined TBCT as conducting home visits of PTB patient to identify contacts at risk were 50.0% (*n*=8). Out of these, 25.0% (*n*=4) had worked for 0 to 1 year, 18.8% (*n*=3) had worked for 2 to 3 years and 6.3% (*n*=1) had worked for more than 4 years. Participants who defined it as conducting workplace visits of PTB patient to identify contacts at risk were 12.5% (*n*=2). They were the only two who had worked 0 to 1 year. Those who defined it as identify and screen contacts at risk of contracting TB were 25.0% (*n*=4). Out of these, 6.3% (*n*=1) had worked for 0 to 1 year, a further 6.3% (*n*=1) had worked for 2 to 3 years and 12.5% (*n*=2) had worked for more than 4 years.

There was no correlation (*r*=0.000) between the experience and definition of TBCT. Similarly, the correlation between the TBCT training and definition of TBCT was *r*=0.208. The finding supported Assumption 1 for the staffing pattern and knowledge of TBCT as organisational factors that affect the utilisation of TBCT.

4.3.5.2.4 Training in tuberculosis contact tracing for the family welfare educators

The educational status of the FWEs included TBCT training only. The researcher analysed the status of TBCT training of FWEs in order to determine further the staffing pattern of community TBCT. The information was obtained from the HCWs. The participants were asked to indicate any of the following response variables: (1) yes, 2) no and (3) do not know. Figure 4.7 shows the results.

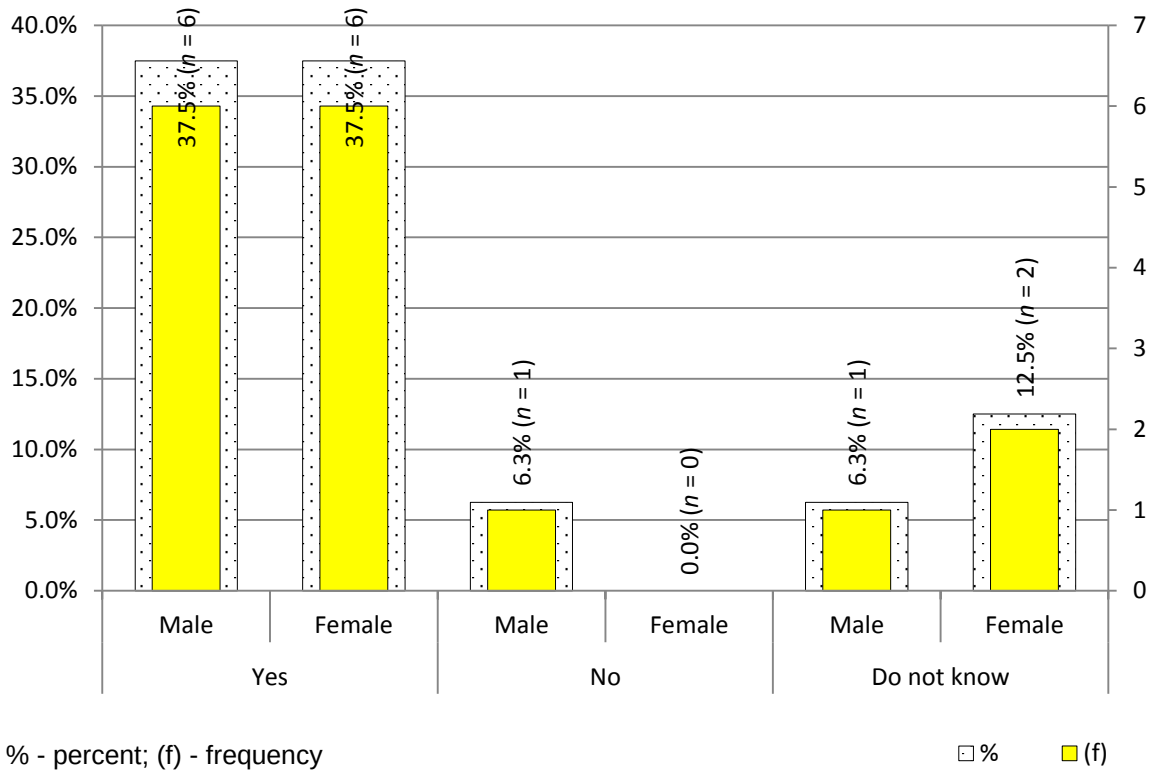


Figure 4.7: Tuberculosis contact tracing training for family welfare educators (*N*=16)

The majority of the participants, that is 75.0% (*n*=12) indicated that the FWEs were trained for TBCT follow-up. The response rate for males and females had a ratio of 1:1, each gender at 37.5%. The values for "no" and "do not know" were less than five. Results indicated that there was no significant association between the training and TBCT (χ^2=3.200, df=2; *p*=0.329).

4.3.5.3 Health care workers' perceptions of knowledge of tuberculosis contact tracing by other health care workers

4.3.5.3.1 The participant's perception of tuberculosis contact tracing by other health care workers

The researcher analysed the perceptions of the HCWs about how their colleagues defined TBCT. This was to assess the TBCT knowledge of other HCWs through the participants. Participants were asked to state what they thought about the knowledge by indicating any of the definitions (1) HCWs visit PTB patients at home to identify and

screen contacts, (2) HCWs visit PTB patients at workplace to identify and screen contacts, (3) PTB patients send their relatives to clinic for screening and (4) other perceptions. The responses were:

The participants who perceived that other HCWs defined TBCT as identifying contacts at risk of contracting TB from PTB patients were 25.0% (*n*=4). The participants who perceived that other HCWs defined TBCT as carrying out household or workplace visits to identify contacts at risk were 50.0% (*n*=8). Out of these, 75.0% (*n*=6) were female HCWs. The participants who perceived that other HCWs defined TBCT as carrying out home visits to assess PTB patients' welfare were 18.8% (*n*=3). Those who had similar perceptions about the PTB patients' definition of TBCT were 43.8% (*n*=7). Those who did not know about the TBCT perception of other HCWs were 6.25% (*n*=1). The participants who did not know of the perceptions of the PTB patients about TBCT were 12.5% (*n*=2), all females. The results support alternative Assumption 2 that the basic knowledge of the TBCT and their case identification are not associated with improving the utilisation of TBCT (*n*=4) of (χ^2=2.794, df=4; *p*=0.641).

4.3.5.3.2 Association between health care workers' tuberculosis contact tracing knowledge and perception with utilisation

The researcher analysed the strategies used in contact tracing in order to determine the association between the HCW's TBCT knowledge, perception and the utilisation of TBCT. The participants were asked to indicate any of the following response variables: (1) active utilisation of TBCT, (2) passive utilisation of TBCT and 3) do not know. Table 4.41 displays the responses.

Table 4.41: Percentage distribution of utilisation of tuberculosis contact tracing by gender of health care workers (*N*=16)

UTILISATION OF TBCT	GENDER OF HEALTH CARE WORKERS (%)		Both
	Male	Female	
Active utilisation of TBCT	31.25	37.5	68.75
Passive utilisation of TBCT	6.25	6.25	12.5
Do not know	0.0	18.75	18.75
Total	**37.5**	**62.5**	**100.0**

Most of the participants, that is 68.8% (*n*=11) indicated that the current HCW knowledge and perceptions was associated with active utilisation of the TBCT. Out of these, 37.5% (*n*=6) were females. The participants who indicated that there was an association of TBCT knowledge with passive utilisation were 12.5% (*n*=2), with males and females each having 6.25% (*n*=1). The participants who did not know of any association were 18.8% (*n*=3). The results show no association between the HCW's TBCT knowledge and perception and the utilisation of TBCT (χ^2=2.230, df=3; *p*=0.835).

4.3.5.3.3 Health care workers' perceptions of pulmonary tuberculosis patients

From the perspective of the HCWs, the researcher analysed the concerns of the PTB patients during visits in order to determine the factors that hinder utilisation of TBCT. The analysis included concerns of a PTB patient during (1) HCWs visit and (2) self-report visit. The response variables for the concerns during a HCW's visit included (1) age of PTB patient, (2) stigma related to TBCT and (3) other. The response variables for the concerns during self-report visit included (1) age of TB contact, (2) gender of TB contact, (3) distance to TB clinic, (4) stigma related to TBCT and (5) other. Table 4.42 shows the responses.

Table 4.42: Percentage distribution of concerns of pulmonary tuberculosis patients and tuberculosis by gender of health care workers (*N*=16)

CONCERNS OF PTB PATIENTS DURING TBCT VISITS		GENDER OF HEALTH CARE WORKERS (%)		Both
		Male	Female	
Concerns during a HCW's visit				
Concerns of a PTB patient during a HCW visit	Age of PTB patient	0.0	6.3	6.3
	Stigma related to TBCT	37.5	56.2	93.7
	Total	**37.5**	**62.5**	**100.0**
Concerns of a self-report visit				
Concerns of a TB contact who self-reports in clinic	Age of TB contact	0.0	6.25	6.25
	Gender of TB contact	6.25	0.0	6.25
	Distance to TB clinic	6.25	6.25	12.5
	Stigma of TBCT	25.0	50.0	75.0
	Total	**37.5**	**62.5**	**100.0**

- *Frequent concerns of pulmonary tuberculosis patient during health care worker's visit*

The participants who indicated age of PTB patient was the most frequent concern were 6.25% (*n*=1), only female. Majority of the participants, that is 93.7% (*n*=15), indicated that stigma related to TBCT concerned the PTB patient most during a HCW's visit. Out of these, 37.5% (*n*=6) were males and 56.2% (*n*=9) females. The concerns during health care worker visit were not significantly associated with hampering TBCT (χ^2=2.286, df=2; *p*=0.626, 95% CI: 0.617 – 0.636).

- *Frequent concerns of pulmonary tuberculosis patient during self-report visit*

Similarly, the majority of the participants, that is 68.8% (*n*=11), reported that stigma related to TBCT concerned the PTB patient most during a self-report visit to the clinic. Out of these, 63.6% (*n*=7) were females. Results supported Assumption 4 that perceptions of stigma hinder the TBCT (χ^2=3.006, df=4; *p*=0.893, 95% CI: 0.886 – 0.899).

The study analysed the most frequent clinic related barrier to TBCT as perceived by the HCWs. The response variables were (1) administrative, (2) organisation of the TB clinic and (3) stigma from the HCWs.

Majority of the participants, that is 56.3% (*n*=9) indicated clinic administrative processes as the most frequent barrier to TBCT. Out of these, 55.6% (*n*=5) were females. Those who reported organisation of the TB clinic as the frequent barrier were 37.5% (*n*=6). Out of these, 66.7% (*n*=4) were females. Only one female participant reported the fear of stigma from the HCWs. The Assumption 1 that organisational and administrative factors hinder TBCT is supported (χ^2=0.830, df=2; *p*=1.000).

The HCWs were asked to state what they perceived as the most difficult problem for the PTB patients during TBCT process. Most of the participants, that is 31.3% (*n*=5) indicated that personal fear was the most difficult problem for PTB patients. Out of these, 60.0% (*n*=3) were females. Of the 25.0% (*n*=4) participants who stated stigma from HCWs, friends and relatives were regarded as the most difficult source of stigma problem. For this response, the male-female ratio was 1:1.

4.3.5.4 Health care workers' knowledge of and adherence to tuberculosis contact tracing policy

4.3.5.4.1 Knowledge of tuberculosis contact tracing and adherence to its policy

The study sought to determine the HCWs' knowledge of the TBCT and the policy regarding when to commence TBCT and adherence to it. The variables used for knowledge included (1) yes, (2) no and (3) do not know. The response variables for when to commence TBCT were (1) immediately after diagnosis and (2) one week after diagnosis. Table 4.43 shows the responses.

Table 4.43: Initiation of tuberculosis contact tracing and adherence to policy by health care works (*N*=16)

INITIATION OF TBCT	HEALTH CARE WORKERS ADHERE TO THE TBCT POLICY (%)			Total
	Yes	No	Do not know	
Immediately after diagnosis	31.25	18.75	6.25	56.25
Within a week after diagnosis	6.25	12.5	25.0	43.75
Total	**37.5**	**31.25**	**31.25**	**100.0**

- *Initiation of tuberculosis contact tracing by health care workers*

The participants who indicated that initiation of TBCT commenced immediately after diagnosis were 56.25% (*n*=9). The participants who said that TBCT was started within a week of PTB diagnosis were 43.75% (*n*=7). The participants who did not know about the time to commence TBCT were 31.25% (*n*=5).

- *Adherence to tuberculosis contact tracing policy*

The participants who indicated that they adhered to the TBCT policy were 37.5% (*n*=6). Those who indicated that they did not adhere to that policy were 31.3% (*n*=5). A further 31.3% (*n*=5) of the participants indicated that they did not know whether they were adhering to the policy or not. Those who said they adhered to the TBCT policy concerning immediate commencement of TBCT were 31.3% (*n*=5). However, 18.8% (*n*=3) of them also indicated that they did not adhere to that TBCT policy and 6.3% (*n*=1) did not know. Among the participants who indicated that TBCT was commenced within a week, 6.3% (*n*=1) indicated that they adhered to that policy, 12.5% (*n*=2) indicated that they did not adhere to that policy and 25.0% (*n*=4) did not know whether they adhered. The alternative Assumption 3 is supported that the HCWs' actions regarding the initiation of the TBCT is marginally associated with barriers of utilisation of TBCT (χ^2=4.487, df=2; *p*=0.154).

4.3.5.4.2 Health care workers' involvement in tuberculosis contact tracing

The research Assumption 3 was that there is association between the HCWs actions and the improvement of TBCT controlling for specific involvement, type of TBCT and most active HCW. The researcher analysed the level of involvement of TBCT in order to determine utilisation. Participants were asked to state their involvement by indicating any of the following variables: (1) planning, (2) implementation, (3) evaluation and (4) not involved. Table 4.44 shows the responses.

Table 4.44: Distribution of level of involvement of health care workers in tuberculosis contact tracing by specific activity (*N*=16)

LEVEL OF INVOLVEMENT IN CONTACT TRACING	SPECIFIC TBCT ACTIVITY PERFORMED FREQUENTLY (%)			Total
	Household/workplace visit to identify TB contacts	Interview TB contacts at TB clinic	Other activity	
Planning	6.25	6.25	0.0	12.5
Implementation	43.75	12.5	12.5	68.75
Evaluation	0.0	6.25	0.0	6.25
Not involved	12.5	0.0	0.0	12.5
Total	**62.5**	**25.0**	**12.5**	**100.0**

- *Specific involvement in tuberculosis contact tracing*

The participants who indicated that they were involved in planning of TBCT were 12.5% (*n*=2). Those who said that they were involved in the implementation of TBCT were 68.86% (*n*=11). Out of these 43.8% (*n*=7) said that they were mainly involved in the household/workplace visit to identify TB contacts. Those who said they were involved in evaluation were 6.3% (*n*=1) and those who said that they were not involved in any activity were 12.5% (*n*=2).

- *Commencement of tuberculosis contact tracing*

The researcher analysed the duration of time after diagnosis until commencement of TBCT in order to determine adherence to policy. The participants were asked to indicate any of the following variables: (1) immediately, one to two days, (2) three to four days and (3) over 5 days. Responses are displayed in Table 4.45.

Table 4.45: Distribution of contact tracing strategy by number of days to commence tuberculosis contact tracing (*N*=16)

CONTACT TRACING STRATEGY	NUMBER OF DAYS TO COMMENCE TBCT AFTER TB DIAGNOSIS (%)					Total
	Immediate	1 – 2 days	3 – 4 days	> 5 days	Do not know	
HCWs visit household PTB patients to identify and screen contacts	25.0	0.0	6.25	18.75	12.5	62.5
PTB patients send their relatives to clinic for screening	0.0	12.5	0.0	0.0	6.25	18.75
HCWs visit workplace PTB patients to identify and screen contacts	0.0	6.25	0.0	0.0	0.0	6.25
Other	6.25	6.25	0.0	0.0	0.0	12.5
Total	**31.25**	**25.0**	**6.25**	**18.75**	**18.75**	**100.0**

The participants who indicated that they commenced TBCT immediately after PTB diagnosis were 31.3% (*n*=5) and were the majority. This was followed by the participants who indicated that they commenced TBCT within 1 to 2 days with 25.0% (*n*=4). Those who indicated commencing TBCT after 3 to 4 days were 6.3% (*n*=1). Those who commenced it after more than five days were 18.8% (*n*=3). A further 18.8% (*n*=3) of the participants did not know when to commence it. There is no significant relationship between TBCT and the time to commence it (χ^2=12.364, df=15; *p*=0.846).

4.3.5.4.3 Strategy used in tuberculosis contact tracing

The researcher analysed further the strategy of TBCT used in order to determine the utilisation of strategies. The participants were asked to indicate any of the following types of TBCT: (1) HCWs visit households to identify and screen TB contacts, (2) PTB

patients send their relative contacts to clinic for screening, (3) HCWs visit PTB patients at work to identify and screen contacts and (4) others. Table 4.45 shows the results.

The majority of the participants, that is 62.5% (*n*=10) indicated that the HCWs used the technique of visiting households of the PTB patients to identify and screen the TB contacts. Out of these, the participants who commenced the TBCT immediately were the majority with 25.0% (*n*=4). Those who indicated that the PTB patients usually send their relatives to clinic for screening were 18.8% (*n*=3). Out of these, 12.5% (n=2) indicated that the TBCT would commence 1 to 2 days after diagnosis. The participants who indicated that the HCWs visit workplace PTB patients to identify and screen contacts were 25.0% (*n*=1) and also among those who would commence TBCT within 1 to 2 days. Those who did not know were 12.5% (*n*=2). Out of these, 6.3% (*n*=1) indicated that TBCT commenced immediately and a further 6.3% (*n*=1) indicated that it would commence within 1 to 2 days of TB diagnosis. The results show differences in commencement of TBCT and in the types utilised. Thus, the results do not support alternative Assumption 3 that the HCWs' initiation of the TBCT improves the TBCT.

4.3.5.4.4 Most active individual in tuberculosis contact tracing

The researcher asked HCWs to state the most active individual in carrying out TBCT follow-up. Response variables were (1) nurse, (2) FWE and (3) other. Table 4.46 shows the responses.

Table 4.46: Distribution of availability of tuberculosis contact tracing plans in clinic by most active health care worker (*N*=16)

AVAILABILITY OF TBCT PLANS IN CLINIC	MOST ACTIVE INDIVIDUAL IN CARRYING OUT TBCT PLANS (%)			Total
	Nurse	FWE	Other HCW	
Available in clinic	12.5	0.0	0.0	12.5
Not available in clinic	56.25	25.0	6.25	87.5
Total	**68.75**	**25.0**	**6.25**	**100.0**

The researcher asked the participants to state the person who was the most active and could best implement the TBCT follow-up. The variables were (1) nurse and (2) the FWE and (3) other HCW. The participants who indicated that the nurse was the individual who was most actively involved in TBCT activities were 68.75% (*n*=11). This was followed by 25.0% (*n*=4) of those who indicated the FWE. Those who indicated others were 6.25% (*n*=1). The others mainly referred to the PTB patients, their relatives and doctor.

4.3.5.4.5 Availability of tuberculosis contact tracing plans

The participants who indicated that the clinic had TBCT plans were 12.5% (n=2). Those who indicated that the clinic had no TBCT plans were 87.5% (*n*=14). Out of these, the nurses were the majority with 64.3%. In summary, most of the participants stated that the clinics had no TBCT follow-up plans and that had an implication on the TBCT implementation (χ^2=7.771, df=3; *p*=0.179).

4.3.5.4.6 Desired change to improve tuberculosis contact tracing by health care workers

The researcher analysed the HCWs' suggestions for desired change in order to improve the TBCT programme. Participants were asked to indicate any of the response variables (1) start contact tracing immediately after diagnosis, (2) provide transport to enhance response to TBCT, (3) visit PTB patients at home and workplace to screen TB contacts and (4) other. Table 4.47 shows the responses.

Table 4.47: Distribution of suggestions to improve tuberculosis contact tracing by gender of health care worker (*N*=16)

SUGGESTIONS TO IMPROVE TBCT	GENDER OF HEALTH CARE WORKERS (%)		Total
	Male	Female	
Improve TB clinic contact tracing plans	18.75	6.25	25.0
Increase number of trained TB contact tracing HCWs	12.5	12.5	25.0
Enhance training in TBCT	0.0	31.25	31.25
Improve TB contact tracing logistics (transport, mobile phone…)	6.25	12.5	18.75
Total	**37.5**	**62.5**	**100.0**

The participants who suggested for the long-term improvement of clinic TBCT plans were 25.0% (*n*=4). Those who suggest increasing the number of trained TBCT HCWs were equally 25.0% (*n*=4). This was followed by the majority, those who suggested enhancing TBCT training were 31.25% (*n*=5). All were female. Those who suggested that providing logistics such as transport and mobile phone to enhance response to TBCT was the most desired change were 18.8% (n=3). The suggestions are significantly associated with intentions to participate in TBCT (χ^2=6.89, df=3; *p*=0.077; 95% CI: 000 – 0.0161).

The researcher analysed the use of mobile phones among the HCWs in order to find acceptability in TBCT. The participants were asked to indicate use of the mobile phone in TBCT by either (1) yes, or (2) no responses. Table 4.48 shows the results.

Table 4.48: Relationship between recommendation and utilisation of mobile phone in tuberculosis contact tracing by health care workers (*N*=16)

HEALTH CARE WORKER RECOMMENDS USE OF MOBILE PHONE IN TBCT	HEALTH CARE WORKER UTILISED MOBILE PHONE IN TBCT (%)		Total
	Yes	No	
Yes	50.0	18.75	68.75
No	6.25	25.0	31.25
Total	**56.25**	**43.75**	**100.0**

Whereas 68.75% (*n*=11) of the HCWs recommended use of mobile phone in the TBCT, 31.25% (*n*=5) did not recommend for its use. Most of the respondents, that is 56.25% (*n*=9), had previously utilised mobile phone in the TBCT. However, 43.75% (n=7) of them had not utilised it before. The use of mobile phone in TBCT is significantly associated with TBCT (χ^2=3.883, df=1; *p*=0.049). The odds ratio is 10.96 indicating that the HCWs who recommended mobile phone and had utilised it before were 10.96 times more likely to accept its use in TBCT than those who recommended and had not utilised it before. The alternative Assumption 3 is supported.

4.3.5.4.7 Suggested strategy and action the health care workers could use in tuberculosis contact tracing

The participants were asked to state the best strategy the HCWs could use to identify TB contacts in the community and the TBCT actions they (HCWs) could use to achieve success in contact tracing. The response variables for the strategy were (1) HCWs actively trace and screen household and workplace TB contacts, (2) TB patients voluntarily send their contacts to the clinic and (3) other. The response variables for the TBCT actions they (HCWs) could use best included (1) HCWs visit PTB patients at home and workplace, (2) HCWs wait for the TB contacts in the clinic and (3) other. Table 4.49 displays the responses.

Table 4.49: Suggested strategy and action the health care workers could use in tuberculosis contact tracing (*N*=16)

SUGGESTED STRATEGY TO IDENTIFY CONTACTS IN COMMUNITY	SUGGESTED ACTION THE HEALTH CARE WORKER COULD USE IN TB CLINIC (%)			Total
	HCW visits PTB patient at home and workplace	HCW waits for TB contacts in the clinic	Other actions	
HCW to actively trace and screen household and workplace contacts	50.0	12.5	12.5	75.0
PTB patients to voluntarily send contacts to clinic	0.0	12.5	0.0	12.5
Other strategies	0.0	12.5	0.0	12.5
Total	**50.0**	**37.5**	**12.5**	**100.0**

Majority of the participants, that is 75.0% (*n*=12), suggested that the HCWs could actively trace and screen household and workplace TB contacts as the best strategy that the HCWS could identify TB contacts in the community. Only 12.5% (*n*=2) of the participants suggested that PTB patients could voluntarily send contact to the clinic. A further 12.5% (*n*=2) of the participants suggested other strategies that included forceful screening.

The participants who recommended that the action the HCWs could best use was to visit the PTB patients at home and workplace were 50.0% (*n*=8). This was followed by 37.5% (*n*=6) who suggested that the HCWs could wait for the TB contacts in the clinic. Only 12.5% (*n*=2) suggested other actions that included screening in the households. The suggestions of the strategies and actions in TBCT were significantly associated with intentions to implement TBCT (χ^2=8.889, df=4; *p*=0.031).

The participants were asked to state perceived immediate priority to improve the TBCT in the clinic and in the community. The response variables for immediate improvement of TBCT in clinic included (1) improve TB clinic contact tracing plans, (2) increase number of trained TBCT HCWs, (3) enhance TBCT training and (4) improve TBCT logistics. The response variables for the first priority to improve TBCT in the community were (1) provide transport support to the TB contacts, (2) increase the number of TBCT-trained FWEs and (3) use of mobile phones. Table 4.50 shows the responses.

Table 4.50: Percentage of immediate priorities to improve tuberculosis contact tracing in community and tuberculosis clinics (*N*=16)

IMMEDIATE PRIORITY TO IMPROVE TBCT IN COMMUNITY	IMMEDIATE PRIORITY TO IMPROVE TBCT IN CLINIC (%)				Total
	Improve TBCT plans in TB clinic	Increase TBCT trained HCWs	Enhance TBCT training	Improve TBCT logistics	
Provide transport support to TB contacts	12.50	6.25	18.75	12.5	50.0
Increase number of TBCT-trained FWEs	6.25	12.5	12.5	0.0	31.25
Use mobile phone	6.25	6.25	0.0	6.25	18.75
Total	**25.0**	**25.0**	**31.25**	**18.75**	**100.0**

- *Immediate priority to improve tuberculosis contact tracing in clinic*

The participants who suggested improving TBCT plans in the clinic were 25.0% (*n*=4). A further 25.0 % (*n*=4) participants suggested increasing TBCT trained HCWs in the clinic. Those who suggested enhancing TBCT training were 31.25% (*n*=5) and were the majority. Those who suggested improving TBCT logistics were 18.75% (*n*=3). From the suggestions, it is clear that the participants desire to improve the TBCT.

- *Immediate priority to improve tuberculosis contact tracing in community*

The participants who suggested providing transport support to the TB contacts as an immediate priority to improve TBCT in the community were 50.0% (*n*=8) and were the majority. However, the suggestions had no significant implication on TBCT (χ^2=3.771, df=6; *p*=0.823). Those who suggested increasing the number of TBCT-trained FWEs as a first priority in improving community TBCT were 31.25% (*n*=5). Those who suggested using mobile phone were 18.75% (*n*=3).

In summary, the HCWs and the PTB patients provided their suggestions to improve TBCT. The suggestions for long-term and immediate priority for improving TBCT in clinic and community were similar.

4.3.6 Gaps in the implementation/utilisation of tuberculosis contact tracing

The results provided some highlights on gaps in the implementation/utilisation of TBCT in the study sites. The gaps included organisational factors; knowledge and perceptions of TBCT; policy implementation for contact tracing and the staffing pattern of the HCWs in the TB clinics.

The TB clinic organisational factors include little or no space for the new PTB patients and their suspects. The risk of mixing PTB suspects and the general patient population exists. The clinics have little or no TBCT visit plans and schedules. Most of the clinics do not display or have no TBCT policy. The community structures that link the TBCT programme are unclear to the PTB patients. Logistics such as transport and communication for the community TBCT follow-up are a constraint in the TBCT

programme. There is a substantial difference in the number of registered TB contacts and the actual TB contacts in the community, thus, it shows a short fall in the TBCT coverage. The clinics mostly rely on passive TBCT despite its weaknesses.

Most of the PTB patients are mainly a young, single in marital status and highly mobile population. Their general knowledge and perceptions of TB is low. Their perceptions about the TBCT indicate gaps in the TBCT awareness enhancement. Some PTB patients' behaviour and living conditions may favour transmission of the MTB and risk of TB re-infection. Instances of behaviour include stigma, fear of medication and defaulter rate, peer alcohol consumption and smoking that encourage crowding. However, most of the households have good nutritional pattern (despite inadequacy) and permanent houses but mainly with crowded rooms. The physical working conditions for most of the employed PTB patients encouraged transmission of MTB due to prolonged proximity to one another. From the 1 539 TB contacts in Phase I, 48.3% were not screened. The household TB contact-case index ratio was 5.4:1 in Phase II and 1.05:1 for the workplace. The average NNT is 2.16.

The HCWs have gaps in TBCT training as evidenced in the definition of and commencement of the TBCT. There is a gap in staffing pattern for the TB HCWs. A general desire for a more innovative TBCT strategy exists among the HCWs, as there is overreliance on the TB suspects for self-report strategy.

4.4 OVERVIEW OF RESEARCH RESULTS

The analysis presented the results of the results that arose from the research participants. The results were linked to the research questions and assumptions. The results covered the factors that affect the TBCT in general. They include the organisational factors such as the TB clinic space needs, TBCT policy, follow-up plans and visit schedules. Moreover, it reports the results of the status of community TBCT linkage structures. The results included the PTB patients' knowledge and perceptions of TB and the utilisation of the TBCT by participation. The report includes results of the status of TBCT participation for the eligible contacts and the TB contact-case index ratio. Among the results were the suggestions on how to improve the TBCT programme. The analysis further reports results of the knowledge and practice of the TBCT by the HCWs. Among the results are the types of TBCT the HCWs used, the coverage rates,

their training in TBCT and experience in working with PTB patients. The results include the suggestions from the PTB patients and the HCWs on how best to improve the TBCT programme.

In summary, the results point the TBCT implementation/utilisation gaps. The gaps may continue to hinder the increased coverage of the TB contacts and achievement of national targets in reducing the transmission of the TB. The questions have been answered and there is need for more efficacious TBCT strategies.

4.5 CONCLUSION

Data were collected through administration of structured questionnaires and interviews during 2015 at Good Hope Sub District and the Lobatse Health District, Botswana. Data were collected in three phases whereby Phase I included observation of the clinics and enrolment of the participants, Phase II involved interviewing the PTB patients and Phase III encompassed interviewing for health care workers. The results revealed deficiencies in the implementation of the TBCT. The results suggest that TBCT has to be focussed and strengthened in order to be effective in reducing high tuberculosis infection rates and the associated mortality. The results further indicate the need for increased participation and training of the health workers on TBCT. The next chapters discuss the results and suggest a strategy for effective contact tracing.

CHAPTER 5

STUDY DISCUSSION

5.1 INTRODUCTION

This chapter discusses the findings of the study and the summary of the research findings including the characteristics of the research participants in relation to contact tracing, contact tracing in Botswana and the challenges of tuberculosis contacts are presented. The chapter will further discuss the needs of tuberculosis patients.

5.2 SUMMARY OF THE RESEARCH FINDINGS

This section discusses the major findings related to TBCT. The section commences with discussing organisational factors that affect utilisation of tuberculosis contact tracing followed by discussion of characteristics of the research participants.

5.2.1 Organisational factors that affect utilisation of tuberculosis contact tracing

5.2.1.1 Tuberculosis clinic spatial characteristics

This section discusses the characteristics of the TB clinic. In particular, it includes the availability of areas for receiving and interviewing new PTB patients and TB contacts. The discussion points out the effect of these results on the TBCT process.

5.2.1.1.1 Reception and interview area for the pulmonary tuberculosis patients and contacts

Most of the clinics that received the new PTB patients in an area separate from that of other patients were more likely to interview (OR=1.20) them either in a separate room with no other activity or, as one HCW said, "… in a consultation room if there is no other activity". Such spatial design promotes privacy and confidentiality of information for the TB suspects and, hence, the TBCT process. Conversely, the clinics that received the new PTB patients or the TB suspects as mixed with other patients, were more likely to

interview them in a space within a room (36.4%) where other patients received health services (OR=1.75). The results portray a space design constraint on the 36.4% that did not have physical TB clinic structures or had modified sections of the clinic for interviews. Notwithstanding the lower percentage, the mixing of patients has far-reaching ramifications on the TBCT. The clinics either mix patients at reception and in interviews or have a separate space for these actions within the same rooms; not a useful strategy in the TBCT. Some of the clinics utilise a sheltered "*cough spot*" outside and separate from the clinic. The lack of space and mixing of patients mean that there is no privacy and confidentiality of information. This may adversely affect the TBCT interviews where the TB suspects, fearing being stigmatised, may feel uncomfortable with those scenarios, and may strive to avoid, not only them but also the TBCT follow-up actions. The inadequate space for patient privacy during history taking and interviews indicates low capacity of the TB clinics. In two of the urban clinics, two HCWs said that they "… improvise from the main clinic a space where we interview TB suspects," and the other said that they mixed them because "… we do not have enough space". In yet another clinic, a HCW stated that the TB suspects were put in "… *coughers* bench outside". In addition, a rural HCW conceded that the TBCT was carried out in the general out-patient department (OPD) after the diagnosis of TB.

In the strategy of separation of patient where there are no designed physical structures, the HCWs effectively subject the TB suspects to unfavourable weather conditions such as low temperatures of winter and the heat of summer. The findings concur with the mixing of patients in Mukono and Wakiso districts in Uganda (Buregyeya et al 2013:360) where coughing patients were not separated from the other patients nor were they given privacy in 90.0% (*n*=47) of the clinics.

5.2.1.2 Policy and instruments for contact tracing in Botswana

Majority of the clinics do not keep the TBCT policy (OR 0.44). The findings show that the TBCT policy was largely unavailable and that it was the prerogative of the HCWs in each clinic to choose what instruments to use. For instance, a HCW respondent who had a locally designed TB contact register stated that "there is no register for TB contact tracing, so I designed this for use during follow-up". Another respondent argued, "We don't keep contact tracing forms here; we refer TB patients to the clinics". In another instance, a respondent stated that the clinic used community TB care policy guidelines

and the TB/HIV policy guidelines in the TBCT programme. Another respondent stated that the "… TB manual is available. We also use contact tracing forms," and yet another stated that the clinic use TB manual in the TBCT programme. Whereas most (81.8%) of them used the TBCT forms, only 9.1% used the TB register only and 9.1% used a combination of the TBCT forms and the register. The interpretation is that the HCWs hardly utilise the TBCT policy, if available. Further, the utilisation of TBCT instruments in the TB clinics is not standardised.

5.2.1.3 Community tuberculosis contact tracing structures and contact tracing plans

The existence of a TBCT structure linking with the local clinic is not clear to 44.50% of the PTB patients. The majority of the PTB patients said there was no community TBCT structure (40.0%, 95% CI: 35.8 – 44.5). A few thought that community TB programme was the TBCT structure that linked with the TB clinic. The fact that it is unclear to the participants what a TBCT structure is may indicate deficiency in community TBCT structures. It also interprets as lack of knowledge and awareness of the TBCT programme. It may also be that the programme does not exist.

Some participants attest to the lack of the structures as one said that "there is no such thing as community TB contact tracing here". Another said that there was none, adding that the HCWs "… should form a contact tracing programme so that they detect people … before the signs appear". Similar to the call by the WHO (2015:17), a respondent urged the TBCT implementers to "… involve us in everything because we know each other better than they know us". Thus, it portrays that there is need for active involvement of the TB patients and their contacts as beneficiaries in the planning, implementation and follow-up, evaluation and operational research TBCT process.

However, some community volunteer groups exist as one respondent stated that there was a community support group working with the clinic for general health matters. Hence the researchers do believe, just as do Hargreaves et al (2011:660), that it was time for a rapid scale up of innovation and actions in the TBCT programme.

5.2.1.4 Workplace tuberculosis contact tracing plans and most active individual

The workplace TBCT is underutilised as portrayed by there being no workplace address in the lists of the TBCT records. Only during health campaigns do the HCWs utilise it. That strategy does not enhance the use of workplace TBCT and may result in missed TB identification opportunities as one respondent HCW stated that, "…it is done once in a while and contact are given an education concerning TB, … and advised to seek prompt health care if they develop s/symptoms". It is passive TBCT with an expectation that the TB suspects would visit the TB clinic on their own when they develop signs and symptoms (Botswana 2011a:13; Pia 2011:330–332; Zellweger 2010:1–25; Zeng et al 2010:5). This strategy takes a reactive stance in that it is utilised after the TB contacts are infected. That would trigger a reaction of the HCWs instead of a proactive prevention. Hence there is lack of planned proactive TBCT activity that aims at early identification of the TB contacts. In Ekwueme et al (2014:1175) in Enugu, Nigeria, the cue to participate in the TBCT may be achievable through a planned TBCT health education programme.

The findings show that the most active HCWs in the TBCT were nurses and the FWEs in that order. In summary, the findings marginally supported alternative Assumption 3, that there was significant association of the lack of planned schedules and the utilisation of TBCT.

5.2.1.5 Summary of the organisational factors and literature review

The results show that the organisational challenges such as the TB clinic spatial capacity and the TBCT visit plans/schedules are in congruence with previous reports. The current research findings confirm reports in the CDC (2011:174) and in Botswana (2007:12) that the implementation of the TBCT measures in Botswana often faces organisational, human and resource challenges that might lead to ineffective monitoring and evaluation of the TBCT. The schedules are a constraint in the TBCT as in those reports. The research results also confirmed that the organisational constraints in the study findings in Nezenega et al (2013:110) provide a potential for a missed opportunity in the TBCT. Furthermore, the findings confirm the report in Chiang et al (2013:598) that facility-specific organisational challenges such as lack of or inappropriate allocation of

specific tasks to specific TB clinic HCWs and failure to keep appointments with the TB patients jeopardise the TBCT programme.

5.2.2 Characteristics of the pulmonary tuberculosis patients

5.2.2.1 Socio-demographic characteristics of pulmonary tuberculosis patients in relation to contact tracing

5.2.2.1.1 Age, gender and marital status of pulmonary tuberculosis patients

The mean age of the PTB patients was 40.9 years (39.57 – 42.05, SD – 14.38) and the median age was 37.0 years. There were increasingly fewer respondents with the advancing age. Fox et al (2012:[3]) in Hanoi, Vietnam found the mean age for the household PTB patients to be 36.3 years. The median age was 37.0 years which meant that the concentration of the respondents were youthful. The lowest legal age was 21.0 years and the highest was 89.0 years.

The findings show the mobility pattern of the 21 – 40 age groups to have significant association with the TB infection. Hence, that will have significant association with TBCT. This is because the current strategy of self-report may not be suitable to use in tracking them unless it is modified to respond to their mobility pattern. They comprised 58.8% (*n*=251), with 82.5% of them being in the 26 – 40 year age group (48.5% of the study population). A similar situation was established in Nigeria whereby Babatunde et al (2013:212) found a significant relationship between age and the TB infection. The same study found that 81.8% of the PTB patients were youth below 25 years old in Babatunde et al (2013:212). In the current study, 48.0% of those aged below 25 years were 21 years old, suggesting for a TBCT strategy focusing in this age group. There is a peak in the 30-34 year age group among the most affected between the ages of 25 and 49 years. As such, it poses a challenge in the TBCT activities that focus on households or self-reports only: it must include active inclusion of their networks. The TBCT programme must consider the mobility pattern of this age group in planning appropriate TBCT strategies.

The results established gender as an influential factor. Males are found to be more susceptible to TB than females. In this study, males with PTB were 58.3% and females

were 41.7%. That is, 1.4 TB-infected males for every TB-infected female. The results in the current research show similarities with those in the health research reports. For instance, in the WHO (2010:78), the 88.6% of 9 155 new TB cases in Botswana had an uneven gender distribution of TB. In the report, there were 1.3 TB-infected males for every 1.0 TB-infected female in 2010. Similarly, Babatunde et al (2013:216) reflected that there was gender distribution of 41.0% TB infected females against 59.0% infected males in Ido-Ekiti, Nigeria in 2010. However, results showed that the gender-TBCT acceptance was more so among the females than males. This corroborates findings in other health reports. Further similarities in Omotowo et al (2012:451–456) show that females were 51.1% (178) compared to 48.9% (170) males in Ebonyi State of Nigeria. Further afield, Fox et al (2012:[3]) reports that 40.3% of the household TB contacts were males in Hanoi, Vietnam. It may be deduced that gender is a determinant factor in that females are more likely to accept to participate in health preventive measures such as TBCT than their male counterparts. This may provide a new thinking in modifying the TBCT strategies especially those that are gender sensitive (Karim et al 2011:84–89).

The results show that marital status has a significant association with the TBCT (χ^2=12.48, df=6; $p < 0.05$). There are more single PTB patients than any other category. Most of them were single-cohabiting followed by non-cohabiting participants. The findings are suggestive of multiple concurrent cohabitations. The question of how the TBCT strategies should actively involve their close cohabiting TB contacts arises.

5.2.2.1.2 Number of household members and tuberculosis contact tracing

The number of household members was a significant factor associated with the TBCT (χ^2=26.907, df=17; p=0.043). Most of the households have significant number of contacts per PTB patient. The implication is that a single PTB patient can yield a high TB contact-case index ratio. Both the TB clinic registers (Phase I) and the interviews (Phase II) showed a significant household TB contact-case index ratio even though they also differed significantly. The study generated a household ratio of 3.5:1 from the clinic registers but 5.4:1 of the same from the field interviews (see sub-section 4.3.3.4). Similarly, the number needed to trace was equally significant for both phases, at least 2.15 TB contacts per household with a PTB patient. Deery et al (2014:535) reports a similar finding in South Africa where the NNT was 4.8 patients in order to locate one positive TB contact. Similar to this is the report in Stapledon and Veney (2010:2). In the

report, there was a possible yield of 4.50% active TB cases when one screens an average of 4.4 household contacts in low and middle income countries. Gandhi et al (2010:1830–1843)assert that such a patient suffering from PTB could spread TB, MDR TB or even XDR TB, with potentially fatal outcomes for his or her household members. The results, therefore, indicate that the current TBCT efforts do not exhaustively trace all contacts. Similarly in the literature report, Deery et al (2014:534–535) stated that only 35.0% households were successfully traced in South Africa in 2012.

5.2.2.1.3 Food security and association with tuberculosis contact tracing

The amount of food adequacy is significantly low (χ^2=11.836, df=4; p=0.014). The findings suggest that the household spend a significant amount of time looking for food for the entire number of household members. The quality and quantity of food is associated with TBCT as Govender and Mash (2009:513) noted that food insecurity was a problem for 42.0%. This is also similar to reports in Nissen et al (2012:40183) in Tanzania that 38.80% of the household respondents had nutrition-based challenges of non-adherence to TB services. Nissen et al (2012:40183) report that respondents bought food instead of using the money they were given for bus fare to the clinic, as one respondent admitted, “I was given bus fare yes, then I spent the money [on food]”. In the like manner, food adequacy may affect the TBCT services where household members prioritise much of their time in ensuring that there was food security. The risk in the current study is that, even if the TB contacts were to be given bus fare to go to the clinic for screening, they may use it for food and miss to go for testing. Hence, the challenge of transport to and from the TB clinic for the TB contacts is a challenge that needs an innovative cost-effective alternative.

5.2.2.2 Occupation, employment and household income

5.2.2.2.1 Occupation and tuberculosis contact tracing

The study revealed that the majority, 62.1%, of the participants do not have any occupation. As such, most of them stayed home without work, especially among the 20.1% sub-population in unskilled labour industry. Examples include “*tirelo sechaba* (a government programme to offer jobs to young unemployed citizens),” “*modisa dikago* (Gate keeper; night watchman),” livestock and poultry farming. Some of the responses

were “I was working as a bar attendant, but stopped due to illness,” “*ke apaya bojalwa* (I brew beer),” “collecting herbs for treatment,” “kitchen hand at a government office” and “I am the headman in a mining company.” Others stated that they moved from place to place selling various goods and still others worked as maids. Most of the unskilled occupations are not permanent and the need for livelihood makes the participants to be ever on the move, thus hampering the TBCT efforts. Cherkaoui et al (2014:[5]) reiterate that participating in the TBCT is as complex as treatment default owing to, among others, migration for work in Morocco, West Africa. The TBCT programme faces a challenge in the need for financial sustenance of the PTB patients and contacts in the TBCT programme. However, results showed that occupation status of the PTB patients was not significant and would not affect their participation in TBCT (χ^2=3.176, df=4; p=0.590).

The occupational and environmental conditions – open or closed, spacious or congested are associated with barriers of TBCT (χ^2=601.904, df=20; $p < 0.05$). The results showed that occupational conditions determine the risk factors, not only for the TB disease, but also the ease of availability of employees for the TBCT strategies such as health education. For instance a participant working as a nurse disclosed that “I felt that I will get TB from the patients, and see, here I am with the TB”. Thus, it portrays the risk that nurses and doctors who work in enclosed premises such as hospitals are at risk of occupational exposure due to prolonged proximity with the TB patients. This finding is similar to the findings in Baussano et al (2011:488–494), Claassens et al (2010:1576–1581) and Kranzer et al (2010:224–226) which indicate that the nurses and doctors have died in South Africa having been infected by the PTB patients for whom they cared. In spite of the high risk, the data show little TB contact tracing actions in the workplace. In addition, the TBCT efforts may be hampered where the contacts at home feel that TB can only be contracted at the workplace as one participant said that she didn’t feel at risk because, “… I am not working”. Another participant wondered why he should fear getting infected with PTB when he is not working. This fallacy assumes that there is no need for the TBCT at households if one can only get infected with TB at workplace.

5.2.2.2.2 Employment and tuberculosis contact tracing

The employment status is fairly associated with TBCT (*N*=427, χ^2=310.963, df=4; *p*=0.027). Employment is a measure of economic enabler that determines the PTB patients' availability to engage in the TBCT. In a similar study to compare challenges in active and passive TBCT in Arkhangelsk, Russia, Kuznetsov et al (2014:4–6) found that 57.0% (*n*=258) of the participants were unemployed. In this study, the category of employer/organisation was significantly associated with TBCT (χ^2=13.634, df=5; *p*=0.018). Employees prefer work to TBCT since it provides a source of income for the PTB patient. Deery et al (2014:535) report that, in South Africa, one of the reasons why 65.0% of households were not traceable is because most of them were out of homes. The study further reported that 27.40% of household members being at work eking out a living. Govender and Mash (2009:513) add that the main reason for poor household TBCT was that 80.0% of them were unemployed.

5.2.2.2.3 Household income and tuberculosis contact tracing

More than half, 50.6%, of the participants are PTB patients who lived in households with no income. Similar to this finding is a socio-economic challenge in Govender and Mash (2009:513) that includes 37.0% household members with no income. The findings in the current study also include 20.0% of the households that earned less than BWP 500.00 per month (χ^2=2.256, df=4; *p*=0.689). Meagre household earnings could determine the level of utilisation of household TBCT. The simple reason is that the PTB patients would first strive to satisfy their household economic needs. That provides a competing first priority factor. Further, Courtwright and Turner (2010:36) add that the fear of loss of jobs and reduced income may prompt TB patients not to participate in the TBCT.

5.2.2.2.4 Education, knowledge and perceptions about tuberculosis and the tuberculosis contact tracing

- *Education and knowledge of tuberculosis patient*

The findings indicate that 20.1% of the respondents had no education and 34.9% had completed primary education. Therefore, more than half (55.0%) of the population of the

participants had no or low educational level. The level of education has significant association with the TBCT (χ^2=26.381, df=3; *p*=0.000) as most of them are more likely to have TB infection than those with higher education. It can be deduced that lack of education hampers the TBCT process. Kuznetsov et al (2014:4–6) compared challenges in active and passive TBCT. The participants with higher educational level (44.9%) have better knowledge of TB and are more likely to adopt TBCT than their counterparts with little or no education. The TBCT study report in Kuznetsov et al (2014:4–6) shows that 57.0% of the participants had secondary school education level of literacy in Russia. The cohort study to in Waako et al (2013:349) in Uganda shows that 85.0% of the TB contacts had less than 7 years of education with a higher incidence of TB compared with 13.9% who had over 7 years of education (OR=0.9; 0.20–4.06) and that TB was seven times more prevalent in participants who were out of school than those in school (OR=6.84; 01.28-36.03).

- *Pulmonary tuberculosis patient's knowledge of the cause of tuberculosis*

It is evident from the results that most of the respondents have good knowledge of the cause of the TB since the majority mentioned germs. The knowledge of the cause of TB supports Assumption 4 that it is not a significant barrier of TBCT (χ^2=5.468, df=5; *p*=0.379). Knowledge of the cause of TB correlates with educational status. Most of the participants with no education do not know the cause of TB. However, the perception that the cause of TB is anything other than germs is more evident among males than the females.

However, some of the participants attributed the cause of TB mainly to divine punishment, witchcraft, eating bad food caused TB and not knowing the cause outright (χ^2=5.468, df=5; *p*=0.361). It appears that many male TB patients associated the cause of TB with their work environment and witchcraft. Some participants mentioned the cause TB as paint fumes, cement dust, sorghum dust or dust in the mines when they worked in building construction, farming industry and mining company respectively. Some male respondents said of the work environment, "*ee, ka gore go lerole* (yes, it is dusty), "it was dangerous, dusty environment," "… I felt I might bet infected while I was in the farm," "… I inhaled a lot of chemicals in the mines …" and "I got this diseases from the dust from sorghum." Others believe that "it's from the curse and witchcraft" or

"… sometimes it comes with air as a curse." One illiterate participant wanted to know, "…where this disease is coming from. I think traditional doctor knows more." Ekwueme et al (2014:1175) allude to perceptions about the cause of disease as having effects on the control of that particular disease. The report in Haasnoot et al (2010:903) in Tanzania shows that 32.0% of adult Maasai study participants believed that TB was a punishment from God, a factor that interferes with self-efficacy in health seeking behaviour and the TBCT.

Such perceptions of the cause have implications on the plans for the workplace TBCT actions. From the premise that the cause of disease determines the strategies and means of prevention and control efforts, such perceptions have far-reaching effects on the health seeking behaviour and the utilisation of TBCT.

Given the proportion of the PTB patients eligible for TBCT in the current sites is 19.80% of 18 525 or 3 668, percentages may be discernible for phases I and II respectively. The results in the current study show that 41.96% are registered PTB patients with a case index-contact ratio of 1.3 in Phase I. According to the field results, Phase II has 63.9% eligible for TBCT with a case index-contact ratio of 1:6. The findings are similar to those found in Uganda in a cohort study in Waako et al (2013:349). Out of the 21.70% (*n*=1 085) TB suspects in the cohort, 18.50% (*n*=201) were TB positive. It is evident that the current TBCT strategy cannot trace all contacts.

Illiteracy was found to be significant among those who did not know about the cause of TB and the TBCT. Similar findings were reported in India (80.0%) in Kar and Logaraj (2010:226-229), Ethiopia (65.4%) reported in Esmael et al (2013:786) and Vanuatu Islands (94.0%) in the pacific as reported in Viney et al (2014:[6]). That was significant among the rural participants than among those in urban areas as in Chang and Cataldo (2014:168–173).

The lack of knowledge of the possibility that the signs and symptoms of TB may not always show the same pattern is a risk factor as one participant said, "I did not feel at risk … just felt I cannot get TB," and saw no need for the TBCT. Such self-perception affirms the literature review in Wieland et al (2012:14–22) that lack of knowledge of the TB transmission in the USA is a risk factor in the TBCT. Further, the respondent's knowledge of TBCT by definition was not significantly different in the sub-population of

educational levels (χ^2=2.358, df=5; p=0.799). Most of the respondents had similar understanding of the TBCT. The goodness-of-fit test of independence was positive (N=427, χ^2=0.000, df=0), hence the model was suitable. Similarly, knowledge of TBCT is significantly associated with completed level of education (χ^2=33.486; df=15; p=0.004). It appears that the participants without education were more unlikely to define TBCT correctly (OR=7.66; $p < 0.05$) than those with higher education (OR=2.19; $p < 0.05$). Ekwueme et al (2014:1175) report that the TB patients and contacts in Nigeria had poor knowledge, not only of the causes and transmission of TB, but also in health seeking behaviour and TBCT.

However, there is significant association of the training received with the knowledge of TBCT (χ^2=81.558, df=15; p=0.000). The findings showed varied length of training on the TBCT. Most of the TB patients had received the TB contact tracing training for a day. This could be the very first day of enrolment into the TB treatment and their contacts being listed. However, some TB patients claimed to have received up to seven days and still, others had had over four weeks of the training. This shows the need to standardise the pattern of training in TB contact tracing. The findings indicate that Assumption 4 is supported that the PTB patients' knowledge about the TBCT may improve utilisation of TBCT.

In summary, results show a significant association between the level of education and knowledge and the utilisation of the TBCT. The PTB patients with no education or completed primary education are more unlikely to define TBCT and participate in it (OR=7.66; $p < 0.05$) than those with secondary and tertiary education (OR=2.19; $p < 0.05$). Therefore, TBCT awareness and training provides a means of enhancing participation in TBCT.

5.2.2.2.5 Perceptions about tuberculosis and tuberculosis contact tracing

- *Living or working with a person infected with pulmonary tuberculosis*

The findings showed that living or working with a person infected with PTB is significantly associated with intentions to participate in TBCT (χ^2=8.276, df=2; $p < 0.05$). Most of the respondents said that they lived or worked with a PTB patient.

An unhappy household participant said of a suspected TB infected sister, "*go na le nkgonne yo o lwalang, mme o gana bongaka* (I have an older sister who is sick but she refuses to go to the clinic)." The participant exhibited a positive perception of utilising the TBCT services and wondered why her sister did not see the need to be contact traced yet. The other common responses include "I was living with them but two of them passed away," "I have been taking care of people with TB; six of them passed away." Some comments of the participants who worked with PTB patients included "I felt that I will get it from the patients, and see, here I am with the TB." A case example is where a PTB patient transmitted MTB to those who served them or those whom they worked with (Baussano et al 2011:488–494). Other instances from the study include transmission of MTB in beer bars and schools. One participant said of a beer bar: "… because it is a bar. People smoke inside and meeting many people in a congested area". A participant who got infected in school said that "… a work mate had TB but would not reveal it to us for fear of stigma." A similar finding in Brazil shows that 56.30% of families of PTB patients expressed fear and sadness of living with a TB patient (Freitas et al 2012:647). Dodor et al (2012:211–218) report that PTB infected individuals were isolated and not allowed to send children for any errands.

In summary, findings showed that the closeness with a PTB patient is an influencing factor in the intention to participate in TBCT (χ^2=20.964, df=5; p=0.000). This is probably because the individual can see the seriousness of the TB disease and that may act as a cue to participate in TBCT.

- *Perceptions of the risk of contracting tuberculosis and implication on tuberculosis contact tracing*

Most of the respondents, did not know whether they were at risk of TB infection or not. A respondent said "no, I just felt I cannot get TB". That portrayed ignorance and complacency about TB and the TBCT. That may be further interpreted to mean that awareness creation about risks of TB infection is a need that determines the status of TBCT. Muture et al (2011:696) indicate 16.70% for personal ignorance of TBCT default among the participants in Nairobi, Kenya. The feeling that someone was at risk of contracting the TB from the respondents was marginally significant (χ^2=7.964, df=3; $p < 0.05$). The finding supports Assumption 4. Only few of the respondents did not know

and the majority knew they were a risk to their contacts. The reasons for the fears could be favourable or unfavourable to transmitting the TB and affecting the TBCT programme.

The findings showed complacency among participants in that their infection was not a risk to their contacts. That might have discouraged PTB patients from participating in TBCT. For instance, some participants argued that their contacts were not at risk of TB and that there was no need for the TBCT. One participant said that her household contacts "… cannot get infected now because they have been traced and screened for TB …" This is a misconception of the purpose of the TBCT and screening – that it was therapeutic. The literature review has similar findings in Uganda. The finding in Buregyeya et al (2013:359) reports a degree of complacency among HCWs in a qualitative arm of TBCT screening. Another reason for the perception that one cannot transmit TB is the belief that no one can get TB "… from me because mine is TB for abdomen". Yet another participant said that none of her contacts was at risk "… because my TB is not pulmonary, it is from the witchcraft". Another participant claimed that it is only when one is still working in the mines that he or she can spread the TB and that the TB from an ex-miner does not spread. A participant argued that the TB disease cannot recur after having been treated and there was no need to participate in TBCT activities. Such unfavourable reasons and perceptions may enhance negative attitude in the uptake of the TBCT. Furthermore, they indicate poor understanding of the TB and TBCT. Community awareness creation about TBCT is a need that the HCWs must include in their health education. The strategies of delivering the TBCT messages in the health education talks need improvement.

- *Importance of the number of days shared with pulmonary tuberculosis patient*

The days shared with a PTB patient in the week prior to the current interview was significantly associated with the intention to participate in the TBCT (χ^2=20.964, df=5; $p < 0.05$). The more the number of days shared with a PTB patient, the more the feeling at risk of contracting the TB. Thus, the fear of getting infected was a cue that prompted the participant to accept TBCT. Chesca et al (2010:202) support this cue adding that in order for a TB contact to utilise preventive services such as the TBCT, an individual must develop fear of contracting TB. In support of this, Kane et al (2013:200–204) stated that 85.0% of study respondents in Dublin, Ireland feared death due to TB. As

such, 90.0% of respondents in the study believed that cure was possible and available upon getting tested.

For some participants, however, the practice of some form of household isolation was the norm. For instance, one participant stated "… we were separating him. He stays alone in his room". A participant who experienced separation said "… I was not sharing food and utensils with them". The literature review in Buregyeya et al (2011:939–940) alludes to such behaviour as avoiding the PTB patients as affecting the TBCT. A rural participant who confessed to have encouraged their sick relative to stay away from home said "… we asked her to stay in hospital for one month ...". However, the infective period is 14 days, a time when the initial intensive phase of ATB treatment is instituted. One male participant who was not happy with family separation complained about "… just staying alone in a separate room. I have been isolated in the house". That way the household members risked stigmatising their sick relatives and hampering the TBCT efforts. The results were further supported in the study findings in Dhaka, Bangladesh (Tasnim et al 2012:[2]) where PTB patients' relatives separated the food of the PTB patients.

- *How tuberculosis co-infection with human immunodeficiency virus is a risk to tuberculosis contact tracing*

The results showed that the co-infection of TBHIV syndemic affected a significant number of participants. It was associated with the PTB patients' participation in TBCT (χ^2=11.471, df=3; $p < 0.05$). A similar report showed that Botswana had 100 MDR TB patients in 2014, largely due to the TBHIV co-infection (WHO 2012f:10–21). It had an average retreatment of 56 (WHO 2012f:10–21). Published studies further showed that, earlier, the MDR TB incidence was 2.45% of which 6.56% were retreatment cases (WHO 2010c:[1]). The findings indicate the seriousness of the co-infection in the country. The existence of two programmes – TB programme and HIV/AIDS programme – poses a risk of dividing attention of a single patient with the syndemic infection. The division may occur in how the HCWs could trace each PTB patient who has HIV. Deery et al (2014:539) stated similar concern and suggest that the TBHIV co-infection may determine the design of the TBCT strategies for effective and cost-effective TB follow-up. Currently, the TBHIV programmes collaborate and that needs strengthening strategies.

- *Risk of alcohol consumption in tuberculosis contact tracing*

The consumption of alcohol was significant (χ^2=41.016, df=3; $p < 0.05$) among the participants. Most of the alcohol consumers were males in the ages of 26 to 40. When age was used as control variable majority were those who consumed both manufactured and traditional beer (χ^2=218.452, df=168; $p < 0.014$).

The frequency of alcohol consumption was significant for TBCT (χ^2=45.427, df=7; $p < 0.05$). Most of those who consumed alcohol did so every day of the week. A participant conceded that "drinking alcohol daily prevented me from going to the clinic". Such a participant cannot be relied upon in the TB contact tracing. To that, another participant suggested encouraging people to stop drinking alcohol and go for testing, adding that "for them to participate in contact tracing, they must stop tracing alcohol and cigarettes" and "people should stop drinking alcohol so they can concentrate of TBCT". The risk in alcohol consumption is in the inhibition of the willingness of the PTB contacts to participate or default in TBCT. The finding is similar to the report in Johnstone-Robertson et al (2011:1246–1255) in South Africa. The report included alcohol consumption as causing poor adherence and increased defaulter rates in the TBCT.

- *Risk of smoking in tuberculosis contact tracing*

Majority (73.8%) of the participants did not smoke at the time of the study but it was because the TB sickness forced them to stop. They stopped mainly because of the perception that smoking caused that sickness. Literature review revealed smoking as a misconception of the cause of the TB disease. Indeed, some respondents believed that smoking caused it as one respondent averred to have been smoking heavily until "... I got this disease". Such perceptions of the cause have implications on the plans for the TBCT actions. From the premise that the cause of disease determines the strategies and means of prevention and control efforts, such perceptions have far-reaching effects on the health seeking behaviour and the utilisation of TBCT. The number of cigarettes smoked per day had significant implication on the TBCT (χ^2=32.093, df=5; p=0.000). As with alcohol consumption, smoking cigarettes encourages peer pressure with regard to

sharing and closeness. It is this behaviour that brings unsuspecting TB contacts with the infected individuals.

- *Risk of medication default and tuberculosis contact tracing*

Defaulting the DOT with ATB medication was a risk factor in the TBCT. Although results showed that almost all the participants took their ATB DOT medications timely (χ^2=18.238, df=3; *p*=0.000), most of those who failed due to defaulting were males. A defaulter becomes increasingly unlikely to go back to the clinic due to a number of reasons. One example is “I suspect TB is caused by too much medication. I got it from previous medication,” “I did not recover because I defaulted treatment” and “Examinations prevented me from going for treatment on time”. Such behaviour not only interfere with the ATB but also TBCT processes as well. Gust et al (2011:5) also portray that the risk for re-infection becomes high if the TB patient does not adhere to treatment due to ineffective follow-up efforts by the HCWs. The finding is corroborated in Viney et al (2014:[7]) in Vanuatu island, thus, defaulter rate increases the likelihood of defaulting further.

- *Health seeking behaviour for pulmonary tuberculosis*

The place where the participants sought initial TB care was not associated with TBCT (χ^2=2.522, df=3; *p*=0.487). However, the action of health seeking for TB care was itself associated with the intention to take up the TBCT (χ^2=15.913, df=6; *p*=0.012). Most of the participants utilised public health facility as the initial TB care seeking behaviour without necessarily intending to utilise the TBCT services. Examples of comments from participants are “*ke ne ke na le setlhabi* (I had pain) so I went to hospital and was told I had TB,” “I went to do routine medical exam, then diagnose TB.” An urban participant said “I was screened when my mother was positive. That’s how I knew I had TB.”

However, some participants consulted traditional doctors initially before ending up the health seeking in public health facilities. The role of the witch doctors and traditional medicine practitioners is a risk factor to the TBCT as the TB contacts often spend time seeking their healing powers. One respondent said “… I suspected myself and went to the witch doctor….” Such a health seeking behaviour wastes vital time that could have

been used for early diagnosis and prompt treatment. This fact lends its credence in Finnie et al (2011:397) who report that delays included consultation with traditional healers first before going to a health facility. Besides, the study in Ekwueme et al (2014:1175) supports this finding. In the study, the TB patients and contacts in Nigeria had poor knowledge of causes and transmission of TB. They thought that evil spirits caused TB and so they sought the healing powers of witch doctors, leading to delayed health seeking behaviour. In another instance, a male participant said that a witch doctor referred him to the clinic. In essence, the participant wasted the important initial days when the infectivity of the mycobacteria is high and probably continued to infect his contacts before getting proper treatment.

- *Difficulties of accessing tuberculosis care through tuberculosis contact tracing*

Some participants feared accessing TB services for a variety of reasons. However, the difficulties of accessing TB care was not significant at 95% CI (χ^2=8.986, df=6; *p*=0.183). Some of the difficulties included financial assistance to cover transport costs to and from clinics. A disabled participant complained of being discriminated against because “I am a disabled person with TB and they don’t provide transport”. For lack of transport, a respondent said that “my chest was not good in breathing, so I did not go to the clinic, the witch doctor was nearer”. The literature review supports the difficulty in transportation. As Govender and Mash (2009:513) report, transport to hospital was a challenge for 79.0% of the participants who used taxi and for 20.0% of those who walked. That underlines the important role the transport costs played in the follow-up and the TBCT activities.

Food security is an important factor in the TBCT activities. One participant argued that food was a problem, “Just money for food, you cannot take it [medication] without food first”. Govender and Mash (2009:513) report that food insecurity was a problem for 42.0% of participants. In order to mitigate the food insecurity and enable TB contacts to participate actively in TBCT, Paz-Soldan et al (2013:290) report that some TB patients suggested that the TB control programme should incorporate income-generating activities.

Stigma from the HCWs and relatives was also seen as a hindrance to intentions to participate in the TBCT services. One participant claimed of complicity from the HCWs

saying "*ke ne ke ba isa tliliniki, mme baoki ba re ga ba lwale. Ga ba tlhatlhobiwa* (I took them [TB contacts] to the clinic, but the nurses said they were not sick. They were not tested." Mwansa-Kambafwile et al (2013:[4]), quote a participant who felt stigmatised to participate in the TBCT slips. Similarly, Chang and Cataldo (2014:168–173) found that stigma deterred TB contacts from accessing screening services. The HCWs may unwittingly interfere with the willingness of TB suspects to participate in TBCT. Even the slightest HCWs' comments may have adequate influence on discouraging the patients' intention to participate in the TBCT. One participant said "the nurse didn't want to talk to me because I was infected the second time," and yet another said "I did not have ID so they did not want to attend to me" In addition, the clinic plans may add to the discouragement to participate in the TBCT as one participant noted, "I am alone at home and busy at school, these clinic schedules take my time…" In one of the urban households, six TB contacts stated that they feared going for TB screening lest they get infected with TB and to avoid perceived painful screening procedures.

A participant claimed that the TB contacts fear to go for testing because the nurse [name withheld] often treated the TB patients as unwanted. The participant suggested that medication should be given in such a way that they [PTB patients] "… will not throw them away in front of nurses."

The results about stigma as a barrier to the TBCT are similar to the findings by other authors. The example in Courtwright and Turner (2010:757) shows that stigma reduces the bearer from a usual person to a tainted, discounted one. In South Africa, Mwansa-Kambafwile et al (2013:[4]) quote a participant who felt stigmatised to participate in the TBCT slips. It is also evident in Hargreaves et al (2011:655–656) that the TB contacts with TB symptoms like persistent cough often fear stigma that may discourage them from participating in TBCT.

In summary, results show a significant association between perceptions and barriers of the utilisation of the TBCT. The PTB patients who do not perceive stigma nor fear medications were likely to participate in the TBCT compared to those who perceived stigma and had fears of the medication procedures.

The involvement of the PTB patients and the TB contacts within the TBCT process enables them to have a sense of self-worth and reduces stigma. Paz-Soldan et al

(2013:290) add that the involvement enables the PTB patients and their contacts to socialise and improve their self-efficacy.

5.2.2.2.6 Education versus perceived benefit of tuberculosis contact tracing to the individual

The study sought to determine the perceived benefits of the TBCT among participants with various highest completed education levels. The perception of the immediate benefit of TBCT to the individual was significantly associated with educational level (χ^2=24.395, df=9, p < 0.004). The participants with completed tertiary education have a rational perception of the benefits of TBCT. The results showed that 33.7% (*n*=144) of the respondents with lower formal education perceived that the immediate benefit of the TBCT to the individual was early screening and treatment of the TB contacts. Those with higher educational level perceived so with higher percentage, 41.7% (*n*=178).

Haasnoot et al (2010:903–904) indicate that the 0.25% Maasai participants with some literacy in Tanzania had a better understanding of the TB. By inference, that population would have a better understanding of the benefits of TBCT than those who did not have good education. The other 2.1% (*n*=9) perceptions of the understanding of the TBCT in the study population had varied responses. Examples were “helping family members to bring their relatives with the TB to the clinic to be helped,” “TB contact tracing helps stigma to go to the cliff [to disappear],” “TBCT helps people and the clinics to work together” and “improve communication and food basket to give people time for TB contact tracing”.

The perception of the benefits of tuberculosis was significantly associated with TBCT ($\chi^{2=}$11.934, df=4; *p*=0.009). The perception was more discernible for participants who had completed education above secondary level. As such, the Assumption 4 is accepted that there is significant association between the perceptions of the PTB patients and the TBCT as measured by the educational level and perceived benefit of TBCT to the individual. Therefore, there is the likelihood of improved uptake of TBCT with the educational level of the PTB patients. That may have implications on the need for health education about the TBCT services in the community.

5.2.2.3 Baseline diagnoses and treatment phases of pulmonary tuberculosis patients

Most of the PTB patients were in the continuation phase of PTB treatment. Males were the majority in all categories of treatment except the re-treatment phase where the majority were females. Even though there was no association between treatment phases (χ^2=6.378, df=5; *p*=0.215) and the TBCT, knowing the PTB patients in different phases would be beneficial in planning for the implementation of TBCT. This is especially so for the health education and PTB patient involvement. Among the findings are the PTB patients suggesting for the involvement as one urban participant said "they do not involve us but I do it [TBCT] on my own". Another participant said that they should be involved in everything that concerns TBCT because "… we know each other better than they know us". In literature review, Cluver et al (2013:748–755) recommend involvement of the PTB patients in planning, implementation and evaluation of TBCT in South Africa. In another report, Paz-Soldan et al (2013:290) quoted a participant in Lima, Peru, as saying "… they give us talks that they should have given us at the start of treatment, like what tuberculosis is. Those who are starting should be separate from those of us who are finishing treatment". It is, therefore, clear that the PTB patients encouraged involvement in all phases of implementation of TBCT.

5.2.3 Characteristics of the tuberculosis contacts

There is a significant difference in the numbers of the TB contacts between those in the clinic records (*n*=1 539) and those enumerated during the interviews (*n*=2 344). There is therefore a potential for 805 TB contacts missing the TBCT services. The variance could be due to enumeration discrepancies for both the clinic records and the interviews. However, the range is worth re-examining. There were more female TB contacts, 61.0% (*n*=939) than male contacts, 39.0% (*n*=600) in both the clinic TB registers and during the interviews with 40.0% (*n*=937) males and 60.0% (*n*=1 407) females. The numbers may determine the plans for the TBCT service implementation when gender is taken into account. This further suggests that the HCWs must strengthen the TBCT strategies to close the gap. The distribution of the TB contacts is highest within the ages of 10 to 39 years in both displays; the TB records having 66.5% and the interviews having 68.0%.

The list of contacts in some TB records in Phase I showed incomplete number of contacts compared to that of the TB index patients' actual count in Phase II. For instance, one participant accounted for six household contacts whereas the checklist elicited only three (50%). Going by the mean of both Phase I and Phase II counts, that is 1 942, the study reveals that 41.62% (*n*=805) of the TB contacts was not included among those that needed screening and possibly early treatment. The disparity in the TB contact record keeping, and hence tracing, casts doubts on the quality of care the TB patients and their contacts receive. The concerns of such findings in the current study sites is in congruence with the concerns of the WHO (2015:1-3) that, of the global 9 600 000 new TB cases in 2014, 37.0% either went unreported or had unknown type of care globally. This indicates the need for an improved strategy of contact tracing.

In summary, there is significant difference in the proportion of the TB contacts to the PTB patients between the checklist analysis in Phase I and that of the PTB patient interviews in Phase II (χ^2=32.73, df=11, $p < 0.05$). The findings support alternative Assumption 2. It assumes that the basic knowledge about the TBCT and case identification rates are significantly associated with improving the utilisation of the TBCT. Therefore, the current strategies of TBCT are not effective enough to find the missing 41.62% (*n*=805) or more TB contacts in the TB registers and cannot upscale the household and workplace TBCT.

5.2.4 Characteristics of the health care workers

5.2.4.1 Education and staffing pattern of the health care workers

The TB focal persons were nurses that were selected through expert techniques were mainly females accounting to 62.5% of the HCWs in the study population. Majority, 87.0%, of them had post-secondary education and completed mid-level college training in nursing. Only 12.5% of the HCWs had completed tertiary level professional education. The findings showed a nursing professional work force that is fairly well prepared. Each clinic had one TB nurse who supervised the tuberculosis programme – hence known as TB focal person.

5.2.4.2 Health care workers' tuberculosis contact tracing training, knowledge and perceptions

5.2.4.2.1 Training in tuberculosis contact tracing

Fifty six percent of the TB focal persons had completed seminar-level training in TBCT (χ^2=5.997, df=6; *p*=0.424). Only two of them had had short course training (up to 14 days) in TBCT. The results showed that 60.0% of them had worked less than a year in the TB clinic post training.

Studies reveal that through KITSO, Botswana had 188 TB trained HCWs of whom 140 were HCWs (BIPAI 2011). Out of that cohort, 60.7% were nurses. That shows good progress. However, the fact that 31.3% of the TB focal persons in the current study were without the TBCT training casts concerns as regards their ability to implement the TBCT programme. This concurs with the finding in Tlale et al (2015:12) in Kweneng District where 60.0% of nurses were trained in TBCT but 54.0% did not know of the TBCT policy. A participant who was worried said that most of the nurses were only 2 months old in the facility, "… they do not know how to conduct TBCT," and added that that factor had affected the uptake of screening. The results confirmed this fact in that the HCWs training in TBCT and knowledge of it by definition (χ^2=6.857, df=9; *p*=0.769: 95% CI: 0.637 – 0.901) were not significantly associated with the utilisation of TBCT. Similarly, there was little correlation between the TBCT training (*r*=0.000) and knowledge of TBCT (*r*=0.208) with the number of years worked. A participant noted, "Most of the staff are not trained in TB management and contact training. The [TB] focal person is mostly occupied by other duties". The results, thus, showed that there is little association between the organisational factors (staffing pattern and TBCT training) and the utilisation of TBCT. The results supported Assumption 1 that the staffing pattern and knowledge of TBCT are organisational factors that affect the utilisation of TBCT.

5.2.4.2.2 Knowledge and adherence to tuberculosis contact tracing policy

The results in general indicate that 25.0% of the participants correctly defined TBCT. Some 62.5% of them defined it as carrying out home visits of the PTB patients to identify contacts at risk. There is no correlation (*r*=0.000) between the TBCT training and that of the definition (*r*=0.208). That further shows the varied knowledge of the

definition of TBCT by the participants and a human resource that needs focused preparation in the TBCT programme.

When asked about what they thought could improve knowledge of TBCT, the participants suggested the introduction of continuous training in TBCT for the HCWs because, as one respondent said, "… staff are transferred and deployed to other facilities all the time".

There was little knowledge of the TBCT policy and that casts doubts in adherence to it. For instance, the HCWs' differed in understanding of when to commence TBCT after diagnosis (χ^2=4.487, df=2; p=0.154) after a new diagnosis of TB. The practice introduces a risk factor for the utilisation of TBCT. Some HCWs indicated that it should be "… within a week but usually we have problems of transport and in most cases its [it is] over a week to even 2 weeks". Some of the HCWs commenced contact tracing after one or two days, and still others commenced it after more than five days. When it was commenced, the HCWs said they utilised household visit to identify the TB contacts. The results supported alternative Assumption 3 about the HCWs' initiation of the TBCT that the varied practices and delays are barriers of utilisation of TBCT. The MOH (Botswana 2007:16–17) is concerned that despite the presence of a policy for immediate initiation of the TBCT and screening within three days, it frequently faces delays.

5.2.4.2.3 Health care workers' perceptions about tuberculosis contact tracing

The HCWs knowledge of the perceptions of TBCT by others was analysed. A few HCWs did not know of those perceptions (χ^2=1.375, df=2; p=0.795). In the words of one participant, the TBCT is "not currently done …". A participant conceded not knowing what the TBCT meant. The poor knowledge about the perception of other HCWs and the PTB patients is a risk factor in TBCT as it interferes with the planning and implementation based on informed knowledge. Most, 56.3%, of the participants stated that clinic administrative processes were the most frequent among the barriers of implementation of TBCT. Therefore, there is no association between the HCW's TBCT knowledge and perception and the utilisation of TBCT (χ^2=2.230, df=3; p=0.835).

The results showed, further, that 37.5% participants reported organisation of the TB clinic as the frequent barrier. Chiang et al (2013:598) report that facility-specific organisational challenges include simple lack of or inappropriate allocation of specific tasks to specific TB clinic HCWs. The research noted that there was incomplete information, such as TB patients' addresses, on the TB register, making it difficult to trace the TB contacts. That partly explains the difference of 805 TB contacts between Phase I and Phase II. In reiteration, some of the TB clinic organisations impede TB patients' time to do their other functions. An example is where one male PTB patient reported that the clinic schedules and timing wastes his time. Studies support this finding where the MOH (Botswana 2011a:12–13) concurs that the TB clinic HCWs hardly schedule time with the TB patients for contact tracing. As a solution to organisational challenges, one HCW participant suggested the provision of a separate space, "… e.g. caravan, for TB patients only and TB contact tracing".

In summary, the section discussed the findings of the characteristics of the health care workers. They include educational preparation, TBCT training and staffing pattern. It also included perceptions of TBCT.

5.2.5 Summary of sample characteristics

In summary, the findings have shown that the population is mainly youthful, highly mobile and most of its members were single-cohabiting. Even though the PTB patients receive food basket, the participants reported that household food was inadequate. Most of the participants are in unskilled occupations and hence there is frequent job migration pattern. These factors are barriers to participating in TBCT. Most of the participants were literate, even though the level of education was mostly in completed primary education. It appears that there is little knowledge of the cause of TB and the purpose of TBCT among the PTB patients. The participants exhibited complacency and perceptions that may discourage their participation in TBCT. However, the higher the education is attained the more likelihood of utilising TBCT. There are a high number of TB contacts per PTB case index. Most of the contacts were young.

The study shows that alcohol consumption prevents the consumers to visit clinics. Most of them are out of homes and that adversely affects TBCT follow-up. Further,

medication default has been associated with increasing the likelihood of defaulting further, not only for medications but also for TBCT.

The findings showed that the HCWs utilised different phases of treatment in carrying out the health education on TBCT. It is also clear that the PTB patients were willing to be involved in the TBCT health education process.

The HCWs were trained in the seminar level of the TB control that incorporated TBCT. However, staffing pattern faces frequent transfers and hence most of them had worked in the TB clinic for less than a year. There is little understanding of the TBCT policy and that had hampered implementation. The findings showed that the commencement of contact tracing practice is incongruent with the TBCT policy stipulation. Consequently, the findings revealed that the current TBCT missed 41.62% (n=805) of the TB contacts that needed tracing and screening.

5.3 MAJOR FINDINGS ON UTILISATION OF TUBERCULOSIS CONTACT TRACING

The major findings are discussed in the light of utilisation of TBCT. It includes participation of the PTB patients in contact tracing. It also includes uptake of household, workplace and self-report contact tracing. Further, the discussion includes suggestions of the participants for improving contact tracing.

5.3.1 Participation and utilisation of tuberculosis contact tracing and screening uptake by method

5.3.1.1 Participation in tuberculosis contact tracing activities

The PTB patients' participation in the TBCT activities was marginally significant (χ^2=9.992, df=4; $p < 0.042$). Most of the respondents did not play any role on community TBCT. Of the participants who took roles, 46.9% were community TBCT volunteers. One urban participant volunteer said that community based volunteers could be utilised in the TBCT programme. The literature report in Nissen et al (2012:40183) in Dar es Salaam, Tanzania support this claim. The report shows the usefulness of the CHWs who aided in referral of the TB suspects such as "… our village health worker came

here and took the child ... for tests". In another similar situation, community health workers (CHWs) improved the TBCT in the intervention period in Barcelona, Spain (Ospina et al 2012:158). A rural participant suggested that the members of the community themselves needed to start the TBCT programme. The intention and urge to participate in the community TBCT is evident among the community members. However, effective community TBCT programme may derive support from the volunteers; it should not depend largely on it. The findings showed some HCWs who took the initiative to encourage TBCT linkage between the community and the clinic. For instance, a rural female PTB patient participant said "I am always advised on how to help in tracing others by the nurse".

The support received for performing the TBCT activities was significantly associated with intention to participate in TBCT (χ^2=13.282, df=5; $p < 0.021$). The main support was supervisory in nature and the TBCT awareness enhancement was minimal. A similar report is that of Ospina et al (2012:158) who mentioned the support of the CHWs. In the report, the CHWs supported the public health nurses in active TBCT, health education sessions and community mobilisation.

5.3.1.2 Utilisation of household tuberculosis contact tracing and uptake

The majority, 86.2%, of the participants did not participate in the TBCT activity in the previous month (χ^2=2.276, df=3; p=0.520). Among the 8.90% who did a TBCT activity in the previous month, many of them voluntarily carried out the TBCT activities in various roles in their communities. Some were household peer educators who were encouraging others with signs and symptoms of TB to go for screening. Some others were community volunteers who urged families to take their relatives for TB screening. A 61 year old female said that her participation in the TBCT was "my own self initiative; it is the best way to respond to the health of the people". She added that the members of the community needed to urge the contacts to be screened. One other said that "*ke rotloetsa badiri ka nna go itlhathoba* (I encourage my colleague to get tested like me)." However, some of them contended that they never did anything regarding TBCT because of the fear of witchcrafts.

For the participants who are taking the initiative to voluntarily carry out the TBCT activities, the programme could strengthen itself by supporting them in training,

supervision and transport. The Project HOPE (2011) in Malawi reports that 400 volunteers were trained on prevention of TB and the TBCT. Locally, the collaboration of BIPAI (2011) and Botswana MOH have trained over 30 auxiliaries through KITSO. The WHO (2012:39) report adds that such support systems must use appropriate, acceptable and affordable actions of involving communities in supportive training and supervision. The TB trainers have not yet embraced focused TBCT strategy in order to upscale the screening. In support of this finding, Bloss et al (2012:1032) and Pothukuchi et al (2011:[4]) stated that the implementation of household TBCT under routine programmatic conditions was sub-minimal.

The results showed that 46.5% of the participants preferred home visits to other means of TBCT follow-up (χ^2=1.956, df=3; *p*=0.649). Most of them were males. Similarly, the majority of those who preferred mobile phone communication in TBCT were males. That may have explanations such as avoiding the stigmatising experiences cited in some TB clinics. It could also be that they prefer it as one of the quickest and convenient means of enhancing the TBCT. The results showed that the HCWs, according to the participants, mostly utilised household visit for the TBCT follow-up. Nevertheless, this was not significantly associated with TBCT ($\chi 2$ =5.382, df=4; *p*=0.248). Since the PTB patients did prefer household visits and the HCWs utilised it, the planners of community TBCT may find this information useful. The association between preferred and utilised method of household visit was significant (Wald χ^2=8.43; df=1; p=0.004), showing that the enhancement of the utilisation of it would only improve the acceptance and effectiveness in the community.

5.3.1.2.1 Uptake of household tuberculosis contact tracing

Over 56.9% (*n*=240) of the participants had contacts that had not been contact traced. The findings indicated missed opportunities for screening in the current TBCT strategies. The strategies have gaps that cannot be ignored. The gaps are in organisational, individual fears and/or stigma forms. Cook et al (2012:302) point out that TBCT programme coordination challenges are common and need addressing. Some examples include a participant who complained that patients were not followed immediately they were diagnosed with TB. Participants from both rural and urban clinics noted that some of the HCWs did not contact trace all the relatives of the TB patients. In addition, the HCWs gave no explanation for not contact tracing all of them. An urban

participant said that the PTB patients were not being consulted about TBCT. This underscores the willingness of the PTB patients to participate in the TBCT. Hence, the uptake of screening was significantly associated with TBCT (χ^2=38.326, df=16; $p < 0.05$).

5.3.1.2.2 Suggestions to improve household tuberculosis contact tracing

The suggestions that participants gave include getting a specific TB HCW to concentrate on TBCT. The most common suggestion to improve people's participation in the TB contact tracing was the creation of awareness to educate people on the importance of TBCT. One respondent recommended that nurses should visit homes of the PTB patients "… because they can easily identify the contacts at risk and take immediate action". In effect they are requesting for utilisation of active TBCT. The WHO (WHO 2015:17) advocates for active involvement of implementers and the beneficiaries in contact tracing. Several other participants suggested that the HCWs should encourage community TBCT especially among the new PTB patients to educate people on the importance of TBCT. That, they suggested, would include formation of a committee of those who took and completed TB treatment and paying them to educate the community. Another suggested that the nurses could carry out house-to-house awareness campaigns especially at the cattle posts and the lands [rural areas] where people "… are coughing and afraid of going to the clinic because of stigma". Some suggestions from the rural participants include introduction of home-based DOT with the aim "… to reduce stigma and people will be courageous to go for testing". However, another participant suggested that first "reduce stigma and people will come out [accept] to be contact-traced and tested". Some participants urged for the introduction of a compulsory TB testing *mo motseng* (in this town) while others suggested the introduction of community based TBCT and treatment programme. This, they asserted, would increase the number of the TB contacts taking up screening. They further urged HCWs to "improve the way you get [administer] injection then people will accept contact tracing". Furthermore, a suggestion from a rural participant was that the government should form a committee of those who took and completed TB treatment and pay them to educate the community about the importance of TBCT.

A participant suggested for the improvement of communication between the TB patients and contacts on one hand and the HCWs on the other. The use of mobile phones may

enhance TBCT as suggested in the literature (Ndlovu et al (2014:275). The literature and the background cite the problem of relocations and internal migrations that hamper the TB contact tracing. The mobile phone could contract the problem as it is being utilised in some parts of the SSA (Bisong et al 2013:69; Brinkel et al 2013:11559–11582). Most of the participants suggested that nurses should visit households of the TB patients because they [nurses] can easily identify the contacts at risk and take immediate action.

5.3.1.3 Utilisation of the workplace tuberculosis contact tracing and screening uptake

5.3.1.3.1 Uptake of workplace tuberculosis contact tracing

The findings showed that the workplace TBCT was hardly utilised. The majority of the participants reported that there were no plans for workplace TBCT visits. As such, there was no association between the target areas and the TBCT (χ^2=1.351, df=2; p=0.757). Similarly, most of the respondents reported that the immediate TBCT was not frequent for the workplace (χ^2=19.727, df=6; p=0.042). The majority of the participants whose workplace contacts were unscreened were 89.1% (n=114). The fallacy is that every PTB patient has a home and that by targeting the households, all the TB contacts would be reached. However, the literature review showed that active workplace TBCT had high number of TB contacts with more at risk contacts (8.4 per PTB patient) in Vila Nova de Gaia, Portugal (Duarte et al 2012:55–59). It improved uptake from 67.60% to 87.30% of identified workplace TB contacts.

The HCWs conceded that the workplace TBCT was seldom utilised. For instance, a HCW participant said that workplace TBCT was done once and where workplace contacts were given TB related health talks. Some of the workplaces that the HCWs mentioned as areas where TBCT was carried out include primary and secondary schools. Such areas of high congregations provide readily available audience for TBCT health education. A female HCW stated that she did not know if there was workplace contact tracing.

5.3.1.4 Utilisation of the self-reporting tuberculosis contacts and screening uptake

5.3.1.4.1 Uptake of self-report tuberculosis contact tracing

The findings showed that the HCWs relied on self-reporting TBCT most often than not but with little reporting. Most of the participants conceded that they did not know what self-report TBCT was. There was no association between self-reporting and TBCT (χ^2=7.467, df=4; *p*=0.095). A HCW stated that TBCT was only done if there was a new TB patient. It is no wonder that 25.0% of the participating HCWs stated that there were no such records in the clinic. The HCWs hardly look for the TB contacts and instead wait for their arrival in clinic. One example of a TB contact that refused to visit the clinic made his relatives to go to the clinic and report: "*ba losika ba ne ba ya ko kokelwaneng* (their relatives went to the clinic)." A HCW said that they always asked relatives of PTB patients to "come to the facility because always there is no transport to follow them up". Such concession indicates the weakness of the current TBCT strategy. However, the example of a female participant who got discouraged after taking her contacts to the clinic but were not tested suffices, "*… mme baoki ba re ga ba lwala* (but the nurses said they are [were] not sick)..." One HCW participant complained that the clinic had no sufficient HCWs and so they wait as "relatives of TB patients come on their own to the clinic for screening." This is a form of passive TBCT as Pia (2011:26) and Puryear et al (2013:1049–1055) reflect. The findings support the Assumption 4 that perceptions of stigma hinder the TBCT (χ^2=2.286, df=2; *p*=0.626).

5.3.1.4.2 Suggestions to improve self-report tuberculosis contact tracing

A HCW suggested that such a problem of passive TBCT would be solved if they were provided with a vehicle specific to TBCT. This suggestion is supported in literature review about active TBCT by both door-to-door visits using mobile van in South Africa (Mwansa-Kambafwile et al 2013:[5]). The report showed that the community screening reduced prevalence of TB from 0.67% for adults to 0.38%. However, some HCWs in the current study show willingness to change the strategy as one said "I would like to do home visits to request patients to send their relatives to the clinic". It indicates a potential for the HCWs to improve the strategies in the slightest logistic support such as means of transport.

5.3.1.5 Health care workers utilisation of tuberculosis contact tracing

The study findings showed that at best, the HCWs in the study sites mostly depended on passive TBCT strategy. Further, the findings confirmed the current concerns of the government of Botswana (2011:12) as it was in 2008 (Botswana 2008:7) that the HCWs hardly implemented the TBCT services according to the expectations of national guidelines of TBCT. According to BNTP (Botswana 2011a:18), this is attributable to various challenges pertinent to the TB clinic-specific organisation of work plans and which might have resulted in poor implementation of TBCT.

In a prospective TB contact investigation in Vietnam, Fox et al (2012:[1]) found that most of the existing TB control strategies are based on symptomatic patients attending health services for investigation and warned that the *approach had not resulted in substantial reductions in the prevalence of TB* despite the national tuberculosis program having achieved high treatment completion rates. Similarly in the current study sites, the results showed that the TBCT strategies are based on self-report in which the TB contacts are solely responsible for visiting the TB clinic as literature states about Vietnam.

Among the suggestions for the improvement of the TBCT included the need to invigorate the strategies. The strategies included organisational, human resource training in TBCT, creation of community TBCT awareness, improvement of logistics such as transport and communication.

5.3.1.5.1 Health care workers' most desired change to improve tuberculosis contact tracing

Twenty five percent of the HCWs stated that the provision of transport for the TBCT programme (χ^2=6.044, df=4; *p*=0.2950.286–0.304). The report in Mwansa-Kambafwile et al (2014:[3]) corroborates the felt-need for transport support in TBCT. In the report, a contact tracing study in Johannesburg, South Africa, had 98.0% participant acceptance rate and 12.0% case detection rate, a success attributable to supervisory support including logistics such as provision of transport. The TBCT services could improve, the HCWs said, if there was provision of financial support for transport and communication.

A participant said that because of the unreliable contacts' dates due to lifestyle and work, provision of transport and mobile communication could improve TBCT.

The use of mobile phones in the TBCT was shown to have wide acceptance as, 51.4% of the PTB patients had positive perception of accepting to be contacted though it. Furthermore, 88.9% of the HCWs conceded to have used it in TBC and 66.7% would recommend its use. This concurs with the literature review report. In a study conducted in 2010 in South Africa, Bristow et al (2013:1-8) found that logistics support, including use of mobile phone calls to the TB patients' families, played a vital component in the TBCT programme. In emphasis Ndlovu et al (2014:275) assert that the TBCT programme can harness mobile phone telecommunication to improve tracing. Already, the mobile telemedicine, "kgonafalo" in Botswana exists and the TBCT programme should integrate its use. While 68.8% of the HCWs urge for improved communication using mobile phones, a participant suggested for provision of a budget for use in TBCT communication saying "… provide airtime to call patients".

Some of the suggestions the HCWs made for the improvement of TBCT include increasing the number of TB-trained nurses and introduction of the FWEs to follow TB patients in the community. Some 75.0% of the participants stated that the HCWs should actively trace and screen household and workplace TB contacts as the best strategy that the HCWS could identify TB contacts in the community (χ^2=8.889, df=4; *p*=0.031). Zellweger (2010:1–25) confirms that the HCWs, mainly nurses, co-ordinate the supervision of the FWEs who carry out follow-up in community from the base of the clinics in Botswana.

5.3.1.6 Conclusion of tuberculosis contact tracing follow-up methods, preferred and utilised

The findings showed that the most active HCWs in the TBCT were nurses and the FWEs in that order. The preferred TBCT methods include the household visits, workplace visits, use of mobile phones, and others.

Although the HCWs significantly preferred and recorded household address in the TB register (χ^2=8.43; df=1; p < 0.004; 95% CI: 2.437 – 98.597), only 43.4% of the HCWs utilise it. That is in spite of the 86.9% of the PTB patients who prefer household visits.

However, the HCWs generally concur that most, 87.5%, of the clinics neither have household nor workplace TBCT plans. Most of the participants stated that the clinics had no TBCT follow-up plans and that had an implication on the TBCT implementation (χ^2=7.771, df=3; *p*=0.179). The findings support Assumption 3. Besides, there is significant association, by preference, of the utilisation of the household visit among the HCWs and the TBCT (χ^2=8.43; df=1; 95% CI: 2.437 – 98.597; $p < 0.05$). Preference without pragmatic effort may not meet the needs of the PTB patients and may result in underutilisation of the household TBCT.

The workplace TBCT is similarly underutilised as portrayed by there being no workplace address in the lists of the TBCT records. It is only during health campaigns do the HCWs utilise it. The strategy does not enhance the use of workplace TBCT and may result in missed TB identification opportunities as one respondent states that. One HCW participant said that it is "… done once in a while and contact are given an education concerning TB, … and advised to seek prompt health care if they develop s/symptoms". As Pia (2011:330–332) reports, this is passive TBCT with an expectation that the TB suspects would visit the TB clinic on their own when they developed signs and symptoms (Botswana 2011a:13; Zellweger 2010:1–25; Zeng et al 2010:5), that is to say after they are infected. That would trigger a reaction of the HCWs instead of a proactive prevention. The literature review reports a study in Ekwueme et al (2014:1175) in Enugu, Nigeria, that the cue to participate in the TBCT may be achievable through a planned TBCT health education programme.

More males (46.5%) than females preferred the use of mobile phone communication during the TBCT follow-up. However, the HCWs hardly utilise that. The cross tabulation on preferred and utilised method of communication in TBCT shows that it has significant association with the TBCT (χ^2=24.537, df=12, $p < 0.05$). That there is low usage of those methods seem to decrease the utilisation of the TBCT. The results support research Assumption 2 since, despite positive mobile phone perception in the TBCT, there is hardly any use of it.

Whereas the PTB patients prefer the use of the mobile phone in the TBCT, most of them do not provide it in the clinic for listing as one of the TBCT follow-up communication strategies despite a wide coverage of mobile phone network. Few HCWs list the mobile phone as a TBCT communication strategy, probably due to the

fact that most of them do not ask for it during medical history taking and the patient interviews. Consequently, the results also showed that the mobile phone was less utilised, probably due to the possibility that it is still in the process of being accepted as an added effective means of official communication. A higher percentage, 40.10%, of the HCWs utilise the mobile phone than that of the PTB patients, 7.70%. This could be possible due to the availability of official mobile phone facility in some clinics. Notwithstanding this, it is encouraging that the perception of mobile phone use is positive among the HCWs, a characteristic that may enhance the TBCT programme.

The HCWS use other methods, 10.0%, in tracing the PTB patients. They include vicinity to landmark features such as churches and schools. Such landmark features may be unreliable given the high mobility of the TB patients, especially those in the most productive age group of 26 – 44 year old.

5.3.2 Summary of utilisation of tuberculosis contact tracing

In summary, the participation of the TB patients and the HCWs in the TBCT programme is stipulated. The utilisation of TBCT largely relies on the self-reporting TB contacts. Household TBCT is preferred by the PTB patients and the HCWs, although there is little effort in its utilisation. The workplace TBCT is hardly utilised. As such most of the PTB patients had contacts that had not been traced. Participants suggested improvement of community TBCT awareness and linkage to the TB clinics. The HCWs suggested for the introduction of transport system and mobile phones to improve TBCT.

5.4 CHALLENGES OF TUBERCULOSIS CONTACTS

5.4.1 Tuberculosis contact-case index ratio

Most of the PTB patients had six to ten contacts (χ^2=13.459, df=5; p=0.665). Majority of the TB contacts were males. The household case index-contact ratio is 1:6. Even though most of the participants did not have workplace TB contacts the few, 13.1% (n=56) who had had between 6 and 15 contacts, mostly males.

The findings in the checklist show that 88.1% of the household TB contacts were screened for TB. Half of that were positive for TB. The findings further showed that

11.9% were missed. Only 18.7% of the workplace TB contacts were tested for TB and 20.3% were positive.

Comparatively, the participant interviews showed that 91.5% of the household TB contacts were tested for TB, out of which 47.1% turned positive. In this category 12.0% were missed. As per the interviews, 30.3% of the workplace TB contacts were tested for TB and the yield was 12.5% positive. That showed that 70.0% were missed.

The household TB contact-case index ratio was 3.5:1 and that of the workplace was 0.19:1 as per checklist in Phase I. That compares unfavourably with the findings during the interviews in Phase II. The household TB contact-case index ratio was 5.4:1 and 1.05:1 for the workplace. Clearly there exists a gap for missed opportunities of TB case finding and testing. The findings are suggestive of the current TBCT strategies that are less effective. In summary, the current study shows a significant TB contact-case index ratio that must be addressed.

5.4.2 Youthful and single cohabiting

The findings portray a more youthful population sub-group that has challenges of single-cohabiting patterns and high mobility. The mean age for the PTB patients is 40.9 years and the median age is 37. Age has an effect on deciding how to advance the TBCT programme. The majority of the respondents are youthful and in the highly mobile population group. This poses a challenge in the implementation of the TBCT if self-report contact tracing is overly relied upon. The population group introduces high migration pattern that the current TBCT strategy may not reach fully.

In addition to having the challenges of a young population, there are more single PTB patients than any other category of marital status. Most of the TB patients are single-cohabiting and that is suggestive of multiple concurrent cohabitations. This may introduce the challenge of reaching out to partners who are not legally in the relationship. The risk is that a strategy that relies only on relationship documents as a basis of enrolling TB contacts for tracing may miss out most of the TB contacts.

The occupation of the PTB patients has an association with TBCT. The unskilled occupations notably make the PTB patients to engage in employments that are

temporary, thus encouraging high job mobility and hampering the TBCT efforts. Employment determines the availability of the PTB patients for the TBCT. Employees give priority to work since it provides a source of income for the PTB patient. Educational level is associated with increased knowledge of TB and the intention to participate in TBCT. Participants with no education are less likely to know the cause of TB and to understand TBCT as compared to those with education above primary level.

Perceptions about the fear of transmitting TB to close contacts exist among the participants. Although it is a weak association, the perception that one may risk contracting or transmitting to contacts is associated with the PTB patients' intention to participate in TBCT and to prevent their close contacts from contracting the disease (χ^2=5.367, df=1; p=0.026). However, unfavourable reasons and perceptions for not transmitting the TB to contacts exist among some PTB patients. The majority of the PTB patients understand TBCT differently from what it exists to do amidst minimal community TBCT awareness creation.

5.4.3 Challenges in utilisation of tuberculosis contact tracing

5.4.3.1 Under-tracing of tuberculosis contacts

With the understanding that the basic knowledge of TBCT determines the utilisation of the TBCT and case identification rates, one would expect complete contact tracing rates. However, the current TBCT strategies are not effective enough to trace the missing 41.62% (n=805) TB contacts in the TB registers. As such, they cannot upscale the household and workplace TBCT. The current study determines that in order to get one new TB case, the number needed to contact trace is, on average, 2.16.

5.4.3.2 Perceptions and knowledge deficits about tuberculosis contact tracing

The participants in the study exhibited complacency and perceptions that may discourage their participation in TBCT. They include poor understanding of the purpose of TBCT. The knowledge and understanding of TBCT varies from TB patients and their contacts to HCWs as influenced by their perceptions, knowledge and experience of the effects of TB illness and the challenges of follow-up care. Despite their experience with

TB infection offering a more meaningful understanding of the importance and purpose of contact tracing, this has not been harnessed adequately.

5.4.3.3 Stigma and isolation

Various forms of stigma and isolation of the PTB patients are among the major findings. The household members including relatives and friends were the source of stigma and isolation. In the TB clinics, the HCWs were the source of stigma.

The study has shown the TB contacts expressed fear of TB amidst little counselling. That was the main prompt for the isolation practices in the households. It has also shown that household isolation of PTB patients arises mainly from the fear of contracting TB and dying. It does not arise due to knowledge of TB facts and positive preventive actions. Besides, that fear of TB turned into a positive cue for some of the respondents to participate in the TBCT However, there are some PTB patients who waste valuable time in seeking TB care initially from the witch doctors. This is due to the poor perceptions of the cause of TB and not understanding the purpose of TBCT.

5.4.3.4 Syndemic co-infection of tuberculosis and human immunodeficiency virus

The interpretation of results indicates that there is a significant TBHIV co-infection in Botswana that need to be considered in the design of more effective TBCT strategies and TB follow-up. The syndemic threatens the lives of the PTB patients and TBCT follow-up. An individual with the TBHIV infection gets overwhelmed to seek health care for the two infections. With no support, they may give up and die prematurely.

5.4.3.5 Communication and means of transport

The use of cellular phones (Botswana 2009:10; Botswana 2011a:13) is minimal despite its wide availability in households and workplace. Communication between the PTB patients and TB contacts in the community on one hand and the HCWs in the clinic on the other hand is wanting. Except for the Emergency Medical Services, the HCWs expressed concern for not having a hotline system that is specific for the contact tracing needs, which in most cases are not of emergency situations. Despite the presence of

Emergency Medical Services, transport is still a challenge for the PTB patients and their TB contacts when they want to visit a TB clinic. Further, it is a challenge for the HCWs who would like to carry out home visits and follow-up in TBCT.

5.4.3.6 Participation in community tuberculosis contact tracing

Few PTB patients took roles in the utilisation of TBCT within the community. Of the few that did so, the majority were community TBCT volunteers working on their own volition. The community TBCT seems to rely largely on them. The existence of a TBCT structure that links the community and the clinic is unclear to the PTB patients. This lack of clarity interprets as lack of knowledge and awareness of the TBCT programme. It may be deduced that the existing TBCT strategies are less effective in creating knowledge of their existence and desired impact. Lack of knowledge of TBCT is significantly associated with barriers of its utilisation. Among the barriers is insufficient TBCT awareness. Moreover, there is significant association of lack of planned schedules of visiting the PTB patients and the utilisation of TBCT.

5.4.3.7 Under-utilisation of tuberculosis contact tracing policy and administrative issues

The discussion shows that the TBCT policy is largely unavailable in the clinics, and where available, the HCWs hardly utilise it. Most of the HCWs choose the TBCT instruments to use, hence the policy is underutilised. The HCWs have varied strategies of implementing TBCT. The operational space constraints have potential for mixing patients at reception and in interviews. The practice discourages utilisation/implementation of the TBCT programme. Significant delays in initiating contact tracing hamper implementation of TBCT. The Assumption 3 is supported that the HCWs' initiation of the TBCT is associated with barriers of utilisation of TBCT. (χ^2=4.487, df=2; p=0.154) even though marginally.

In addition, the findings showed that facility-specific administrative challenges hinder the implementation of contact tracing in the study sites. The Assumption 1 that organisational and administrative factors hinder TBCT is supported (χ^2=0.830, df=2; p=1.000). Most of the challenges in the TB clinic are related to and can be solved by the HCWs. The type of TBCT practice is faced with facility-specific administrative

challenges and standardisation needs. The need for improved TBCT knowledge of the HCWs and the right time to initiate TBCT is expressed by the participants in the study sites. Some of the HCWs have under-utilised TBCT skills and are ready to enact change in them in implementing TBCT. Similarly, some of the PTB patients and their contacts expressed concern for dismal involvement.

5.5 NEEDS OF TUBERCULOSIS CONTACTS

5.5.1 Number of tuberculosis patients needed to contact trace

The research results showed that the number needed to contact trace for Phase I is 2.17 (412/189) and 2.15 for Phase II. The difference between the two is negligible. The current study determines that in order to get one new TB case, the number needed to contact trace is, on average, 2.16. The number needed to contact trace is much less than 13.6 that Puryear et al (2013:1049) report during a home visit follow-up of 548 TB contacts of 163 TB patients in Gaborone, Botswana in 2009. Comparatively, the prevalence of the PTB patients is higher than at the time of Puryear et al (2013:1049) study. The TBCT strategies must take cognisance of the current prevalence of TB in its programme. Further, Begun et al (2013:21) found that the increase in the number of TB contacts screened accrue when individuals adopt utilisation of the TBCT. The time is now more than ever to scale up the tracing of TB contacts and the current TBCT strategy does not achieve that.

5.5.2 Contact tracing needs of the youthful population sub-group

There is need to understand the needs of TB contacts from the point of view of their case index patients. It is a fact that the majority of the PTB patients and their contacts were youthful and highly mobile. The understanding will enable the TBCT programme implementers to device a means of reaching them physically and psychologically in order to understand their needs. Given the mostly single-cohabiting relationships, it is imperative for the TBCT programme to use the old adage, “it takes two to tango” to understand the need for inclusion of all contacts in the TBCT.

5.5.3 Counselling needs in tuberculosis contact tracing

The fear of TB may be utilised positively. It should be a fear arising from clear understanding of the seriousness of TB facts and not myths. Similarly, the isolative actions of the household members need to be supported by the understanding the necessary preventive strategies and not stigma. This may only be possible through community TBCT counselling.

The voluntary counselling and testing (VCT) programme in Botswana provide counselling needs for the PTB patients. The counselling mainly focuses on the syndemic co-infection with HIV. The testing that follows is mainly to determine the co-infection with HIV. When the test is negative, it is presumed that the client is healthy unless he or she complaints of TB. The TB status determination normally comes when the contact presents with symptoms of TB. Some of the PTB patients said that they were advised by nurses about coughing etiquette, opening windows and sleeping alone. This comes when they are already diagnosed to have TB. There must be a proactive TB counselling for the contacts of PTB index cases in households and workplace. That way, the TB contacts will understand better the TB and the need for TBCT. Moreover, with better knowledge about the disease, better preventive strategies may be exercised and stigma will be reduced. The counselling must be a continuous part of the TBCT implementation.

5.5.4 Health education and awareness needs of tuberculosis contact tracing

The participants expressed the need to understand TBCT in the community. Only through community TBCT awareness creation could the understanding be clarified. There is need to utilise those who have a successful experience during health education about TBCT awareness. Involvement of the PTB patients, using their experience with infection, in creation of awareness could, therefore, produce the necessary change in their perceptions and utilisation of TBCT.

5.5.5 Community linkages for tuberculosis contact tracing

Volunteer community support groups and village health committees exist. They work with the TB clinics for general health matters of the community members in study sites.

The collaborative efforts of the TBCT implementers and beneficiaries may improve TBCT and screening. However, the collaborative effort in TBCT between the two groups lacks strong network as expressed by the PTB patients and the HCWs. The findings also showed that the TBHIV syndemic threatens to divide the TBCT follow-up into the need for TB follow-up and that of the HIV/AIDS It is necessary to enhance reintegration of the linkages in the TBCT programme as it is practical. Integration of TBHIV need to be strengthened at all levels of implementation of TBCT.

The PTB patients prefer household visitation for TBCT purpose. At the same time, the HCWs utilised it most of the time. Since this is an expressed need by the participants, the information is valuable in developing a more effective community TBCT. Most of the participants have useful suggestions for the improvement of TBCT. The suggestions of the strategies and actions in TBCT were significantly associated with intentions to implement TBCT (χ^2=8.889, df=4; p=0.031).

5.5.6 Expressed means to improve tuberculosis contact tracing

5.5.6.1 Standardisation of tuberculosis contact tracing

By deduction of the results, the participants, both the PTB patients and the HCWs expressed dissatisfaction with the current implementation strategies for TBCT. In addition, they offered suggestions and means of improving the contact tracing strategies. They include active household and workplace visits, mobile phone communication, transport means. The HCWs suggested having a standardised TBCT, clear policy guidelines, training and continuous education on TBCT.

5.5.6.2 Logistics for tuberculosis contact tracing

The mobile phone communication is perceived as one feasible way of harnessing resources (Botswana 2011a:13) in TB control strategies. Convenience of communication between a TB case index and a HCW in the TB clinic is a felt need often seen especially in the course of TBCT. There is a felt need among the PTB patients to be involved in all phases of implementation of the TBCT. The mobile phone user perceptions in the TBCT programme is a felt need as the “kgonafalo” strategy shows. It

is evidence proven that the HCWs should work mutually with the patients in scheduling visit times. Mobile phone communication may prove useful in this endeavour.

Transport needs were expressed by both the PTB patients and the HCWs. Whereas the PTB patients and contacts need transport to and from the clinic; the HCWs require it for use in improving household follow-up. The need to ensure that the TB contacts do not waste the important initial period after infection is crucial, thus justifying the need for effective transport and communication systems. Active case finding is imperative and can be achieved through a TBCT network that actively links with the TB clinic.

5.6 CONCLUSION

This chapter has summarised the findings already discussed in Chapter 4. These included sample characteristics for the PTB patients, the TB contacts and the HCWs. They also included utilisation of tuberculosis contact tracing, mainly the types and their screening uptake. Further, the challenges of tuberculosis contact tracing were discussed. They included the TB contact-case index ratio, challenges of a youthful, mainly single cohabiting population and the utilisation of TBCT. The discussion included the needs of tuberculosis contacts such as number needed to trace, needs of the youthful population, counselling needs and community linkages in TBCT. Finally, expressed suggestions for long term and immediate means of improving TBCT were discussed. They included standardisation needs of TBCT and logistics for contact tracing.

The researcher has inferred from the data the meaning and significance of the findings in the TBCT. The discussion has compared the current findings with those of other studies.

CHAPTER 6

PROPOSED STRATEGY FOR TUBERCULOSIS CONTACT TRACING

6.1 INTRODUCTION TO EVIDENCE BASED GUIDELINES

In this final chapter, an alternative strategy that is based on the major findings of the study is proposed. Table 6.1 below summarises key findings grouped into challenges, spin offs from the challenges presented as effects on TBCT and the needs that arose out of these factors.

Table 6.1: Challenges, effects and needs in tuberculosis contact tracing

Challenges	Effects on TBCT	Needs for TBCT
Under-tracing of TB contacts	The current TBCT leaves out 41.62% of contacts untested. The household case index-contact ratio is 1:6. The left out TB suspects may harbour MTB and continue to infect other people including those that had been treated.	An integrated comprehensive strategy that ensures 100.0% tracing and testing of all TB contacts.
Youthful and single cohabiting	The mean and median ages of the PTB patients are 40.9 and 37.0 years respectively. This young population sub-group is mainly in single-cohabiting relationships and highly mobile. The self-report type of TBCT strategy that is currently utilised is not effective enough to bring cohabiting partners for testing due to stigma and other challenges.	A youthful and highly mobile population sub-group requires a more effective TBCT strategy. The strategy must be devised to address their social needs. The strategy must be flexible in reaching out to this group even though their behaviour change is necessary
Perceptions and knowledge deficits about TBCT	The PTB patients exhibited complacency and perceptions that discourage their participation in TBCT. The poor knowledge of TB and the purpose of TBCT cause them to delay TB health-seeking while consulting traditional health practitioners. Their experience with TB infection offers a more meaningful understanding of the importance and purpose of TBCT. However, that has not resulted in increased uptake.	The need for improved knowledge of TB and TBCT is imperative. The expectation is that the PTB patients and contacts will utilise that knowledge and their experience to readily participate in an integrated comprehensive TBCT.

Challenges	Effects on TBCT	Needs for TBCT
Stigma and isolation	Use of disdainful remarks and practices of isolation or keeping aloof by relatives and friends are the source of stigma for the PTB patients and TB suspects in households. In the TB clinics, the HCWs are the source of stigma. That creates fear of the TB contacts to access TBCT services. Stigmatised, the individuals also keep off and end up seeking care from the traditional healers. The TBCT services, thus, are underutilised.	De-stigmatisation of TB may enable the PTB patients and their contacts to appreciate utilisation of TBCT. This may be done by imparting knowledge through integrated community TBCT awareness creation.
Syndemic co-infection of TBHIV	The TBHIV syndemic depletes the energy of the PTB patients to participate in TBCT follow-up and receive health care for the co-morbidities. Without support, they may give up and die prematurely.	There is need for an integrated comprehensive TBCT strategy that not only identifies early a TB suspect, but also one that reaches out to such an individual and provides appropriate support.
Communication and means of transport	The means of establishing initial and subsequent communication between the TB contacts and the HCWs is a concern. Transport is a challenge for the PTB patients and their TB contacts when they want to visit a TB clinic. It is also a challenge for the HCWs who would like to carry out TBCT home visits for follow-up and prompt referral of the patients.	Communication between the PTB patients and TB contacts on one hand and the HCWs on the other is vital in the TBCT follow-up. It enables the early identification, prompt contact with a HCW and appropriate TB care. The presence of Emergency Medical Services call line (997) is available and may be enhanced to cater for the needs of integrated comprehensive TBCT. An IC-TBCT specific mobile phone hotline system within the system may offer the necessary alternative.
Participation in community TBCT	Many PTB patients were not aware of any community TBCT services or structures. Lack of knowledge of TBCT is significantly associated with barriers of its utilisation. This may explain the inability of the current TBCT strategy to reach all contacts.	The community members rely mainly on FWEs and community TBCT volunteers, most of them working on their own volition. Community system needs to be strengthened and supported by providing formal links with the TB clinic and the DHMT.
Under-utilisation of TBCT policy and facility-specific administrative issues	The TBCT policy is largely unavailable in the clinics. As such the HCWs choose the TBCT instruments to use. Some HCWs designed their own TBCT instruments. Consequently, the HCWs have varied strategies of implementing TBCT. Hence, the TBCT policy is underutilised. Facility-specific administrative challenges abound.	There is need for standardisation of TBCT. The HCWs expressed the need for standardisation and support in doing so. There is need for integrated comprehensive TBCT training in the existing KITSO and all TB training.

In the light of the findings as presented in Table 6.1 above, a strategy that would make a more effective impact in contact tracing is required. In line with the call in WHO (2015:18), such a strategy calls for integration of new strategic innovations (WHO 2015:18) that are more effective in ensuring early tracing of all the TB contacts. The aim is to ensure prompt contact between the TB contacts and the health care system through the HCW for immediate and appropriate care.

6.2 A STRATEGY FOR TUBERCULOSIS CONTACT TRACING

In this section, a more effective strategy for TBCT is proposed. A strategy (Merriam-Webster's Dictionary 2003) is a careful plan or method for achieving a particular goal usually over a long period of time. It is the skill of making or carrying out plans to achieve a goal. For this study, it means a method or plan chosen to bring about a desired future of TBCT, such as achievement of tracing all TB contacts as a goal or solution to the TB incidence and mortality problem.

The section discusses vision, mission, goal and implementation of the strategy. It also discusses operational activities, integrated comprehensive services and the structure. It is envisaged that the proposed strategy is more effective than the current TBCT which mainly uses passive means including self-report.

This section is linked to Objective 6, that is to construct an alternative context based and needs based strategy that links TB clinic organisational factors, TBCT knowledge and actions of the HCWs and participation of the TB patients in the development of the comprehensive TBCT strategy. The alternative strategy is the Integrated Comprehensive Tuberculosis Contact Tracing (IC-TBCT). The challenges of IC-TBCT integration and their meaning must first be addressed.

- The strategy suggests that TBCT should be integrated into all tiers of the TB control programme. The integration of comprehensive TBCT must be such that it promotes smooth implementation of TBCT services for ease of access to the user and the health care provider.
- The DHMT should ensure that the integration of comprehensive TBCT does not require significant additional personnel. Neither does it put additional demands on the existing staffing pattern. The IC-TBCT service delivery is simply a switch from

the current practice to one that ensures accountability for every specific PTB patient from the time of diagnosis to the time all the TB contacts have been contact traced. It is also part of responding to the call for innovation in Dharmadhikari et al (2012:1104–1109) and closing the chasm that Green (2014:25–29).

- The integration and delivery of comprehensive TBCT into the existing TB control programme is a milestone. It requires political will, technical expertise and administrative skills in order to successfully manage the change. The success of TBCT service delivery may require action at all levels, including sustained commitment from the DHMT. The commitment of the HCWs will be a paramount requisite that might require some sort of incentive to achieve. Staff development in terms of initial training and immediate support may suffice to motivate the HCWs. It must be borne in mind that every change meets with some resistance, no matter how good. Also, change in TBCT behaviour will take time. The time may be shortened by consistency of support and insistence of production of quality service.

The integration seeks to respond to the call in WHO (2015:18) under the pillars and components of the End-TB strategy for 2016–2035. The IC-TBCT is an alternative strategy that links TB clinic administrative and organisational factors, TBCT knowledge and actions of the HCWs and participation of the TB patients. The strategic innovation in IC-TBCT is the introduction of pragmatic evidence of participation and accountability for action by HCW, FEW and the PTB patient responsible for TBCT. It embraces the use of information technology. It also enhances the communication among those who participate in the TBCT and encourages collaborative partnership. Further, it incorporates active implementation of both active and passive TBCT strategies.

6.3 RATIONALE FOR INTEGRATION OF COMPREHENSIVE TUBERCULOSIS CONTACT TRACING INTO OTHER TUBERCULOSIS PROGRAMMES

Integration refers interdisciplinary, inter-professional, non-hierarchical blending of approaches' that provide continuum of client/patient centred care. It is a collaborative approach, based on mutual understanding and a shared vision. The WHO (2008:1–10) contend that there are several permutations of integrated health services. It defines integration as the organisation and management of health services so that people can

get the care they need when they need it in ways that are user-friendly, achieve the desired results and provide value for money. The WHO (2008:3) also defines integration as to mean a package of preventative and curative health interventions for a particular population group. Suter, Oelke, Adair and Armitage (2009:16–23) describe integration as having key principles. They include:

- Patient-centred care reflected by population-based needs assessments that drive service planning and information management and the desire to redesign internal processes to improve patient satisfaction and outcomes.
- Comprehensive services across continuum of care. These include services from primary through tertiary care with cooperation between health and social organisation.
- Geographic coverage. It means that the system can take responsibility for an identified population in a geographic area, with patients having to exit if they wish to seek services from elsewhere.
- Standardised care delivery through inter-professional teams. Roles and responsibilities of the team members are clearly identified to ensure smooth transition of patients from one tier to another.
- Performance management. There is need for a well-developed performance monitoring systems that include indicators to measure outcomes at different levels. It involves a structured approach to analyse performance and how they might be addressed.
- Electronic system. The information system should also enable system wide patient registration and scheduling coordination as well as management of clinical data.

These elements strengthen the impact of delivery of any health service such as contact tracing. Contact tracing of PTB patients exists as a health service activity within TB control in Botswana. However, the strength and seriousness of an integrated health service is a felt need in the TBCT. No single HCWs is accountable for a given number of PTB patients for follow-up. The geographic coverage for TBCT is undesignated. The practice of TBCT is varied and standardised protocols are not utilised. There is need for structures that link with the community TBCT. Moreover, the continuing incidence and mortality of TB amidst service demand and staff shortages have intensified the call for more effective integrated health service delivery (Suter et al 2009:16–23). According to

Suter et al (2009:16–23), integrated health systems are widely considered to provide superior performance in terms of quality and safety as a result of effective communication and standardised protocols. The WHO (WHO 2015:18) made a global call to governments to show commitment to intensify linkages at policy and programme levels in order to witness progress and cost-cutting measures. Botswana government had earlier heeded to the call and reviewed its service provision. One success is the TB and the HIV/AIDS programmes. In so doing, it optimised current resources to provide more integrated, comprehensive and coordinated health services. It is expected that the new IC-TBCT will only fit in the already existing structure at the TB programme and aims to address the challenges listed in Table 6.1 above.

6.4 ALTERNATIVE STRATEGY FOR INTEGRATED COMPREHENSIVE TUBERCULOSIS CONTACT TRACING

This section presents the vision, mission, goal and strategic objectives of the Integrated TBCT strategy. The section will further present implementation, monitoring and evaluation mechanisms of the suggested strategy.

The strategy should be supported by a functional communication system in order to reduce delays and or bottlenecks in establishing effective contact with the PTB patients and their contacts. Further, the strategy should be supported by the functional logistics and transport system to include reference laboratory, utility space and stationery and evidence based tuberculosis contact tracing transport system.

6.4.1 Vision

The vision of integrated comprehensive tuberculosis contact tracing (IC-TBCT) is a Botswana that is free of TB disease and TB related deaths.

6.4.2 Mission statement

In accordance with the United Nation’s Sustainable Development Goal (SDG) 3, the mission for IC-TBCT is to develop TB Programmes in such a way as to ensure health and well-being for all in Botswana including ending the epidemic of TB.

6.4.3 Goal

The goal of the IC-TBCT strategy is to contribute to eradicating the TB epidemic in Botswana by 2035. This is in line with the TB eradication target of Botswana Ministry of Health, the End-TB Strategy of the WHO (WHO 2015:17) and the 2030 Agenda for Sustainable Development. Cherkaoui et al (2014:[3]) reiterate that the goal of any epidemiologic study "…should be to propose concrete strategies for intervention…"

6.4.4 Strategic objectives

The proposed strategy will have three (3) strategic objectives; namely:

- To integrate comprehensive contact tracing into the National TB Programme (NTP)
- To strengthen the Botswana NTP Health Communication System
- To strengthen Botswana NTP Logistics and Transport System

6.4.5 Implementation of integrated comprehensive tuberculosis contact tracing in Botswana

6.4.5.1 Administration of integrated comprehensive *tuberculosis contact tracing*

The administrative organ of the IC-TBCT will basically be the MOH through the BNTP at the national level. The implementing DHMTs will be the administrative organ at the district level. The TB clinics will be an intermediary implementing units that will work directly with the community TBCT. Figure 6.1 shows the structure of integration.

Administration will be effected by the health personnel including public health professionals, that is, medical personnel and nurses with preparation in TBCT training. The administrative personnel will include leaders and community members. The positions should preferably include persons who have successfully completed ATB treatment and selected the PTB patients on community DOT.

6.4.5.2 Composition of integrated comprehensive tuberculosis contact tracing

The integrated TBCT (IC-TBCT) is a new innovation in the TB control programme. The IC-TBCT will be set up and housed within the existing TB programme. It will not be a replacement but an incorporation of the strategy in the existing TB section. The IC-TBCT will be resourced with personnel with skills mix: health professionals, administrative leaders and support personnel.

The IC-TBCT section will have a public health nurse (PHN) as the head. The professional preparation of the PHN should include sufficient training in TB HIV/AIDS and at least a certificate course in the TBCT. The section should actively collaborate with the HIV/AIDS section in the organisation and management of the programme, in monitoring and evaluation and in reporting of the IC-TBCT activities in the district. The support personnel will include logisticians, drivers, office assistant and an information technology (IT) officer.

6.4.6 Operational activities

6.4.6.1 Conducting training in integrated comprehensive tuberculosis contact tracing

The HCWs that are actively involved in the TBCT will be trained IC-TBCT. They include the physicians, public health nurses, FWEs, community volunteers and the PTB patients. The focus will be on training on tuberculosis, transmission of MTB, prevention methods and IC-TBCT strategy. The methods will include short courses, seminars, workshops, and community TBCT awareness.

6.4.6.2 Conducting effective individualised contact tracing

There will be regular follow-up in homesteads and workplaces of all TB contacts wherever they may be found. The TB clinic will have a planned schedule of daily individualized TBCT activities. The strategies will be active and passive IC-TBCT. The active IC-TBCT will proactively involve the public health nurse in regular household and workplace visits of the PTB patients. Through informed consent, their contacts will be requested to consent to a spot-screening using a prompt diagnostic method, for

instance the x-pert method or immediate referral to a clinic with optimized laboratory (Ramos, Schumacher, Siedner, Herrera, Quino, Alvarado, Montoya, Grandjean, Martin, Sherman, Gilman & Evans 2010:896–901). The nurse will institute immediate referral (to the relevant health facility) of those who test positive for TB for prompt care and treatment. The passive IC-TBCT will involve the prompt enrolment of the self-reporting TB contacts in the TB clinic. An automatic task allocation system (developed in the clinic) will be used to select the primary nurse for the TB contact. The primary nurse will take over the care of the new patient and ensure that he or she [patient] gets the necessary health needs. Besides, the primary nurse will be responsible for documentation of activities, the evaluation and report of the tasks related to that patient from enrolment into care to the end-outcome of complete treatment and recovery, treatment failure, default or death. The primary nurse will use electronic documentation and storage of records as a basis to identify gaps and discuss health care delivery to individual PTB patients for improvement of quality care.

6.4.6.3 Building active community participation in integrated comprehensive tuberculosis contact tracing

The IC-TBCT programme will have structures that link the TB clinic with the community it serves. The structures that will be harnessed for this purpose include the TBCT committee (with members from the HCWs, PTB patients, administrative and community leaders and members of the community). The organogram will reflect these structures.

6.4.6.4 Enhancing operational link between tuberculosis and human immunodeficiency virus programmes

The IC-TBCT strategy will use the necessary links and collaboration with HIV/AIDS programmes in follow-up of TBHIV patients. This is in the understanding that the dual infections are syndemic and the patient care should likewise have a similar approach. The primary nurse will be responsible for the TBHIV related needs of the patient at all times.

6.4.7 Integrated communication system

The MOH could set up an IC-TBCT hotline communication system and enter into a corporate agreement with a local mobile communication network provider for reduced rates on TBCT services. A special coding system could provide security of information and usage of the network service. The same code could also determine the validity of use that ensures that the charged rate is justified. That would curb the unwanted abuse of the hotline and limit costs to the budget. The evaluation of its use must be part of the quarterly report.

6.4.8 Logistics and transport system

The logistics and transport component will ensure availability of three sub-components, namely, the reference laboratory, utility space and stationery and the IC-TBCT transport system.

6.4.8.1 Reference laboratory

The programme will identify a reference laboratory that will ensure standardised procedures in the TB screening. It will have the relevant and qualified personnel to carry out various tests and quality assurance. The laboratory will be conveniently accessible. The IC-TBCT will have laboratory technician designated for the IC-TBCT in order to maintain standards and ensure ethical compliance.

6.4.8.2 Tuberculosis clinic

There will be appropriate utility space for reception and interviewing/examination of the TB contacts in accordance with ethical needs of privacy and confidentiality. Office space will be necessary for use to plan and carry out the IC-TBCT activities. The space will enable for the installation and use of a computer, its IT components and stationery. There will be need for a small space for carrying out focused health education on TB and TBCT. The primary nurse will also prepare that space (with presentation equipment) for training and learning needs. Further it will be available for IC-TBCT meetings and small discussions or conferences.

6.4.8.3 Integrated comprehensive tuberculosis contact tracing transport system

A designated IC-TBCT vehicle will be availed for use by the primary nurse and associates mainly during the active household and workplace contact tracing and other IC-TBCT associated needs. The vehicle will utilise a sign-out sign-in log-system to prevent abuse. Two drivers with first aid skills will operate the IC-TBCT designated vehicle for 24 hours in each area covered by the TB clinic.

Similarly, the IC-TBCT transport system will organise for a shared transport system in which the TB patients and their contacts pay an agreed percentage of fare, for instance 50.0%, and the programme pays the remaining percentage.

Alternatively, the programme may use a non-monetary system that will enable all eligible TB contacts to visit the TB clinic. In order to prevent abuse, the programme will design a card that must be presented to the PTB patient and TB contact for use as fare. The driver (for combi or taxi) receives the card and presents it to the primary nurse who determines the validity (in writing) and the PTB patient and TB contacts signs up the receipt of the service. In turn, the primary nurse presents the IC-TBCT card at the logistics section for entry and process of payment.

6.4.9 Structure of integrated comprehensive tuberculosis contact tracing

6.4.9.1 Functional structure of integrated comprehensive tuberculosis contact tracing

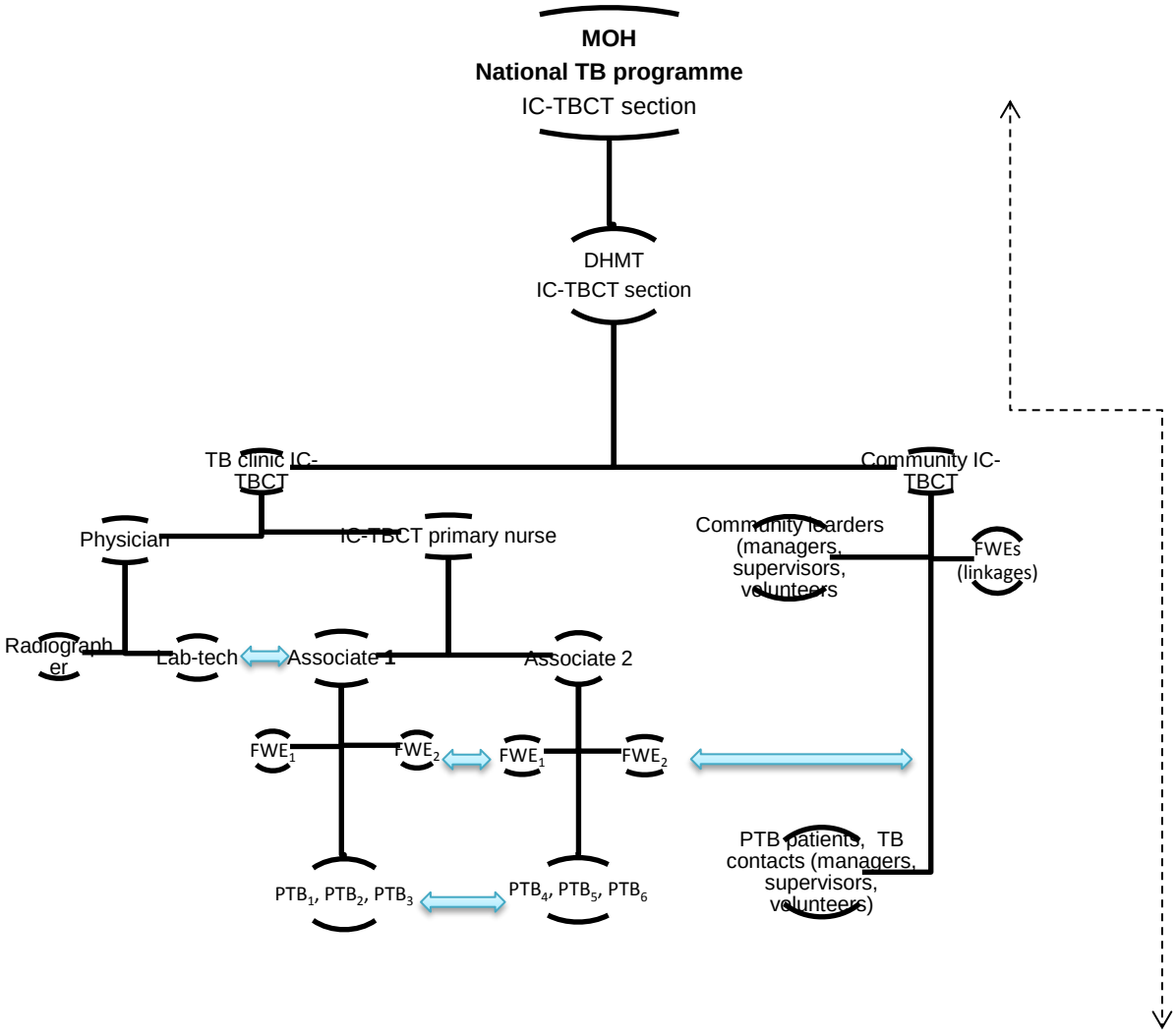


Figure 6.1: Structure for integrated comprehensive tuberculosis contact tracing

(Source: researcher)

Figure 6.1 shows the proposed functional structure of the IC-TBCT as designed by the researcher. The model shows linkages from the community up through the DHMT to the Ministry of Health. The IC-TBCT sections at each tier will avail and display the linkages and roles and responsibilities for the positions.

The IC-TBCT section will have the TB clinics as the major functional areas. The TB clinic is the core of the implementation of the IC-TBCT. The clinic should avail utility

space for separate reception and interviewing of patients with infectious diseases, such as the PTB patients. It should also avail IT equipment and stationery, sufficient staffing pattern (according to TBCT training) and provision of TBCT policy guidelines. The staffing should include, in the least, primary and associate nurses whose work schedule will cover 24 hours. That ensures the presence of an IC-TBCT nurse in every shift of duty. The role of the HCWs (primary nurse and associates) in the clinic IC-TBCT will supervise the implementation of IC-TBCT activities on a day-to-day basis. That will involve primary interaction of the HCWs, the PTB patients and the TB contacts. The HCWs will have detailed and intensive documentation of activities in the clinic. Therefore, every PTB patient and his or her contact will find a readily available nurse to attend to them. The pattern will also act as contingency in the event that a primary or associate nurse is off-duty, away from clinic, sick or on vacation.

The clinic will have medical personnel for the purpose of prompt diagnosis and evaluation of the patients. The other necessary personnel include the IT experts, radiographers and the auxiliaries.

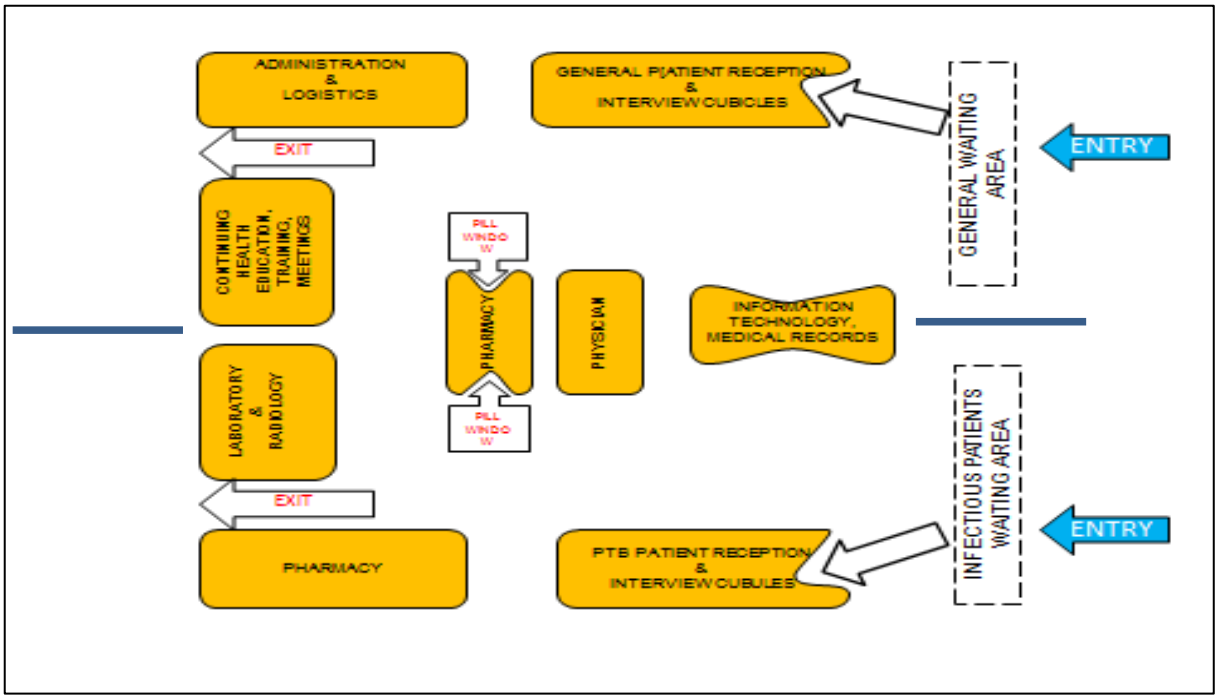


Figure 6.2: Structure for tuberculosis clinic with integrated comprehensive tuberculosis contact tracing

(Source: researcher)

Figure 6.2 shows the proposed simple organisation of the TB clinic. The design is organised in line with the flow of PTB patients and those of the general populations to

minimise transmission of TB. It is envisaged to facilitate smooth flow of TBCT activities, foster collaboration, health education and comfort of all patients.

6.4.9.2 Community-based tuberculosis contact tracing structures

The IC-TBCT section will collaborate with the community health and administrative leadership in the establishment or strengthening of community TBCT structures. They may include the village health committees, community TB programme, community volunteers and the local administration. It will work with the PTB patients and TB contacts as both the beneficiaries and participants in implementation of integrated community TBCT. That fulfils the WHO's call for community involvement (WHO 2015:17–18).

6.4.9.3 Initiation of integrated comprehensive *tuberculosis contact tracing*

When a new diagnosis of PTB is positively identified, the patient is assigned to a primary nurse who will start the TBCT immediately. Each patient will have one primary and one associate nurse. The PTB patient provides the details of contacts to the nurse. The nurse will establish initial contact with the PTB contact using the hotline mobile phone call. The process of having the subsequent contact between the nurse and the TB contact should, by IC-TBCT standard, take no more than 4 hours. The acceptable duration of time should be limited to locating the TB contact, the preparation of logistics and x-pert screening method. The acceptable delay for each process should not be more than 1 hour.

6.4.10 Monitoring and evaluation (M&E) of integrated comprehensive tuberculosis contact tracing strategy

6.4.10.1 Monitoring integrated comprehensive tuberculosis contact tracing activities

Continuous monitoring of the implementation of the services will be ensured. An IT officer will develop an IC-TBCT software field within the existing electronic TB register (ETR) or spreadsheet in the computer. That field will be for use in data entry. The primary nurse in collaboration with IC-TBCT personnel will collect necessary information

and, with the assistance of the IT officer, log-in notable activities in that specific spreadsheet. The information will continuously build up reports that will be extracted in every quarter. The reports will provide for the evaluation of programme activities.

6.4.10.2 Evaluating integrated comprehensive tuberculosis contact tracing activities

The implementation of IC-TBCT will have quarterly reports of the activities. Since all the activities will revolve around the PTB patient and the primary nurse, the reports will originate from each primary nurse with the assistance of associate nurses. It will show the progress of implementation, gaps and suggested solutions. The report will be the source of data to be included in the existing ETR.

6.4.10.3 Objective performance evaluation system for integrated comprehensive tuberculosis contact tracing

There is a need to objectively gauge IC-TBCT performance using categories of pass rates to make appropriate suggestions and/or remedial measures for improvement.

Objective Performance System (OPS) evaluates progress and performance through follow up output of the primary nurse and the associates in the IC-TBCT programme. It analyses number of TB contacts recruited and tested in order to determine quantity pass rates, quality pass rates and failure rates. The TB programme evaluations should include these analyses as a pointer to where the IC-TBCT implementers did best (commend) and where they need improvement (remedial measures).

Based on the number of PTB patients served in the TB clinic within a particular geographical location in a quarter of a year, the following will be determined:

- number of TB contacts traced
- number of TB contacts tested

Table 6.2: Pass rates for integrated comprehensive tuberculosis contact tracing

Percent of TB contacts traced	Percent of TB contacts screened for TB	Comment on TB clinic
100.0%, Grade A	100.0% TB contacts are screened	Centre of IC-TBCT excellence award (Category A)
90.0% - 99.5%, Grade B	All traced TB contacts are screened	Centre of IC-TBCT excellence award (Category B)
80.0% - 89.5%, Grade C	70.0% to 79.5% of TB contacts screened	DHMT Commendation
70.0% - 79.5%, Grade D	60.0% to 69.5% of TB contacts screened	DHMT and clinic discuss improvement
Below 70.0% , Grade E	Below 59.5% of TB contacts screened	DHMT Meeting to investigate cause, discuss remedial measure(s) and way forward

6.4.10.3.1 Determining pass rates of integrated comprehensive tuberculosis contact tracing

The category of pass rate depends on the proportion of TB contacts screened to that of the TB contacts reached. The formula is:

$$\text{Evaluation pass rate} = \left(\frac{\text{Number of contacts screened for TB}}{\text{Number of TB contacts reached}}\right)100$$

Evaluation pass rates are graded A, B C D and E with Grade A being the highest and Grade E, the lowest. Grade A is defined as a pass rate of 100.0% of TB contacts reached and all are screened for TB. Grade B is a pass rate of 90.0% to 99.5% of contacts traced and all are screened. Grade C is a pass rate of 80.0% to 89.5% of contacts traced and 70.0% to 79.5% of TB contacts screened. Grade D is a pass rate of 70.0% to 79.5% of contacts traced but 60.0% to 69.5% of TB contacts screened. Grade E is a pass rate of less than 70.0% and less than 59.5% of that is screened. The analyses should be portrayed in a continuous graphic display for visualisation. The TB clinic that achieves Grade A is branded Centre of IC-TBCT Excellence (Category A) and that which attains Grade E requires the DHMT to investigate cause, discuss remedial measure(s) and way forward.

The advantage of the IC-TBCT mode of evaluation is that it is objectively output based. Also, the contribution of a HCW's performance, such as primary nurse, to the grade

obtained can be recorded. Consequently, the information becomes valuable during his or her evaluations and that of the IC-TBCT programme. The disadvantage is that a HCW may unwittingly or intentionally enter wrong patient information in order to get desired grades in evaluations. However, strict supervision of PTB patient follow-up and recording would eliminate the practice.

6.5 RECOMMENDATIONS FOR THE RESEARCH

The researcher suggests the following recommendations for the IC-TBCT strategy. The suggestions will be of benefit to policy makers, researchers, institutes of health training and practicing health professionals. The recommendations are based on the findings on the challenges and needs of TBCT in the study.

6.5.1 Recommendations for policy makers

6.5.1.1 Strengthen tuberculosis contact tracing

There is need to improve the TBCT programme and find linkage strategies. Strengthen the TBCT awareness through training of the HCWs and the community as a means of enhancing utilisation of the TBCT. Further, it is imperative to create strategies that enhance the effectiveness of the TBCT programme. The strengthening of the existing community support groups may provide the necessary TBCT links. The participants with good understanding of the TBCT should be encouraged, trained and involved in pertinent multi-level TBCT activities.

6.5.1.2 Institute non-monetary communication and transport system

The TB programme should consider instituting a non-monetary transport system that enables the TB contacts to visit the TB clinic for TBCT activities. The programme could organise for a shared transport system in which the TB patients and their contacts could pay an agreed percentage, for instance 50.0% for fare and the programme pays the remaining percentage. Furthermore, the involvement of the PTB patients in the implementation of TBCT could enable them to earn income and augment the food that the TB programme provides currently.

6.5.1.3 Utilise active tuberculosis contact tracing

The high TB contact-case index ratio indicates that the TBCT programme should utilise a more active household TBCT. Enhanced comprehensive TB case follow-up and identification of contacts must be a priority screening strategy in Botswana as a high TB prevalence area. The TBCT strategies need to take into cognizance this prevalence and the number needed to contact trace (n=2.16) in its efforts.

There is need for a more effective TBCT strategy that will trace the missing 805 or more TB contacts and improve the household and workplace TBCT. Similarly, an active and effective TBCT may reduce defaulter rate of medication and TBCT follow-up. A primary nurse in the IC-TBCT is able to promptly identify defaulter in medication and the TBCT. That way, he or she will institute prompt measures.

Since the PTB patients preferred household visitation during TBCT and the HCWs utilised it, the planners of community TBCT should design a more effective TBCT using this information. Some of the relevant suggestions by the PTB patients for the improvement of the TBCT must be harnessed in the programme. That may improve community ownership and increase TBCT uptake.

6.5.2 Recommendation for contact tracing support group

The TBCT programme must consider the mobility pattern of the youth (21 – 25 year age group) and most productive and highly mobile 26 – 40 age group in planning appropriate TBCT strategies. There is need to provide a new thinking in modifying the gender-sensitive TBCT strategies especially for the males as they are more susceptible to TB infection that are females. There is also need to innovate strategies of involving the youth in TBCT. The multiple concurrent cohabitations suggest the need for a TBCT support group that will actively involve cohabiting TB contacts. There is need to consider the TBHIV co-infection in designing a TBCT strategy that combines effective follow-up of the two syndemic diseases. In order to achieve cost effective TBCT follow-up of the TBHIV patients, the TB programme must incorporate the HIV section in contact tracing.

The TBCT programme should consider strategies of economic empowerment of the PTB patients and their contacts. The TBCT programme may mitigate the need for financial sustenance by training and engaging the PTB patients in the implementation of the programme. The enabling strategies include establishment of community TBCT structures and recruitment and remuneration of the PTB patients as community TBCT implementers. Such structures must provide clear active hierarchical link with the DHMT.

6.5.3 Recommendations for training

6.5.3.1 Tuberculosis contact tracing for the health care workers

The need for training the HCWs and the FWEs is imperative. A continuous training on IC-TBCT not only sustains its implementation but also improves the skills of the HCWs and the FWEs.

6.5.3.2 Community awareness for PTB patients and contacts

The role of TBCT in detection of LTB must be improved among TB contacts and HCWs. It is important for them to understand that what is hitherto unknown – LTB – is riskier than what is known – TB disease. In this case, there is need to enhance PTB patient and community TBCT training in order to enhance efforts for a more effective TBCT. The fact that there exist perceptions and actions for and against TBCT indicate further need for health education about the disease and the TBCT by the HCWs.

It is important to consider the phases of treatment when planning the TBCT services that would enhance effective follow-up. The PTB patients want to be involved especially in the health education as they have a first-hand experience of the TB infection. The phases of treatment would enable focused health education in that relevant information may be targeted at the relevant recipients. The clinic health education schedules are an important forum for this.

6.5.4 Recommendation for health care professionals

6.5.4.1 Short-term plan for integrated tuberculosis contact tracing

There is need for the health professionals to improve awareness creation about IC-TBCT. Community awareness creation about the benefits of IC-TBCT is expected to be a forum. The awareness could improve the knowledge of PTB patients and their contacts through the platforms of village health committees. It behoves the HCWs to carry out health talks directed at educating the PTB patients and contacts about the effects of TB and the benefits of the TBCT. The appropriate forum for that is a focussed health education that incorporates PTB patients as educators and recipients of the health talks.

The HCWs must integrate community IC-TBCT volunteers in an effective contact tracing programme that links with the TB clinic. That should derive support from the volunteers, most of whom are PTB patients themselves. The TB trainers must embrace the focused IC-TBCT strategy in order to achieve increased tracing and screening.

6.5.4.2 Long-term plan for integrated comprehensive tuberculosis contact tracing

The health care professionals always strive to improve health strategies to be more responsive to people's needs. The IC-TBCT programme must incorporate a continuous educational activity about the IC-TBCT for the health care personnel. Innovation in IC-TBCT is one such strategy that will need to be incorporated in the appropriate curriculum.

6.5.5 Future research in tuberculosis contact tracing

The researcher recommends a continuous build-up of data base for contact tracing activities through IC-TBCT strategy. The data base will inform further research on TBCT. The Botswana government, through the appropriate Human Research and Development Unit (HRDU) in the ministry of Health, should lead a TBCT research and

build up the data base that will inform TBCT policy development. Future research may also carry out prospective study on contact tracing and on a wider scale.

6.6 STRENGTHS, CONTRIBUTION AND LIMITATIONS OF THE STUDY

6.6.1 Strengths of the study

The study took place in a familiar social milieu setting for the participants. All the participants spoke Setswana (local dialect of Botswana). They also shared similar health care and TBCT services. This made it easy for the researcher to understand their TBCT knowledge, perceptions and practice.

The current study is the first one of its kind in Botswana. It focused on the knowledge, perceptions and practices of TBCT among the PTB patients and the HCWs. It applied the Health Belief Model appropriately since the prevalence of TB is still high.

6.6.2 Unique contribution of the study to the body of knowledge

The unique contribution of the current research is that it has generated literature that is valuable to the body of public health nursing knowledge. The contributions include those of the nursing practice and nursing administration. It also includes nursing academia, community involvement and public health research.

6.6.2.1 Contribution to the nursing practice

The study has shed more light on current knowledge, perceptions and practice of the PTB patients, the TB contacts and the HCWs as regards TBCT implementation. From the interpretation of the findings, the researcher outlined the challenges of TB contact-case index ratio, youthful population and utilisation of TBCT. The researcher also deliberated on the needs of the TB contacts to include number needed to trace, contact tracing needs of the youthful population, community linkages and the means of improving TBCT. These are the challenges in the public health nursing practice that the research has extracted and provided a way forward in their solution.

6.6.2.2 Contribution to nursing administration

Another unique finding of the study is that the researcher was able to suggest a strategy for the TB programme. This is an important contribution on theoretical level. The ministry of health will find this model a useful tool in the quest to find a more cost-effective and efficient means of contact tracing in the country. It will use it to benchmark on how best to administer the programme. Down the tier, the DHMTs could use the model to improve the administration of TBCT in the districts. In addition, the TB clinics will use the model to re-structure the staffing pattern, clinic TBCT plans and how best to provide reception, interviewing and treatment of the PTB patients and their suspects.

6.6.2.3 Contribution to the nursing academia

Learning about the strategies of TBCT has the potential to extend the knowledge base in the nursing profession. Through the current research, the nursing profession will have access to a knowledge base to benchmark whenever it proposes to incorporate the IC-TBCT in appropriate public health nursing curricula. Besides, the innovation of IC-TBCT provides a new thinking that may improve contact tracing as it ensures a near to zero missed opportunities for the TB contacts. It is believed, therefore, that the strategy responds to the WHO (2015:18) vision of reducing TB incidence and mortality by 50.0% and 75.0% respectively by 2025.

6.6.2.4 Contribution to community involvement

The study succeeded in developing IC-TBCT process guidelines. The IC-TBCT guidelines are simple and appropriately designed to include the participation of the communities in IC-TBCT. Primarily, the guidelines provide for the involvement of the PTB patients and the TB contacts at appropriate levels of implementation of TBCT in the community. It also provides direct formal linkages between the DHMT in addition to TB clinics. Finally, as the last tier of the IC-TBCT, the community could use it to improve TBCT awareness, contact identification and immediate referral to the TB clinic for appropriate care

6.6.2.5 Contribution to public health research

The literature in the current study is an extension of the body of knowledge of public health. The IC-TBCT provides innovations that must be re-studied, tested and if need be modified. Not only will the innovations be useful in the quest to eradicate the scourge of TB, but can also be applied in other health fields.

The research findings and recommendations are based on Botswana and its populace. However, public health researchers may find them applicable in other geographical populations elsewhere. Hence, the literature provides the public health researchers with a basis for benchmarking in what may be termed as *lessons learned.*

6.6.2.6 Limitations of the study

The HCWs were conveniently selected using expert technique. This could have easily introduced selection bias. In addition, the study was conducted in only 2 districts out of 8, the Good Hope Sub-district and the Lobatse District of the southern region. Hence some form of selection bias could have easily been introduced. In mitigation, even though this may be a limitation, the findings may be generalised to the entire population in Botswana. This is because the study population shares similarities with those in other districts with regard to language (*Setswana*), culture and public health system organisation. In this regard, the findings of the current study may, therefore, be a valuable resource in further studies of TB prevention and control strategies in other districts.

The intention of the researcher was to conduct a larger prospective study in terms of population and geographical coverage. However, research funds and time were limiting.

6.7 CONCLUSION

The aim of the study was to develop a strategy for TBCT in Botswana based on the identified problem that the current TBCT strategy is not effective enough to trace all TB contacts. The focus was to explore the existing TBCT strategies, programmes, activities and to identify gaps. The study also aimed at identifying PTB patients' perceptions, knowledge of TB and practices of TBCT. Further, it aimed at identifying suggestions

from the participants and utilising those in the improvement of TBCT. The thrust of this study has been that any effort aiming at effectively reducing the rate of TB infections should address the risk factors to contracting TB. That would reduce the vulnerability to exposure and being infected as a result of ineffective contact tracing.

The current study revealed challenges that exist in the implementation of the current contact tracing strategies. They encompass clinic space needs, administrative and organisational challenges. They also encompass the challenges of perceptions, knowledge and utilisation of TBCT that cut across the PTB patients, TB contacts and the HCWs. The main findings in the study included the following: The under tracing of the TB contacts showed a gap for missed opportunities of TB case finding and testing. The household TB contact-case index ratio was 5.4:1 and 1.05:1 for the workplace and the number needed to contact trace is 2.16 on average. The current study shows a significant TB contact-case index ratio that must be addressed.

With the mean age for the PTB patients being 40.9 years and the median age being 37 years, the PTB patients and their contacts are largely a youthful population. In addition, majority are in single cohabiting relations and highly mobile. That is a challenge in the implementation of the TBCT if self-report contact tracing is overly relied on. There is significant participant complacency and perceptions that discourage their participation in TBCT. They include poor understanding of the purpose of TBCT.

Stigma and isolation of the PTB patients are prevalent. The source of stigma included relatives, friends and the HCWs. This is due to the poor perceptions of the cause of TB and not understanding the purpose of TBCT. The TBHIV syndemic is a threat to the TBCT follow-up when an individual with the TBHIV infection gets overwhelmed while seeking health care. There is need to strengthen support for the PTB patients with co-morbidity.

Participants expressed concerns about the communication between the PTB patients, the TB contacts and the HCWs despite availability of Emergency Medical Services call line. The transport system is still a challenge for the PTB patients and HCWs in utilisation of TBCT. Participation of the PTB patients and their contacts in community tuberculosis contact tracing is minimal. The existence of a TBCT structure that links the community and the clinic is unclear to the PTB patients and that hampers TBCT. There

is need for community TBCT initiation and awareness creation. The non-utilisation of tuberculosis contact tracing policy is one of the facility-specific administrative barriers of TBCT. The policy is underutilised and the TBCT practice is faced with facility-specific administrative challenges and standardisation needs. The study identified the TB clinic administrative and organisational factors, perceptions and knowledge of the PTB patients about TBCT. It also determined the HCWs actions in implementation of TBCT programme with specific reference to PTB patient reception, initiation of the TBCT programme, TB record keeping, TBCT planned events and mobile phone user perception.

The study critically analysed different strategies describing TBCT and strategies for reducing TB infection rates. A solution to these challenges is within the realm of the implementers and beneficiaries of TBCT. The strategy that takes the involvement of all the factors is equally within the suggestions of the implementers and the beneficiaries. Hence the study constructed a context based and needs based alternative TBCT strategy that links TB clinic organisational factors, TBCT knowledge and actions of the HCWs. It also involves the participation of the TB patients in the implementation of the TBCT strategy. As such, the study proposed the IC-TBCT strategy for a more effective contact tracing.

The IC-TBCT strategy will have a vision, mission and purpose that will guide the implementation of contact tracing. The strategy will use more effective evidenced tiers that will respond to the WHO's call (WHO 2015:7) for community involvement in the TB prevention and control strategies. The strategies will not only aim to trace all the TB contacts, but also to reduce the delays in LTBI screening. It will have evidenced linkage backed with documentation of activities. There is need to ensure that every TB contact is tested and treated if need be. The proposed IC-TBCT strategy has the potential to realise the SDGs 2016 – 2035 and improve the lives of the communities.

The current research also provided the forum for the researcher to explore the TBCT strategies in the study sites. It further improved the skills of quantitative research and kindles the desire to conduct a prospective TBCT research with a wider coverage.

In summary, the researcher is of the view that the study objectives have been met. This was achieved by answering a number of research questions outlined in Section 1.4.

Among the main research questions were “Are organisational factors related to the utilisation/implementation of TBCT programme?” “How do the actions of the HCWs regarding implementation of contact tracing relate to PTB patient reception and initiation of the TBCT?” and “What perceptions do the TB patients have about the utilisation of the TBCT programme?”

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ANNEXES

Annex A: Approval from the University of South Africa

UNISA university of south africa

UNIVERSITY OF SOUTH AFRICA
Health Studies Higher Degrees Committee
College of Human Sciences
ETHICAL CLEARANCE CERTIFICATE

HSHDC/121/2013

Date: 30 January 2013 Student No: 4489-191-1

Project Title: Tracing of tuberculosis patients' contacts in Botswana.

Researcher: Koskei Justice Kiplangat

Degree: D Litt et phil Code: DPCHS04

Supervisor: Prof VJ Ehlers
Qualification: D Litt et Phil
Joint Supervisor: Dr E Kip

DECISION OF COMMITTEE

Approved [√] **Conditionally Approved** [ ]

Prof L Roets
CHAIRPERSON: HEALTH STUDIES HIGHER DEGREES COMMITTEE

Dr MM Moleki
ACTING ACADEMIC CHAIRPERSON: DEPARTMENT OF HEALTH STUDIES

PLEASE QUOTE THE PROJECT NUMBER IN ALL ENQUIRES

Annex B: Letter seeking consent from Ministry of Health, Botswana

Institute of Health Sciences
P. O. Box 309 Lobatse
BOTSWANA
Tel. +267 53330496
Cellular phone: +267 7 550 8268
Fax. +267 5333301
February 28 2013

The Director
Human Research and Development Unit
Ministry of Health
Private Bag 038, Gaborone
BOTSWANA

Dear Sir,

RE: APPLICATION FOR PERMISSION TO CONDUCT RESEARCH

I am a registered PhD student at the University Of South Africa (UNISA) and wish to apply for permission to carry out a study on TRACING OF TUBERCULOSIS PATIENTS IN BOTSWANA. The setting for this study is Good Hope sub-District and Lobatse Health District. It will include .Athlone Hospital, Good Hope Primary Hospital and their feeder clinics. The study will begin in April 1 2013 until September 30 2015. This is part of the requirements for Doctor of Literature and Philosophy degree in health studies.

In order to ensure improved care for the TB case indices and their contacts, there is need to learn more about contact tracing and their personal characteristics and experiences. This will involve interviewing of TB case indices and perusal of TB registers and contact tracing slips. The principles of respect for human dignity and protection of the institutions will be adhered to.

I hope that the findings from this study will provide critical information necessary for better planning of their care. This will be a basis for formulation of strategies for improvement of TB contact tracing. With your permission, the findings will be disseminated to all stakeholders in health care so that the data informs the development of policies, programmes and practices to improve the quality of people with TB.

Attached, please find the Application for Approval of Human Research (14 copies), and four (4) copies of each of the following: study proposal, consent form, questionnaires, my CV, Ethical Clearance Certificate No HSHDC/121/2013 of the University of South Africa, and document checklist.

I shall be very pleased if you granted me permission to carry out the study. If you have any questions, please contact me or my promoter on the contact details provided below.

Faithfully,

Koskei JK (Researcher: +267-75508268 or +267-53330496)

Prof. VJ. Ehlers (Promoter: 012- 429 6731)

CC. The Hospital Superintendent
Athlone Hospital
The Hospital Superintendent
Good Hope Primary Hospital
DHMT (Att: District Public Health Officer)
Lobatse Health District
DHMT (Att: District Public Health Officer)
Good Hope District

Annex C: Letter of approval: Botswana Ministry of Health

TELEPHONE: 5484333/ 5486236
FACSIMILE: 5486295
TELEGRAM: NGAKA
REFFERENCE:

REPUBLIC OF BOTSWANA

DISTRICT HEALTH MANAGEMENT TEAM
P O BOX 175
GOODHOPE

REF: GHPH 5/8/2 V (53)

11th December 2015

Mr J.K. Koskei
University of South Africa
P. O. Box 3920003
Pretoria

Dear Sir

PERMISSION TO CONUDCT RESEATCH AT GOODHOPE PRIMARY HOSPITAL – YOURSELF

Reference is made to your letter dated 1st August on the above subject matter.

Permission is hereby granted to you to conduct research at Goodhope Primary Hospital.

I trust that you will observe all protocol as required by Ministry of Health Research Unit and wish you all the best with your study.

Thank you.

Yours faithfully

Dr. T.K. Sarona
Chief Medical Officer

Annex D: Letter of approval: Good Hope District Health Management Team

TELEPHONE: 5404333/ 5486236
FACSIMILE: 5486295
TELEGRAM: NGAKA
REFFERENCE:

REPUBLIC OF BOTSWANA

DISTRICT HEALTH MANAGEMENT TEAM
P O BOX 175
GOODHOPE

REF: GHPH 5/8/2 V (54)

11th December 2015

Mr J.K. Koskei
University of South Africa
P. O. Box 3920003
Pretoria

Dear Sir

PREMISSION TO CARRY OUT A RESEARCH TITLED: TRACING OF TUBERCULOSIS PATIENTS'CONTACTS IN BOTSWANA

I would like to acknowledge receipt of your letter on the above matter.

I am pleased to inform you that permission to carry out the study at Goodhope DHMT health facilities is granted.

The criterion to give you permission is because you have followed all necessary procedures and I hope that you will observe all protocol as required by the Ministry of Health Research Unit.

Please see relevant authorities whenever you get to respective units.

Thank you.

Yours faithfully

Dr. T.K. Sarona
DHMT HEAD

Annex E: Letter of approval: Lobatse District Health Management Team

Tel. No. 5330333
Fax No. 5330719

REPUBLIC OF BOTSWANA

Athlone Hospital
Private Bag 20
LOBATSE
BOTSWANA

REF: REF: AH/5/2

28 October 2015

J. K. Koskei
University of South Africa
P. O. Box 3920003
Pretoria

RE: PERMISSION TO CARRY OUT A RESEARCH TITLED: TRACING OF TUBERCULOSIS PATIENTS' CONTACTS IN BOTSWANA

I would like to acknowledge receipt of your letter on the above matter

I am pleased to inform you that permission to carry out the study at Lobatse DHMT health facilities is granted.

The criterion to give you permission is because you have followed all necessary procedures and I hope that you will observe all protocol as required by the Ministry of Health Research Unit.

Please see relevant authorities whenever you get to respective units.

Thank you

Sincerely,

T. J. Mokgatle
HEAD OF DHMT - LOBATSE

Annex F: Letter of approval: Good Hope Primary Hospital

TELEPHONE: 5404333/ 5486236
FACSIMILE: 5486295
TELEGRAM: NGAKA
REFFERENCE:

REPUBLIC OF BOTSWANA

DISTRICT HEALTH MANAGEMENT TEAM
P O BOX 175
GOODHOPE

REF: GHPH 5/8/2 V (53)

11th December 2015

Mr J.K. Koskei
University of South Africa
P. O. Box 3920003
Pretoria

Dear Sir

PERMISSION TO CONUDCT RESEATCH AT GOODHOPE PRIMARY HOSPITAL – YOURSELF

Reference is made to your letter dated 1st August on the above subject matter.

Permission is hereby granted to you to conduct research at Goodhope Primary Hospital.

I trust that you will observe all protocol as required by Ministry of Health Research Unit and wish you all the best with your study.

Thank you.

Yours faithfully

Dr. T.K. Sarona
Chief Medical Officer

Annex G: Letter of approval: Athlone Hospital

Tel. No. 5330333
Fax No. 5330719

REPUBLIC OF BOTSWANA

Athlone Hospital
Private Bag 20
LOBATSE
BOTSWANA

REFERENCE NO: AH

30th October 2015

J.K. Koskei
University of South Africa
P.O. Box 3920003
Pretoria

Dear Sir,

PERMISSION TO CONDUCT RESEARCH AT ATHLONE HOSPITAL – YOURSELF

Reference is made to your letter dated 1st August 2015 on the above subject.

Permission is hereby granted to you to conduct research at Athlone Hospital.

I trust that you will observe all protocol as required by Ministry of Health Research Unit and wish you all the best with your study.

Yours faithfully

Dr. B. Lecoge
Hospital Superintendent

Annex H: Pulmonary tuberculosis documents data Checklist

Serial Nº

Introduction by the interviewer:

I am in a study to explore practices of pulmonary tuberculosis patients' contact tracing. This will involve data about your checklist on the PTB documents in the Infectious Disease Control Centre (IDCC). The information to be extracted will include the PTB diagnosis, type of treatment, contacts, the PTB patients' characteristics, contact tracing addresses and the TB relevant information.

The information in the PTB records may provide potential information necessary for understanding the needs of the PTB patients and those of their contacts. The information extracted will be treated with confidentiality and no names or identifying information will appear on this checklist. No personal or institutional identifiers will be put in the publications and presentations.

Section A: IDCC clinic characteristics

1. Check if the IDCC/clinic is designed to facilitate TB contact tracing.

   - ☐ Yes, as in-built part of the main health facility
   - ☐ Yes, as modified part of the main health facility
   - ☐ Yes, separate structure from the health facility
   - ☐ No IDCC structure

2. Check the main practice of receiving PTB suspects at reception in this clinic.

   - ☐ Separated from other patients
   - ☐ Mixed with other patients
   - ☐ Other (specify……)

3. Check the area for interviewing the PTB patients' contacts.

   - ☐ Separate room with no other activities
   - ☐ Separate space in a room with other activities
   - ☐ Other (specify……)

4. Check if the Botswana national TB contact tracing policy is available in the clinic.

- ☐ Available and displayed
- ☐ Available, not displayed
- ☐ Not available

5. Check the type of record(s) you mainly utilise in TB contact tracing.

- ☐ The TB Contact Tracing Forms
- ☐ The TB Contacts Register
- ☐ The TB Contact Tracing Forms and TB Contacts Register
- ☐ Other (specify…..……)

Section B: Demographic characteristics of the PTB patients and their contacts

6. Please check TB diagnosis.

- ☐ New PTB case
- ☐ Re-treatment PTB
- ☐ MDR-TB
- ☐ XDR-TB

7. Please check the end diagnostic plan used before the treatment of the PTB patient.

- ☐ Tuberculin skin test (TST)
- ☐ Smear microscopy
- ☐ Culture
- ☐ Radiology (X-ray)
- ☐ Other (specify…….)

8. Please check the current category of treatment of the PTB patient.

- ☐ Initial Isoniazid, Rifampicin, Pyrazinamide, Ethambutol
- ☐ Continuation four months' Isoniazid, Rifampicin, Ethambutol
- ☐ Retreatment PTB
- ☐ Completed PTB treatment
- ☐ Treatment failure of PTB
- ☐ Other (specify……)

9. Please check the gender, age, relationship and number of TB contacts.

	(a) HOUSEHOLD CONTACTS				(b) WORKPLACE CONTACTS		
Contact # 1	M	F	Age	Relationship	M	F	Age
Contact # 2	M	F	Age	Relationship	M	F	Age
Contact # 3	M	F	Age	Relationship	M	F	Age
Contact # 4	M	F	Age	Relationship	M	F	Age
Contact # 5	M	F	Age	Relationship	M	F	Age
Contact # 6	M	F	Age	Relationship			
Contact # 7	M	F	Age	Relationship			
Contact # 8	M	F	Age	Relationship			
	TOTAL #				TOTAL #		

Check the number of TB contacts screened for TB in the past 12 months.

	Household TB contacts	Workplace TB contacts
Screened for TB	10.	11.
Testing positive	12.	13.

14. Check the preferred method listed for TB contact follow-up.

- ☐ Household address
- ☐ Workplace address
- ☐ Mobile phone
- ☐ Fixed phone
- ☐ No contact address
- ☐ Other (specify……..)

15. Check the method most utilised for follow-up of the TB contact.

- ☐ Household visit
- ☐ Workplace visit
- ☐ Mobile phone
- ☐ Fixed phone
- ☐ None
- ☐ Other (specify……)

Annex I: Questionnaire for Pulmonary Tuberculosis Patients and Tuberculosis Contacts: English version

Serial Nº

☐ ☐ ☐ ☐

Instructions for interviewer

1. Ask participant to respond to each question as honestly as possible.
2. Do not write participant's name anywhere on this questionnaire.
3. Mark X in the box adjacent to the most appropriate response.

Section A: demographic and household characteristics

1. What is your gender?

   ☐ Male
   ☐ Female

2. How old were you at your last birthday? ……)
3. What is your marital status?

   Married monogamous

   ☐ Married polygamous
   ☐ Single non-cohabiting
   ☐ Single cohabiting
   ☐ Divorced
   ☐ Separated
   ☐ Widowed

4. What is the highest level of education that you have completed?

   ☐ Primary school
   ☐ Secondary school
   ☐ Post-secondary college/university
   ☐ None

5. What category best describes your occupation?

   ☐ Unskilled labour (e.g. groundsmen, labourer etc.)
   ☐ Skilled labour (e.g. accountant, nurse, teacher etc.)
   ☐ Student
   ☐ Other (specify……)
   ☐ None

6. What is your employment status/organisation?

- ☐ Government employee
- ☐ Private organisation employee
- ☐ Self-employed
- ☐ Not employed (go to question 8)

7. Which of the following categories best describes your employer/organisation?

- ☐ Service industry (e.g. hospitals, restaurants…etc.)
- ☐ Manufacturing industry (e.g. factories, meat processing)
- ☐ Mining industry (e.g. coal, diamond)
- ☐ Farming (e.g. poultry, livestock, bee-keeping)
- ☐ Other (specify.....)

8. What is the range of the total monthly income (in BWP) for this household?

- ☐ Below 500.00
- ☐ 501 – 1 500.00
- ☐ 1 501 – 2 500.00
- ☐ Over 2 501.00
- ☐ None

9. (a) What type of a house do you live in?

	9 (b) # rooms
☐ Temporary (grass thatched, mud walls & floor)	.....
☐ Semi-permanent (iron sheet-roofed, mud walls & floor)	.....
☐ Permanent (iron sheet/brick-roofed, concrete walls & floor)	.....
☐ Other (specify type…….....)	.....

10. How many people live in the house you described in question 9 (a)?.....

11. How many hours in a day do you spend with your household members?……

12. How many meals in a day do you usually have in your household?

- ☐ One meal per day
- ☐ Two meals per day
- ☐ Over three meals per day
- ☐ Other (specify frequency.....……..)

13. Which three types of food do you usually eat at meal times in your household?

- ☐ Raese, nama, sorghum meal
- ☐ Nama, phaleche, morogo
- ☐ Potatoes, raese, bogobe
- ☐ Others (specify…….)

14. Is the amount of food served during meal times in your household sufficient?

- ☐ Yes
- ☐ No

Section B: Workplace, lifestyle, the TB infection and the TB contact tracing

15. Have you ever lived/worked with someone with the TB infection?

- ☐ Yes, I am living/working with now
- ☐ Yes, I lived/worked with before
- ☐ No, I have never lived/worked with (go to question 18)

16. How many days last week did you share enclosed space with a TB patient?.....

17. How many days of last month were you in close contact with the TB patient?

- ☐ Every day
- ☐ 1 – 7 days
- ☐ 8 – 15 days
- ☐ 16 – 21 days

18. Which conditions below best describes your working environment?

- ☐ Closed and spacious
- ☐ Closed and congested
- ☐ Open and spacious
- ☐ Open and congested

19. How many people do you work with daily in close contact?.....

20. What do you think is the cause of TB?

- ☐ Eating bad food
- ☐ Witchcraft
- ☐ Germs (mycobacteria)
- ☐ Devine punishment
- ☐ Other (specify.....)
- ☐ I do not know

21. Did you feel at risk of contracting TB at home or work environment?

- ☐ Yes: a household member with cough has/had not been tested
- ☐ Yes: a workmate with cough has/had not been tested
- ☐ No: no household member has/had cough
- ☐ No: no workmate has/had cough
- ☐ Other (specify…….....)
- ☐ I do not know

22. Have you ever suffered from TB before the current infection?

- ☐ Yes, this once
- ☐ Yes, more than once
- ☐ No (go to question 25)

23. If you have suffered from TB before, how did you know you had TB?

- ☐ Prolonged coughing and chest pain
- ☐ Self-suspicion and seeking care
- ☐ Contact tracing by HCW
- ☐ Diagnosed in clinic
- ☐ Told by traditional doctor
- ☐ Other (explain.....)

24. Where did you initially seek treatment when you learnt that you had TB?

- ☐ Self-treatment
- ☐ Public health facility
- ☐ Traditional health practitioner
- ☐ Other (specify….....…….…)

25. What most difficult problem did you encounter while seeking treatment for TB?

- ☐ Money for transport
- ☐ Stigma and discrimination (say how you feel discrimination……..…….)
- ☐ Personal perceptions of treatment (state the perception…….……)
- ☐ Clinic schedules
- ☐ Distance to clinic
- ☐ Other (specify…….....….....)
- ☐ No difficulties

26. If you have suffered from TB before, how did you recover?

- ☐ Treated in public health facility
- ☐ Treated with traditional medicine
- ☐ Combined hospital and traditional medicine
- ☐ Other (specify.....)

27. Do/did you suspect that someone is/was at risk of getting TB from you?

- ☐ Yes, in the household (explain why.....)
- ☐ Yes, at workplace (explain why.....)
- ☐ No (explain why not.....)
- ☐ I do not know

28. How many of your contacts have been tested for TB?.....

29. How many of your screened contacts were diagnosed with the TB?.....

30. Do you know your HIV status?

- ☐ Yes, I have HIV
- ☐ Yes, I do not have HIV
- ☐ Yes, I will not disclose my HIV status
- ☐ No, I do not know my HIV status

31. What is TB contact tracing according to your understanding?

- ☐ The HCWs visit homes of PTB patients to assess their welfare
- ☐ The HCWs visit homes of PTB patients to identify contacts at risk
- ☐ The HCWs visit workplaces of PTB patients to identify contacts at risk
- ☐ Identify and screen contacts at risk of contracting TB from an index patient
- ☐ I do not know
- ☐ Other (specify.....)

32. How long have you been trained about TB contact tracing?

- ☐ 1 to 2 days
- ☐ 3 to 4 days
- ☐ Over 5 days
- ☐ Not trained

33. What is your specific role in your community TB contact tracing programme?

- ☐ TBCT peer educator
- ☐ TBCT management team member
- ☐ Community TBCT volunteer
- ☐ No specific role (go to question 35)
- ☐ Other (specify……....)

34. How many days during last month did you do a TB contact tracing activity?

- ☐ 1 to 2 days
- ☐ 3 to 4 days
- ☐ Over 5 days

35. How many days last month did your neighbour do a TB contact tracing activity?

- ☐ 1 to 2 days
- ☐ 3 to 4 days
- ☐ Over 5 days
- ☐ Not involved
- ☐ I do not know

36. What main support do you receive to promote the TB contact tracing activities?

- ☐ Financial
- ☐ Supervisory
- ☐ Transport
- ☐ Contact tracing training
- ☐ Other (specify……)
- ☐ None

37. What community TB contact tracing structure link with your nearest clinic?

- ☐ Community TB programme
- ☐ No community TBCT programme
- ☐ I do not know
- ☐ Other (specify…….)

38. Who can best identify the TB contacts during contact tracing follow-up?

- ☐ PTB patients
- ☐ Nurses
- ☐ Family welfare educators (FWEs)
- ☐ I do not know
- ☐ Other (specify.....)

39. What type of cigarettes do you normally smoke?

- ☐ I do not smoke cigarettes (go to question 42)
- ☐ Manufactured cigarettes
- ☐ Traditional/homemade cigarettes
- ☐ Manufactured and traditional/homemade cigarettes
- ☐ Other (specify…….....…….....……...….)

40. How many cigarettes do you normally smoke in a day?.....

41. How often do you share a partly smoked cigarette with a friend?

- ☐ Often share
- ☐ Sometimes share
- ☐ Seldom share
- ☐ Never share

42. What type of alcohol do you normally drink?

- ☐ I do not drink alcohol (go to question 44)
- ☐ Manufactured/bottled/canned alcohol
- ☐ Traditional/homemade alcohol
- ☐ Manufactured/bottled/canned and traditional/homemade alcohol
- ☐ Other (specify.....…….)

43. How many days in a week do/did you drink alcohol while on TB medication?.....

44. How many days in a week would you fail or go late for DOT for TB?

- ☐ 1 to 2 days
- ☐ 3 to 4 days
- ☐ 5 to 6 days
- ☐ 7 days
- ☐ None

45. How many days during last month did you share your prescribed take-home pills with someone?

- ☐ 1 to 2 days
- ☐ 3 to 4 days
- ☐ 5 to 6 days
- ☐ Over 7 days
- ☐ None

46. How many days during last month did you borrow prescribed pills from someone?

- ☐ 1 to 2 days
- ☐ 3 to 4 days
- ☐ Over 5 days
- ☐ None

47. What may best improve people's participation in the TB contact tracing?

- ☐ Provide transport to contacts
- ☐ Improve contact identification procedures
- ☐ Involve community TB contact tracing volunteers
- ☐ Create TB contact tracing awareness
- ☐ Other (specify…….)

48. What is the immediate benefit of contact tracing to a TB contact?

- ☐ Early testing and treatment of TB
- ☐ Reduce transmission of TB
- ☐ Better home care for the TB contact
- ☐ Other (specify…….)

49. What is your most preferred communication method during the TB contact tracing?

- ☐ Mobile phone
- ☐ Home/work fixed phone
- ☐ Home visit
- ☐ Workplace visit
- ☐ I do not know
- ☐ Other (specify…….)

50. For one eligible TB contact: have you been contact traced for TB screening?

- ☐ Yes, at household level
- ☐ Yes, at workplace level
- ☐ Not contact traced
- ☐ Other (specify…….)

Thank you for your responses. If you have any question to ask me, please do so:

Annex J: Questionnaire for Pulmonary Tuberculosis Patients and Tuberculosis Contacts: Setswana version

Serial Nº

Kitsiso ka mmotsolotsi

Ke mo patlisisong ya go sekaseka (tlhotlhomisa) maiteko a balwetsi ba TB a go latedisa kamano, Patlisiso e e tla a akaretsa potsisiso e e dirwang go lebaganwe mabapi le tekodiso ya gago ya go latedisa ba o amaneng nabo, mmogo le dintlha dingwe ka wena tse di ka re nayang kitso e e botlhokwa go tlhaoganya se se tlhokegang mo go ba o kileng wa amana nabo. Se e tla nna motheo wa mananeo a go tokafatsa tatediso ya kamano. Go tsenelela patlisiso e ke boithaopo fela, ebile o ka nna wa gana kgotsa wa emisa mo kgatong nngwe le nngwe fela go sa senye kalafi le go fiwa melemo ga gago.

Dintlha tse o tla a di ntshang di tla a tshegediwa e le sephiri, ebile maina kgotsa sepe fela se se ka senolang gore o mang ga di na go tsena gope mo lenaneong la potsolotso e. Godimo ga moo, ga go na disupi dipe tsa gore omang tse di tla a tsenngwang mo dikgatisong le mo dipegong tsa patlisiso e. Re ka leboga thata fa o ka tsenelela patlisiso e. Tswee tswee araba dipotso tsotlhe ka boammaaruri jotlhe jo bo kgonegang. O tsenelela patlisiso ka boithaopo ebile o gololesegile go tlogela potsesiso mo kgatong nngwe le nngwe e o e batlang. O ka itlhophela go araba dipotso ka Sekgoa kana ka Setswana, kgotsa ka dipuo tsoo - pedi.

Ditaela go mmotsolotsi:

Tlhomamisa gore moarabi o tlhaloganya dipotso

Itsise moarabi gore o ka araba ka Setswana kana Sekgoa, kgotsa ka dipuo tsoo – pedi.

Tshwaya letshwao la X mo bokoseng e e bapileng le karabo e e maleba

Karolo A: Dintlha ka Moarabi

1. Tswee tswee tshwaya bong jwa gago.

   ☐ Monna

   ☐ Mosadi

2. Kwala dingwaga tsa gago ka botlalo mo bokoseng o lebile matsalo a gago a fetileng ……

3. Seemo sa gago sa nyalo ke eng?

   - ☐ Ke nyetse/nyetswe ke motho a le mongwe
   - ☐ Ke nyetse/nyetswe lefufa
   - ☐ Ga ke a nyala/nyalwa ebile ke tshela ke le nosi
   - ☐ Ga ke a nyala/nyalwa mme ke nna le mongwe Ke tlhadile/tlhadilwe
   - ☐ Re arogane
   - ☐ Ke tlhokafaletswe ke monna/mosadi

4. O feletse fa kae mo sekolong?

   - ☐ Sekolo se se botlana
   - ☐ Sekolo se segolwane
   - ☐ Dithuto tse di kgolwane (tsa kholeje)
   - ☐ Ga ke a tsena sekolo

5. Tiro ya gago ke eng?……...……..…….....

6. Maemo a gago a tiro ke afe (o bereka mo go eng)?

   - ☐ Mo ga goromente
   - ☐ Mo dikhamphaning (makalana) tse di ikemetseng
   - ☐ Ke a ipereka
   - ☐ Ga ke bereke (ya kwa potso 8)

7. Ke dife tsa tse di latelang tse di tsamaelanang le lekalana le o le direlang?

   - ☐ Makalana a ditirelo (jaaka dipatela,dikgolegelo, mafelo a dijo…etc)
   - ☐ Lekalana la madirelo (jaaka madirelo a dilwana, madirelo a dinama
   - ☐ Tsa meepo (jaaka magala, teemane)
   - ☐ Tse dingwe (tlhalosa.....….....)

8. Supa selekanyo sa madi otlhe a o a dirang mo kgweding ka Dipula.

- ☐ Kwa tlase ga makgolo a matlhano
- ☐ Makgolo a matlhano le bongwe - sekete le makgolo a matlhano
- ☐ Sekete le makgolo a matlhano le bongwe - dikete tse pedi le makgolo a matlhano
- ☐ Go feta dikete tse pedi le makgolo a matlhano le bongwe
- ☐ Sepe

9. (a) O nna mo borokong (ntlo) jwa mofuta ofe?

	9 (b) dikamore
☐ Jwa nakwana	.....
☐ Jwa lobakanyana mme e se sennela-ruri	.....
☐ Jwa sennela-ruri	.....
☐ Mo gongwe (tlhalosa mofuta.....)	.....

10. O nna le batho ba le kae mo ntlong ee o e kaileng mo potso 9?.....)

11. O nna di oura di le kae mo letsatseng o na la ba losika la gago? …..……

12. Mo lelapeng la lona lo ja ga kae ka letsatsi?

- ☐ Ga ngwe fela ka letsatsi
- ☐ Gabedi ka letsatsi
- ☐ Gararo ka letsatsi
- ☐ Mo gongwe (tlhalosa gore ga kae.....…)

13. Kwala dijo tse tharo tsa konokono tse di nnang di jewa (boelelwa) ka nako ya dijo mo lelapeng la lona:

- ☐ Raese, nama, bogobe jwa mabele
- ☐ Nama, phaleche, morogo
- ☐ Ditapole, raese, bogobe
- ☐ Tse dingwe (tlhalosa.....)

14. A dijo tse lo di tsholelwang ka dinako tseo di a a lo lekana mo lelapeng la lona?

- ☐ Ee
- ☐ Nnyaa

Karolo: Sebopego sa (ditironyana) maiteko a go latedisa balwetsi ba TB le go tshela ga motho

15. A o nna/bereka le mongwe yo o nang le TB?

    - ☐ Ee
    - ☐ Nnyaa (ya kwa potso18)

16. Fa go ntse jalo o (ne o) nna le ene mo lefelong le le tswetsweng ga kae mo bekeng?

    - ☐ Letsatsi le letsatsi
    - ☐ Malatsi a mabedi mo bekeng
    - ☐ Malatsi a mararo mo bekeng
    - ☐ Go feta malatsi a mararo mo bekeng

17. O na le lobaka lo lo kae o ntse o kopana le motho yo o belaelang gore o ka tswa a na le TB?

    - ☐ Dibeke tse pedi kgotsa kwa tlase
    - ☐ Go feta dibeke tse pedi, go tsamaela kgwedi
    - ☐ Go feta kgwedi e le nngwe

18. O ka tlhalosa/tshwantshisa jang lefelo le o berekelang mo go lone?

    - ☐ Le tswalegile (diofisi, meepo,dikoloi/dipalamo)
    - ☐ Le bulegile (ditshingwana, dithunya, masimo)
    - ☐ Tse Dingwe (tlhalosa.....)

19. Go na le batho ba le kae ba o berekang le bone ba o nnang o pataganela ditiro nabo le atamalane?

    - ☐ Tlase ga bobedi
    - ☐ Boraro go ya go bone
    - ☐ Go feta botlhano
    - ☐ Gagona
    - ☐ Mo gongwe (tlhalosa.....)

20. O akanya gore TB e bakwa ke eng?

- ☐ Go ja dijo tse disa siamang
- ☐ Boloi
- ☐ Megare
- ☐ Kotlhao
- ☐ Tse dingwe (tlhalosa.....)
- ☐ Ga ke itse

21. A o ne o ipona o le mo diphatseng tsa go tsenwa ke TB kwa o berekang teng?

- ☐ Ee. Ka gore mmereki ka nna o na le TB mme ga a mo kalafing
- ☐ Ee. Ka gore mmereki ka nna o a go tlhola mme ga tlhathobelwa TB
- ☐ Nnyaa ka gore gagona ope yo onang le TB ko tirong
- ☐ A mangwe (tlhalosa…….....)

22. A o kile wa bolawa ke TB pele?

- ☐ Ee. Gangwe fela
- ☐ Ee. Gantsi ntsi
- ☐ Nnyaa. (ya kwa potso 25)

23. Fa gontse jalo, o ne wa itse jang gore o tsenwe ke TB?

- ☐ Ke neke ipelalela
- ☐ Ka go latedisiwa kamano ke modiri wa botsogo a re etetse
- ☐ Mo gongwe (tlhalosa.....….....)

24. O ne wa kopa kalafi kae nako ya ntlha o sena go lemoga gore o na le TB?

- ☐ Ke ne ke ikalafa mo lapeng
- ☐ Mafelo a botsogo a setšhaba (sepatela/tliliniki)
- ☐ Ngaka ya setso
- ☐ Tse dingwe (tlhalosa ….....….....…….…..)

25. O iditswe ke eng go kopa thuso mo ditlamelong tsa botsogo tsa TB?

- ☐ Madi a se palamo
- ☐ Go tlontlologa (ditlhong) (tlhalosa gore o bona e tlontlolola jang …….....)
- ☐ Tsa go ikutlwa mo mmeleng (bolelela gore a ke go tshaba botlhoko jwa dimao, ditlamorago tsa melemo, ditsamaiso tsa tlhatlhobo, diipone.....)
- ☐ Ditlamelo tsa kokelwana ga di a ntshiamela (tlhalosa gore ke eng o akanya jalo.....…….....)
- ☐ Bokgakala jwa kokelwana
- ☐ Tse dingwe (tlhalosa.....)

26. Fa o kile wa lwala TB, o ne wa fola jang?

- ☐ Kalafi mo bookelong
- ☐ Kalafi ya melemo ya setso
- ☐ Ke tlhakantse kalafi ya sepatela le melemo ya setso
- ☐ Mo gongwe (tlhalosa.....….....)

27. A o belaela gore o ka tswa o tshetse mongwe TB?

- ☐ Ee, mo lapeng (tlhalosa gore ka go reng.....)
- ☐ Ee, kwa tirong (tlhalosa gore ka go reng.....)
- ☐ Nnyaa (tlhalosa gore ka go reng .....)
- ☐ Ga ke itse

28. Ke ba le kae ba o amaneng le bone ba ba kileng ba tlhatlhobiwa TB? .....

29. Fa e le gore batho botlhe ba o kileng wa amana nabo ba tlhalhobilwe, go fitlhetswe TB mo go ba le kae?.....

30. A o itse seemo sa gago sa mogare (HIV)?

- ☐ Ee, ke na le mogare
- ☐ Ee, ga ke na mogare
- ☐ Ee, mme ga ke bolelele ope
- ☐ Ga ke itse

31. Go ya ka kitso ya gago, TBCT ke eng?

- ☐ Badiri ba botsogo ba etela molwapa a balwesi ba TB go tlhathoba ko fa bannong ka teng
- ☐ Badiri ba botsogo ba etela molwapa a balwesi go bona ba ba mo boraing jwa go tsenwa ke balwesi jwa TB
- ☐ Badiri ba botsogo ba etela malelo a tiro a balwesi ba TB go bona ba ba mo boraing jwa go tsenwa ke balwesi jwa TB
- ☐ Go tlhathoba b aba mo boraing jwa go tsenwa ke TB go tswa mo molwetsing wa TB
- ☐ Ga ke itse
- ☐ Tse dingwe (tlhalosa……)

32. O tsene thutuntsho ya lobaka lo lo kae gore o tlhaloganye TB le thibelo ya yone?

- ☐ Letsatsi go ya ko go a mabedi
- ☐ Malatsi a mararo go ya ko go a mane
- ☐ Go feta malatsi a matlhano
- ☐ Ga ke thutuntshwa

33. O thusa/tsena jang mo go diragatseng lenaneo la TB mo morafeng wa ga eno?

- ☐ Jaaka mokaedi/moruti wa balekane
- ☐ Jaaka leloko la lekoko la ditirelo tsa tlhokomelo ya TB
- ☐ Jaaka moithaopi wa motse/setšhaba
- ☐ Ga tsene gope (ya kwa potso 35)
- ☐ Tse dingwe (tlhalosa…....…….....……..)

34. O memiwa (bidiwa) go le kae mo dipuisanyong tsa ditirelo tsa tlhokomelo ya TB mo bekeng?

- ☐ Letsatsi ya ko go a mabedi
- ☐ Malatsi a mararo go ya ko go a mane
- ☐ Go feta malatsi a matlhano

35. Ke malatsi a le kae kgwedi e e fitileng oneng watsenelea ditirelo tsa TBCT?

- ☐ Letsatsi ya ko go a mabedi
- ☐ Malatsi a mararo go ya ko go a mane
- ☐ Go feta malatsi a matlhano
- ☐ Ga a tsenelele
- ☐ Ga ke itse

36. O fillwe thuso e e ntseng jang gore o tsamaise ditiro tse di rotloetsang thibelo ya TB?

- ☐ Thuso ya madi
- ☐ Thuso ya boeteledi pele
- ☐ Thuso ya dipalamo
- ☐ Tse dingwe (tlhalosa ……..…….)
- ☐ Sepe

37. Ke lenaneo lefe la TBCT mo motseng le legolaganeng le kokelwana ee gaufi?

- ☐ Lenaneo la TBCT mo motseng
- ☐ Ga gona lenaneo la TBCT
- ☐ Ga ke itse
- ☐ Tse dingwe (tlhalosa ……..…….)

38. O akanya gore ke mang yo o ka dirang tiro eo botoka?

- ☐ Balwetsi
- ☐ Baoki
- ☐ Bommaboitekanelo (FWEs)
- ☐ Ga ke itse
- ☐ Ba bangwe (tlhalosa.....)

39. O goga motsoko/disekerese tsa mofuta ofe?

- ☐ Tse di diretsweng ruri
- ☐ Tse di itshophelwang mo gae
- ☐ Tse di diretsweng ruri le tse di itshophelwang mo gae
- ☐ Tse dingwe (tlhalosa ….....……)

40. O goga disekerese di le kae mo letsatsing?.....

41. O goisana le ditsala go le kae (le amogana sekerese)?

- ☐ Re nna re goisana/amogana
- ☐ Nako nngwe re a goisana/amogana
- ☐ Re goisana/amogana ka sewelo
- ☐ Ga nke ke goisana le ope

42. O aga o nwa bojalwa jwa mofuta ofe?

- ☐ Jo bo diretsweng ruri jwa mabotlolo/ditsiri
- ☐ Jo bo omelwang mo gae
- ☐ Jo bo diretsweng ruri le Jo bo omelwang mo gae
- ☐ Mo gongwe (tlhalosa…….....……)

43. Ke malatsi a le kae o nwang kgotsa o noleng bojalwa o le mo kalafing ya TB?...

44. Ke malatsi a le kae o paletsweng kana o ileng morago ga nako?

- ☐ Letsatsi go ya ko go a mabedi
- ☐ Malatsi a le mararo go ya ko go a le mane
- ☐ Malatsi a le matlhano go ya ko go a marataro
- ☐ Malatsi a le supa
- ☐ Sepe

45. Ke malatsi a le kae o kileng wa abela dipilisi tsa gago kgwedi

- ☐ Letsatsi go ya ko go a mabedi
- ☐ Malatsi a le mararo go ya ko go a le mane
- ☐ Malatsi a le matlhano go ya ko go a marataro
- ☐ Malatsi a le supa
- ☐ Sepe

46. Ke malatsi a le kae o kileng wa adima dipilisi tsa mongwe mo kgweding?

- ☐ Letsatsi go ya ko go a mabedi
- ☐ Malatsi a le mararo go ya ko go a le mane
- ☐ Go feta malatsi a le matlhano
- ☐ Sepe

47. Ke eng se seka tokafatsang tatho go tsaya karolo mo dipatlisisong ka bolwetsi jwa TB Ke malatsi a le kae o kileng wa adima dipilisi tsa mongwe mo kgweding?

- ☐ Go thusa ka dipalamo
- ☐ Go tokafatsa dithulaganyo tsa balwesi
- ☐ Go dirisa batlhaopi ba TBCT
- ☐ Go tlhama ditirelo tsa TBCT
- ☐ Tse dingwe (tlhalosa……)

48. Ke eng se se masolo ka dipatlisiso tsa TB?

- ☐ Tlhatlhobo le kalafi ya TB
- ☐ Go fokotsa kanamo ya TB
- ☐ Tlhokomelo mo lapeng ya molwetsi wa TB
- ☐ Tse dingwe (tlhalosa.....….....)

49. Ke mofuta ofe wa dipuisanyo o ka diriswang mo dipatlisisong ka TB?

- ☐ Mogala wa letheka
- ☐ Mogala wa molapeng/tirong
- ☐ Go etela malapa
- ☐ Go etela mafelo a tiro
- ☐ Ga ke itse
- ☐ Tse dingwe (Tlhalosa.....)

50. Ya motho yo onnang le motho yo onang le TB a le dingwaga di le masome a mabedi le bongwe: a o kile wa tlhatlhobelwa TB?

- ☐ Ee, ko lapeng
- ☐ Ee, ko tirong
- ☐ Ga ke ise ke tlhatlhobiwe
- ☐ Tse dingwe (tlhalosa…….....)

Re go lebogela go araba dipotso tse. Fa o na le dipotso tse o eletsang go di mpotsa tswee tswee di botse:

_____

Annex K: Questionnaire for Health Care Workers

Serial Nº ☐☐☐☐

I am involved in a study to explore practices of pulmonary tuberculosis patients' contact tracing. It will involve face-to-face interview with you concerning contact tracing. The information obtained will provide understanding of practices of follow-up and the needs of TB contacts, a basis for strategies to improve case identification and their care. Participation is entirely voluntary and you may decline or withdraw at any stage with no effect on you and your work.

The information you provide will be treated with confidentiality and no names or identifying information will appear on this interview schedule. Similarly, no personal identifiers will be put in the publications and presentations. Your contribution in responding to these questions will be appreciated. Please respond to each question as honestly as possible.

Section A: demography, knowledge and perceptions of TB contact tracing

1. Please check your gender.

   ☐ Male
   ☐ Female

2. What highest level of education have you completed?

   ☐ Primary
   ☐ Secondary
   ☐ Mid-level college
   ☐ University
   ☐ Other (Specify.....)

3. What is the duration of your training in the TB contact tracing?

   ☐ Seminar/workshop (7 days' continuous training)
   ☐ Short course (14 days' continuous training)
   ☐ No training on TB contact tracing
   ☐ Other (specify.....)

4. How many completed years have you worked in this clinic?.....

5. Which statement most correctly defines the TB contact tracing?
   - ☐ Carry out visits for TB patients to assess their welfare
   - ☐ Carry out only home visits for TB patients to identify contacts at risk
   - ☐ Carry out only workplace visits for TB patients to identify contacts at risk
   - ☐ Identify and screen contacts at risk of contracting TB from an index patient
   - ☐ I do not know
   - ☐ Other (specify.....)
6. How do the health care workers in this clinic best define TB contact tracing?
   - ☐ Carry out visits for TB patients to assess their welfare
   - ☐ Carry out only home visits for TB patients to identify contacts at risk
   - ☐ Carry out only workplace visits for TB patients to identify contacts at risk
   - ☐ Identify and screen contacts at risk of contracting TB from an index patient
   - ☐ I do not know
   - ☐ Other (specify.....)
7. To the best of your knowledge, how do the PTB patients define TB contact tracing?
   - ☐ Carry out visits for TB patients to assess their welfare
   - ☐ Carry out only home visits for TB patients to identify contacts at risk
   - ☐ Carry out only workplace visits for TB patients to identify contacts at risk
   - ☐ Identify and screen contacts at risk of contracting TB from an index patient
   - ☐ I do not know
   - ☐ Other (specify.....)
8. What does the TB contact tracing policy state on when to initiate contact tracing?
   - ☐ TB contact tracing is started immediately after TB diagnosis
   - ☐ TB contact tracing is started within a week of TB diagnosis
   - ☐ I do not know
   - ☐ Other (specify.....)
9. Do the actions of the HCWs adhere to the TB contact tracing policy in Botswana?
   - ☐ Yes
   - ☐ No
   - ☐ I do not know
10. How many days after PTB diagnosis do you start contact tracing?.....

Section B: Characteristics and utilization of TB contact tracing

11. What is the main type of TB contact tracing follow-up in this clinic?
    - ☐ The HCWs visit PTB patients at home to identify and screen contacts
    - ☐ The PTB patients send their relatives to clinic for screening
    - ☐ The HCWs visit the PTB patients at work to identify and screen contacts
    - ☐ Other (specify.....)
12. What change do you desire most to improve the TB contact tracing in this clinic?
    - ☐ How to start contact tracing immediately after diagnosis of PTB
    - ☐ Provide TBCT vehicle to enhance quick response to contact tracing
    - ☐ How to visit PTB patients at home and workplace to screen contacts
    - ☐ Other (specify.....)
    - ☐ I do not know
13. Who is the most responsible person in conducting TB contact tracing follow-up?
    - ☐ The TB patients
    - ☐ Nurses
    - ☐ Doctors
    - ☐ The FWEs
    - ☐ Other (Specify.....)
14. What process of the TB contact tracing are you most frequently involved in?
    - ☐ Planning
    - ☐ Implementation
    - ☐ Evaluation
    - ☐ Not involved (go to question 16)
15. What specific activity do you perform most frequently in TB contact tracing?
    - ☐ Do home/workplace visits to identify TB contacts
    - ☐ Interview TB suspects at IDCC
    - ☐ Other (specify.....)
16. Have you ever used your mobile phone to trace TB contacts during follow-up?
    - ☐ Yes
    - ☐ No
17. Would you recommend use of mobile phone in the TB contact tracing follow-up?
    - ☐ Yes
    - ☐ No
    - ☐ Not sure

18. What is the most frequent action that the TB patients use in TB contact tracing?
    - ☐ Inform their contacts to visit IDCC
    - ☐ Escort their contacts to IDCC
    - ☐ I do not know
    - ☐ Other (specify.....)
19. Who can best perform the TB contact tracing follow-up actions?
    - ☐ The TB patient
    - ☐ The TB nurse
    - ☐ The FWE
    - ☐ Other (specify.....)
20. Does your clinic have TB contact tracing follow-up plans?
    - ☐ Yes
    - ☐ No
    - ☐ I do not know
21. How frequent is the immediate household contact tracing of a new PTB patient?
    - ☐ Once in 1 week
    - ☐ Once 2 weeks
    - ☐ Not frequent
    - ☐ Other (specify.....)
22. How frequent is the immediate workplace contact tracing of a new PTB patient?
    - ☐ Once in 1 week
    - ☐ Once in 2 weeks
    - ☐ Not frequent
    - ☐ Other (specify.....)
23. Which workplaces do your clinic HCWs mostly conduct TB contact tracing visits?
    - ☐ Public (e.g. government offices)
    - ☐ Private (e.g. hotels)
    - ☐ No plan of visits
    - ☐ I do not know
    - ☐ Other (specify.....)
24. Are the FWEs trained in TB contact tracing to carry out TB patients follow-up?
    - ☐ Yes
    - ☐ No
    - ☐ I do not know
25. What was your clinic percent coverage in the last quarter for:
    a) Household TB contact tracing……..……..……..……%
    b) Workplace TB contact tracing……..…..……..……%

26. What was the case identification rate in the last quarter for:
    a) Household TB contact tracing by the HCWs…….....……..……....%
    b) Workplace TB contact tracing by the HCWs……..……%
    c) Self-reports in the clinic by the TB contacts ……..…….....%
27. What most concerns a TB patient when a HCW makes a contact tracing visit?
    - ☐ Age of TB patient
    - ☐ Gender of TB patient
    - ☐ Stigma related to TB contact tracing
    - ☐ I do not know
    - ☐ Other (specify.....)
28. What most concerns a TB contact who self-reports in the clinic for screening?
    - ☐ Age of TB contact
    - ☐ Gender of TB contact
    - ☐ Distance to IDCC clinic
    - ☐ Stigma related to TB contact tracing
    - ☐ I do not know
    - ☐ Other (specify.....)
29. What is the most frequent clinic related barrier to the TB contact tracing?
    - ☐ Administrative (staffing pattern, skills mix, logistics)
    - ☐ Organization of the IDCC (duty allocation, timing, lab delays)
    - ☐ Stigma from the HCWs
    - ☐ Other (specify.....)
30. Where do the TB patients initially seek treatment before coming to this clinic?
    - ☐ Self-treatment
    - ☐ Public health facility
    - ☐ Traditional practitioner
    - ☐ Other specify.....)

31. What is most difficult for the TB patients during TB contact tracing process?
    - ☐ Transport costs
    - ☐ Stigma (from HCWs, relatives, friends
    - ☐ Fear (side effects of injections, drugs, diagnostic procedures)
    - ☐ Clinic schedules are an inconvenience (timing, distance)
    - ☐ Other (specify……..)
32. What is the effect of the current HCWs' knowledge and perceptions of TB contact tracing on implementation?
    - ☐ Active implementation of TB contact tracing
    - ☐ Passive implementation of TB contact tracing
    - ☐ I do not know
    - ☐ Other (specify……...)
33. How best can the HCWs identify the TB contacts in the community?
    - ☐ The HCWs should actively trace household and workplace TB contacts
    - ☐ The TB patients should voluntarily send their contacts to the clinic
    - ☐ Other (specify.....)
34. Which TB contact tracing actions could the HCWs use best in the clinic?
    - ☐ The HCWs should visit TB patients at home and workplace
    - ☐ The HCWs should passively wait for the TB contacts in the clinic
    - ☐ Other (specify.....….....)
35. What would be the first priority to improve the TB contact tracing in the community?
    - ☐ Provide transport support to TB contacts
    - ☐ Increase number of TBCT trained FWEs
    - ☐ Use of cell phone services
    - ☐ Enhance awareness of TB contact tracing
    - ☐ Other (specify.....….....)
36. What would be the first priority to improve TB contact tracing services in this clinic?
    - ☐ Improve IDCC contact tracing (visit plans, medication procedures)
    - ☐ Increase number of trained TB contact tracing HCWs
    - ☐ Enhance training in TB contact tracing
    - ☐ Improve TB contact tracing logistics (lab supply, stationery)
    - ☐ Other (specify.....)

Thank you for your responses. If you have any question to ask me, please do so:

_____

Annex L: Informed Consent Form for Pulmonary Tuberculosis Patients: English version

I understand that I will be part of the study on practices of tuberculosis patients' contact tracing practices in Botswana and that I have the right to revoke this authorization and withdraw from this interview at any time. Furthermore, I do understand that:

- The information discussed in this interview is strictly confidential and there will not be any disclosure of names or identity.
- The information obtained from this interview is for the sole purpose of research on TB patients' contact tracing practices for improved case identification and screening.
- The research will involve an interview which will take place at the TB clinic and a possible follow-up in my household quarters and my place of work.
- During the interviews each participant will be asked a series of questions relating to demographic, health, and social aspects of the lives of patients with TB and their contacts.

I also understand that I can contact any of the following if I have questions about my rights as a participant: Mr. Koskei (+267-7550-8268), Hospital Administrator Good Hope (+267-548-6236), Athlone (+267-533-0333), DHMT Coordinator, TB clinic manager, Mr. Khulumani at HRDU, Ministry of Health Headquarters (**+267-391-4467)** and Dr Mmusi-Phetoe R (+27-12-429 6021) or Professor Tshweneagae GT (+27-12-429-2195). In the light of this, I hereby volunteer to participate in the study and grant the researcher/research team permission to contact me for the purpose of collecting data.

I agree to participate

dd	mm	yy

Annex M: Informed Consent Form for Pulmonary Tuberculosis Patients: Setswana version

Ke tlhaloganya gore ke tsena mo patlisisong ya" maiteko a balwetsi ba TB" ditiro tsa go latedisa kamano mo Botswana, le gore ke na le tshwanelo ya go tlhanogela tumalano e ke be ke tswa mo patlisisong e nako nngwe le nngwe. Godimo ga moo, ke tlhaloganya gore:

- Dintlha tse di buisanngwang mo patlisisong e ke sephiri ebile ga go na go ntshiwa maina kgotsa disupo tsa gore motho ke mang.
- Kitso e e tla a tswang mo potsisisong e e tla a dirisediwa patlisiso ya tatediso ya kamano ya balwetsi ba TB fela, go tokafatsa go ba lemoga le go ba lekola.
- Patlisiso e tla a akaretsa potsisiso e e tla a tshwarelwang kwa IDCC mo sepateleng sa Athlone, mmogo le tatediso ya kwa ke nnang teng le kwa ke berekelang teng
- Mo potsisisong mongwe le mongwe o tla a bodiwa dipotso ka go latelana mabapi le dikgang tsa gore ke mang, botsogo jwa gagwe le tsa matshelo fela tsa balwetsi ba TB mmogo le ba ba amanang nabo

  Ke tlhaloganya gape gore ke ka ikgolaganya le batho ba ba latelang fa ke na le dipotso mabapi le ditshwanelo tsa me jaaka moarabi: Mr. Koskei (+267-7550-8268), Mookamodi wa Sepatela sa Good Hope (+267-548-6236), Athlone (+267-533-0333), Mr. Khulumani kwa diofising dikgolo tsa Lephata la Botsogo (Ministry of Health, +267-391-4467) le Dr Mmusi-Phetoe R (+27-12-429 6021) kana Professor Tshweneagae GT (+27-12-429-2195).

  Ka go tlhaloganya se, ke ithaopa go tsenelela patlisiso, ebile ke fa lekoko la patlisiso tetla ya go ikgolaganya le nna ka maikaelelo a go kokoanya dintlha.

Ke dumelana le go tsaya karolo: Letsatsi | dd | mm | yy |

Annex N: Informed Consent Form for Health Care Workers

I am studying the ways in which contacts of tuberculosis patients are traced. Participating in this study will involve completing a questionnaire concerning the contact tracing of TB patients as practiced at your institution. The information obtained will provide an understanding of practices used to follow up the contacts of TB patients, and to develop a basis for strategies to improve tracing TB patients' contacts in future. Participation is entirely voluntary and you may decline or withdraw at any stage with no effect on you or your job at this clinic/hospital. You may also decline to answer any specific question if you feel uncomfortable to do so.

The information you provide will be treated with confidentiality and no names or identifying information will appear on any questionnaire. No personal information will be supplied in any report and only facts, figures and statistics will be presented. Your contribution in responding to these questions will be appreciated. Please respond to each question as honestly as possible.
Your signed consent form will not be linked with your completed questionnaire.
Thank you for taking the time to complete the questionnaire. Your participation is appreciated.

I agree to participate in this study concerning a strategy for effective tracing of TB patients' contacts in Botswana out of my own free will by signing the consent form and responding to the interview questions.

dd	mm	yy

Signature: (optional) Date

Annex O: Research Work Plan

ACTIVITY	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Writing proposal and submission of drafts - 3 months					2013	2013	2013	2013	2013	2013	2013	2013
Submission of chapters - 2 months			2014	2014	2014							
Interview technique expert review , pre-testing of interview schedule and pilot study - 3 months			2014	2014	2014							
Training of research assistants Application for approval of research – 3 months			2015	2015	2015							
Participant recruitment and follow-up interviews - 6 months				2015	2015	2015	2015	2015	2015			
Data Analysis - 4 months	2016	2016	2016	2016								
Finalisation of report - 3 months			2016	2016	2016							
First complete review of report - 3 months						2016	2016	2016				
Professional language control and editing - 2 weeks								2016				
Final proof reading - 2 weeks								2016				
Duplication and binding of report - 2 weeks									2016			
Submission of final report - 2 weeks									2016			

Annex P: Research Budget

Item	Number	Rate/unit (R)	Computation	R	USD
Personnel:					
Annual UNISA registration fees	1 student	R 11 000.00/year	1 X R11 000 X 3 years	R 33 000.00	USD 4 714.29
Training research assistants	3 days	R 150.00/day/person	10 x R150 x 3 days	R 4 500.00	USD 642.86
Research assistants' emoluments	10 FWs	R 200.00/day/person	10X R200 x 31 days	R 62 000.00	USD 8 857.14
Services of translator	2 instruments	R 5 000.00/instrument	1 x R5 000 x 2 instruments	R 10 000.00	USD 1 428.57
Services of statistician	1 thesis	R 15 000.00/thesis	1 x R15 000 x 1 thesis	R 15 000.00	USD 2 142.86
Professional editor of final thesis	1 editor	R 50/page	1 x R50 x 600 pages	R 30 000.00	USD 4 285.71
Professional typing of final thesis	1 typist	R 2500.00/page	1 x R25 x 600 pages	R 15 000.00	USD 2 142.86
Sub-total				**R 169 500.00**	**USD 24 214.29**
Administration:					
Buy set of computer, printer, ink	1 set	R 10 400.00/set	R 10 400.00 x 1 set	R 10 000.00	USD 1 428.57
Preparation & photocopying of questionnaires	188	R 10.00/copy	R 10.00 x 188 copies	R 1 880.00	USD 268.57
Report writing	1 report	R 150.00/day	R 150.00 x 1 x 14 days	R 2 100.00	USD 300.00
Photocopying and binding of four examination copies	4 copies	50c/page	50c x 4 x 600 pages	R 1 200.00	USD 171.43
Photocopies of final copies **after** examiners' comments	4 copies	50c/page	50c x 4 x 600 pages	R 1 200.00	USD 171.43
Binding of five final copies	5 copies	R 150.00/copy	R 150.00 x 2 x 5	R 1 500.00	USD 214.29
Produce 3 CD-ROM copies	5	R 50.00/copy	R 50.00 x 1 x 5 copies	R 250.00	USD 35.71
Sub-total				**R 18 130.00**	**USD 2 590.00**
Data collection and analysis:					
Travelling costs for data collection for 10 field workers	31 round trips	R 30.00/day	R 30.00 x 10 x 31 days x 2	R 18 600.00	USD 2 657.14
Travelling costs for principal investigator	31 round trips	R 30.00/day x 10 facilities	R 30.00 x 10 x 31 days x 2	R 18 600.00	USD 2 657.14
Postage, telephone calls, Internet time			R 1 000.00	R 1 000.00	USD 142.86
Sub-total				**R 38 200.00**	**USD 5 457.14**
Stationery:					
Duplicating paper	25 reams	R50.00/ream	R50.00 x 25 reams	R 1 250.00	USD 178.57
Memory stick (4 GB)	1 piece	R80.00/piece	R80.00 x 1 piece	R 80.00	USD 11.43
CD-ROM	2 pieces	R20.00/piece	R20.00 x 1 piece	R 20.00	USD 2.86
File folder (1 for @ FW; 1 for @ IDCC)	20 files	R12.00/file	R12.00 x 20 files	R 240.00	USD 34.29
Box files (1 for @ IDCC	10 box files	R25.00/box file	R25.00 x 10 box files	R 250.00	USD 35.71
Note book (1 for each FW, 1 for PI)	11 pieces	R25.00/piece	R25.00 x 11 pieces	R 275.00	USD 39.29
Assorted pens (1 per FW; 1 for PI)	11 pens	R10.00/pen	R10.00 x 11 pens	R 110.00	USD 15.71
Pencils (HB) (1 per FW; 1 for PI)	11 pencils	R5.00/pencil	R5.00 x 11 pencils	R 55.00	USD 7.86
Rubber (1 per FW; 1 for PI)	11 rubbers	R4.00/rubber	R4.00 x 11 rubbers	R 44.00	USD 6.29
Sub-total				**R 2 324.00**	**USD 332.00**
TOTAL				**R 228 154.00**	**USD 32 593.43**
Contingencies		10%		R 22 815.40	USD 3 259.34
GRAND TOTAL				**R 250 969.40**	**USD 35 852.77**

US$ 1.00 = ZAR 7.00