THE TEMPOROSPATIAL DIMENSION OF HEALTH IN ZIMBABWE

by

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Declaration

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ABBREVATIONS

AIDS	Acquired Immunodeficiency Syndrome
BCC	Behaviour Change Communication
CAM	Complementary or Alternative Medicine
CD4	Cluster Difference 4
CSO	Central Statistics Office
DALYs	Disability-Adjusted Life-Years
DHIS	Health Information System
DPT	Diphtheria, Pertussis and Tetanus
ECONEX	Economics Consultancy Organisation
GAVI	Global Alliance for Vaccines and Immunisation
GDP	Gross Domestic Product
GMOs	Genetically Modified Organisms
HDI	Human Development Index
HIV	Human Immunodeficiency Virus
ICTs	Information Communications Technologies
IMF	International Monetary Fund
LDCs	Less Developed Countries,
LEDCs	Less Economically Developed Countries
MDC	More Developed Country
MEDC	More Economically Developed Country
MHCW	Ministry of Health and Child Welfare
NATO	North Atlantic Treaty Organisation
NGO	Non-governmental Organisation
NHI	National Health Insurance
ORT	Oral Rehydration Therapy
PHC	Primary health care
TCM	Traditional Chinese medicine
TMP	Traditional Midwives Programme
UMP	Uzumbamarambapfungwe

UK	United Kingdom
UNICEF	United Nations Children's Fund
USA	United States of America
USSR	Union of Soviet Socialist Republics
VHW	Village Health Worker
WHO	World Health Organisation
YLD	Years Lost due to Disability
YLL	Years of Life Lost due to Premature Mortality
ZIMSTAT	Zimbabwe National Statistical Agency
OECD	Organisation for Economic Cooperation and Development
CAM	Complementary or Alternative Medicine
ZEPI	Zimbabwe Expanded Programme on Immunisation
ZINATHA	Zimbabwe National Traditional Healers Association

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ABSTRACT

Inequalities in levels of health between regions within a country are frequently regarded as a problem. Zimbabwe is characterised by poor and unequal conditions of health (both the state of people's health and health services). The health system of the country shows severe spatial inequalities that are manifested at provincial, district and even local levels. This research therefore examines and analyses the spatial inequalities and temporal variation of health conditions in Zimbabwe. Composite indices were used to determine the people's state of health in Zimbabwe. Administrative districts were ranked according to the level of people's state of health. Cluster analysis was also performed to demarcate administrative districts according the level of health service provision. Districts with minimum difference were demarcated in a single cluster. Clusters were delineated using data on patterns of diseases and health and such clusters were used to demarcate the country's spatial health system according to the Adapted Epidemiological Transition Model. This was used to evaluate the applicability of the model to Zimbabwe. It emerged from the research that generally the country's health conditions are poor and the health system is characterised by severe spatial inequalities. Some districts are experiencing poor health service provision and serious health challenges and are still in the age of pestilence and famine but others have good health service provision as well as highly developed health conditions and are in the age degenerative diseases of the epidemiological transition model. It further emerged that the country's health has been evolving with signs of improvement since the 1990s. Recommendations were made regarding possible adjustment to previous strategies and policies used in Zimbabwe, for the development of the health system of the country. New strategies were also recommended for the improvement of the health system of the country. Some proposals are made for further research on the spatial development of health in the country.

KEY TERMS

Health indicators; State of health; Cluster analysis; Epidemiological transition; Composite index; Spatial patterns of health; spatial inequalities; Disease diffusion; Health evolution; Health region and Disease incidence.

CHAPTER 1

INTRODUCTION TO THE STUDY

1.1 Introduction

According to the 2008 World Health report (WHO, 2008a), people today are generally healthier and live longer than 30 years ago. The importance of health for human kind is uncontested and fundamental. Without good health, life loses meaning. Good health is morally worthy, while illness in not. However, the rapid progress in health over the past number of decades has not been very equal. There has been an improvement in general health in most countries in the world, but at the same time health conditions in more and more countries are deteriorating or health related developing are very slow (WHO, 2008a: 6). A wealth of evidence exists concerning the nature and degree of such inequalities at different scales. There are variations at global level, between the less and more developed countries (Murray and Topez, 1996), disparities at continental level, for example, in Europe (Kunst, 1997), in countries, such as England and Wales (Wiggins *et al.*, 1998, Senior *et al.*, 1998) and in urban areas, for example, Glasgow (Sooman and Macintyre, 1995). Murray and Topez (1996: 42) argue that such contrasts in health and health delivery systems are more severe in developing countries. The spatial inequalities in health at whatever scale and in whatever region are highly unacceptable as they have severe socioeconomic and political impacts.

The current research analytically examines the problem of spatial disparities in health conditions specifically the state of people's health and health services in Zimbabwe in 2002. An adapted epidemiological transition model is applied to the spatial economy of Zimbabwe. Such spatial disparities reveal a static pattern and changes over time must also be considered. The evolution of the health system must also be examined. Based on the past and current trends in health conditions in the country, projections can be made on the future patterns of health. The research also endeavours to recommend strategies for spatial development of health in the Zimbabwe.

1.2 Background

Zimbabwe is a developing country in Southern Africa and like many other developing countries has serious problems in its health sector. Zimbabwe is characterised by poor and unequal conditions of health (both state of people's health and health services). WHO (2008a: 10) observes that, the health delivery system and state of people's health have also started to deteriorate since the early 1990s. In addition to this, the health system also shows pronounced spatial inequalities. The country is going through various socio-economic challenges and the health sector is not spared.

Infectious diseases are rampant among the malnourished people. According to WHO (2008a: 11), more than 11700 cases and 473 deaths were recorded between August and 30 November 2008. WHO (2008a: 11) further maintains that in some parts of the country, the Case Fatality Rate reached 50% in areas during the outbreak. The international Case Fatality Rate benchmark should be below 1%. The country has a high prevalence rate of HIV, with an official rate of 15% (ZIMSTAT, 2011: 2). The implication is that certainly tuberculosis and other opportunistic infections should be increasingly thriving in the HIV-positive environment. Such proliferation of diseases is likely to result in sharp escalation of Case fatality rates because according to WHO (2008a: 12) the country has a nationwide shortage of medicines, care providers and poor health facilities.

The variation in the physical environment in Zimbabwe has not only affected the pattern of human economic activities, hence socio-economic development, but has also led to polarisation in conditions of health within the country. The country has a cooler, wet central highveld and hotter, drier lowveld (Sithole and Mayamba, 2001: 128). The temperature in the hot, drier lowveld creates conducive conditions for the proliferation of disease vectors such as tsetseflies and mosquitoes. Sithole and Mayamba (2001: 128) note that diseases such as malaria are predominant in the hot, drier lowveld of the country. Some areas in Zimbabwe particularly urban districts (concentrated in the highveld) such as Harare, Chitungwiza, and Bulawayo are relatively well resourced in terms of health services but on the other hand, administrative districts that are predominantly rural (concentrated in the lowveld) for example Zaka, Binga, Chivi and

Uzumbamara-Mbapfungwe have comparatively limited health resources. The existence of such spatial variation in health conditions in a country impacts negatively on development especially on health in particular and therefore, has far reaching implications in terms of policy formulation.

Analyses of the temporospatial dimension of health in a country require data on a large number of variables for small spatial (geographic) areas and for various years. National census data are the main and sometimes only source of such data. The timing of national censuses therefore influences the time period for such research. Time periods selected must coincide with years in which full population censuses were held in Zimbabwe. A further requirement is that the time periods must include data for similar variables and spatial units. National censuses were enumerated in 1982, 1992, 2002 and 2012, in Zimbabwe. Although a full census was held in 2012 in Zimbabwe the data was not available in the correct format for all the spatial units required when this research was initiated.

As indicated in the preceding paragraph, a census was held in 2012 in Zimbabwe. Although the results of the census were approved by the Director-General, ZIMSTANT (Zimbabwe National Statistical Agency) in October 2013, they became accessible to the public in March 2014 and at that time the data analysis for this study was already done. This is the reason why the 2002 data were used instead of the 2012 data. The results of the 2012 census are available on the website of ZIMSTA (http://www.zimstat.co.zw).

1.3 Assumptions

Theories and research instruments are developed based on assumptions that may or may not be recognised by the researcher. Assumptions influence the development and implementation of the research process and the logic of the study. The following assumptions are embedded in the philosophical base of the framework, the study design, and the interpretation of the findings.

- The existence of spatial variation in health in terms of state of people's health and health service provision in Zimbabwe.
- The adoption of the Epidemiological Transition Model which is applicable to the spatial health system of Zimbabwe.
- The country's health system has been changing over the years, and
- New policies or strategies can be put in place and existing health policies can be adjusted to improve the health system of the country.

1.4 Statement of the problem

On a global scale, there are numerous health problems, especially in developing countries which carry a heavy burden of disease. One of the biggest health problems faced by developed and developing countries are health inequalities. The problem is more critical in the developing world and has serious negative socio-economic and political impacts. The spatial inequality in health conditions (state of people's health and health services) in a country can create social, economic and political problems in that country and also in other countries, especially neighbouring countries.

Zimbabwe is characterised by poor and unequal conditions of health in terms of state of people's health and health services. The health system of the country is facing severe challenges including spatial inequalities as well as overall poor conditions of health service delivery. Nyazema (2010: 236) observes that, despite some impressive expansion in the health sector of Zimbabwe during the period from 1981 to 1989, the country is facing crises in the health delivery system as well as a huge disease burden. The spatial inequalities in health in Zimbabwe are manifested at provincial, district and even local levels. Nyazema (2010: 233) argues that such inequalities in the health system of Zimbabwe date back to the pre-period before independence in 1980. The causes of the poor conditions of health and the inequalities in Zimbabwe are manifold. The factors can be categorized into four groups of influence. This is in keeping with Arah *et al.* (2006: 6)'s categorization of the determinants of health. Firstly, there are lifestyle factors that represent behaviour which may or may not be conducive to good health. Secondly, there are social networks or community influences that affect health. Thirdly, there are factors

related to working and living conditions as well as access to facilities and services in the local area. Finally, there is a set of wider structural determinants representing the influence of broad-scale social conditions on individual health.

The conditions of health also evolved over time. Zimbabwe's health system has been undergoing change over time, sometimes for the better and at other times for the worse. The health system evolves in terms of temporal patterns and evolutionary trends. Therefore there is need to understand the spatial patterns of health in Zimbabwe as well the processes that have shaped the pattern over time and find explanation for the trends that emerge.

The main problem that needs to be investigated is the spatial patterns of inequalities in health conditions in Zimbabwe within a given time period (static pattern) and the evolution of the health system of the country (dynamic pattern) over time. The problem is however not only limited to the spatiotemporal dimensions of health in Zimbabwe but extends to possible strategies or policies that can be implemented for the spatial development of health in the country. The available strategies and policies that can be used by government and other relevant stakeholders interested in redressing the spatial inequalities as well as improve the health sector of the country, which is facing serious problems, needs to be investigated.

1.5 Aim and Objectives

The aim of the current research is to investigate and analyse the temporospatial dimension of health in Zimbabwe. The health system, particularly state of people's health and health service provision of the country, is analysed from a temporospatial (space in time) perspective. This means that the spatial and temporal patterns of health in the country are analysed and the processes that have shaped the patterns over time are examined. An attempt is made to explain the patterns and recommend possible strategies to mitigate the problem of unequal patterns of health in Zimbabwe.

- The first objective of the research is to examine the variations in the spatial patterns of health in terms of state of people's health and disease as well as health care (health services) in Zimbabwe as it was in 2002.

- The second objective is to demarcate the spatial economy of 2002 into a hierarchy of health regions by clustering districts with similar patterns of health service provision.

- The third objective is to apply the Adapted Epidemiological Transition Model to the spatial health system of Zimbabwe in 2002 and to evaluate the extent to which the model applies.

- The fourth objective of the research is to assess the evolution of the country's health system (temporal patterns and evolutionary trends) by comparing the spatial patterns of health as it is 2002 to that of 1992.

- The last objective is to investigate and recommend strategies for spatial development planning and policies that are suitable for spatial development planning of health in Zimbabwe.

1.6 Research questions

In the light of the formulated objectives, the following overarching research questions are posed. These questions have to be examined and answered in order to clarify the major spatial and temporal aspects of Zimbabwe's health system.

- *How does the spatial pattern of health in terms of state of people's health and disease as well as health care (health services) vary in Zimbabwe in 2002?* In answering the question, the researcher examines the spatial variation in state of people's health across all the administrative districts of the country in 2002.

- *Is there a hierarchy of health regions with similar patterns of health service provision in Zimbabwe in 2002?* This research question requires the demarcation of the spatial economy of 2002 into a hierarchy of health regions by clustering administrative districts in the country with similar patterns of health service provision

- *Can the epidemiological transition model be applied to the Zimbabwean spatial health system as it was in 2002 and what is the result of such an application?* The research question is not only about the evaluation of whether the model can be applied successfully to the country's spatial health system but also with the results when the model is applied.

- *How has the country's health system (temporal patterns and evolutionary trends) evolved or changed between from 1992 to 2002?* The focus of this question is on the changes that have occurred in the health conditions of all the districts in Zimbabwe between 1992 and 2002 by determining where health conditions of districts improved, declined or remained static.

- *What strategies or policies are available and can be recommended for the spatial development planning of health in Zimbabwe?* The focus of this question is the evaluation of health improvement policies that are available worldwide as well as those that have been adopted in Zimbabwe. Such an evaluation enables the researcher to recommend policies/strategies for spatial development planning of health in Zimbabwe.

1.7 Justification of the research

A significant amount of research has been done in Zimbabwe on health in general in the past 10 years. The researches include those by Gregson *et al.* (2005), Chikanda (2006) and Gregson *et al*. (2010). In spite of such research in Zimbabwe about health in general, there has been no significant research examining the spatial patterns of health in

Zimbabwe or on the evolution of the health system of the country. Tren and Bate (2005: 2) observe that, in spite of the acute problems in the health system of Zimbabwe, a small amount of research has been conducted on the topic in country. Dirwai (2002: 31) asserts that research on the spatial aspects of health in Zimbabwe has been piecemeal. Consequently, this research is significant and fills a gap in knowledge. The research can also lead to the formulation and implementation of appropriate and informed policies or strategies to reduce spatial inequalities in health in Zimbabwe.

Lack of such research to the country is problematic because Zimbabwe like other developing countries has several health challenges including spatial inequalities in terms of people state of health and health service provision. The current research is essential in that it examines and analyses the spatial aspects of health in the country which has experienced lack of research for many years. The collection and analysis of both secondary and primary data on the health situation in the country should assist in bringing out a meaningful picture of the country's current health situation from a geographical perspective. This will improve the awareness of all the relevant stakeholders (academics, government, international organizations, Non-governmental Organisations and the general public) who are interested to know the country's state of health. This will enable such stakeholders to make informed decisions or give the relevant resources where possible.

Application of the Adapted Epidemiological Transition Model to the spatial health system of Zimbabwe done in Section 5.5 of this study has presented an interesting challenge to this research. This is intended to demonstrate that different parts of a country are at various phases of the Adapted Epidemiological Transition Model.

Application of the model to the Zimbabwean spatial health system therefore is a profound methodological development. Certainly this will make a significant contribution to the existing body of knowledge in geography for two important reasons. Firstly, as indicated in Section 7.2 in Chapter 7, no application of the model has been done in an African context. Secondly, it has been more than 30 years since a similar application was made by Hellen (1983) in Nepal and much could have changed in this period. It is necessary to constantly

examine the application of such models in the modern dynamic world especially their degree of adaptation to country specific.

1.8 Geography and health geography

The definition of geography has been marred by lack of agreement among the community of geographers. Issues around what is studied in geography and with what method have invited a significant amount of controversy within the discipline. The meaning of geography has also changed throughout the ages, and that makes it difficult to give a single definition of a discipline that is it as it so all-embracing and vibrant. Some definitions have become highly anthropocentric; others have become highly geocentric while others have a moderate stance. By the beginning of the 21st century the discipline had many different meanings.

Newbigin (2012: 7) defines geography as a subject that is about the surface-relief of the earth, and the influence which that relief exercises upon the distribution of other phenomena, and especially upon the life of man. Small and Witherick (1986: 89), however, define geography as the study of earth's surface as the home of the human race. Whatever the magnitude and form of such lack of agreement, about the meaning of geography, it can be argued that the primary focus of geography is the temporospatial distribution and interaction of phenomena within the human-environment system. This argument is supported by Musanga (2009: 3), who defines geography as a discipline "which studies the temporal and the spatial distribution of phenomena, processes, and features as well as the interaction of humans and their environment". Geographers study the elements of the human-environment system from a space-in-time perspective. This implies that whatever is studied in geography, whether it is physical phenomena or human or economic phenomena, it should be studied from a space-in-time perspective.

Geography of health is regarded as a subdiscipline of human geography and its field of study is the health subsystem of the man-environment system. According to Fotheringham *et al.* (2000: 1), geography of health views health from "a holistic perspective encompassing space and society", and it takes into account the role of

location, place and geography in well-being, disease and health. Emphasis is on the spatial aspects of health, disease and health care. The primary focus of health geography is the application of geographical information, perspectives, and methods to the study of health, disease and health care (Gatrell, 2002: 15). Health geography also requires an understanding of other fields such as epidemiology and climatology. Although the geography of health is closely related to epidemiology, its main distinctive focus is the spatial patterns and relations. The focus of epidemiology is the biomedical model and an emphasis on the biology of disease, whereas geography of health examines the political and sociocultural contexts of health within a spatial organisation framework (Dummer, 2008: 1).

When geography of health was first recognised as a separate subdiscipline of geography it was called medical geography and it was based on the biomedical model of health and closely aligned to the logical positivism philosophy (Andrews, 2002: 221). The social or socio-ecological model adopted in geography of health, takes a more holistic approach to illness and disease. It focuses on treatment of the whole person and not just components of the system. Under this model, new illnesses, for example mental ill health are recognised and other types of medicine for example formal medicines are combined with traditional medicine. This alternative approach implies that medical geography was extended to include philosophies such as social interactionism, structuralism, structuration and post-structuralism (Gatrell, 2002: 28). Thus the field of health geography emerged.

1.9 Paradigms in health geography

All scientists subscribe to a specific paradigm when practicing their discipline and geographers and health geographers in particular, are no exceptions. However, by the beginning of the 21st century, many new paradigms had emerged in geography, leading to the discipline being viewed as a multiparadigmatic science. There are various paradigms in geography and in health geography in particular. This implies that health geographers have a choice with regard to the paradigm they can use to structure their research. The present section of the chapter is therefore dedicated to the discussion of the various

paradigms that have been used in health geography and in the current research in particular.

The positivist approach is the earliest paradigm that was adopted in health geography but at that time it was called medical geography. The method relies on accurate measurement and recording and searches for statistical regularities and association (Gatrell, 2002: 26). The approach generally makes use of the quantitative method (involving statistical and sampling techniques). The end goal of such a process is to make generalisations and laws. Emphasis based on mapping and spatial analysis is about what is measurable and observable. The approach involves adopting a biomedical model. The body is seen as a machine that may not be in good working order and needs to be "mending" (Gatrell, 2002: 27). What matters mainly is to investigate specific diseases, their causes and treatment and nothing more than that. The ontological position of the positivist philosophy is that there is only one truth, which is seen as an objective reality that exists irrespective of human perception. In this approach the epistemological position is that researcher and researched are independent entities. The researcher can study a phenomenon without exerting influence on it or being influenced by it and "inquiry occurs as through a one way mirror" (Guba and Lincoln, 2004: 110). The approach is usually criticised for adopting a reductionist position. The individual is "reduced" to a collection of body parts and behaviours.

The social interactionist approach arose as a reaction to the weaknesses of the positivist paradigm. Emphasis is no longer on the observable, the measurable, the generalisable and the quantifiable. In the social interactionist approach, the primary concern is on the meaning of disease and illness to the person as well as the subjective experiences of health and illness (Aggleton, 1990: 42). By extension, social interactionists emphasize on small numbers of people; or small neighbourhoods as well as small communities, rather than large areas or large numbers. The aim of researchers using the interactionist approach is "to construct an animating, evocative description (text) of human actions, behaviours, intentions, and experiences as we meet them in the lifeworld" (Aggleton, 1990: 43).

The methods used in this approach are qualitative and according to Gatrell (2002, 28), the goal is empathetic understanding and interpretation of the meanings that make someone act in a certain way. For example, not going for HIV testing may be perfectly irrational to the health professional yet perfectly logical to the patient. Positivists argue that the interactionist approach has the weakness that it is difficult to verify the results and the conclusions drawn from small numbers are difficult to credit.

The structuralist paradigm is one of the approaches to health geography that came to the fore in the 1970s. In structuralism, structures are neither concrete nor physical. Structures refer to mental models built after concrete reality (Glazer, 1994: 2). These structures and their structuralist models exist only in human minds, and not in nature. Gatrell (2002: 43) argues that structurationism acknowledges that structures shape social practices and actions, but in turn, such practices and actions can create and recreate social structures. In the real world, social structures require that particular activities can only be carried out at particular times and in particular settings, but equally so, such structures may themselves be transformed by social action. As an example, the opening time of a clinic can dictate when a person can see a nurse; structure of health care delivery constrains action. On the other hand, the problems that a parent might face in having a child vaccinated may ensure that the patterning of health care resources in space is re-fashioned; in other words, agency may transform structure.

It is argued in this paradigm that people are not always free to make choices about lifestyle and usage of health services. Young (1996: 8) argues that there are geographical constraints such as transport and location of health services as well as economic constraints, for example, low incomes of people. These and other constraints mean that people sometimes seem to neglect their health yet there may be underlying causes. A patient may not go to a hospital to get a service just because he/she does not have the required hospital fees.

The argument in the structuralist paradigm is that the underlying causes of disease and health are embedded in political and economic relations of a society. As Turshen (1984:

11) contends, that sickness lies not in the body but in the body politic. Explanations about disease and health are not sought at the level of the individual, for example, the “unhealthy” lifestyles that one adopts but it is the wider social context that is important in this paradigm. Brothwell (1993: 19-21) for example demonstrates how conquests of Peru and Mexico by Spain in the early sixteenth century led to epidemic diseases such as smallpox, yellow fever, measles, typhus and influenza, in those former colonised states. The author argues that the epidemic diseases were inevitable because such countries had no natural immunity to the diseases. The basic argument from the structuralists is that economic relations and structures underpin all areas of human activity, including health and access to health care. This approach draws heavily from Marxist theories of oppression, domination and class conflict, were inequalities are embedded in society.

More recently, some geographers, in common with other health researchers have began to engage with post-structuralism. It emerged as an antinomian movement critiquing structuralism. Post-structuralism offers a way of justifying these criticisms, by revealing the underlying assumptions of many Western norms. The prefix post; in post-structuralism refers to the fact that many contributors, to the paradigm, rejected structuralism and became quite critical of it. The post-structuralist approach, in essence, is concerned with how knowledge and experience are constructed in the context of power relations. Emphasis on difference is the key feature of the post-structuralist paradigm. They draw attention “to the fact that the assumed human subject of western modernist discourse is an exclusive subject in that it is predominantly male, European, heterosexual, middle class and middle aged” (Petersen and Lupton, 1996: 10). These sweeping generalisations are totally unacceptable as this would be ignoring the substantial body of public health research concerned with inequality, whether according to social class, gender or ethnicity. Post-structuralism is manifested by the rejection of essentialist and totalising concepts. A totalising concept puts all phenomena under one explanatory concept, such as, it's the will of God. An essentialist concept suggests that there is a reality which exists independent of or beyond language and ideology and also that there is such a thing as 'truth' or 'beauty'

Craddock (1995: 966) argues that the blaming of Chinese as having brought the smallpox disease into San Francisco in the latter half of the nineteenth century is a clear example of a mistake of generalisations without scrutinisation, as Smallpox may have been diffused into San Francisco not by the Chinese but by other immigrants. Craddock (1995: 967) argues that, the “threatening” urban space (the Chinatown in Francisco) was reproduced in the image of a threatening of disease. Post structuralists therefore argue that totalizing and essentialist concepts as well as generalizations without scrutinisation can lead to misinformed judgments such concepts are therefore unacceptable.

The current study does not subscribe to one paradigm. The fact that the current study makes use of qualitative and quantitative data analysis implies the researcher draws heavily from both the positivist and the social interactionist paradigm. Four major health paradigms have been used but the positivist and the social interactionist paradigm are vital in the research.

1.10 Study Area

Zimbabwe is a landlocked developing country in Southern Africa. It is bordered by South Africa in the south, Zambia in the northwest, Mozambique in the northeast and Botswana and the Caprivi Strip of Namibia in the southwest. Harare is the capital city of the country. There are 10 provinces and 61 administrative districts in the country. Administratively, Harare province has Harare urban, Harare rural, Epworth and Chitungwiza districts and Bulawayo province has Bulawayo rural and Bulawayo urban districts.

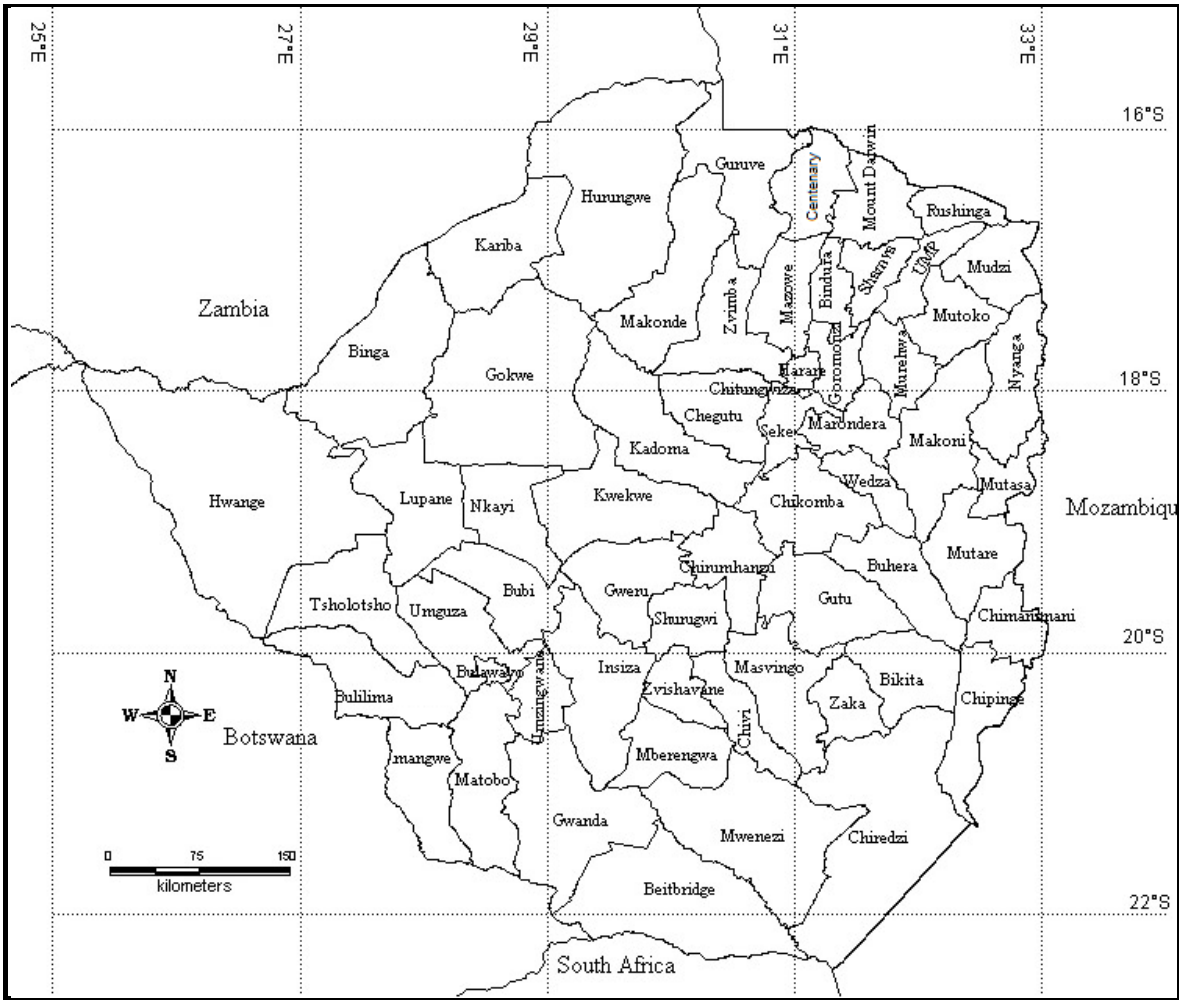

Figure 1.1: Administrative Districts of Zimbabwe (Source: Adapted from Ministry of Health and Child Welfare, 2004)

The demarcation of districts used by to the Ministry of Health and Child Welfare (2004) is used as spatial units of analyses for the examination of the state of people's health conditions and the provision of health services in Zimbabwe (Figure 1.1). This is because some of the variables used in this study (such as incidence rates of dysentery, measles and diarrhea, distribution of hospitals and clinics, number of hospital beds, distribution of doctors and nurses) where obtained from the National health profile of the Ministry of Health and Child Welfare (2004).

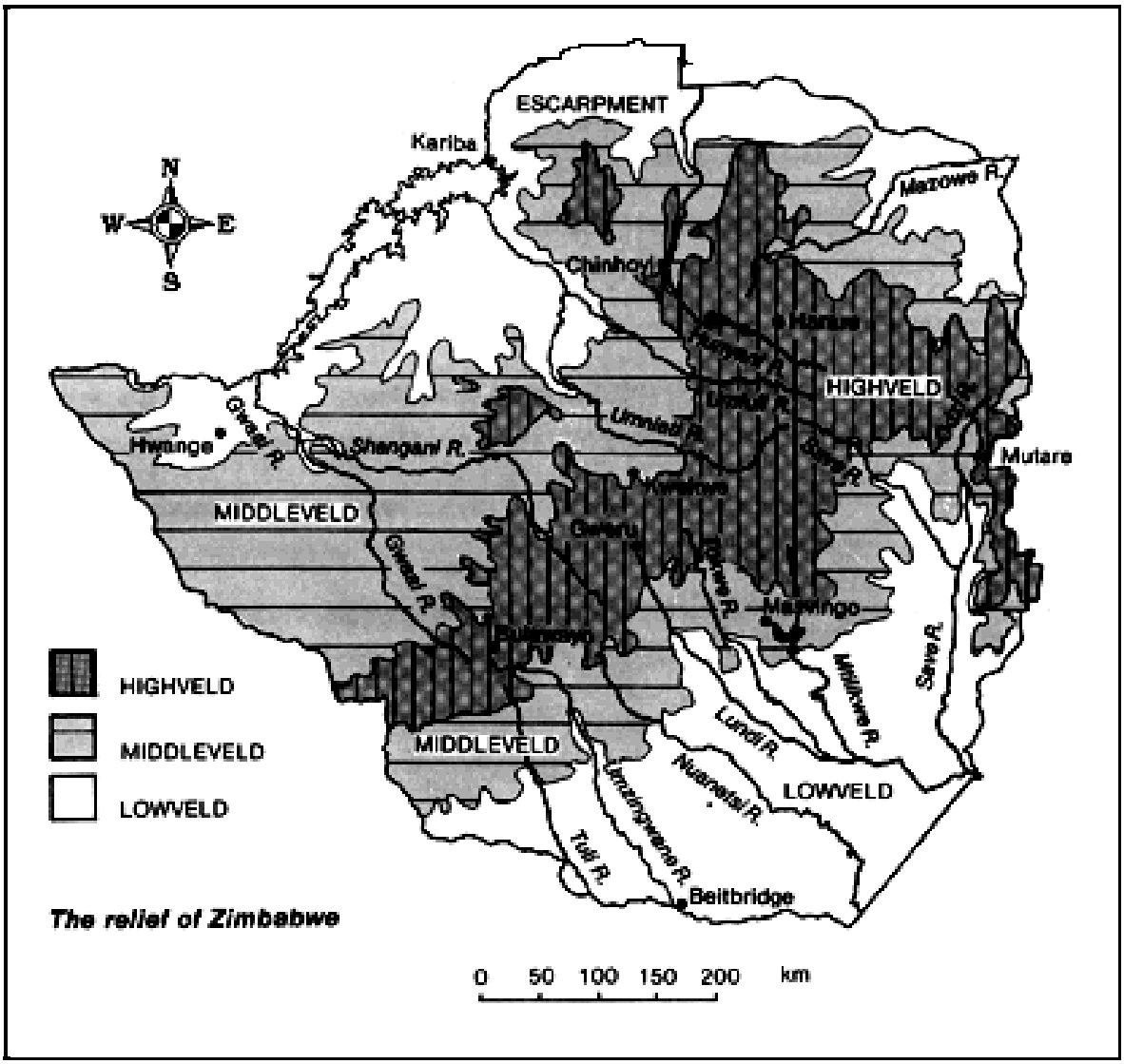

Figure 1.2: Relief regions of Zimbabwe (Source: Adapted from Musanga, 2009)

The National Health profile of the Ministry of Health and Child Welfare (2004) includes Harare and Chitungwiza districts as part of Harare Province while the Bulawayo Province only has Bulawayo as district. The state of people's health and health service provision are highly unequal among and within the administrative districts.

The country lies between longitudes 25° and 33°E, and latitudes 15° and 23°S. A large part of the country is elevated in the central plateau (highveld) which stretches from the

northeast to the southwest at altitudes between 1,200 and 1,600 m. The eastern part of the country is mountainous and the Nyangani mountain is the highest point at 2,592 m. Approximately 20% of Zimbabawe can be regarded as lowveld at an altitude of less than 900m. One of the world's largest and most famous waterfalls, Victoria Falls, is located in the northwestern part in the Zambezi River. The relief regions of the country are shown on the map in Figure 1.2. Zimbabwe has a wet season from about late October to March but severe storms are rare. The country has a subtropical climate sand the altitude has a moderating effect on the climate. According to Musanga (2009: 34) Zimbabwe however frequently experiences droughts.

1.11 Research Design

Research requires formal design and close adherence to defined systems of inquiry to be able to find new facts or collate existing ones (Trochim 2002: 1). Babbie and Mouton (2007: 74) define research design as a plan or blueprint of how a researcher intends to conduct the research. It is the overall approach to or an outline of the study that details all the major components of the research (Houser 2008: 183). A research design can therefore be visualized as the structure of the research or the plans and strategies developed to seek, to explore, and to discover relevant answers to a research problem.This section of the chapter deals with discussion of how data is going to be collected and analysed. The description of the area under study is also done in this section.

1.11.1 Data collection

According to Burns and Grove (2011: 41), data collection involves the gathering data relevant to the research purpose. The actual steps followed in data collection are specific to each study and are dependent on the research design and measurement methods. Data may be collected through observation, testing, measurements, questioning or recording, or any combination of these methods, and the researcher is actively involved in this process either by collecting data or supervising the data collectors. Geographical data can be obtained from field observations or through surveys or it can be obtained from

published or archival sources referred to as secondary data. Primary data can be obtained by making use of instruments such as interviews, questionnaires and direct observations. When data for the whole country is required, researchers mostly make use of published data such as population census data or data from reports of government departments.

The current research makes use of qualitative and quantitative data. The mixing of qualitative and quantitative methods has proved singularly useful with insights from in-depth interviews adding explanatory power to quantitative studies (Gatrell, 2002: 87). It is therefore advisable for a researcher to be eclectic or mix the tools so that the weaknesses of one tool are countered by others. The researcher endeavoured to reduce over-dependency on one tool and therefore data was collected through both quantitative and qualitative means. Interviews and questionnaires were used to gather primary data while secondary sources were also used. Such diversity of data contributes to the reliability of the results when proper data analysis is done.

In order to determine the spatial patterns of health in the country, the variables for which data was be collected are given in Table 4.2 in Chapter 4 of the current research. The variables are socio-economic in nature. Appendix A and B give the different questions that were asked to elicit both quantitative (Appendix A) and qualitative data (Appendix B). Questions in Appendix A were answered by the sampled residents in each district while questions in Appendix B were answered by health official in the Ministry of Health and Child Welfare of the country. Some of the primary data was collected through sample surveys conducted in each of the 61 Administrative districts of the country. Some questionnaires were posted whilst others were handed over to the respondents in person for completion. In the case of interviews, high ranking officials from the Ministry of Health were interviewed. More discussion is given in Section 4.2 in Chapter 4 regarding the choice of respondents and how data was collected. It is recognised that such interviewees did not constitute a representative sample of the population but information obtained through such interviews provided a more qualitative evaluation and a large body of

information on the health situation in the country. The data from these primary sources complements the data from secondary sources.

Secondary data for the identified variables were obtained from Zimbabwe National Statistical Agency (ZIMSTAT) and Ministry of Health and Child Welfare. These include published reports of the 2002 population census data (Central Statistics Office, 2004), published reports of the 1992 (Central Statistics Office, 1994) and published National Health profiles of 1994 (Ministry of Health and Child Welfare, 1994) and published reports National Health profiles of 2004 (Ministry of Health and Child Welfare, 2004). The use of secondary data in this research is necessary because it is difficult to obtain data for the whole country through primary means (direct measurement). Some of the data required is of a historical nature and was used to evaluate the evolution of the Zimbabwean health system.

1.11.2 Data Analysis

Data analysis is the systematic organisation and synthesis of research data and in quantitative studies data is used for testing of hypotheses (Polit & Beck 2008: 751). Various techniques are available to geographers for analyses of quantitative as well as qualitative data. The two methods of data analysis should augment one another as it is normally questionable to over-rely on one method. The current research made use of quantitative techniques (such as cluster analysis and composite indexing) as well as qualitative techniques (discussing information from interviews). A brief description of how data was analysed is given below but a more detailed discussion of the data analysis is given in Chapter 5.

1.11.2.1 Quantitative analysis

The second and third objectives of the research involve the demarcation of regions. The process of regional demarcation can be viewed as a special type of classification. Abler *et al.* (2002) holds that the purpose of classification is to give order to the things we experience. Cluster analysis is the method which was used to demarcate Zimbabwe

according to levels of state of people's health and health service provision in the regions (administrative districts). Cluster analysis has been used in geography of health and health related studies with significant success (Wishart 1978; Harner and Slater 1980; McGlasham 1981; and MacGlasham 1982). The technique encompasses a number of various methods and algorithms for combining objects of similar kind into specific categories. In an endeavour to achieve the second objective of the research, the administrative districts of Zimbabwe were demarcated into four clusters and an evaluation was done of the spatial pattern of health service provision in the country. In order to apply the adapted epidemiological model to the spatial health system of the country (objective three of the research), three clusters were created.

Some researchers (Vattani, 2011 and Honarkhah and Caers, 2010) have used K-means clustering, others (Zhang and Raichle*,* 2010 and MacGlasham, 1982) have used tree clustering (hierarchical clustering). In this research tree clustering (hierarchical clustering) was used to group administrative districts into clusters. Hierarchical clustering generates groups of objects which can be represented in a tree like structure called a dendrogram. The root of the tree consists of one cluster containing all observations, and the leaves correspond with individual observations. Hierarchical clustering can be either agglomerative, in which the researcher begins at the leaves and successively merges clusters together; or divisive, in which one begins at the root and recursively splits the clusters. Divisive clustering is a method of cluster analysis in which the algorithm is run repeatedly to divide clusters into sub clusters until a specified stopping point is reached (Sureshkumar *et al.,* 2013: 1748). This implies that divisive algorithms begin with the whole and successively proceed to divide it into smaller clusters. These are the ones that were used in the current study. The analysis was done with Minitab 17 Statistical Software (2010). Administrative districts were assigned into clusters (subsets) so that observations in the same cluster are closely similar to each other. This led to the successful demarcation of the country into health regions with the same conditions of health.

In addition to cluster analysis, composite index analysis was also employed. Composite indexing was employed in the examination of state of people's health (the first objective of

the research) and in the analysis of the evolution of the health system of the country (the fourth objective of the research). In each case, simple indices were calculated first and these were then combined into the composite indices. The full details of how the composite indices were calculated are described in Section 5.2.1.1 of Chapter 5.

1.11.2.2 Qualitative analysis

The current study is not purely in medical geography but it is in the broader health geography and this implies that it is not only grounded in positivism (hence quantitative data analysis) but incorporates other approaches (as indicated in Section 1.9). This means that for such a kind of study, quantitative analysis and qualitative analysis would augment one another. As alluded to in Section 1.11.2 of this chapter, there is a gap that quantitative analysis alone cannot address. According to Acheampong (2011: 175) the qualitative approach examines people‘s words and actions in narrative or descriptive ways more closely, representing the situation as experienced by the participants. In other words, to seek a better understanding of human beliefs, values and actions, qualitative analysis (analysing data from interviews) is necessary. Mackian (2000: 97) asserts that qualitative analysis allows us to understand the respondent’s experiences and what has shaped them. Qualitative analysis thus will afford the researcher a deeper examination and explanation of the nature of Zimbabwe’s health system.

While data obtained from secondary sources and questionnaire was analysed using quantitative methods, the data derived from interviews was analysed using qualitative methods. The qualitative analyses augmented the quantitative analyses. Quantitatively analysed data was useful in bringing out the generalised picture of the health status of the country. Interviews provide a richer body of information about health at the individual level. A total of 5 interviews were conducted with high ranking officials in the Ministry of Health and Child Welfare. As indicated in Section 1.11.2, more details of these interviews appear in Section 4.2 of Chapter 4. This means that combining both forms of analyses helped in bringing out the full interpretation and understanding of Zimbabwe’s health system.

1.12 Validity and reliability of the study

Validity considers the accuracy, meaningfulness and credibility of a study as well as its results and may be at external, internal or content levels. In the following section, the validity and reliability of this research are discussed. Validity is defined by Polit and Beck (2008: 457) as the degree to which an instrument measures what it is supposed to measure. To ensure results are generalisable, use was made of data from all the spatial units and administrative districts were used as spatial units, to increase the generalisability of the research findings.

The reliability study relates to the extent to which the designed instrument can be employed repeatedly under constant conditions and can produce the same results (Babbie; 2007: 143). This refers to the consistency, stability, and dependability with which an instrument of research is found to be free of error. Consistency or the potential for using an instrument, such as a face-to-face interview repeatedly, as in qualitative studies is questionable because the interviews are developed to be used for a specific study or for a particular group. This challenge was kept in mind during the planning of the interviews so that accurate description of phenomena under study was achieved. The reliability of the research instruments in the current study was assessed by conducting a pilot study before it was used for the study, to ensure that it was stable and consistent.

1.13 Ethical considerations

The College of Agriculture and Environmental Sciences Research and Ethics Committee gave ethical clearance for the study. In order for the researcher to comply with Zimbabwe Laws, authorization was obtained from the Ministry of Health and Child Welfare, to allow the researcher to access some health data from the health institutions. All the ethical principles were observed. The principles observed are those given by Polit & Beck (2006) and Stommel & Wills (2004: 377-378) and these are beneficence, respect for persons, privacy and justice. The issues defined below were particularly important to adhere to in the study.

1.13.1 Beneficence

Beneficence means doing good to the research participants as opposed to doing harm. The participants were the interviewees. The selection of such participants was based on the criteria of targeting officials who have in-depth information about the Zimbabwean health system. In this study, no emotional or physical harm was anticipated or expected, and participants and respondents were not exploited. The research proposal was approved by the Research Ethics Review Committee of the College of Agriculture and Environmental Sciences, UNISA, and no person or institution was harmed and no vulnerable people were used in the study.

1.13.2 Justice

In the context of research participation, justice encompasses the right to privacy and the right to fair treatment. This implies that, according to this principle, all participants should be treated the same and no group or individual should be treated in a different manner from others. In this study, the right to privacy and fair treatment were observed. Care was taken to treat the participants with fairness, and because the researcher had limited resources, no allowances were paid to any group. Those who took part during the research were kindly requested to voluntarily do so.

1.13.3 Confidentiality and anonymity

Confidentiality involves the ability to safeguard data and personal information gathered during the research and making sure that others who are not part of the research group, do not have access to the information. Completed questionnaires are kept undisclosed, in a safe place, to maintain confidentiality. This implies that findings of the research cannot be traced to participants at a specific location. Ensuring anonymity on the other hand, means that research participants can not be identified by name. In other words, the names of the participants were not made available to anyone in this study. Codes, rather than names, were used during the analysis of data. Complete anonymity was possible

since focus group discussions were not used but individuals were interviewed separately. The researcher did not link any names to data provided during the data analysis process and the reporting of findings.

1.13.4 Informed consent

As indicated by Holzemer (2010: 17), informed consent is the cornerstone of ethically sound research. It gives the participants the opportunity to make decisions without compulsion based on complete information. In this study, the purpose of the study was first explained to the participants and respondents before informed consent was obtained in writing form them. The respondents were treated as independent beings and they were told that they had the right to withdraw from the research if they so wanted without any restriction. Signing the consent form meant that the details of the study had been explained to the respondents, and that they were making informed decisions having agreed to take part in the research.

1.13.5 Privacy

The right to privacy is applied even after informed consent has been obtained, and should the respondent feel uncomfortable about the questions being asked, they have a right to refuse to respond to some questions (Holzemer 2010: 174). In this research, all respondents gave informed consent to participate. The right of respondents to privacy was taken into account as individually identifiable information was not used in the process of sharing results of the study with persons outside the research group or even during report writing.

1.13.6 Respect for persons

Respect for persons involves the right to autonomy and full disclosure. As was done in this research, respect for persons is practiced when the researcher explains the details of the study and obtains consent for the research (Stommel & Wills 2004: 373). At the same time, participants are treated as independent beings, appointments are kept, and the

researcher was flexible and provided the option to respondents for withdrawal at any stage during the study without being restricted or penalised. All the appointments made by the researcher were kept, respondents did not have to wait for the arrival of the researcher and they were treated as independent beings.

1.14 Problems in the research

Even with careful and effective planning for research, certain problems were inevitable during the research process. Problems were experienced in obtaining the relevant literature, during data collection, in the use of models or techniques formerly used by other researchers in the analysis of data. The current research is no exception and the problems encountered during the research are discussed in the following paragraphs.

Data on some important health variables such as GDP per capita per district and on prevalence rate per district of some diseases, for example malaria, cholera and HIV/AIDS per district that significantly influence the health pattern of Zimbabwe is either unavailable or if available, it is normally incomplete and outdated. The unavailability of some crucial data created some challenges in the current research. The problem of data unavailability in developing countries has been echoed by Nhandari (2008: 23) when the researcher indicated that research in developing countries is usually constrained by shortage and outdatedness of data. Related to this problem was the nature of the data that was available. In many instances, although censuses and surveys were done, the necessary data was either not yet readily available or such data was not available at the scale of the spatial unit of analysis that was used, the administrative districts. A census was held in 2012 in Zimbabwe but the data is not yet available for use in research. The trend in the country has been that, after a census has been conducted it takes two years for the data to be published. It is however hoped that the use of the 2002 data is good enough to be used for the examination of the country's health system. Besides, the primary data collected complemented the secondary data.

The composite index method was used in many stages of data analysis in the current research. It was used to analyse the spatial patterns of health in Chapter 5 and during the

analysis of the evolution of the health system of the country in Chapter 6. Even during cluster analysis, indicators were first converted into indices. Although the composite index method was an effective method of ranking the administrative districts of Zimbabwe during the analysis of data in both chapters, there were certain challenges. One of the challenges that emerged in the use of the composite indexing method was that all the indicators of health had equal weight in the measurement of the composite index of health. In reality, some indicators are more effective than others in the measurement of the level of health. A method whereby some indicators carry more weight than others would have possibly produced a different pattern of the spatial distribution of levels of health in Zimbabwe. It is acknowledged that such attaching of weights to indicators might be desirable but for practical purposes it is not an easy task to achieve. Weighting of indicators can create serious controversies among researchers as to how they should be weighted. The question that comes up is how should the researcher proceed weighting some indicators over numerous others? A demonstration of the limitations of weighting indicators comes from a research by Becker *et. al.* (1987). These researchers studied the standard of living of people in the 329 urban centres of the United States of America, based on indicators such as healthcare, climate, crime rate, and economics that are usually used to rank urban centres. Becker *et al.* (1987) discovered that, depending on the weights given to the indicators, there were 134 different urban centres that could be ranked first and 150 different urban centres that could be ranked last. Indeed, there were 59 urban centres that could be ranked either first or last, depending on the different types of weighting of the very same indicators. Researchers inevitably give differential importance to various indicators.

Through the use of the unweighted indicators, the spatial pattern of state of people's health emerged, as discussed in Section 5.2.1 of Chapter 5. The pattern could be explained by the existing socio-economic and physical conditions. Even though weights were not attached to indicators, it is believed that the use of the composite indices was successful in the examination of state of people's health in Zimbabwe.

As will be reflected in the conclusion of Chapter 5, the use of cluster analysis was successful. In the use of cluster analysis to demarcate the regions according to health service provisions, a similar problem occurred just like in using composite indexing. Indicators were treated as if they are homogeneous in terms of their contribution to quality of health service provision. If weights were attached to indicators, a different pattern of the spatial distribution of health service provision in Zimbabwe could possibly have emerged. The explanation as to why the weights were not attached to indicators was given in the preceding paragraph. Despite the failure of the researcher to apply the weighting of the indicators, it is believed that cluster analysis provided reasonable analysis for the successful demarcation of the regions.

1.15 Organisation of the thesis

Chapter 1: Introduction to the study

This chapter introduces the study and the research problem and background of the study are discussed. The assumptions, the research design, geography and geography of health, paradigms in health geography, research objectives, research questions, ethical consideration and organisation of the thesis is also a major issue to be explained in this chapter.

Chapter 2: Health Concepts, Models and Policy

In this chapter literature on some health concepts and health models is reviewed. The health models discussed are the epidemiological transition model, the adapted epidemiological transition model and the disease diffusion models which can be used in the analysis of health phenomena in space. The various policies that can be implemented to develop the health system of a country are also discussed.

Chapter 3: Global health situation: A comparative approach

In this chapter literature is reviewed pertaining to the health situation in developing and developed countries. A comparative approach is adopted in this chapter by comparing

research done in developed and developing countries. Special attention is given to the health situation in Zimbabwe as this is the area of study. Detailed literature review is undertaken on the health situation in Zimbabwe. Literature on health issues in selected developed and developing countries is also reviewed in Chapter 3.

Chapter 4: Indicators and data sources

In this chapter the data collection process (for both primary and secondary data) is explained. The indicators used for the measurement of the health conditions (both state of people's health and health service provision) as well as the temporal patterns of health in Zimbabwe are discussed. The sources of secondary data used are also discussed.

Chapter 5: Spatial distribution of health

In this chapter the analysis and interpretations of the data is explained. The data analysis gave rise to spatial patterns of health in Zimbabwe and these are examined and discussed. The chapter discusses the methods of data analysis that are used. Demarcation of the country into health regions is also explained. An attempt is made to apply the adapted epidemiological transition model to the spatial health system of the country. Such demarcation assisted in showing that the administrative districts of Zimbabwe are not at the same level of health development. Some parts of the country have relatively good health while others are lagging far behind in terms of health development.

Chapter 6: Temporal analysis of the Zimbabwean health system

The evolution of the health system of Zimbabwe is examined in this chapter. The researcher examines the evolution starting from the 1990s when data on all the indicators used in this study started to be available. The data is used to analyse the evolution of the country's health system. Based on pattern in 1992 and 2002, projections are then made for the period up to 2015.

Chapter 7: Synthesis, Recommendations and Conclusion

This is the final chapter of the thesis. In this chapter, an overview is provided of the main findings and conclusions drawn from the research. The findings are divided into those from the primary research (from data analysis) and those from the literature review. In this chapter, the researcher recommends policies/strategies for spatial development of health and reduction of health inequalities in Zimbabwe. Adjustments to policies or strategies that are already in use in Zimbabwe (for spatial health improvement) are suggested. New policies that have not yet been used in Zimbabwe are recommended. Finally, recommendations for further studies are given.

1.16 Conclusion

In this chapter a number of issues were covered to set the tone towards achieving the aim of the research on the temporospatial dimension of health in Zimbabwe. A general framework for the study was presented. The key issues include the background to the study, some assumptions, the statement of the problem, objectives and research questions, the research design, ethical considerations, some problems experienced in the research and the organisation of the thesis.

In chapter 2, the focus is on a review of literature on health concepts. Literature on concepts such as health, disease, health regions as well as concepts related to the magnitude of the disease prevalence rate such as epidemic, endemic and pandemic. Literature is also reviewed on health models. Finally, literature on health policies and strategies is reviewed.

CHAPTER 2

HEALTH CONCEPTS, MODELS AND POLICY

2.1 Introduction

Health is a multidimensional concept. There are many perspectives and dimensions to the concept of health. This makes the definition of the concept cumbersome, making the determination of the variables that affect health equally a difficult task. Such divergent views on what health is have inevitably given rise to lack of consensus on modelling health. Models of health, like other models, are open to criticism and this makes them require constant re-evaluation. Despite criticisms levelled against many of the models of health, those that deal with temporospatial aspects of health generally seem to strike the consensus that health varies from place to place and from time to time. An examination of the spatial patterns of health at all levels (global, continental, national and even local) generally manifests some inequality in the state of people's health and health services. Such inequalities are undesirable as they create social, economic and political problems. This calls for policy formulation so as to eradicate the spatial imbalances in health. The current chapter discusses concepts, models and policies in health geography. It starts with the discussion of the definition of the concepts of health and disease. This is then followed by discussion of the meaning of the concepts of endemics, epidemics and pandemics. Determinants of health are then discussed. This is followed by an examination of models of health. Finally, the various policies that can be implemented to develop the health system of a country are discussed.

2.2 The concepts of disease and health

A disease can be defined as an abnormal condition that affects an organism. It is usually understood as a medical condition associated with particular symptoms and signs. It may be due to conditions originating from an external source, such as infectious disease, or it may be as a result of internal dysfunctions, such as non-

infectious diseases. “In humans, "disease" is often used more broadly to refer to any condition that causes pain, dysfunction, distress, social problems, or death to the person afflicted, or similar problems for those in contact with the person” (Emson, 2007: 812). “In this broader sense, it sometimes includes injuries, disabilities, disorders, syndromes, infections, isolated symptoms, deviant behaviors, and atypical variations of structure and function, while in other contexts and for other purposes, these may be considered distinguishable categories” (Emson, 2007: 812). Diseases usually affect people physically and can also affect them emotionally, as living with a disease can change one's perception on life, and their character. Disease is classified as a natural cause of death. Diseases can also be classified as communicable and non-communicable disease. Communicable diseases can be called pathogenic diseases while deficiency, hereditary and physiological diseases are classified as non-communicable ones.

Although highly valued and pursued throughout the history of humankind, the concept of health has proved difficult to define and describe with any degree of precision. As alluded to in the introduction, the concept of health is cumbersome to define. Many perceptions surround the meaning of the concept of health. To many people, health is simply the absence of illness. Agere (1986: 67-68) classifies this approach as “contagionism” and health is merely taken to be “absence of disease”. To such people, poor health is synonymous with illness. This biomedically oriented approach to the concept of health has shown many deficiencies to the proper meaning of the modern health concept. There is a growing realisation that the traditional logical positivist approaches (firmly rooted in the biomedical model) to health research no longer provide questions and indeed answers for many health problems. It is without due regard to the social, economic and political factors within which health systems operate. This is a compelling vision that challenges the traditional biomedical approach to health. As a reaction to the criticism given against the contagionism approach to the definition of health, another approach emerged and Agere (1986: 67-68) classifies that approach as “anticontagionism” that tends to place sufficient emphasis on the socio-economic and political factors as being critical to the meaning of health. Basically, this is the approach

adopted by the WHO (1948: 100) that health is a state of complete physical, mental, and social well-being and not merely the absence of disease or infirmity. Overall health is, thus, achieved through a combination of physical, mental, and social well-being.

Despite the apparent convincing nature of the definition by WHO (1948), it has stimulated a significant amount of criticism over the years. Saracci (1997: 1409) for example argues that the WHO definition is utopian, rigid and impractical, and that including the term "complete in the definition" makes it highly improbable that anyone would be healthy for a reasonable period. Saracci (1997: 1409) further maintains that it also appears that 'a state of complete physical, mental, and social well-being' corresponds more to happiness than to health yet the two words have different meanings. They designate different life experiences whose relationship is neither fixed nor constant. Saracci (1997: 1409) therefore defines health as "a condition of wellbeing free from disease and infirmity, and a basic and universal human right". Bircher (2005) also has his share of criticism on the WHO (1948) definition. The Scholar argued that the definition lacks consideration of the changing health needs of people especially in relation to gender, culture, age and personal responsibility.

In spite of the criticisms leveled against the WHO (1948) definition of health, it serves to provide very valuable insights to the concept of health given its multidimensional nature. The multidimensional nature of the definition of health is also acknowledged by other scholars. Bircher (2005: 336), for example, defined health as a state of wellbeing that is dynamic and characterised by a mental, physical and social potential, which satisfies the demands of a life in relationship with age, culture, and personal responsibility. The term potential appears to be appropriate, as it contains all future capacities to cope with these life demands. This implies that a person in good health has much greater future potential to respond to all sorts of problems than a person who has poor health or with a disease. The current study asserts that health should be regarded as a multidimensional phenomenon with physical, mental and social aspects to it.

2.3 Pandemic, endemic and epidemic

Generally in health and epidemiological studies in particular, the terms endemic, epidemic and pandemic are normally confusing. These terms are often used interchangeably, yet they mean different things.

2.3.1 Endemic

A condition needs not affect a majority or even a very large number of people in a population to be considered an endemic. An endemic condition is one characteristic of a particular region, population, or environment. Endemic diseases are normally associated with intermittent preventive treatment because their frequency and rate can be predictable. Endemic means that a disease occurs persistently and at a predictable rate in a particular location or population (Sithole, 2001: 123). This means that the practice of giving drugs at regular intervals to a population at risk in an area of endemic disease regardless of whether the individual is already infected or not, is essential in order to prevent the severe effects of the disease. “In epidemiology, an infection is said to be endemic in a population when that infection is maintained in the population without the need for external inputs” (WHO, 2008a: 22). In such a situation, the disease does not disappear but the size of the infected population does not increase exponentially. The disease is considered to be in an endemic steady state.

2.3.2 Epidemic

According to Green *et al.* (2002: 3), in epidemiology, an epidemic is considered to exist when new infections of a certain disease, in a given population, and during a given period, considerably exceed what is anticipated, based on past experience. To visualise an epidemic, one could take an imaginary example of many people contracting the same disease in a particular location. More infections emerge throughout the region, but the concentration remains confined to a small area or in a few locations. In the location where the disease occurs, the infection rate remains higher than would usually be anticipated. This is an example of how an epidemic occurs. In epidemiology, an outbreak is usually taken to be synonymous to epidemic, but the general public usually

considers outbreaks to be more local and less serious than epidemics (Green *et al*., 2002: 3). According to Flegal (2006:72) the crucial defining aspect of an epidemic is whether the cases, regardless of their number, exceed 'normal' expectations. Flegal (2006:72-73) further argues that for a condition (disease) to be considered to be epidemic, there must be high prevalence and rapid increase in the spreading of the condition.

The factors which influence the outbreak of epidemics include contaminated food supplies such as infected drinking water and the migration of populations of certain organisms, such as tseteflies and mosquitoes, which can operate as disease vectors. Certain epidemics are seasonal in nature: for example, whooping-cough occurs in spring, whereas measles are common in winter. Influenza, the common cold, and other infections affecting the upper respiratory tract, such as sore throat, occur largely in the winter. "There is another variation, as regards the number of persons affected and the number who die in successive epidemics: the severity of successive epidemics rises and falls over periods of five or ten years" (Green *et al.*, 2002: 4).

2.3.3 Pandemic

According to Taubenberger and Morens (2009: 188), the term pandemic refers to a disease that extends over large geographic areas. A pandemic also affects more people than an epidemic. An epidemic is specific to one urban centre, region or country, while a pandemic goes much beyond the national boundaries. Simply put, when an epidemic gets out of hand it is called a pandemic. It is a disease or infection that affects or attacks population in numerous countries, regions, continental and even globally. Taubenberger and Morens (2009: 188) for instance, indicate that the 14th-century plague (the Black Death), cholera, influenza, and human immunodeficiency virus (HIV) AIDS are examples of pandemics. It is essential to take into account the geographical scale when defining a pandemic. This is also echoed in Hays's (2005: ix) definition of a pandemic as a disease that occurs on a very wide geographical scale or perhaps world scale.

2.4 Determinants of health

Roemer (1997: 1539) categorised the determinants of health into four groups as shown in Table 2.1. Roemer (1997: 1539) argues that by providing adequate housing, sanitation and portable water and by ensuring increased education with commensurate

Table 2.1: Determinants of health (Source: Adapted from Roemer, 1997)

Social environment	**Physical environment**	**Health services**	**Personal traits**
Education	Geography	Health promotion	Genetic background
Occupation	Climate	Disease prevention	Immunity
Income	Water	Treatment	Habits
Relationships	Food	Rehabilitation	Age
Urbanisation	housing		Sex / Gender

increased income, governments actually improve the health status of communities. Similarly, the health system adopted by governments should not only promote good health and disease prevention, but also provide reasonable access to treatment in the event that people fall ill and subsequently require rehabilitation (Roemer 1997: 1539, Daniels *et al*., 2000: 740-749). According to Roemer (1997: 1539), personal traits (given in table 2.1) are also important determinants of health.

In agreement with Roemer (1997), Van Rensburg (2004: 6) argues that the socio-cultural environment affects health. Van Rensburg (2004: 6) introduces the concept of *extraneous* (external) political factors: the financing and actual health delivery system, the degree of state control versus autonomy in the healing professions, and the degree of regulation or deregulation, bureaucratisation, centralisation or regionalisation in health care.

WHO (2010: 8) maintains that the main determinants of health are the socioeconomic environment, the physical environment and the personal characteristics of the individual and behaviour. Generally, the context in which an individual lives is of great significance to his quality of life and status of health. The socioeconomic environment is a key factor in determining the status of health of individuals. Thus, good health is not only maintained and improved through the improvement and application of health science, but also through the efforts and intelligent lifestyle choices of the person and society. This implies that people can voluntarily control part of their health but that there is a part that cannot be voluntarily controlled.

The physical environment is one of the most essential factors that should be considered when determining individual health status. This includes factors such as uncontaminated air and water, safe roads and houses all contributing to good health. The United Nations (2006: 3) maintains that water quality is a major environmental factor affecting health, especially for the health of infants and children in less developed countries. In the more developed countries however, the situation is different. Research has shown that in those countries, the lack of neighborhood leisure space that includes the natural environment leads to lower levels of neighborhood contentment and higher levels of obesity; thereby, lowering the overall wellbeing of the person (WHO, 2010:17). This implies that the positive psychological benefits of natural space in urban environments must be taken into account in urban development policy and land use planning.

Human biology is also important when considering the health of a person. “Human biology refers to the biological or genetic constitution that determines how the human body primarily functions to maintain a healthy state and how it responds to other, mainly exogenous, determinants of health” (Arah *et al.,* 2006: 6). This implies that the habits and behaviour of individuals develop during their life and particularly in terms of lifestyle choices are closely related to human biology or genetics. For example, individuals who come from families whose members have a more active lifestyle and follow healthy diets, non-smoking and non-alcohol consumption are more likely to follow the same pattern in their life. The relationships that one has with the family and friends can have a big impact

on one's general health. Genetics can also determine the ways in which individuals cope with stress. Moreover, the World Health Organisation came up with a list of other factors that can affect the well being of an individual. According to WHO (2010: 12), health services, gender and social support services, in terms of quality and access to them are appropriately regarded as determinants of health.

According to Braveman (2003: 181) healthcare refers to all the main aspects of health service provision, including not only utilisation but quality, funding, and distribution of resources. One of the major determinants of health is access to healthcare and this may be even much more important than the quality of the service. People in less developed countries are more prone to suffer from different health problems because their access to the healthcare system is subject to limited financial resources. Such a restriction makes their health poorer compared to their counterparts in developed countries.

Arah *et al.* (2006: 6) argue that, health is determined by many interdependent factors, one of which is healthcare. The factors, as well as their interdependence, are illustrated in Figure 2.1. This multi-determinant approach to health is mainly based on Evans and Stoddart's (1990) seminal paper. The non-health care determinants were basically grouped into three major fields namely: environment, lifestyle, and human biology. Arah *et al.* (2006: 6) define *environment as* both physical and social (living) conditions of human existence, and how these improve or disturb health. *Lifestyle* refers to the life choices related issues such as feeding styles, drinking, smoking, and other habits and behaviour, as well as education or knowledge-based activities that affect health and illness (Arah *et al*., 2006: 6). Human biology and healthcare have been defined in the previous paragraphs of the current section. Besides its direct effects on health and illness, *health care* can act indirectly on the other determinants of health to sustain or improve health. Healthcare has some influence on human biology (for example, through the pharmacodynamics of anti-hypertensive drugs) and the host–environment interaction (such as drug effects on biological pathogens of diseases in the person's body). In Figure 2.1, 'response' refers to the person's biological and psychosocial reaction to the constellation of the determinants of health, acting separately or in combination.

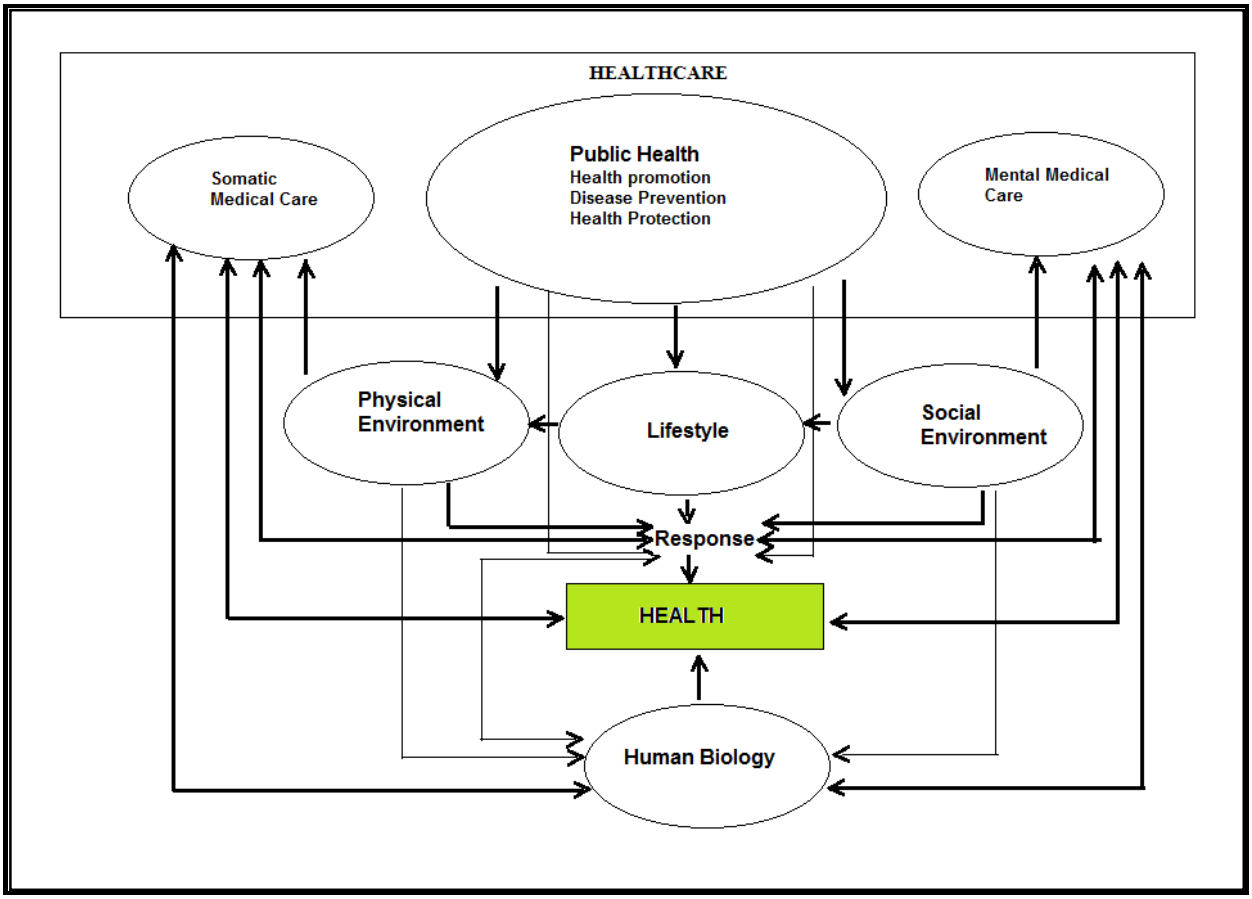

Figure 2.1: Health determinants model (Source: Adapted from Arah *et al.*, 2006)

Arah *et al.* (2006: 7) maintain that, while the determinants of health affect health status, there are linkages between the health care system and other health determinants which are of three main types, namely:

(i) between healthcare and health (shown in Figure 2.1 by the arrows connecting the healthcare and health spaces, as well as those running through 'response');

(ii) between healthcare and non-health care determinants (shown in Figure 2.1 by the arrows connecting the healthcare system and the non-health care determinants.

(iii) non-healthcare determinants and health (shown in Figure 2.1 by the arrows connecting the environment, lifestyle, and human biology to the health space, mainly through the 'response' box).

The determinants of health highlighted in the current section, while serving as useful indicators of what affects people's health, however, suffer the problem of context stripping. Context stripping refers to consideration of the health of people detached from the society and societal structures within which they live (Lincoln and Guba, 2001). According to Lincoln and Guba (2001: 22), the individual's perceptions, behaviour, values and health status become far detached from the complex environments including the communities to which they are linked. Despite such a weakness of the approach in generalising the determinants of health, the notable advantage of such an approach is that it works with what is measurable and observable. In addition, results drawn from large numbers are easy to verify and credit. The current research, however, mixes the positivist approach with other approaches.

2.5 Regions and health regions

While historians divide time into periods or eras, the geographical equivalent of that are regions. Geographers have found it necessary to divide the total geographical space, which they study, into units or subdivisions in order to facilitate description and analysis. Subdivisions of this kind are necessary in any discipline or in fact in any activity. A region is a basic analytical tool which geographers use to facilitate their work (Conyers, 2001). In geography, the basic unit or subdivision is usually called a region. A region can be defined as a unit of geographical space identified for a particular purpose (Conyers 2001:10). This is a broad definition designed to incorporate most types of regions. It emphasises two main characteristics of a region: a region as a unit of geographical space and a region identified for a particular purpose. The fact that regions are important basic analytical tools has led to many geographers undertaking regional demarcations. Many geographers have done quite a lot of regional demarcations. An example of regionalisation in the demarcation of ecozones is by Schultz (2005), and in the demarcation of environmental domains is by Coops *et al*. (2009).

2.5.1 Regional demarcation methods

There are various methods available for regional demarcation in geography. Ginsburg (1986) developed a methodology of sophisticated numerical techniques for regionalisation and various geographers have applied these techniques to demarcate regions in different parts of the world. The techniques include the application of principal component, cluster and discriminant analyses as used by Harmse (2004) and the application of cluster analysis as used by Sugumaranet *et al*. (2009) and Li and Wei (2010). These multivariate techniques require an exact data base in the form of matrix in which each variable is numerically measurable. Multivariate analysis can only be done with programmes such as SPSS or Minitab. In the current study, multivariate analysis and cluster analysis in particular, was used. The Minitab programme was used to perform cluster analysis. The preference for Minitab over SPSS is motivated by the fact that the data used were already quantitative in nature. There was therefore no need to convert the data from being qualitative to quantitative as is often done when using SPSS. Before data were used in cluster analysis, indices were first calculated. The details of the regions that were demarcated are found in Section 5.3 of Chapter 5.

There are many geographers who have used these indices in regional demarcations. Liebenberg (1993) used the composite index method to demarcate African Countries into development regions. The researcher demarcated the African countries into four categories of development regions using quartiles. The researcher used twenty (20) variables (as indicated in Sections 4.4.3, 4.5 and 4.6 of Chapter 4) to demarcate countries of Africa in development regions. Conyers (2001) demarcated the Zimbabwean space economy into development regions. The researcher used nine variables and ranked the census districts of Zimbabwe according to the level of socio-economic development.

2.5.2 Types of regions

There are many types of regions. Geographers and regional scientists, however, normally recognise three main types of regions, namely: polarised (functional), homogeneous (formal) and administrative regions (Conyers, 2001: 26). These three different types of regions serve different purposes and are demarcated in different ways.

A homogeneous region is a spatial unit that is uniform in nature. In other words, there is relatively little variation from one part of the region to the other. A homogeneous region does not have to be uniform in all respects; it is only uniform in terms of the particular characteristic, of concern. Thus, a homogeneous topographical region is one in which the topography or relief is the same throughout the region but other characteristics such as population distribution may not be necessarily the same. Glasson (1978: 145) calls homogeneous regions formal regions.

Polarised regions are often called nodal or functional regions. Feldman *et al*. (2005: 4) described polarised regions as an area defined by economic and business activities rather than by administrative or historical factors. A polarised (nodal or functional) region is a spatial unit in which the functional parts are interrelated (Conyers, 2001: 33). It demonstrates a certain functional interdependence and coherence of parts. The urban region is an example of a polarised region. In an urban region the central point is the urban centre and the movement of people, goods and services link it with its hinterland (Figure 2.2). The boundary of the urban region is the boundary of the hinterland. For example, the New York metropolitan area is a functional region that spans over several states in the United States of America. It is connected by patterns of commuting, flows of trade, broadcasts of radio and television, newspaper circulation, movements for recreation and entertainment. Other examples of functional regions include those involved in shopping centered on shopping centres or supermarkets, areas served by banks, ports and their spheres of influence. According to Nel *et al*. (2008: 133) functional regions represent the day-to-day regions in human lives, for example, they are products of the different decisions and preferences of individuals and enterprises. This implies that functional regions are phenomena arising from human activity, and can be defined as a community of interests. The region has a distinct core and retains a particular attribute which diminishes outwards. To be recognised as a functional region, at least one form of spatial linkage must exist between the core and all other parts of the region. A polarised region is organised around a core, with the surrounding sphere of influence connected to that core by transport systems, communication, or other economic relationship involving such activities as manufacturing and retail trading.

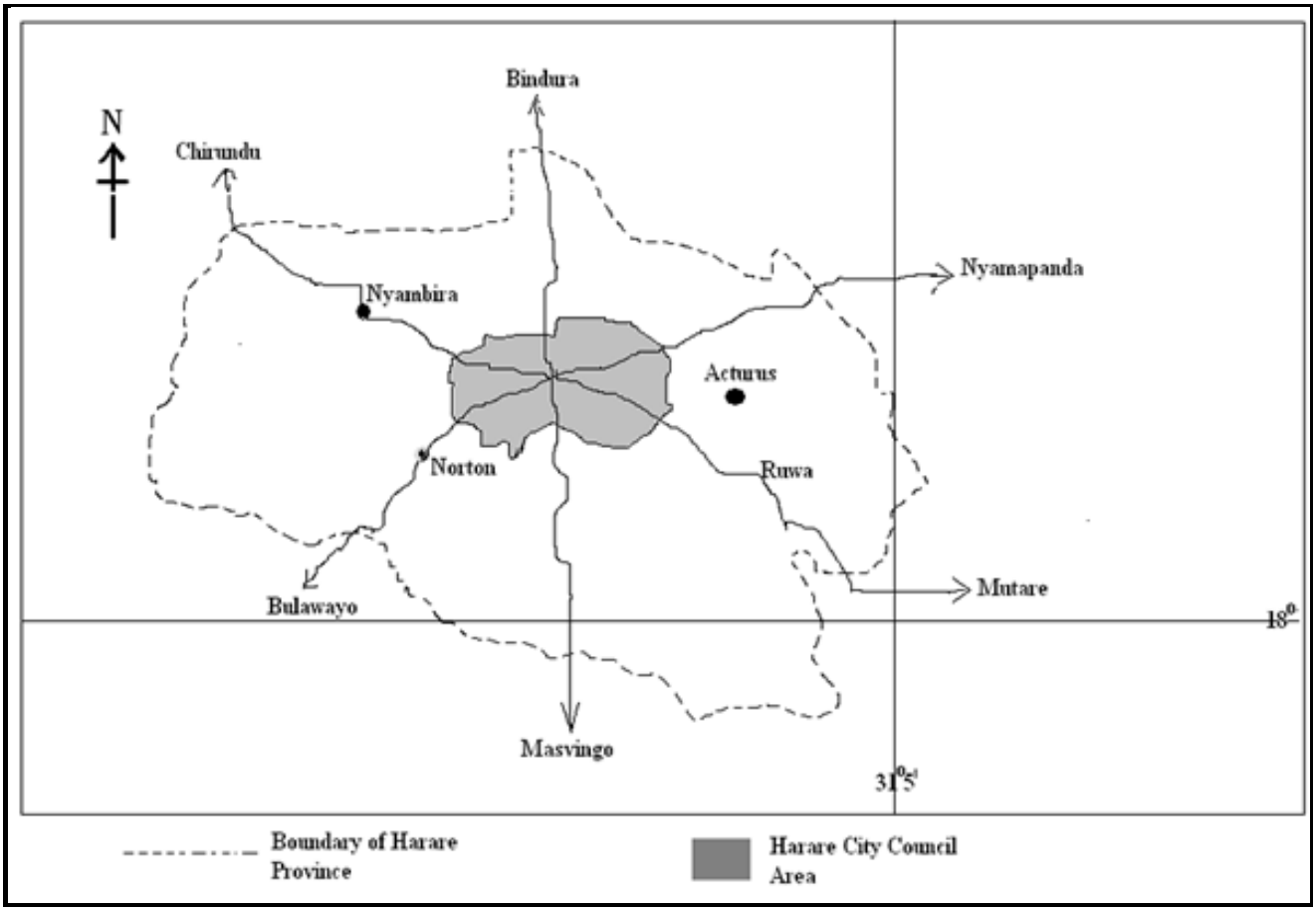

Figure 2.2: Greater Harare Area Polarised Region (Source: Adapted from Conyers, 2001)

Nel *et al*. (2008: 134) hold that administrative regions are demarcated on political or ideological basis. The exercise of power is a central feature of human society and this inevitably justifies the emergence and existence of jurisdictional or administrative units. Countries, continents also, and even the world, is subdivided into administrative regions. In a country such as Zimbabwe, the main administrative subdivisions today are provinces, districts, villages and wards (Conyers, 2001: 40). Whatever variation such regions may have in scale and complexity, one thing differentiates them from other types of regions, that is, they are demarcated for a specific purpose. As indicated by Conyers (2001: 44), the concept of an administrative region is, therefore, different from that of other regions in that it is defined not on the basis of characteristics or the way it functions but on the basis

of the purpose for which it is used. In the field of political geography, regions are closely related to administrative regions. A term that can be used interchangeably with administrative regions is political regions. Political regions tend to be based on political entities such as sovereign states, subnational divisions such as provinces, countries, districts and multinational groupings, including formally defined groupings such as the European Union, the Association of Southeast Asian Nations, and NATO, as well as informally defined regions such as the Third World, Western Europe, and the Middle East. Effectively the description of political regions has minimal or no deviation from that of administrative regions as given above.

2.5.3 Health regions

The geography of health (as a sub-discipline of geography) makes use of what are called health regions. The implication here is that the geography of health is not an exception to the use of the regional concept. Subdivisions of this kind are useful as they serve certain functions and are demarcated for specific purposes (Conyers, 2001:38). The world over (in developing and developed countries), the concept of health regions is becoming increasingly important. Statistics Canada (2009:4) defines health regions as geographic entities or administrative areas by which health and health related data are generated. Thus, health regions represent spatial units of responsibility for health authorities and hospital boards. In some countries, health regions coincide with census district or administrative districts. In others, however, such correspondence is lacking. In Zimbabwe, the research conducted by Chazireni (2003) indicated that development regions generally coincide with administrative spatial units. The convenience of such correspondence is that some information (for example, demographic) collected for census purposes may end up finding its use in health and health related analysis. In some countries there can be a mixture of correspondence and non-correspondence. Statistics Canada (2009), for example, indicates that largely in Canada, health regions coincide with administrative or Census districts, especially in the Atlantic Provinces, Ontario and Quebec (with slight exceptions in northern Ontario). Health regions in the western provinces rarely match census division and census subdivision boundaries. Comparatively, the western provinces

have low population densities and that is why one health region can cover a large area which is more than one census division. According to Statistics Canada (2009: 19), 62% of the Canadian population lives in Quebec and Ontario provinces.

In a study on the temporospatial analysis of mortality inequalities and healthcare in China, Li and Wei (2010: 767-787), demarcated the country into health regions. The authors applied GIS-based spatial statistical methods and multilevel regression analysis to detect temporal and spatial patterns of health care (hospital beds per 10000 persons) and mortality (deaths per 1000 persons), and demarcated the country into health regions. It emerged from the research that health conditions (healthcare and mortality rate) in China are characterised by inequalities. Li and Wei (2010: 780-781) have also demonstrated that during the period from 1990– 2008, healthcare and mortality were evolving in China. The findings suggest that both mortality and regional health inequality decreased and healthcare improved during the period.

Guimarães (2007: 97-98) demarcated Brazil into three health regions based on variation in disease distribution and accessibility of healthcare. More specifically, the variables used are: the prevalence rate of infectious diseases, the prevalence rate of chronic diseases and the level of healthcare accessibility. According to the demarcation by Guimarães (2007: 97-98), the region to the northern part of Brazil has higher prevalence of infectious diseases and less accessibility to health services. The region to the southern part of the country has higher prevalence of chronic diseases and more accessibility to health services. Between the northern and the southern regions, there lies a large diversity of situations in terms of standard of living and accessibility to healthcare services (Guimarães, 2007: 98). Both infectious and chronic diseases are found in the central part of the country and health care accessibility is moderate. It is evident from the demarcation that the Brazilians who live in the southern part of the country have better health care accessibility and less infectious diseases than their northern counterparts. In the southern part of the country, life expectancy is 20 years above that in the north (Brasil, 2004). This generally implies that the southern part has better health conditions than the northern region.

2.6 Models of Health

The real world is very complex. In trying to make sense of the structure of the real world, geographers often attempt to simulate reality by substituting similar but simpler forms for those that they are studying (Haggett, 1983: 18). A model is a simplified representation of reality. A model is, therefore, not reality but simply human construct to help us better understand the real world. Various geographical phenomena can be represented by models and health is not an exception. There are various health models. In the current section, there is discussion of the Epidemiological Transition Model, models of health care and Disease diffusion model. These models are all primarily concerned with the health and disease dimensions of health.

2.6.1 Epidemiological Transition Model

The Epidemiological Transition Model was postulated by Omran in 1971 (Omran, 2005). Conceptually, the theory of epidemiologic transition concentrates on the complex change in patterns of disease and health and on the linkage between these patterns and their demographic and socioeconomic determinants and consequences (Omran, 2005: 732). He further asserts that ample evidence exists to support the transition in which degenerative and man-made diseases replace pestilence and famine as the main causes of morbidity and mortality. This means that, an epidemiologic transition has developed parallel to the demographic and technologic transitions in the more developed countries of the world and is still in progress in less-developed ones. According to Omran (1983: 305), epidemiological transition is a phase of development in which there is a sudden increase in population growth rates caused by medical innovation in disease or illness therapy and treatment, followed by a re-stabilising of the growth of population due to declines in fertility rates. This implies that, improvements in healthcare and medicine such as antibiotics, reduces infant mortality and increases the average life expectancy which, coupled with declines in fertility rates, reflects a transition to man-made and degenerative diseases as the major causes of mortality. Omran (1983: 312) argues that this transition may also be associated with the structural changes in the economy or sociological adjustments associated with migrations of people from rural to urban areas, and a shift from primary

based production to technological and tertiary-sector-based economies. Man-made and degenerative diseases, however, became major causes of death.

The aim of Omran (2005) on the epidemiological transition was two fold. First, he attempted to crystallise and unravel the determinants as well as consequences of health and disease changes in different socioeconomic contexts. Secondly, he aimed to shed light on the health and disease challenges of developing countries and to provide information needed to treat those problems

2.6.1.1 Ages of the Epidemiological Transition Model

Omran (2005) divided the epidemiological transition model into three ages and these are:

- **The age of Pestilence and Famine**

For all practical purposes, the age of pestilence and famine represents an extension of the pre-modern model of health and disease (Omran, 2005: 737). This implies that, in this stage, the major causes of mortality are the Malthusian "positive checks," namely, epidemics, wars and famines. According to Omran (2005: 737), during this age mortality is high and fluctuating, preventing chances of sustained population growth, with low life expectancy of between 20 and 40 years. In early pre-agricultural history, infant mortality rates were high and average life expectancy low. The age of pestilence and famine in Omran's model can be exemplified by many of the Sub-Saharan African nations where life expectancy in those countries remains relatively low, and typically not exceeding 30 years of age (Corruccini & Kaul, 1983: 49).

- **The age of Receding Pandemics**

According to Omran (2005: 737), the age of receding pandemics occurs when mortality declines increasingly; and the rate of decline goes faster as epidemic peaks become less frequent or disappear. The mean life expectancy at birth rises steadily from about 30 to about 50 years (Omran, 2005: 737). This age involves improvements in medicine and the developments in the healthcare system. The discovery of penicillin during the mid 20th

century is one treatment breakthrough of note. This has led to widespread and dramatic declines in mortality rates from previously deadly diseases such as syphilis. Omran (1983: 310) states that during the period from the 1950s to the 1970s population growth rates rose by about 1.8% per year with the world gaining a population of about 2 billion between the 1950s and the 1980s alone.

- **The age of Degenerative and Man-Made Diseases**

Omran (2005: 737) asserts that, this age occurs when death rate continues to fall and ultimately approaches stability at a comparatively low level. The average life expectancy gradually rises until it exceeds 50 years (Omran, 2005: 737). It is during this phase that fertility starts to be a significant factor in population growth (Omran, 1983: 310). Death rate continues to fall and ultimately gets to stability at a comparatively low level. Omran's third age occurs when fertility rates decline from high positive to stable replacement rates. The transition basically represents the net effect of people's choices on family size and the capacity to put into practice those choices. Omran (2005: 738) asserts that there is a huge decline in communicable diseases and at the same time, an increase in degenerative diseases during this age.

2.6.1.2 Variations in the Epidemiological Transition Model

Omran (2005) acknowledged that there are three basic models of the epidemiological transition which vary in pattern, rate, determinants and consequences of demographic change. The models are: the classical or western model (western countries); the accelerated model (e.g. Japan, eastern European countries); and the contemporary or delayed model (developing countries). Every country is, however, unique in its pace of transition due to numerous political and socioeconomic and geographical factors. Caselli (1996: 107) observed that critics argue that, at the time Omran (1971) was developing his theory of epidemiological transition, prevailing events seemed to validate his views. Developing countries, in transition, were predominantly experiencing infectious diseases, but they showed signs of approaching conditions in the developed countries. Developed countries, on the other hand, experienced too low incidences of infectious diseases that

any further reduction could not lead to any considerable gain in the average life expectancy. Caselli (1996:108) asserts that, what was feared at the time was that the increases in average life expectancy might be lost because of the increase in degenerative and man-made diseases. For example, these problems seemed to be more likely than the prospects of new progress in regions then thought to be governed by the unavoidable degeneration of age, such as cardiovascular diseases. “Towards the end of the 1950s, life expectancy in the United States had reached a threshold of about 70, and Russia and Japan were close to reaching that level” (Caselli, 1996:108).

According to Caselli (1996: 108), some scholars generally argue that what Omran's theory could not anticipate was that the increase in man-made diseases would be restrained by efficient policies, and that a medical revolution would occur in the curing of cardio-vascular diseases. Towards the end of the 1960s, this revolution gave rise to increases in average life expectancy in countries where it had reached or even gone beyond 70 years (Caselli, 1996: 109). Countries which reached the age of degenerative and man-made diseases were not all able to embrace the medical revolution in the treatment of cardiovascular diseases. In the mid-1960s, average life expectancy in countries of Eastern Europe and the USSR, on the contrary, began to stagnate or even decline, due to an increase in death rate from cardiovascular diseases and to the spread of man-made diseases (linked in particular to alcoholism and accidents). The less developed countries experienced health transition much latter, and by the early 1950s, their average life expectancies were considerably lower than those of the developed nations (Caselli, 1996: 109).

However, once again this pattern has many exceptions for the less developed countries. Though the fight against communicable diseases, especially tropical ones, was at first successful, some countries, mainly in Africa, were unable achieve such progress. According to Timeus (1998), during the 1980s and 1990s, this pace of progress for some African countries began to slacken and in some cases all progress even ceased. For example, Nigeria, which started at the same level as Tunisia in the 1950s, was far less successful than the latter. “Today, life expectancy in Nigeria is 20 years shorter than in

Tunisia. Worse still, and this is particularly true of Africa, the arrival of AIDS often caused severe reversals and towards the end of the 1980s, life expectancy levels suddenly dropped" (Timeus, 1998: 17). According to Timeus (1998: 17), this was the situation in Zambia, the country lost 11 years of life expectancy between 1980-1985 and 1995-2000, Zimbabwe lost almost 17 years of life expectancy during the same period. Today, Zambia's life expectancy has fallen to its level of the early 1950s, that is, to 40 years, while the life expectancy Zimbabwe has dropped far below its 1950 level (42.9 as compared to 47.7) (Timeus, 1998: 17).

This research is not the first to apply the Epidemiological Transition Model to the spatial health system of a region in Africa. Agyei-Mensah and Aikins (2010) have applied the model in Accra, Ghana. The difference between Agyei-Mensah and Aikins's (2010) research and the current one, however, is that, the former is concerned with a city while the later is concerned with the whole country. Agyei-Mensah and Aikins (2010) examined the epidemiological changes that took place in Accra, Ghana during three time periods: colonial (1877-1957), post-independence (1957-1982) and adjustment program (1983-2007) Accra. The post-adjustment period is the period following the introduction of the Structural Adjustment Program in Ghana. Agyei-Mensah and Aikins (2010: 893) assert that there is concurrent existence of communicable and chronic diseases in Accra. The concurrent existence of communicable and chronic diseases had been manifested since the establishment of specialist health services in the 1920s, but became evident and gained more public health significance in the 1960s as hospital records on morbidity and mortality became more readily available (Agyei-Mensah and Aikins, 2010: 893). It emerged from the study that while wealthy communities are at higher risk of non-communicable diseases, poor communities are at higher risk of communicable ones and a double burden of infectious and chronic diseases in the same city.

It is important to take note of the fact that while the Epidemiological Transition model can be applied to the transition of the country as a whole, it can also be applied to the sub-national level. Different regions of the same country can be at various stages of the Epidemiological Transition Model (Dirwai, 2002: 18-23). Dirwai, (2002: 18-23), managed

to demonstrate the linkage between level of development of regions in a country and the type and nature of diseases experienced in those regions. It emerged from the study that the less developed regions of the country are characterised by certain diseases, the infectious ones. This means that they are at the early stages of the Epidemiological transition model. The regions that generally have these infectious diseases, according to Dirwai (2002), are predominantly rural. The more developed regions (predominantly the urban ones) are largely characterised by degenerative diseases and therefore in the late stage of the model. These, according to the study, generally emerged in the big cities in the country. According to Dirwai (2002), the moderately developed regions of the country are then characterised by a mixture of degenerative and infectious diseases.

The fact that there is a significant amount of criticism levelled against the epidemiological Transition Model should not mean that the model can now be discarded. It is argued in the current study, that despite some shortcomings of the model, it serves to show the general trend experienced by countries as they develop from the Third World to First World status. Like any other model, it is a generalised representation of reality.

2.6.2 Spatial disease diffusion models

The disease diffusion model needs attention in this study because the model is used to explain how diseases, infectious diseases in particular, spread in space. The idea of demonstrating the spreading of disease using a diffusion model is relatively modern, compared to earlier methods of disease mapping, which are still used today (Walter, 2000: 225). The point of departure for this model is that disease, like any other phenomenon in space, is subject to spreading out from one point (the source) to another as long a gradient in disease incidence exists between the source and other areas. Disease diffusion occurs when an infectious virus or bacteria is transmitted to a new location (Cromley and McLafferty, 2002: 190). It implies that a disease spreads out from a central source. The diffusion of diseases can be explained in three patterns and these are expansion, relocation and combined diffusion.

2.6.2.1 Expansion diffusion

Expansion diffusion refers to the spreading of a phenomenon or innovation through a population in an area, in such a way that the number of those influenced grows progressively larger (Walter, 2000: 4). While such diffusion can apply to phenomena in general, health phenomena are, and disease in particular is not an exception to this. Walter (2000: 4) maintain that, in this expansion process, the disease that is diffusing remains, and often intensifies, in the originating region, but new areas are also affected by the disease in subsequent periods. The implication of this is that initially, the diffusing phenomenon is small in magnitude but as diffusion progresses, it becomes continuously larger. It is easy to conceptualise such progressive growth by imagining how veldfire spreads. It can start with a match stick fire but thousands of hectares can burn within some hours. Once the fire has started it cumulatively grows out to other areas. Expansion diffusion can be further divided into hierarchal diffusion and contagious diffusion.

Hierarchical diffusion takes place when a phenomenon or disease spreads through an ordered series of regions or classes. Gould *et al.* (1991) describe the spreading of AIDS from large urban centres to smaller towns in the United States of America, as an example of hierarchical diffusion. The fact that such urban areas do not occur everywhere in space means that when mapped, hierarchical diffusion would produce a series of non-contiguous spots. Normally, hierarchical diffusion facilitates rapid disease diffusion in those countries or regions with a well developed transport network. Transport networks are important as they facilitate movement of goods, services and people themselves. This is essential for the satisfaction of human needs and wants. It is however important to note that the same networks facilitate the spreading of diseases particularly infectious ones.

According to Ali and Keil (2005: 500) the diffusion of the Severe Acute Respiratory Syndrome (SARS) virus illustrates the hierarchical diffusion of the infection between world cities. The disease originated in the rural parts of southern China, then moved to major urban centres in China through animal markets, ultimately finding its way to the major

urban centres of Hong Kong, which then served as a significant interchange point for its global spread (Ali and Keil, 2005: 500).

Contagious diffusion is another type of expansion diffusion. The phenomenon that is diffusing does not disappear in the source region. This type of diffusion resembles the waves produced by a rock dropping into a pond of water. The phenomenon (the wave) spreads out through the uniform medium. Gould *et al.* (1991: 5) indicate that contagious diffusion is based on proximity and contact. It is subject to distance decay as intensity decreases as the distance from the source increases. Diseases are also subject to this distance controlled diffusion type. This type of diffusion occurs when there is contact. It, for example, occurs during the spread of infectious diseases (such as measles) through the direct contact of individuals with those infected. It is often argued that contagious diffusion is a type of expansion diffusion as the phenomenon basically diffuses from a particular source. Normally, contagious diffusion dominates when settlements are not well connected. The resulting spread of disease will be relatively slow and a function of distance.

2.6.2.2 Relocation diffusion

According to Bailey and Gatrell (1995: 348) relocation diffusion takes place when the spreading phenomenon or disease moves into new regions, departing its origin or source point of the disease. A good example of this is the migration of persons from rural to urban areas. In the case of a disease, the disease would spread to another area but in the source region, the disease will disappear. An example of this type of disease diffusion is bubonic plague bacilli. It originated in Asia but eventually disappeared there and spread to countries in Europe and North and South America (Sithole, 2001: 10).

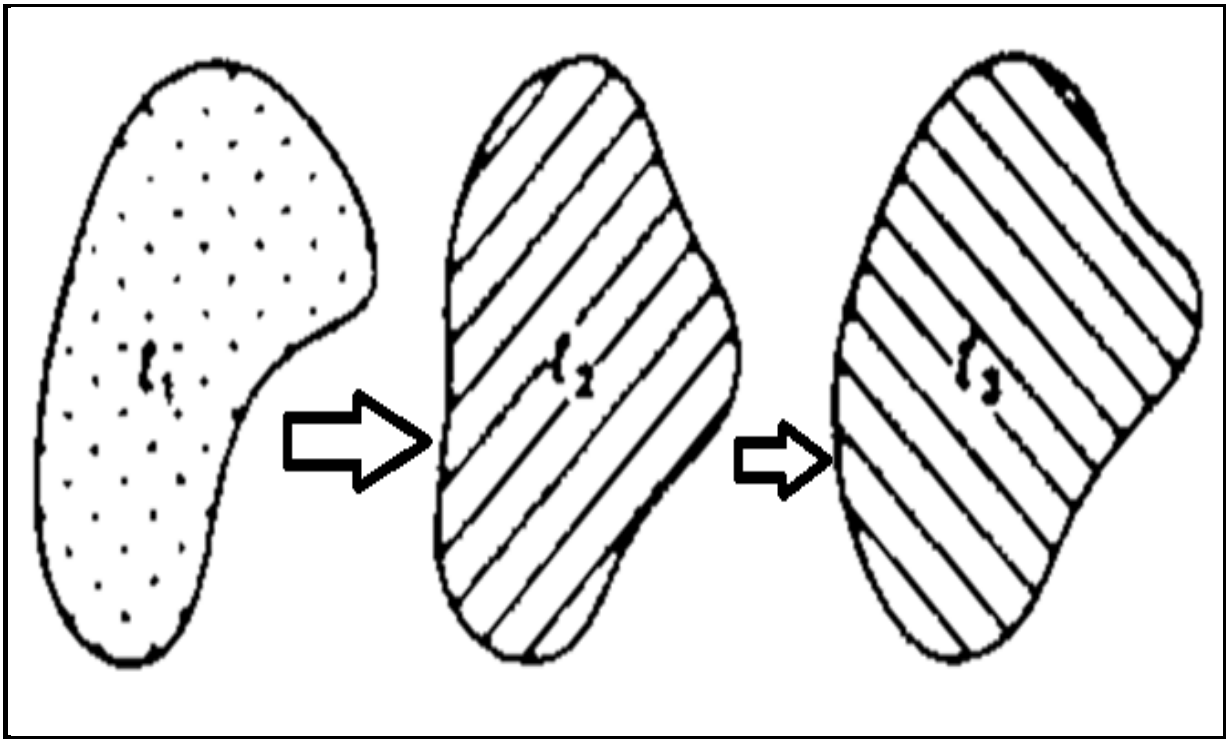

Figure 2.3: Illustration of relocation diffusion (Adapted from Walter, 2000)

The *t1, t2, t3* denotes time 1, 2 and 3 respectively. The phenomena or disease has spread out from the source at the central part of the region to other regions. The phenomena or disease has spread out from the source at the central part of the region to other regions. In this type of diffusion, the phenomenon (in this case disease) will only exist in the region to which it has spread. It will cease to exist in the source region. This must be common in infectious diseases that have distinctive cycles.

2.6.2.3 Mixed or Combined diffusion

As implied in the use of the term mixed, this diffusion type is a combination of all forms of diffusion (contagious, expansion, network and hierarchal and relocation diffusion). It is not confined to one type of diffusion. It is often said that HIV and AIDS is an important example in modern day society of a mixed diffusion of disease. It can spread along the hierarchal, network, and contagious diffusion patterns. In the real world, mixed diffusion is normally the case as the existence of a type of diffusion on a particular phenomenon does

not necessarily prevent the coming in of another type of diffusion. Sithole (2001) made use of stochastic modelling to examine the spatial diffusion of tuberculosis in the Western part of Zimbabwe. It emerged from the research that the diffusion of such a phenomenon (disease) is not confined to any one type of diffusion. Sithole (2001) argues that there is existence of both contiguous and non-contiguous types of diffusion.

2.6.3 Models of healthcare

This term 'healthcare' refers to services that go beyond the treatment of disease to include biomedical, psychological and social-economic factors and risks that contribute to or hinder total human wellbeing. Health-care focuses on prevention, treatment and post-treatment (palliative and rehabilitation). It includes all resources designed to promote health, whether directed to individuals or to the population as a whole, to help maintain health and to prevent and treat diseases (WHO, 2010:1-2). There are different types of models of health care (health care systems). These health care systems can differ from country to country or from region to region depending on the socio-economic and political circumstances that prevail in the particular country. Reid (2009) observes that there are four basic models of health care.

2.6.3.1 The Beveridge Model

The name of the model is derived William Beveridge, who designed Britain's National Health Service. According to Reid (2009:15), health services in this system are supplied and funded by the government through taxes just like teachers, the police force and other public services and goods. Most of the hospitals and clinics are owned by the government. The minority of them belong to private players. This system seems to have low average costs per person since the government as the sole payer, controls what doctors can do and what they can charge. Countries that use the Beveridge system include Great Britain, Spain, New Zealand, Scandinavia and Hong Kong (Reid, 2009:15). Cuba follows the extreme case of the Beveridge model, having the full government control on the health system. This is probably because of its strong advocacy for the ideology of socialism.

2.6.3.2 The Out-of-Pocket Model

As the name implies, private players command the major part of the health care system. This implies that if one does not have money, there will be no access to medical care for that individual. The majority of the countries of the world, the less developed countries (perhaps 160 countries of the 200 countries of our planet), do not have established health care systems (Reid, 2009:17). The basic principle in such a model is that the affluent people get more medical care and the poor have less access to medical services and, therefore experience more morbidity. Some people in rural parts of Africa for example go the whole of their lives without ever seeing a doctor. They cannot afford the payments that the doctor would demand. They can go to the local village healer who may accept payment even in non-monetary terms such as potatoes or a chicken (Reid, 2009:17).

2.6.3.3 The Bismarck Model

The model was named after the Prussian Chancellor Otto Von Bismarck, who invented the Welfare state as part of the unification of Germany in the 19th Century. According to Reid (2009:17), the model uses an insurance system. The insurers' contributions are called "sickness funds" and these are usually financed jointly by employers and employees through payroll deduction system. These funds have to cover everybody including the unemployed but the funds do not make a profit. Doctors and hospitals tend to be private in this type of model. Countries adopting this model include Japan and Germany, France, Belgium, Netherlands, Switzerland and to a degree in many countries in Latin America (Reid, 2009: 18).

2.6.3.4 The National Health Insurance Model

The model has elements of both the Beveridge and the Bismarck models. Reid, (2009:22) indicates that in this system, providers of services are from the private sector but payments are funded through a government run insurance program that every citizen pays into. The universal insurance programs tend to be relatively cheap because marketing costs are very low and there is no profit motive. In this model, the individual

patient has considerable market power to negotiate for lower prices from the private-sector providers and pharmaceutical companies since the costs incurred by the providers are relatively low. Countries that follow this system include Canada and newly industrialised countries such as Taiwan and South Korea (Reid, 2009:23).

2.7 Policies for spatial development of health

Many policies have been devised to 'regulate' health development. In this section, a number of these policies are discussed. "Health policy can be defined as the decisions, plans, and actions that are undertaken to achieve specific health care goals within a society" (WHO, 2011: 2).

2.7.1 Environment and health

Spatial planning can helpful in the improvement of people's health and reduce health disparities by addressing the wider determinants of health. A huge body of evidence indicates that the environment can affect people's health (Larkin 2003; Curtis *et al.* 2004; Feldman and Steptoe 2004; Frank *et al.* 2006). Evidence also shows that the area where people live exerts a significant influence on their health (Kawachi and Berkman, 2003: 5). Environmental conditions, whether affected by global change or within a local setting, play an important role in influencing people's health. In less developed countries, exposure to modern forms of agriculture, industrial and chemical pollution worsens the burden of disease stemming from traditional health risks within the household and community. "A major challenge remains in breaking the vicious cycle that links poverty, environmental degradation and ill health, along with redressing the continuing inequities related to gender and economic development" (Kawachi and Berkman, 2003: 5).

The policy implications of this are that, firstly, environmental Surveillance for Health Initiative should be undertaken by various countries, particularly the developing ones. Numerous risk factors should be monitored continuously to enable timely action so as to achieve the desired impact on environmental protection and significantly improve people's health. Currently, very few fundamental indicators related to risks factors are gathered,

analysed and used for decision-making (WHO, 2005: 3). In addition, there is no methodical and integrated surveillance of the main risk factors to enable the prevention of the health problems in the community. Only a small number of countries have proper databases on environmental determinants of human health and their related risk factors. WHO (2005: 4) recommends that the following should particularly be monitored: water quality (biological, chemical and physical parameters), vectors of disease in endemic prone areas (malaria, cholera) and air (toxic matter, sulphur and nitrogen dioxides, and lead).

Secondly, countries should be endowed with the essential technical competences, including human resource materials and logistics, to establish national environment surveillance systems. The technical support is necessary given the fact that in most of the developing countries, such human resources and logistics are desperately needed. Financial resources will have to be made available to relevant departments to actively embark on environment surveillance events (WHO, 2005: 5).

Finally, Environmental and Health Impact Assessments should be undertaken. It is known from experience that development (natural resources, agricultural expansion, infrastructure improvement and expansion, energy generation, growth of mines and industries, the construction of tourist amenities and urban growth) while inevitably necessary, inadvertently, can have some undesirable impact on the health of specific vulnerable groups. Ministries of health in many African countries are increasingly becoming aware of the possible negative impacts of economic growth (WHO, 2008a: 35). Countries are increasingly, therefore, urged to undertake Environment and Health Impact Assessment.

2.7.2 Food safety and health

The world over, and particularly in developing nations, food safety is an issue of great concern. Due to the fact that there is generally inadequate food to meet demand in the developing countries, the majority of people (in such countries) are only concerned with fulfilling hunger and do not give sufficient attention to food safety and this impacts

negatively on their health. “Food safety is an essential component of food security and is defined as protecting the food supply from microbial, chemical and physical hazards that may occur during all stages of food production, including growing, harvesting, processing, transporting, retailing, distributing, preparing, storing and consumption, in order to prevent food borne illnesses” (WHO, 2008b: 2). Food security refers to physical and economic access to adequate, healthy and nutritious food to meet dietary needs.

The burden of food borne diseases in Africa is hard to quantify, but available data on diarrhoea due to infected food and water estimate the mortality to be around 700 000 people per annum (WHO, 2008b: 3). WHO (2008b: 3) maintains that there are numerous factors that lead to food contamination in the environment. The contaminants can enter food during different stages of production, cooking, processing, harvest, storage, retailing and transportation. The major causative agents of food borne diseases in the developing countries are bacteria, viruses and fungi. “Outbreaks of cholera, which occur due to contaminated water, are common in the African region and available data show an upward trend” (WHO, 2008b: 4). Food borne diseases and chemical contamination of food from agricultural drug residues are also causing problems in Africa. These issues are really pertinent and have serious implications for the development of African countries and need to be addressed. WHO (2008a: 4) warns that unless these concerns are dealt with, African countries will have a challenge in attaining the health-related Millennium Development Goals. It is imperative that food safety remains a concern in all situations particularly in developing countries. Strong political will and relevant food security systems are essential, from production to consumption. “Resolution AFR/RC53/R5 of the WHO Regional Committee for Africa has, for example, urged countries to strengthen food safety programmes, and was endorsed in 2003” (WHO, 2008a: 4). Since then, many countries have initiated activities to improve food safety (WHO, 2008a: 4).

There are various policy implications for the scenario presented on the problem of lack of food safety. Firstly, the preparation, protection, selling and consumption of street foods in unsuitable areas should be banned. Street foods are sources of nourishment and income for the poor people living in urban areas. Some street foods are pathogenically safe and

provide alternative sources of nourishment (Mosupye and Von Holy, 1999: 1279). However, “the hygiene of most street foods is substandard due to incorrect handling as well as lack of sanitation, running water, washing facilities, refrigeration and disinfection. Washing of hands is rare, and food is often exposed to flies and other insects” (Agyei-Mensah, 2002: 550). In addition, other risk factors are the preparation of foods well in advance of consumption and manual food preparation. Some foods, that should be kept refrigerated such as milk, meat and sauces, have high potential for transmission of disease when sold at after being kept at a high temperature.

Secondly, there should be more food borne disease surveillance systems in developing countries. Capacity building in terms of food monitoring and pathogen and chemical testing of foods should be improved. Genetically-modified organisms (GMOs), defined by WHO (2005: 5) as “food products containing some quantity of genetically modified organisms as an ingredient” have certain potential benefits, including high agricultural output per unit area due to resistance to plant diseases, and larger nutritional content. There are however a number of concerns about food safety and health emanating from such foods. Genetically-modified varieties of cereals, legumes, fruits and vegetables are available in many countries. Laboratory facilities should be there for testing foods on the market and to determine the quantity of GMOs being consumed in the countries, as well as to monitor the imports of such food to avoid dumping of food that is not fit for human consumption (WHO, 2005: 5).

Finally, countries should have food control legislation. This can be done through the establishment of national standards authorities that create food standards based on Codex Alimentarius guides (WHO, 2005: 5). The Codex Alimentarius Principles deal with issues of safety of food and risk assessment. Legislation should be there on agricultural chemical residues, food preservatives and contaminants, toxins, and genetically-modified organisms (WHO, 2005: 6). Developing countries seem to be predominantly preoccupied with addressing the problem of food shortage, an issue of quantity. To them, food quality inevitably becomes a secondary issue. Such legislation is, therefore, not normally existent in the developing countries.

2.7.3 Resources and health

Resources, whether they are human (manpower) or infrastructural, are essential for the health system of a country to develop. The paradox of the developing regions of the world is, however, that while they are the ones facing a critical shortage of human resources, are less capable to train sufficient health professionals. In addition to this, such countries generally suffer a severe brain drain of the few health professionals they produce as the professionals look for greener pastures in more developed countries. The same countries (developing) have severe shortage of the necessary health infrastructural resources. Under such conditions of acute shortage of health resources, achievement of the Millennium Development Goals of high level health services becomes a difficult task. For example, according to WHO (2009), for Zimbabwe to achieve its Millennium Development Goals, it needs 250 doctors, nurses and midwives per 100000 population. This is similar to training more than double the present number of health staff and it is not easy to achieve.

The health gap between the developed regions of the world and the developing ones can be reduced by adopting different policies. Adoption of a human resource health policy that will contribute to the retention of doctors and nurses within the country and the public sector can be useful strategy in Developing countries. In such a policy, governments should be committed to improving the conditions of service for health staff, taking into account salary scales in neighbouring countries. The paradox of the developing country here is that the country is immersed in poor economic conditions of limited national revenue, but at the same time it must strive to raise salaries of health workers to competitive levels. Raising salaries under such poor conditions is a difficult target to achieve. Attempts must, however, be made to at least reduce the salary gap with other countries, especially neighbouring ones. Bilateral agreements should be encouraged between governments so that health staff is not freely allowed to move to other countries, in order to minimise the brain drain in the poorer ones (Ministry of Health and Child Welfare, 2009: 128)

A robust health infrastructure needs to be constructed and constantly improved, especially in developing countries if the health gap between the developed and the developing countries is to be reduced. More hospitals, health funds, pharmaceuticals, research laboratories, clinics, better transport services and other forms of infrastructure are needed in the developing countries. This is not easy to achieve given the limited financial resources of such countries, but one way to solve the problem can be to make use of appropriate infrastructure or appropriate technology, for example, the use of refrigerator for vaccines and use of salt and sugar solution for diarrhea. That is affordable even under the poor financial conditions of developing countries.

2.7.4 Primary health care (PHC)

Primary health care is one of the policies which can be adopted, especially in the developing countries. Primary care is generally the initial point of contact for a patient. Primary care is normally offered by general practitioners. It is where most preventative healthcare can be obtained and where early diagnosis is done and this may prevent the individual from going for the more expensive hospital treatment. “Primary health care is essential health care based on practical, scientifically sound and socially acceptable methods and technology that are universally accessible to individuals and families in the community through their full participation and at a cost that the community and the country can afford to maintain at every stage of their development in the spirit of self-determination” (WHO, 2008a: 6). By its nature, primary care involves discussion with the patients, developing personal links with patients, going out into the society, making use of outreach programs for encouraging preventative and health lifestyles. As such, it is considered to be a really cost-effective approach.

Poor regions of the world in particular desperately need primary health care so that the gap between them and the developed ones can be reduced. “It was adopted at the 56th World Health Assembly held in Alma Ata and became a core concept for the World Health Organisation, serving as the basis for the WHO's goal of Health for all” (WHO, 2011: 2). The Alma-Ata Conference mobilised a “Primary Health Care movement” of health experts

and institutions, governments and civil society associations, scholars and grassroots organisations that undertook to tackle the political, social and economical health disparities in all countries. This implies that, the final goal of primary health care is improved health for all. WHO (2011: 3) has identified five key elements to achieving that goal. “These are reducing social disparities in health, organizing health services around people's needs and expectations, integrating health into all sectors, pursuing collaborative models of policy dialogue and increasing stakeholder participation” WHO (2011: 3) . To achieve meaningful primary health care, an integrated approach is, therefore, inevitably necessary. All elements identified by the WHO really need attention.

2.7.5 Complementary medicine and alternative medicine

In developed and developing countries, people use various forms of complementary or alternative medicine (Littlewood & Vanable, 2008: 110). Mills *et al.* (2005: 400), however, argue that the efficacy of most of these therapies has not been verified. Alternative medication refers to a group of diverse healthcare systems, practices, and products that are not currently taken to be an integral component of formal healthcare (National Center for Complementary and Alternative Medicine 2004: 3). Alternative medication practices have also been described as herbal or traditional medicine, and as home remedies. Complementary medicine is sometimes used along with conventional medicine. However, the term “alternative medicine” implies that practitioners may be involved with health-care practices that are very different from conventional practices. Examples of therapies involving complementary and alternative medicine include chiropractics, acupuncture, massage, and self-directed practices (such as dietary and herbal supplements), meditation, and more recently, the use of magnetism. In the context of the current study, complementary and alternative medicine was supplied by individuals, research organisations, groups of people and multinational firms. According to Khayesi (2011: 97), the level of training varied from traditional methods for training herbalists to professional and on-the-job training provided by complementary and alternative medicine colleges and international companies.

2.8 Conclusion

The present chapter focused on health concepts, models and policy. It emerges from this review that there is no consensus over the meaning of the term health. While some take the narrow definition of health (rooted in the biomedical approach), others take a multidimensional approach to the concept. The various determinants of health were examined. The concept of health regions was also discussed in the current chapter. Models that can be used to describe and explain spatial patterns of health were discussed. The models discussed in the chapter range from those that deal with health and disease, to those that deal with health care. The different policies that can be adopted to develop the health system of a country were also examined in the current chapter. The fact that health is a multidimensional concept implies that the policies should also address all the dimensions of health. This has been taken into account when discussing the various policies that can be used to develop the health of a country or region.

In the next chapter, literature is reviewed on the health situation in both developed and developing countries. This will assist in illustrating what has been done by other researchers in the field of geography of health. Literature on health, disease and health care in Zimbabwe will also be reviewed in that chapter.

CHAPTER 3

GLOBAL HEALTH SITUATION: A COMPARATIVE APPROACH

3.1 Introduction

In line with the objectives of the research, literature has been reviewed on the global health situation, adopting a comparative approach. Health inequality is one of the central concerns of health geographers. In the current chapter there is a discussion of the health situation in both developing and developed countries. This helps to demonstrate what other scholars have done in the field of geography of health. Literature on health issues in selected countries, with special attention to Zimbabwe, is also reviewed.

The benefits of good health can extend beyond a single healthy generation. This is particularly vital for poor people as they have a tendency of having more children but limited economic resources to invest in the education and health of the children. According to Benzeval *et al*. (1995), children who tend to do better in school are generally those who escaped the cognitive and physical consequences of early childhood diseases. Generally, such children are unlikely to experience disabilities in later life and so are less likely to endure unbearable medical expenses. They are, therefore, more likely to achieve their life goals and potentials. Then, as healthy adults, they have more economic resources to invest in the health and socioeconomic development of their own children. The contemporary high-level focus on health by the international community recognises this strong correlation between poverty and health. As presented in Khanal (2011: 57-58), of the eight Millennium Development Goals, three of them call for health promotion by the year 2015. The goals are; reducing child deaths, reducing maternal mortality and slowing the spread of HIV and AIDS, malaria and tuberculosis. Moreover, health is viewed as basic to the first Millennium Development Goal, eradicating poverty and extreme hunger.

3.2 Developed and developing countries: an overview

In the current chapter, there is frequent reference to the terms 'developed' and 'developing' countries. There cannot be a meaningful discussion on the health of people in a region without reference to the level of development of that region. That there is a linkage between health and development has been indicated by various researchers including Lopez and Mathers (2006), Phillips (2006) and WHO (2010). It is therefore necessary to have a section in this chapter that deals with an overview of developing and developed countries.

There are many terms that have been used for the concept of developed countries. Terms which are often used in place of developed country include industrialised country, more developed country (MDC), advanced country, more economically developed country (MEDC), the North, the First world, and Post-industrial country (Sachs, 2005). The terms can be used interchangeably in the development discourse. The term industrialised country may be generally misleading, because industrialisation is a continuous process that is difficult to define.

Many criteria exist in the differentiation of developing from developed countries. According to IMF (2011), the economic dimension of development has tended to dominate in the differentiation. For example, the use of the income per capita criterion is widespread. Countries which possess high gross national product (GNP) per capita are generally described as developed. "Developed or upper-middle or high income countries have a gross national income per capita of US$3 596 - US$11 115 and above" (World Bank, 2008: 3). Industrialisation is another economic criterion often used. Countries in which the tertiary and quaternary sectors of the economy dominate are often described as developed. Recently, the Human Development Index (HDI), which combines national income with other measures, such as life expectancy and education, has become prominent. In this criterion, developed countries are defined as those countries with a high Human Development Index rating. However, many anomalies exist when differentiating developed from developing countries. To eliminate the anomalies, composite indexing as used by Conyers (2001) can be a very useful technique. This technique takes into

account the overall effect of various indicators on development of a region or country. They also experience low levels of premature mortality, and they have high levels of literacy and good health-care for their populations.

As indicated in the above paragraph, the developed countries, on average, have high per capita incomes. Such high per capita incomes generally can translate into relatively good infrastructure, steady governments, high level of economic development, high quality education and health-care (with consequent low death rate). Developed countries generally have a huge volume of exports which increase foreign currency inflow into the country, and the volume of imports is comparatively small and this tends to raise the aggregate demand or national income for the country (Musanga, 2009: 44).

The terms utilised when discussing developing countries are less developed countries (LDCs), less economically developed countries (LEDCs), underdeveloped nations, the South, Third World nations, and non-industrialised nations. Developing countries tend to be associated with low and middle income with a gross national income per capita of under US$ 3595 (World Bank, 2008: 3). Countries that fit in this group are considered to be in a state of economic development and therefore fall into the category of "developing countries". Developing countries are less industrialised than developed countries and characterised by having high levels of premature mortality, illiteracy and poor healthcare for a large part of their populations (Anand, 2000: 2029-2049). The developing countries also have low levels of affluence. This inevitably translates into lower education quality, low capital formation and poorer healthcare (with a consequent high death rate). Diseases and natural disasters are predominantly high in such countries. Developing countries usually suffer from political instability and war. Developing countries also have a high unemployment rate and experience high inflation because of the low investment levels.

Most developing countries look towards developed countries for economic support and for models of development. As observed for developed countries, health is one of the indicators used to determine levels of development among nations. Health is one of the key yardsticks for human development (Khayesi, 2011: 45). In many developing countries, healthcare services are provided by both the government and the private sector. In most

cases, public health facilities are affordable for low income earners in developing countries. Services in public health facilities may not be within reach of most people, particularly those from rural areas. With the exception of charitable health institutions, the private sector often provides health services at a profit making level, making it too expensive for poor people to benefit from them (Khayesi, 2011: 45). In Zimbabwe, like in other developing countries, healthcare services are provided by both the government and the private sector. According to Osika *et. al*. (2011: 14), private hospitals and clinics now account for 16.01% while government hospitals and clinics account for 83.99% of healthcare centres in Zimbabwe.

3.3 Global spatial distribution of the state of people's health

Huge disparities in overall health conditions exist between developed and developing nations. Much of such disparity has to do with the inadequacy of the basic needs of life such as; food, water, sanitation and primary health care common to developing nations (Organisation for Economic Cooperation and Development, 2006). People in developed countries thus generally live considerably longer with healthier lives than their counterparts in developing nations. The burden of disease is higher for developing than for the developed countries (Murray and Lopez, 1996). ECONEX (2009: 1) defines a country's burden of disease as the combination of morbidity, mortality, injuries, disabilities and other risk factors specific to that country. According to WHO (2009), causes of death are grouped into three classes. The first class consists of communicable diseases, maternal, perinatal and nutritional disorders, the second class consists of non-communicable diseases and the third of injuries.

Murray and Lopez (1996) introduced a new method for the measurement of the burden of disease in a particular area called disability-adjusted life-years (DALYs). The DALY is a measure that combines the effects of illness, disability and mortality on population health. In other words, the DALY measure combines the time lived with disability and the time lost due to premature mortality. A DALY can be taken to be a year of 'healthy' life lost. Bradshaw *et al.* (2003) define the DALY as measure quantifying the health gap between a given population's actual health status and a specified standard of health. For example,

DALYs for a disease involves the addition of the years of life lost due to early mortality (YLL) in the population and the years lost due to disability (YLD) for the cases of the health condition. That is, DALY =YLL+YLD. One DALY represents the loss of one year of equivalent full health. “A health gap measure such as the DALY is chosen because it permits categorical attribution of the fatal and nonfatal burden of diseases and injuries to an exhaustive and mutually exclusive set of disease and injury causes” (Mathers *et al.,* 2002). By contrast, health expectancy measures do not logically lend themselves to disaggregation by categorically defined causes. “Methods such as disease elimination are required to quantify the contribution of disease causes to overall health expectancy measures, as well as for dealing with risk factors” (Mathers *et al.,* 2001: 48).

Developing countries generally have more burden of disease compared to developed countries. A comparison of the absolute burden of disease between developed and developing countries is given in Figure 3.1. In some developing countries (for example South Africa) the burden of disease, is approximately four times bigger than that of developed countries (ECONEX, 2009: 2). In Figure 3.1 disease burden of selected developing countries (South Africa, Ghana, Tunisia, Brazil, Colombia, Indonesia and Thailand) is compared to that of selected developed countries (Canada, Germany, the UK and the USA). It is, therefore, reasonable to expect a bigger burden on financial resources, health facilities and human resources in developing countries, compared to these requirements in the developed countries. The paradox here is that the countries that do not have the health resources are the ones that have greater burden of the disease.

Developed countries generally have less burden of disease (Figure 3.1). As countries develop, the burden of disease is expected to change from one with many different categories of diseases, to a single disease burden, usually concentrated in non-infectious disease category such as cardiovascular diseases, cancers, diabetes and other chronic diseases (WHO, 2009: 5). A clear picture emerges where non-communicable diseases as causes of death consist between 80% and 90% of the disease burden in the developed countries examined here. The situation of South Africa’s quadruple burden of disease also

serves to further support the assertion by (WHO, 2009), that in developing countries, the burden of disease has many different facets, as alluded to above.

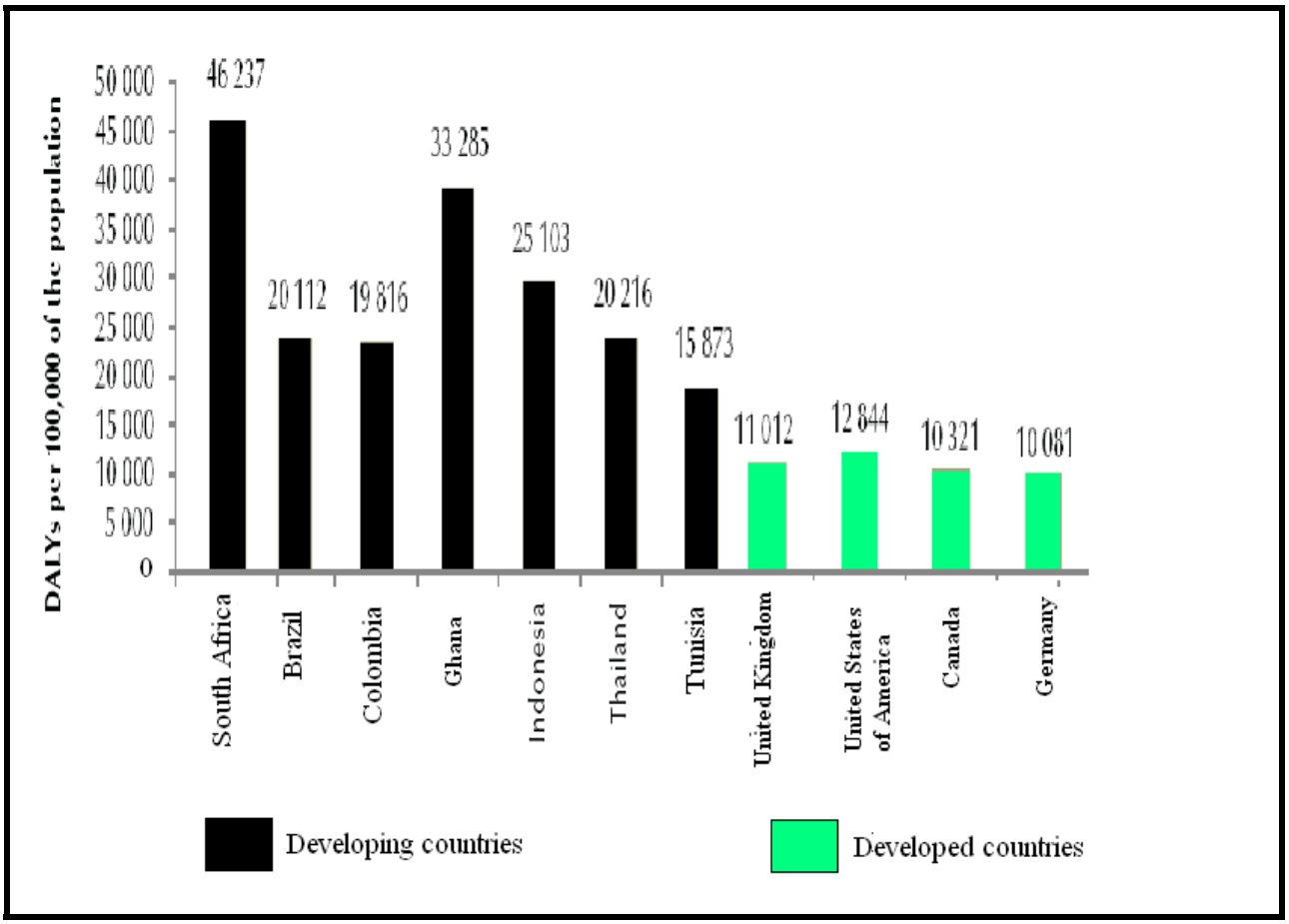

Figure 3.1: Absolute Burden of Disease: A comparison between developed and developing countries (Source: Adapted from World Health Organisation, 2009: 3).

Another striking feature of the international health pattern is the variation in types of disease burden. The disease profile of developed countries differs significantly from that of developing countries (See Figure 3.2). It is evident from Figure 3.2 (for the selected countries) that the disease profile of more developed countries usually changes from one of communicable diseases, high child mortality and malnutrition to a prevalence of degenerative and man-made diseases. Murray and Lopez (1996: 3) indicate that life expectancy rises and exceeds 50 years, with fertility becoming the crucial factor in population growth. Murray and Lopez, (1996) further argue that the transition generally

represents the net effect of people's choices on family size and the ability to put into practice those choices.

The situation in the developing countries differs significantly from the one in the developed nations. Developing countries frequently experience a double burden, resulting from the concurrent occurrence of both communicable and non-communicable diseases. In some developing countries, for example South Africa (see Figure 3.2), there is the added burden of high prevalence rate of HIV and AIDS (Norman *et al.,* 2006). The implication of the scenario in developing countries is that they have a multi-faceted disease burden and this creates a serious burden on their limited health resources.

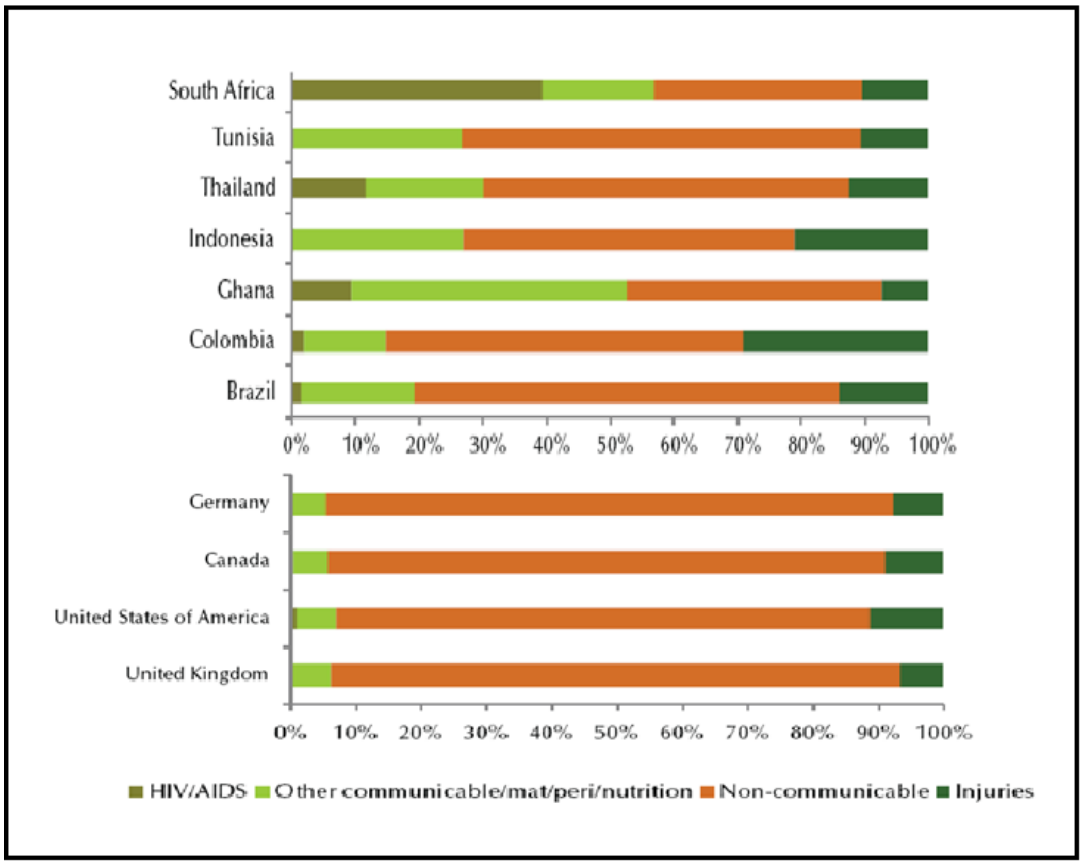

Figure 3.2: Facets of Disease Burden: a comparison between selected developed and developing countries (Source: Adapted from World Health Organisation, 2009: 5).

It emerges from Figure 3.1 and Figure 3.2 that developing countries bear the greater burden of diseases but, ironically, the expenditure on health is small. The developing world experiences 90% of the disease burden, but less than 10% of its annual budget is allocated to healthcare services (Chudi, 2010: 10). This situation can be disastrous and generally leads to a vicious cycle of poor health, disease, poverty and backwardness in developing countries.

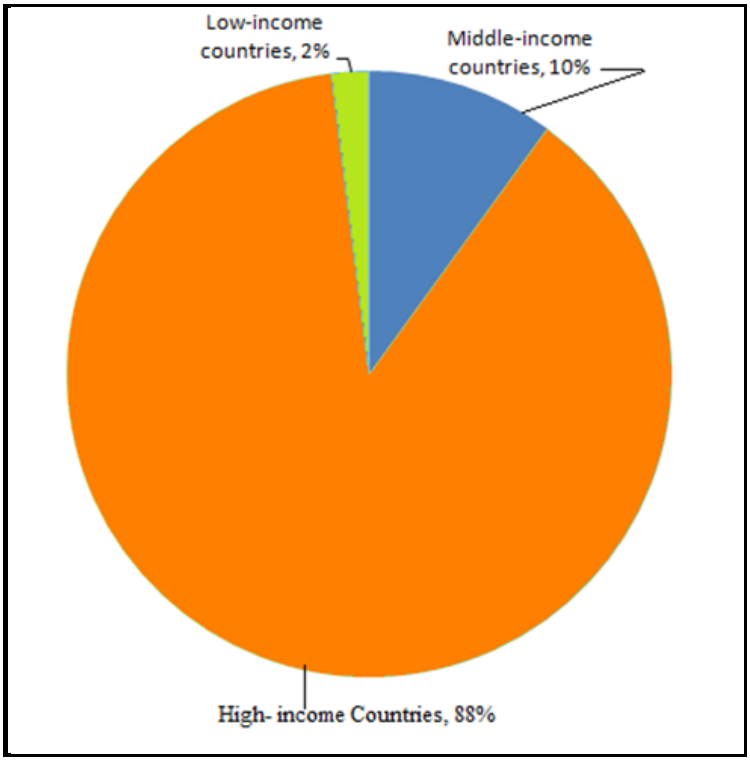

Figure 3.3: Global health expenditure as part of GDP, 2002 (Source: Adapted from World Bank, 2005: 8)

Chudi's (2010) argument is a reinforcement of the argument already made by Mathers *et al*. (2008), of the mismatch between size of disease burden and health expenditure in developing countries. According to Mathers *et al*. (2006: 277) about 12% of the total income was used on health in low and middle income countries, which has 84% of the global population, 20% of global Gross Domestic Product (GDP), and 90% of the global

disease burden. This is highly ironical because when a region bears a disproportionately bigger disease burden, the expectation is that expenditure on health should be disproportionately larger. Figure 3.3 is a presentation of the findings of the World Bank. According to World Bank (2005: 3), low-income countries spend 2% of the global GDP, middle-income countries spend 10% of the global GDP and the high income countries spend 88% of the global total GDP. Mathers *et al.* (2006) are in agreement with the World Bank (2005) about the global health expenditure. According to the analysis by Mathers *et al.* (2006: 277), the developed countries have 16% of the global population, 80% of the global GDP and 10% of the global burden of the disease. Compared to the developing, the developed countries are in a very desirable position.

3.4 Health service provision in both developed and developing countries

The provision of health services, often called healthcare, involves a number of functions as indicated in Section 2.4 of this research. Braveman (2003: 181) defines healthcare as all the main aspects of the provision of health services, including not only utilisation but quality, funding, and distribution of resources. This means that healthcare encompasses medicines, health personnel and facilities. The structure of healthcare service provision in the world varies as broadly as the health issues facing the inhabitants of every country. Funding for healthcare services is equally variant across the globe and mainly determined by both the economic and developmental conditions of each country. As alluded to in Section 2.7.3 of Chapter 2, the brain drain syndrome plagues many developing countries. The developed countries are depriving African countries of health personnel (Coombes, 2005: 923). The provision of health services is a serious challenge in developing African countries. The brain drain syndrome aggravates the health service provision crisis. It is ironical that developing countries which should be manpower receivers are instead manpower donors. This leads to a reduction in available health workers, especially highly skilled medical staff. It is a serious challenge that the brain drain happens amid a scenario whereby, in many developing countries the number of health workers such as doctors and nurses is generally small in proportion to the population. Such a scenario has given rise to a skewed distribution of health personnel in favour of the developed countries.

A related challenge is also that some of the available health professionals dislike working in public health institutions and rather prefer to run private medical practices. Such private hospitals are generally more expensive and charge fees that are beyond the reach of the ordinary person. In some cases, the health system makes it difficult and frustrating for health staff to work efficiently as equipment and facilities are usually lacking. Lack of facilities and equipment to work with in clinics and hospitals of developing countries are common problems faced by health workers (Chudi, 2010: 2). It is frustrating but common in developing countries for a radiologist to be employed in a hospital without a functioning X-ray machine or ultrasound. Equally so, a neurosurgeon can be employed in a hospital without computerised tomography scans. Health systems of developing countries should be strengthened with resources to make them functional. On the contrary, health professionals in the developed countries basically have enough equipment and facilities.

Thomas (2009:1) cites the multifactorial nature of the factors that lead to failure of the national health programmes in developing countries. According to the researcher, the most important among these is the half-hearted approach by the government officials involved in putting into practice the programmes. The researcher further argues that, apart from the poor involvement of government in these programmes, the funds (which are often donated from developed countries) get diverted to other non-health programmes or is lost due to other corrupt dealings. Very often the intended beneficiaries ultimately receive less than 1% worth of what is envisaged in the health programme. Who then should be blamed? All people, involved in programme planning right up to implementation, are responsible for the undesirable state of affairs (Thomas, 2009:1).

3.5 Health evolution in developed and developing countries

It has long been recognised that societies seem to pass through various changing patterns of morbidity and mortality during the development process, even if not all the stages and sequences are identical in every case. The demographic transition, described as an upward shift in population dynamics associated with socio-economic development such as rising incomes, education, employment, improvements in health status and life

expectancy and changes in lifestyles, has been said to be accompanied by an epidemiological transition (Lee, 2003: 168). In general, health improves while morbidity and mortality fall, and life expectancy increases; this comprises the epidemiological transition. These changes generally come with modernisation and appear to be part and parcel of the process. They seem to occur at a different pace in varying countries and, in recent years, these have been to some extent related to the application of modern medical techniques and technology as well as changing standards of living, nutrition, housing and sanitation.

It can be inferred from numerous studies (Phillips, 2006; Omran, 1971 and Trowell and Burkitt, 1981) that during the early phases of the epidemiological transition, communicable, parasitic and nutritional diseases are the cause of the bulk of morbidity and mortality. Many developing countries still have large proportion of the poor people who experience the brunt of illnesses, largely infectious in nature and related to malnutrition. By contrast, in the more advanced societies, such conditions make up only a trivial amount of real ill-health and little mortality, although childish conditions such as measles, chickenpox, of course continue. Often only pneumonia and influenza are the real causes of danger and affect mainly the older age groups. On the other hand, whilst in the early stages of modernisation, what are essentially chronic degenerative conditions associated mainly with older adulthood, such as heart diseases and cancers, are relatively unimportant (but long-standing conditions related to parasitism and malnutrition may be important causes of morbidity). In more modern societies, chronic degenerative conditions rapidly seem to make up the majority of causes of morbidity and mortality. These are often regarded as western diseases but they are becoming increasingly visible in many Third World countries (Trowell and Burkitt, 1981). The aging of population is triggering an epidemiological shift towards a disease burden dominated by non-communicable diseases. Deaths or illness due to injury, accidents and violence tend to make up a small, if important, proportion of mortality and morbidity and certainly lead to considerable loss of work and reduced quality of life.

3.6 Perspectives (Approaches) to the International Health Inequalities

It has emerged from the descriptions in Section 3.3 that health conditions in developed nations are better than those in the developing nations. As indicated in Section 3.3, people in developed countries generally live longer experience healthier lives than people those in poorer countries. The occurrence of inequality between developed and developing nations is not a chance or a stochastic outcome and there are certain factors that act as fundamental drivers of global health inequality. There are various approaches or perspectives that can be used to explain the health inequalities between the developed and the developing countries. In this section of the chapter, the influence of the natural environment on health, the material and structuralist approach, and the role of public policy, life-course perspective and politics and political ideology are discussed. These perspectives are grounded in various social, economic political and environmental factors.

3.6.1 The natural environment and health

People are exposed to a whole variety of factors in the natural environmental that can either promote good health or be hazardous to health. As indicated in Section 2.4 of Chapter 2, the physical environment is a major determinant of health. Kjellstrom (2007) concurs with Roemer (1997) that the conditions in the physical environment such as climate, water quality and quantity, housing, location in space, food and air quality affect people's health. Kjellstrom (2007: 87), however, argues that the social determinant driving forces lead to pressures on the environment that change the state of the environment, which create exposures that cause health effects. For example, urban people with low incomes are likely to end up living in slums which have unhealthy living conditions. Exposure to pathogens and disease vectors is high in such housing conditions. It emerges from this discussion that exposures to hazardous physical conditions is detrimental to human health. The physical environment is a major determinant of human health.

A study conducted by Deschenes and Greenstone (2011) has revealed that there is a linkage between health outcomes and temperature in the USA between 1968 and 2002. Deschenes and Greenstone (2011: 7-8) maintain that there is temperature-mortality

response function. The key finding is that temperature-days above 32°C and below 4°C are associated with statistically significant increases in the annual mortality rate in the U.S. The estimates indicate that each day where the average temperature exceeds 32°C leads to an increase in the annual mortality rate by 0.1%, while days where the average temperature lies between 27°C and 32°C do not lead to significant changes in the mortality rate. It is also evident that cold-related mortality is important, at least in the United States. Days where the average temperature is below 4°C are associated with excess mortality, although the magnitude is smaller than the heat-related excess mortality of the >32°C days. This suggests that the overall impact of climate change that leads to a right shift in the daily temperature distribution is a priori ambiguous, as it might lead to a reduction in cold-related mortality and an increase in heat-related mortality (Deschenes and Greenstone 2011: 12).

3.6.2 Material/Structuralist approaches

The materialist/structuralist explanation gives emphasis to the material conditions under which people live their lives. It is generally acknowledged in this approach that socio-economic circumstances play the major part in subsequent health differences among people (Whitehead, 1992). These conditions include availability of economic resources to access the amenities of life, working conditions, and nature of available food and accommodation among others. As already discussed in Section 3.2, developed countries have better material conditions than developing nations and therefore according to this perspective, have better health conditions. These materialist or structuralists' perceptions have been improved such that analysis is now concentrating on three frameworks by which social factors come to influence health (Bartley, 2003). These frameworks are: materialist, neo-materialist, and social comparison. The materialist explanation is about how conditions of life and the social determinants of health that constitute these conditions of life influence health. "Material conditions of life determine the differing likelihood of physical (communicable diseases, problems of malnutrition, non-communicable diseases and injuries), developmental (cognitive problems, personality of the individual, and social development), educational (learning disabilities, poor learning,

early school dropout), and social (social interactions, preparation for work, and family life) problems" (Graham, 2007: 14).

The neo-materialist approach extends the materialist explanation by asking how these living conditions come into existence. Exposures to the material conditions of life are significant for human health, but these material conditions are so unevenly distributed between the developed and the developing countries. The neo-materialist approach is mainly concerned with how regions differ and how economic and other resources are distributed among the population. According to Lynch *et al*. (2000: 1222), some countries especially the developed have less inequality in the distribution of resources and the gaps that exist among the people in their exposure to the socio-economic determinants of health is narrower than regions where the gaps among the people are larger (in the developing countries).

3.6.3 Life-course perspective

Increasingly, both adults and children are encouraged to adopt "healthy lifestyles" as a way of reducing the development of chronic diseases such as cardiovascular diseases and diabetes, among others. Life-course approaches, in contrast to these approaches, emphasise the effects of experience across the life span in understanding the safeguarding of health and the onset of disease (Chronic Disease Prevention Alliance of Canada, 2003). It is often argued that the prevailing model for adult disease, which emphasises adult health risk factors, especially aspects of adult life style, has been criticised in recent years by researchers who have shown that lack of socioeconomic development and poor early environmental conditions are linked to an increased risk of adult chronic disease (Kuh and Ben-Shilmo, 1997). More specifically, it is apparent that the socioeconomic conditions as well as the social determinants of health under which people exist have a huge effect upon the likelihood of developing any number of diseases. In developing counties such probability is comparatively higher, hence their multi-faceted disease burden as exposed in Section 3.3. Organisation for Economic Cooperation and Development (2006: 4) observed that the basic needs of life such as: food, water, shelter,

sanitation and primary healthcare are generally lacking in less developed countries. This inevitably tends to increase their burden of disease.

Hertzman (2000: 32-33) outlines three health factors that are crucial to the life-course perspective. Firstly, there are the latent effects. These are related to human biological or developmental, early life experiences that influence health later in life. Low birth weight, for example, normally leads to incidence of heart diseases and diseases such as diabetes in later life. Occurrence of nutritional deficiency during early life years has health effects in later life. Secondly, there are the pathway effects. These are the experiences which set individuals onto life courses that affect health, well-being, and competence of the individual. As one example, children who enter school with delayed vocabulary are set upon a path that leads to lower educational expectations, poor employment prospects, and greater probability of poor health and disease across their lifespan. Finally there are the cumulative effects of problems time that manifest themselves in poor health. They involve the combination of latent and pathways effects.

3.6.4 Public policy

The underlying point in the public policy perspective is whether any particular analysis of social determinants of health is politicised or not. A politicised approach is one that takes account of the fact that the quality of the social determinants of health to which inhabitants of a jurisdiction are exposed is created by public policy shaped by governments. Social determinants of health do not exist where there are no people. Their quality and availability to the population are usually a result of public policy decisions made by governing authorities. Esping-Andersen (2002: 38) gives the example of the social determinant of health in early life. Human life in later years is shaped by availability of adequate economic resources that assure sufficient educational opportunities, nutrition and accommodation among others. Much of this has to do with employment, security, the quality of working conditions and wages. The availability of quality, regulated childcare is an especially important policy option in support of early life (Esping-Andersen, 2002). This implies that these are not issues that usually come under individual control. Governments of developing countries are likely to give less favourable policies (compared

to their counterparts in developed nations) for health in such countries lack the necessary resources to support the public policies. This inevitably leads to contrasts in health between developing and developed countries.

3.6.5 Politics and political ideology

Governments are shaped by political parties who come to power with a set of ideological beliefs concerning the type of society and the nature of governments they prefer. The thrust of this perspective (Politics and political ideology) is to recognise the role played by politics and political ideology in shaping the health system of a country (whether developed or developing). This perspective (of Politics and political ideology) is related to the concept of the welfare state. The welfare state is about the extent to which governments or the states use their authority to offer citizens with the means to live safe and satisfying lives (Navarro, 2004). Navarro (2004: 9) argues that every developed country has some form of a welfare state. Whereas, developing countries generally do not have such a welfare state. This idea resonates with Reid (2009:17) as indicated in Section 2.6.3.2 of the current research. Reid (2009: 17) argues that the majority of the poor countries of the world do not have established health service systems. To access health, financial resources are needed. In such countries therefore, the rich are better placed to get medical care and the poor generally suffer. This kind of scenario inevitably makes the health systems of developing countries comparatively weaker than their counterparts, the developed nations (Reid, 2009:17).

3.7 Health situation in selected developing countries

In Section 3.3 the health systems of developed and developing countries were compared. This comparison was for generalised health conditions. In this section diseases, health and healthcare in a number of selected developing countries are reviewed in more detail. It seems nothing will deviate much from the main features highlighted in the comparison in Section 3.3 but some specific aspects can be seen to emerge. It is not possible to discuss the health situation in all developing countries and a selection was made to demonstrate that such countries would serve to potray the situation in the respective categories of

developing countries. The review of developing countries in this section will begin with Zimbabwe.

3.7.1 Health situation in Zimbabwe

A number of researchers the world over have conducted studies on the geography of health and health in general. However, limited research has so far been carried out on the health system of Zimbabwe. As indicated in Section 1.7 in Chapter 1, research has been done in Zimbabwe on health in general but limited research has been conducted on the health system from a space-in-time perspective. It is against this background that research of this kind becomes necessary.

Turshen (1999) conducted a study on the health system of Zimbabwe and she argued that Zimbabwe's health system has worsened because of the Economic Structural Adjustment Programme introduced in 1992. Turshen (1999) further argued that despite the concentration of health care resources in the two main cities (Harare and Bulawayo) prior to 1992 the government was able to deliver adequate health services to 80 percent of the rural population. In 1992, however, the imposition of Economic Structural Adjustment Programme by the World Bank saw the abolition of 1200 health and nursing posts. Fees were introduced at hospitals and clinics. This situation Turshen (1999) argues, led to serious deterioration of the country's health system. Turshen (1999), in agreement with Marquette (1997: 1143), indicated that the benefits of the national health system were eroded by structural adjustment of the 1990s. The country experienced frequent outbreaks of infectious diseases, for example, plague in 1994. In 1990 the life expectancy of Zimbabwe was one of the highest in Africa, at 62 years (WHO, 2009: 12) but it dropped to one of the lowest life expectancies in the world (44 for men and 43 for women) in 1994 (Madslien, 2008). The sharp drop has been attributed mainly to the HIV and AIDS pandemic. Infant mortality rose from 5.9% in the late 1990s to 12.3% by 2004 (Madslien, 2008). Currently, the infant mortality rate is showing signs of declining from the 2004 level. According to ZIMSTAT (2012: 12), it is 6.4%.

Sithole (2001) applied quantitative methodologies in the study of health phenomena in Zimbabwe. Sithole (2001) made use of stochastic modelling to examine the spatial diffusion of tuberculosis in the Western part of Zimbabwe. It emerged from the research that tuberculosis is a prevalent disease in the western part of Zimbabwe and that the diffusion of such a phenomenon (disease) can be both contiguous and non-contiguous. Apart from the methodological contribution of the research, Sithole (2001) focuses on infectious diseases which are very relevant since there is a predominance of infectious diseases in Zimbabwe. The arguments raised in the context of the spatial diffusion of tuberculosis may be equally relevant to other communicable diseases in Zimbabwe (Sithole, 2001: 12).

In a related study, Dirwai (2002: 41-44) evaluated the linkage between the epidemiological transition model and development (particularly in health as a component of development). To a large extent, this was an endeavour to evaluate the applicability of Omran's (1971) Epidemiological Transition Model. The researcher demonstrated that poor regions of Zimbabwe are characterised by certain diseases (mainly infectious) hence they are at a certain stage on the first phase of the Epidemiological transition model. In contrast, according to Dirwai (2002), the developed regions which are predominantly urban are characterised by non-communicable diseases and are in phase 3 of the Epidemiological Transition Model. The research by Dirwai (2002) is methodologically related to the current study. It is however different in that, in the current research there shall be a more in-depth examination of the applicability of Omran's (1971) model than undertaken by Dirwai (2002) who basically used only the rural and urban as spatial units of analysis. It is argued in the current study that, there is internal variation in the rural as well as in the urban areas and these must be examined and exposed. It emerged from Dirwai's (2002) study that inequalities in health situation between the urban and the rural counterparts is a characteristic feature of Zimbabwe's health system.

Zimbabwe health care system has manifested a number of serious challenges. According to the Central Statistics Office (2004), 70% of the Zimbabwean population lives in rural areas. The irony is that while such rural areas have majority of the population, the spatial

distribution of health personnel in Zimbabwe in the public and private sector is skewed in favour of urban areas. According to Ministry of Health and Child Welfare (2004: 18), 80% of the public sector doctors and 60% of the public sector nurses are in urban areas. This means that 20% of the public sector doctors and 40% of the public sector nurses are found in the rural areas. The maldistribution in public sector personnel is not only exhibited between rural and urban areas but is also found amongst the urban areas. According to the Ministry of Health and Child Welfare (2004: 10) 55% of urban doctors and nurses' posts are in Harare and 35% are in Bulawayo. The rest of the smaller urban centres (about 10) share the remainder but serve bigger populations and areas with their general hospitals and provincial referral centres. The disparities in the spatial distribution of health personnel are not only found in the public sector, they are even more glaring in the private sector. Cities and towns have almost all (about 98%) of private health centres and private hospital facilities (Ministry of Health and Child Welfare, 2004: 22). The health system has been showing signs of going down. By the end of November 2008, three of Zimbabwe's four biggest hospitals namely, Harare, Mpilo and United Bulawayo Central Hospital, had closed down, together with the Zimbabwe Medical School while in the fourth major hospital, Parirenyatwa Central, two wards and operating theatres were no longer working (Hungwe, 2008). Hungwe (2008) further indicated that due to hyperinflation, those hospitals that were still open were not able to obtain essential drugs and medicines. The political and economic crisis contributed to the emigration of the doctors and other health professionals with crucial experience, knowledge, skills and expertise.

Zimbabwe like many other developing countries has a troubled health sector. According to WHO (2010: 7) the disease burden of the country is multi-faceted and is composed of nutritional deficiencies, communicable, maternal, perinatal, and non-communicable conditions. The country has poor and unequal conditions of health (both the state of people's health and health services). As alluded to in Chapter 1, the health delivery system and the state of people's health have also drastically deteriorated over the last few decades. In addition to this, the health system also shows severe spatial inequalities. Infectious diseases are rampant among malnourished people. According to Tren and Bate (2005:1), the HIV rate can well be one of the highest in the world with an official rate

of 25%. The implication is that certainly tuberculosis and other opportunistic infections should be increasingly thriving in the HIV-positive environment. Such proliferation of diseases is likely to result in sharp escalation of Case Fatality Rates because according to WHO (2008:2), the country has a nationwide shortage of medicines, care providers as well as poor health facilities.

3.7.1.1 Health improvement strategies used in Zimbabwe

Over the years, various strategies and policies have been formulated and implemented in an effort to improve the health situation in Zimbabwe. An overview of strategies that can be used in reducing health inequalities and in the improvement of health in general was provided in Section 2.7. The strategies discussed in that section were those that can be used in reducing health inequalities and in the improvement of health in general. In this section of the chapter, the strategies and policies that were introduced in Zimbabwe in the past and are still being implemented are discussed.

- **Primary Health Care approach (PHC)**

According to Nyazema (2010: 233) Zimbabwe adopted the concept of Primary Health Care in order to address the inequalities in healthcare that had existed prior to independence in 1980. The implementation of the Primary Health Care approach demanded the channelling of health resources towards previously neglected areas such as improvement of nutrition and the control of preventable diseases. This strategy emphasised the conscious and active involvement of communities in changing their own health. The government recognised the existence of numerous uncoordinated healthcare providers and an unbalanced distribution of health personnel between urban and rural areas and between social classes. This threatened the establishment of a national unified health system and according to the Transitional National Development Plan (1983) various measures were put in place: the elimination of racially discriminatory laws, introduction of strict laws on the expansion of private health facilities, the bonding of health workers to the public sector after training, restriction of immigrants from private practice, recognition of the traditional health sector, closer monitoring of therapeutic

procedures through the establishment of an essential-drugs list and encouragement on the establishment of a national health insurance scheme.

The execution and delivery of healthcare services has been steadily transformed, in line with the new Primary Health Care (PHC) approach. The therapeutic and preventive structures have been incorporated into the subnational health structures, themselves accountable not only to higher levels of the health structure but to the local government structures at the level of service. The health worker in the rural health centre is no longer concentrating on curative work only, but is responsible for mobilising, through the other health players, the variety of promotive, therapeutic and rehabilitative services being developed, as well as the training of new health workers and integration with other sectors. Relevant steps have been taken to restructure health education to train health workers more appropriately towards the country's needs.

The Zimbabwe Expanded Programme on Immunisation (ZEPI) was commenced in 1982, with the purpose of increasing coverage of all ZEPI vaccines to 90% of the country's population by the year 2000 (Ministry of Health and Child Welfare, 2008: 47). This is another important health improvement strategy introduced since independence. After independence, the first five years witnessed rapid improvements in areas such as coverage of immunisation, access to healthcare services, and contraceptive use prevalence rate (Marquette, 1997:1141). The expanded programme focused primarily on the six main childhood communicable diseases, and tetanus in pregnant women. The six childhood killer diseases are: tetanus, diphtheria, whooping cough, polio, tuberculosis and measles. Studies confirm that the percentage of children between 12 and 23 months who were wholly immunised in rural areas of Zimbabwe increased from 25 to 42 % between 1982 and 1984 (Ministry of Health and Child Welfare 1984a), whilst the percentage in Harare City increased from about 56 to 80 1983 and 1986 (Ministry of Health and Child Welfare, 1984b).

According to Chadambuka *et al.* (2012)'s assessment, by 2000, the programme had achieved remarkable results. Vaccination coverage of children who received three doses of diphtheria, tetanus and pertussis vaccine (DPT3) rose from 46% 1982 to over 90 % in

2000 (Chadambuka *et al.,* 2012: 163). Chadambuka *et al.* (2012: 163) further indicated that the dropout rates during that period reducing from 35 to 6 per cent. The dropout rate refers to percentage of children who obtained the first but not the third dose of diphtheria, tetanus and pertussis (DPT). The goal of the World Health Organisation is to have all countries, including Zimbabwe attain 90% routine vaccination coverage by 2015 (UNICEF, 2005: 11). In support of this goal, Chadambuka *et al.* (2012: 163) observed that the Zimbabwe Expanded Programme on Immunisation has received support from the Global Alliance for Vaccines and Immunisation (GAVI) for training health workers, buying of cold-chain gas, and obtaining vaccine supply.

The National Village Health Worker Programme (VHW) which is part of the Primary Health Care strategy was launched in November 1981 (Sanders, 1990: 11) to improve the health system of the Zimbabwe. Village Health Workers were trained and tasked to assist in their local communities. Village Health Workers were introduced as the first amongst community healthcare staff and are the main link between the village community and the local health services. The function of Village Health Workers is basically educative, promotional, and preventive, organising the community and people for preventive health activities. Village health workers are the first line healthcare staff for curing of basic medical conditions, disease prevention and monitoring and for enhancing health information systems. Supervision of Village Health Workers is done by the local health staff of the local healthcare centres, who keep the village health workers supplied with medicines and other materials at government's expense. Village Health Workers refer and also advise people to get early treatment from a local healthcare centre or clinic. Related to this programme was the Traditional Midwives Programme (TMP) meant to develop the skills of household level women activities in identifying pregnancies at risk, basic midwifery, basic hygiene, and elementary child care. Such primary health care activities are in high demand in Zimbabwe, particularly in its rural areas where health centres (Clinics for example) are too far away from each other. Under such circumstances people get immediate assistance from the Village Health Workers.

- **Healthcare Building Programme and infrastructure development**

To improve the provision of health services after independence, the government embarked on the hospital and rural healthcare centre building programme. The large-scale construction and upgrading programme of healthcare centres was undertaken after independence and by January 1987, 224 rural health facilities had been completed (Sanders, 1990: 10). In addition, numerous provincial and district healthcare centres and many rural clinics were upgraded. According to Ministry of Health and Child Welfare (1984a: 4) the priority task after independence was the re-establishment and rehabilitation of the war damaged health infrastructure. With the realisation that the causes of poor health lay in the conditions of people's lives and in the context of an urban, racially and curatively biased health care system, the government in 1980, therefore, undertook to change healthcare so that all citizens would have access to an all-inclusive integrated National Health Service. This healthcare system was envisaged as integrally connected to other development programmes, such as the organisation of rural infrastructure, transport, education, water and sanitation, housing and food production. In this Post-independence health policy, emphasis was therefore not confined to the health sector per se but to other sectors linked to health as well. Equity in Health reflected the wider national objectives described in the Transitional National Development Plan, to create a society founded on democracy, socialism and egalitarian principles and to end imperialism through more equitable Zimbabwean ownership of the means of production (Ministry of Health and Child Welfare, 1984a: 4).

- **Diarrhoea programme**

In February 1982, the Diarrhoeal Disease-Control Programme was declared a priority by government According to Sanders (1990: 10), diarrhoeal diseases include cholera and dysentery. “Emphasis was on improved case management, mainly by oral rehydration therapy (ORT), epidemic control, improved nutrition, prolonged breast feeding, improved environmental hygiene through water supply and sanitation, promotion of standard

hygiene practices to reduce risks of contracting diarrhoeal diseases, as well as improving the availability of essential paediatric drugs" (Sanders, 1990: 10).

Although hard data cannot be obtained, interviews and questionnaire responses obtained at the end of 1984 indicated that the number of people with diarrhoea at healthcare centres showed a decrease (Cutts, 1984). There has been a considerable increase in the proportion of rural women who can prepare a proper solution for Oral Rehydration Treatment, so that home-based management of diarrhoea is increasingly undertaken (De Zoysa, 1984; Mtero, 1985; Ministry of Health and Child Welfare, 1984a).

The provision of clean water and sanitation is necessary for improvement of the standard of living of the population. It also considerably contributes to the decrease in morbidity and mortality from diarrhoeal diseases. After independence, Zimbabwe invested and made great improvement in water and sanitation programmes. According to the Labour Force Survey the proportion of rural households with access to clean water declined from 75.1% in 1999 to 66.5% in 2004 (Ministry of Health and Child Welfare, 2008). With the persistent problems in provision of water and sanitation in urban areas, it has been argued that some of the piped water is not safe and definitely not consumable.

- **Nutrition**

According to Sanders (1990: 11) the Department of National Nutrition was established in 1982. The government recognised that nutrition affects people's health and therefore established that Department. Its functions included nutrition and basic health education, with particular emphasis on breast feeding and weaning practices, child growth and nutrition monitoring using child health cards, and supervision of the Children's Supplementary Feeding Programme and food production plots. By June 1984, 80% of children aged one possessed a growth card (as against 71% in 1982) and 83 % had been weighed at least twice in the first year of life (58 % in 1982) (Ministry of Health and Child Welfare, 1984b), although only 35 per cent of Harare women could consistently and correctly interpret the growth curves (Ministry of Health and Child Welfare, 1985). A daily energy-rich supplementary meal was given to predominantly undernourished children in

rural areas. The programme operated from 1981 to 1985, at the peak of drought, and over a quarter of a million children in over 8 000 rural area feeding points, received such food (Working Group, 1982; Ministry of Health and Child Welfare, 1984a).

- **Policy on alcohol, tobacco and drug abuse**

There are various efforts being undertaken by the government of Zimbabwe to limit the consumption of alcohol and tobacco as well as stop drug abuse. Zimbabwe is implementing the WHO- Alcohol, Smoking and Substance Involvement Screening Test (WHO, 2008: 88) and this enabled the government to determine the approximate number of abusers and to detect the problems and intervene rapidly. There is a law in Zimbabwe that prohibits the use of drugs. Smoking in public places is also prohibited and there is prohibition of children under age of 18 years from drinking. Educational campaigns on the effects of drug, tobacco and tobacco abuse on school children and the general public are also being undertaken. WHO (2008: 87) notes as part of the strategy to reduce alcohol misuse, the government of Zimbabwe is restricting approvals of new licences for retailers to sell alcohol at off-site consumption points near high crime areas, schools, and parks. There are also programmes that help women to give up smoking before or during pregnancy which were put in place in Zimbabwe. In practice, the law seems to have limited effectiveness because according to the Ministry of Health and Child Welfare (2008: 68), evidence exists that there is an increase in the incidence of lifestyle related diseases, for example, respiratory diseases, liver cirrhosis, injuries and some of the psychiatric conditions.

- **Family Planning Policy**

Perhaps the most significant intervention to decrease maternal and neonatal morbidity and mortality in Zimbabwe after independence was the development and sustenance of a strong national family planning and child spacing programme which was introduced in Zimbabwe long before independence. Zinanga (2010: 3-4) describes the outlook of family planning in Zimbabwe from its inception to the period around independence. According to the researcher, family planning was introduced in Zimbabwe as a voluntary movement in

the 1950s. Volunteers created a Family Planning Association in the mid-1960s. The government became interested in family planning in the late 1960s after analysis of the 1961 population census. The Family Planning Association was given an annual grant, contraceptives were allowed to be obtainable at the Ministry of Health facilities, and allowed non health personnel to initiate and distribute condoms and oral contraceptives to family planning clients with. Before Zimbabwe attained independence in 1980, family planning was viewed with immense suspicion by the black majority, so the program's effectiveness was limited to urban areas. A new era began after independence. The new government took over the responsibilities of the then Family Planning Association and altered its outlook entirely. Through government and the international donor community, the family planning programme was restructured and enlarged.

The Family Planning Programme of Zimbabwe was intended to avoid unwanted pregnancies and to promote child spacing. Sanders (1990: 3) observed that in 1989, fundamentally as a result of its activities, Zimbabwe had the highest rate of contraceptive use in Sub-Saharan Africa. The Contraceptive Prevalence Rate, or the proportion of married women using the family planning method in Zimbabwe, rose steadily from 48% in 1994 to 65% in 2008 (Ministry of Health and Child Welfare and Child Welfare, 2008: 2). The Ministry of Health and Child Welfare (2008: 2) further indicated that oral contraceptives were used by 43% of all women and this was the most commonly used method of family planning. The Contraceptive Prevalence Rate was higher in urban (69%) compared to rural areas (63%). The Total Fertility Rate consequently fell from 5.2 in 1999 to 3.4 in 2008 (Ministry of Health and Child Welfare, 2010: 33).

- **Complementary or Alternative Medicine**

Conventional health-care or Western medicine was first introduced in the country by missionaries and the colonial government. This implies that in Zimbabwe it was brought into the country around 1890. As for complementary or alternative medicine it dates back to prehistoric times. Zimbabwe National Traditional Healers Association (ZINATHA) is an organisation composed of traditional healers. According to Nago (2009: 4) the association was formed in 1981. The association is officially recognised by the government. This is a

clear sign of the government's appreciation of the role of traditional medicines. In Zimbabwe today people are using both the traditional or complementary as well as the conventional medicines.

Most of the practitioners operate independently of one another although there is a CAM association that welcomes the membership of CAM practitioners (Nago, 2009: 5). This implies that the CAM system lacks the administrative structures like the ones found in conventional health-care systems. The administrative structure in the governmental health-care system, often referred to as the public healthcare system, is headed at the ministerial level and branches out into provincial, district and divisional administrative levels.

3.7.1.2 Evaluation of the health improvement strategies used in Zimbabwe

It is clear from the discussion above that over time different policies were introduced in Zimbabwe in an endeavour to improve the health system (the state of people's state and provision of health services) of the country in general. In spite of the multiplicity of such strategies, the general state of health of the country largely failed to improve. Spatial inequalities in health conditions have persisted and the anticipated spatial integration of the health system has to a large extent failed to materialise. Nyazema (2010: 236) argues that the initially reduced gap between health in rural and urban areas, during the period from 1981 to 89, has started to manifest indications of growing disparities in health and healthcare. These indications often seem to have been disregarded and have been increasingly downplayed as the Government of Zimbabwe implemented its Economic Structural Adjustment Policies between 1991 and 1995 and health policy changes (Nyazema, 2010: 236).

Nyazema (2010)'s argument reinforces what was earlier indicated by Conyers (2001) that the efforts to reduce regional inequalities across the different dimensions of development (health included), in Zimbabwe, have been piecemeal and most of the policies concentrated on racial rather than spatial inequalities. Conyers (2001: 186) further argued that although some progress has been made in reducing interracial inequalities, the

inherited disparities between rural and urban areas and between the various districts in the spatial economy continue to exist.

Some of the causes of spatial inequalities in the Zimbabwean health system can be traced back to the 1980s. Davies (1988: 143) argued that the persistence of severe inequalities and the general failure of earlier strategies in Zimbabwe are, in the first place, because of lack of reference to spatial research and analytical methods or spatial policy. He continues to argue that development towards the application of spatial policy is piecemeal or hesitant at best. Spatial planning and policy have not received the attention they deserve even in conditions highly favouring them (Davies, 1988: 143). Spatial inequalities in Zimbabwe's health system have therefore persisted as a problem that is receiving insufficient attention. The implementation of any policy or strategy aimed at improving the country's health system has budgetary implications. The health improvement programmes require expansion in government expenditure. As alluded to in Chapter 1 of the current research, Zimbabwe is experiencing various economic challenges. Such challenges make it difficult for the government to effectively implement any health improvement strategy as financial and other health resources are needed. It can be argued with a reasonable degree of certainty that the lack of success of some of the policies or strategies is due to poor economic performance of the country.

The impression so far created in this section is that the past health improvement strategies have not achieved anything. This is not the case; some improvement has been registered in some policies. For example, in the case of the family planning strategy, knowledge of family planning options is almost universal in Zimbabwe, meaning that men and women in the country have enough knowledge about the methods available for controlling births and planning their families. According to the Ministry of Health and Child Welfare (2006: 39), the level of knowledge of at least one modern method of family planning among all women aged between 15-49 years is at 98 percent, and for currently married women it is almost universal at 99 percent. On another positive note, there was improvement in health infrastructure particularly health centres. As indicated in Section 3.7.1.1 of the current chapter, in the period from 1980 to 1987, 224 rural health centres

were completed. This is evidence of the improvement in the health services and serves as an indication that the health care building programme strategy achieved something. Data analysis in Chapter 6 of the current research has also revealed an overall positive shift in the health system of Zimbabwe. The success stories of the strategies such as these can be used to justify that previous policy or strategies have been useful to a reasonable extent.

Despite the numerous success stories of previous health improvement strategies in Zimbabwe, it is worrisome that the overall conditions of health in Zimbabwe are still in a bad state. As alluded to Section 1.2 of Chapter 1, Zimbabwe's health system is in a bad state. Data analysis in Chapter 5 will show that the majority of the administrative districts of the country are still in a bad state of health (in the age of pestilence, famine and endemics). Even though some improvements were registered in health (according to data analysis in Chapter 6), such progress was very negligible. The situation can not be left unattended. Strategies should be established to ensure that the health system of the country is improved to meet at least the minimum international benchmarks of normal health standards and service provision. The policy recommendation in Chapter 7 involves suggestion of new ones being formulated or adjustments being made so as to improve the health system of the country. The failure of many of the previous and existing policies has resulted in continued and severe dualism in the spatial health system of Zimbabwe.

3.7.2 Health situation in South Africa

There is justification in reviewing literature on the South African health situation. The country is a neighbour of Zimbabwe and is generally classified as one of the more developed countries on the continent. Despite this, South Africa's burden of disease is approximately four times bigger than that of developed nations, and in most cases almost doubles that of many other developing countries (ECONEX, 2009). ECONEX, (2009: 2-3) further highlights the quadruple nature of the disease burden of South Africa particularly the high prevalence rate of HIV and AIDS. Due to the lack of healthcare infrastructure, developing countries experience disproportionately large disease and other public health

problems. South Africa, for example, is home to more than 5.7 million people living with HIV and was ranked 175 out of 191 in the healthcare survey by WHO (2009). The recent worldwide economic crisis restricts the depth of economic resources allocated by South Africa to any one government sector, and healthcare is no exception. It is against this background that literature should be reviewed so as to understand what goes on in the health system of such a developing country.

Various studies have been conducted on health and health related issues in South Africa. Hatingh *et al.* (2006) for example, investigated the health care environment in South Africa from 1652 to 2006. The research describes in detail how public and community health care evolved during different eras. The analyses distinguished between the time periods 1652 to1910, 1911 to 1977 and 1978 to 2006. The research concludes that over the centuries, many developments in health care led to improvements in the national health system. Prevention of disease and promotion of health were main aspects of this improvement in the health system. There was a shift from a strictly curative approach to a preventive and rehabilitative healthcare system over the centuries. The major government priorities were the reduction of inequalities in healthcare access and service delivery in the public health system. These still remain priorities today (Hatingh *et al*., 2006: 11).

Baron (2011) indicates that immunisation against measles in South Africa increased between 2001 and 2009, from 68,5% of infants in 2001 to 98,3% of children of the same age in 2009. There was an increase in the percentage of infants who had received all their primary vaccines for tuberculosis, diphtheria, whooping cough, polio, tetanus, measles, hepatitis B and haemophilias influenza from 2001 to 2009. The immunisation rates for primary vaccines rose from 66,4% in 2001 to 95,3% in 2009. Baron (2011) further indicates that the data based on reported live births from the District Health Information System (DHIS) (2010) shows that the proportion of women in South Africa whose live birth took place in a healthcare centre increased from 76,6% in 2001 to 94,1% in 2009. This indicates a significant development in the extent of services provided at healthcare facilities in South Africa.

According to Baron (2011), HIV prevalence rate in South Africa appears to be stabilising after hitting the highest point in the 1990s and early 2000s. South Africa has the biggest Antiretroviral (ARV) Therapy Programme in the world. Baron (2011) adds that in April 2010, the upscaled HIV and AIDS Prevention and Treatment Plan was introduced and measures include:

- all infants receive ARV treatment if they test HIV-positive, irrespective of CD4 level;
- all patients with both Tuberculosis and HIV get ARV treatment if their CD4 count is 350 or less;
- a massive counselling and testing programme has been introduced; and
- massive increase in the supply of male condoms from 450 million per year to more than 1,5 billion.

On Improving quality of healthcare service, Baron (2011) reports that quality improvement plans will be developed in 70% of all public sector healthcare centres by 2013, focusing on improving six key areas, namely patient safety, prevention of diseases and control, availability of medication, waiting times, hygiene and attitudes of health workers. By 2013, 90% of public-sector hospitals would be conducting patient satisfaction surveys.

To improve access to health, Baron (2011) indicates that National Health Insurance (NHI) was proposed and by mid-2010, a solid foundation was laid for the introduction of the NHI. A dedicated NHI technical support unit was established within the Department of Health, to steer the implementation. Through the NHI, the Department of Health will ensure access to good quality and affordable health services for all South Africans. The major objective is to put into place the necessary funding and health service-delivery mechanisms that will enable the creation of an efficient, equitable and sustainable health system.

There are several challenges faced by the South African health system. There is evidence of a worsening health system. Life expectancy in 2008 was 12 years lower than in 1996 and both maternal and child mortality rates have fallen since the early 1990s (Marais, 2010: 3). According to Marais (2010: 3) this can largely be attributed to the AIDS and

tuberculosis epidemics. As elsewhere in Africa, private sector providers and out-of-pocket payments are essential components of the South African health system.

McIntyre *et al.* (2006: 436) indicate that, not only was there a huge private sector for the provision of healthcare services before 1994 but also that the system remained highly commercialised in 2005, regardless of recent efforts to reduce the private sector and broaden the public sector. The health system is also facing a problem of inequality. In South Africa, access to healthcare for all is enshrined in the constitution; yet, considerable disparities remain, chiefly because of distortions in resource allocation (Gilson *et al.,* 2007:673). Political, social, economic and rural-urban differentials in health outcomes, and between the private and public health sectors, remain challenging (Gilson *et al.,* 2007:673). There is empirical evidence which shows that such inequalities exist. Harris *et al*. (2011: 103) for example, indicates that in 2005, spending per private medical scheme member was nine times bigger than public sector expenditure, and one specialist doctor served less than 500 people in the private sector but around 11 000 in the public sector. Disparities in the South African health system are being experienced in the people's health status, utilisation of outpatient services (annualised number of visits/person in the last month), and inpatient services (number of admissions per 1000 people/year) services, health insurance status of people, healthcare delaying time, affordability by a patient and access dimensions of availability (distances and travel mode to facilities) (Harris *et al*., 2011).

3.8 Health situation in selected developed countries

In Section 3.7, the health situation in Zimbabwe and South Africa was discussed. The global health situation cannot, however, be clearly understood iwithout a discussion of the situation in developed countries. In the current section, therefore, selected developed countries are discussed so as to expose the health situation in those countries. Once the situation in both developed and developing countries have been discussed, it becomes easier to see how their health systems differ.

3.8.1 Health situation in the United Kingdom

Connolly *et al.* (2010: 95) pointed out that following the political devolution in the United Kingdom (in 1999) the resultant variations in the health policies mean that it is no longer meaningful to talk of a 'United Kingdom National Health Service'. Healthcare in the United Kingdom is a decentralised matter, meaning Northern Ireland, England, Scotland and Wales each have their own different systems of privately and publicly funded healthcare, together with complementary and alternative health services. Each region having diverse policies and priorities has resulted in a variety of differences existing between the systems. Each region provides public healthcare to all United Kingdom citizens that is free at the point of need, being funded from general taxation. Government policies in Scotland and Wales have increasingly deviated from those in England: instead of patients being allowed to choose between competing pluralist providers, these governments favour a publicly owned national health system run by authorities that are integrated with providers (Connolly *et al*, 2010: 95).

Taking all regions together, the World Health Organisation (2009) ranked healthcare provision in the United Kingdom as fifteen from the top in Europe and eighteen in the world. Such a ranking overall indicates that healthcare provision in the United Kingdom is relatively good. In spite of such a good healthcare system, there is significant evidence supporting the existence of spatial inequality in the healthcare systems of the United Kingdom. Sutherland and Coyle's (2009) analysis of the performance of the four regions (England, Scotland, Wales and Northern Ireland) across a range of indicators in the domains of healthcare across the United Kingdom showed that there were important differences between the four regions. It, however, further emerged from their (Sutherland and Coyle, 2009) analysis that there is no persistent pattern in which one region consistently performed better than any other. The existence of the inequalities among the regions (England, Scotland, Wales and Northern Ireland) has also been confirmed by Connolly *et al.* (2010) who indicated that their analysis has identified important and systematic differences between the regions in terms of waiting times, time taken by

ambulances to respond to emergency calls and productivity rate of hospital doctors and nurses.

In spite of the low disease burden of the UK (and incidentally in most developed countries as alluded to Section 3.3), the country shows spatial health inequalities. Shaw *et.al.* (2000) investigated the patterns of health in Britain from 1051 to1991. It emerged from the research that there are inequalities in mortality between groups of people as defined by district of residence. It has also emerged from the research that not only is there inequality in health between regions in Britain, but that the extent of such inequality is increasing. The researchers, (Shaw *et al.,* 2008), managed to demonstrate that with increasing prosperity and limited redistribution, there are increasing socio-economic inequalities and a widening health gap in Britain.

In a related study, Smith and Easterlow (2004) examined the geography of health inequalities in the United Kingdom. The researchers indicated that although the health situation in Britain is comparatively good, the existence of spatial inequalities in the health system is a cause for concern. Inequality within the core (in the developed world) is definitely a surprising phenomenon but it exists.

3.8.2 Health situation in Canada

Canada is a developed country and the disease burden of that country is low. As illustrated in Section 3.3, there is predominance of non-communicable diseases. As indicated in Section 2.6.3.4 of Chapter 2, Canada uses the National Health Insurance Model. Reid, (2009:22) indicates that the health system uses private sector providers, but the funding is done from the government run insurance programme that every citizen is a member to. Almost all doctors' clinics in the country are privately owned and nearly all hospitals are private, but they operate on a non-profit base with basically all of their funding from the government (Zakirova *et al*., 2012: 246). Zakirova *et al.,* (2012: 246) further state that most health workers (doctors and nurses) work in private practice, but get paid by the government according to a fee schedule negotiated between the government and their respective territorial medical associations. The health care system

is thus a socialised group of integrated health insurance plans that provides coverage to all Canadian people. Most Canadian citizens qualify to get healthcare services regardless of medical history, individual income, or living standard. The healthcare system is funded by the government. It is administered and financed on a provincial or territorial basis, within parameters set by the federal government (Health Canada, 2005: 13).

The Canadian health system is not homogeneous across all the 13 provinces and territories. Armstrong and Armstrong (2008: 11) state that there is considerable variation in terms of the administration of finances, delivery methods and variety of public health care services. Despite the differences, access has become considerably equitable not only for the affluent and underprivileged but also among the territories because extra federal funds are used to support healthcare in provinces that lack the economic resources to provide enough access on their own. Zakirova *et al.* (2012: 246), however, argue that while the healthcare system has been doing well in maintaining a high level of human health and has undergone a series of improvements, many challenges are emerging. These include the ageing population, growing health care expenditure, particularly for medicines, long waiting times, and scarcity of health human resources. Some health scholars argue that the current controversy in Canada on whether these organisations are sufficiently funded, and whether, in contrast to non-profit organizations, "for profit" institutions should be more centrally involved in the direct provision of services through public financing (Zakirova *et al.,* 2012: 246).

Direct comparisons of health statistics across countries are difficult. The Canadian health care system is often compared to the United States' system. The United States spends the highest amount of money, in terms of the world per capita, and was ranked 37th in the world by the World Health Organisation in 2000, while Canada's healthcare system was ranked 30th. Canada spent around 10,0% of GDP on healthcare in 2006, more than one percentage point higher than the average of 8,9% in OECD countries (Organisation for Economic Cooperation and Development, 2006: 14).

3.9 Conclusion

It has emerged from the discussions in this chapter that the diseases and health conditions of most developed countries are generally the same; they generally share the same features. The same cannot be said about developing countries. The disease burden of developing countries is big and multi-faceted, whether it is in Asia, South America or Africa. Ironically these are the countries whose healthcare systems are not sufficiently advanced to take care of the big and predominantly multi-faceted disease burden. By contrast, the disease burden of developed countries is generally low and dominated by non-communicable diseases. Developed countries generally have highly developed healthcare systems. This probably explains why their disease burden is low. The scenarios presented here have, sadly, led to a global health system that is highly unequal.

There are, however, also inequalities within national health systems in both developing and developed countries and the aim of this research is to investigate the spatial inequalities of the health system, particularly state of people's health and health service provision in Zimbabwe. The following chapter (Chapter 4) deals with the collection of data to attain this aim. In the chapter, the reasons of why and the processes of how data was collected are discussed. The general indicators used by different researchers as well as the specific indicators that were used for the measurement of the health status of the different spatial units in Zimbabwe are also explained. The various sources of data used and the problems related to obtaining such data also receive attention.

CHAPTER 4

INDICATORS AND DATA SOURCES

4.1 Introduction

Health and development indicators for the demarcation of health regions are very subjective and diverse and therefore an explanation of how suitable variables for the examination of the temporal and spatial dimensions of the country's health were identified is necessary. An overview of the indicators or variables used by other researchers is given in order to explain the variables selected to measure levels of health (both people's state of and the provision of health services) in Zimbabwe. The way in which the data for the identified indicators or variables was collected also needs clarification since a large number of variables are used and there is a diversity of sources from which secondary data were obtained. Positivistic and phenomenological methodologies are used in the analysis and these are also explained in this chapter. At the end of the chapter, the collection of data on the evolution of the health system of Zimbabwe according to the Adapted Epidemiological Transition Model is explained. This chapter contains a critical explanation of the indicators, the data sources and the methods used to collect data to achieve the first four objectives of the research and some of the problems experienced in the process.

4.2 Data collection

According to Burns and Grove (2011: 41), data collection is the process of gathering data relevant to the research purpose. The actual steps of gathering the data are specific to each study and depend on the research design and measurement methods. Geographical data can be either obtained from primary or secondary sources. Normally data on indicators for the whole country cannot be obtained through direct measurement. Such data on variables (social, economic and physical) for the whole country is available from secondary sources such as published census reports and other government reports.

Zimbabwe National Statistics Agency (ZIMSTAT) regularly conducts censuses every 10 years in Zimbabwe. Results of censuses are usually published after two years. For example, the results of the 1982 were published in 1984 and those of 1992 were published in 1994. Although different spatial units are used when collecting data during the census, the administrative district is the main unit of spatial analysis during the census. Most of the data on health and health related variables are collected on districts as spatial units. Data is collected on different types of variables during a census. The variables include; infant mortality rate, crude death rate, birth rate, life expectancy, fertility ratio, unemployment rate, literacy rate, housing conditions, age distribution of the population, age distribution of the population, Maternal mortality rate, incidence rate of diseases such as Diarrhoea, Measles, diarrhoea and dysentery incidence rate.

Secondary data for this research were obtained from the published documents of ZIMSTAT and the Ministry of Health and Child Welfare of Zimbabwe. ZIMSTAT and the Ministry of Health and Child Welfare are funded by government and/or non-governmental organisations to collect and publish the data. This research is not the first to utilise secondary data for the examination of the spatial patterns of health in a country. Secondary data have been used by other researchers such as Smith and Easterlow (2005) and Turshen (1999) to examine spatial patterns of health in a country as a whole. Derived data are normally a ratio of one kind or another. This means that the raw data obtained from secondary data sources are usually converted into indices or ratios to the national average and is not used in its original form.

Data unavailability on some important health and health related indicators in Zimbabwe such as HIV/Aids, malaria, heart related diseases, tuberculosis and per capita income was a major challenge in this research. The spatial units of analysis used in this study are administrative districts and the data for some important variables are not available at the level of districts in Zimbabwe. Outdatedness of the data for most of the indicators of health was yet another problem because the census which is the major source of the data is held only every ten years. This implies that there is a dearth of information on many health and health related variables for research in Zimbabwe. In this research, data were

required for the whole country and some of the data are of a historical nature. In such cases, it was not easy to get such data. Secondary data from population census as well as published data from reports from government departments were used.

Primary data were collected through sample surveys conducted in each of the 62 administrative districts of the country. Some questionnaires were posted while others were handed over to the respondents in person for completion. Appendix A (the questionnaire) gives the list of questions that were answered by the sampled respondents in each district. The questionnaire was meant to solicit data on cancer, accidents and injuries, metabolic disorders, cardiovascular diseases, auto-immune and the duration that respondents worked at the hospital. Such data are required in this research for the assessment of the applicability of the Epidemiological Transition Model in Zimbabwe (the third objective of the research). The choice of respondents in this research was based on purposive sampling. The principle used in the purposive sampling in this research was that people who have expertise in the area of diseases and the prevalence rate of diseases were targeted as respondents. Involving ordinary people, who have limited knowledge about the diseases, would have created problems since they would not have been able to answer most of the questions. The sample size was 61 respondents. This was based on the fact that data on diseases were supposed to be collected from each of the 61 administrative districts of Zimbabwe.

As indicated in Section 1.11.2 in Chapter 1, interviews were used to complement data from secondary sources and the questionnaires. Interviewing implies a form of questioning, usually characterised by verbal questioning as the technique for collecting data. The face-to-face interviews were held with the officials from the Ministry of Health and Child Welfare. The officials were the Permanent Secretary, the National Director of Health and Provincial Directors from the Ministry of Health. In addition to these, four doctors were interviewed (two from Mpilo in Bulawayo and two from hospitals in Harare). These are the biggest hospitals in Bulawayo and Harare. The choice of respondents was guided by the nature of the data that were required. The questions in the interview guide (Appendix B) needed people in high offices to be in a position to answer them. The

sampling type used was of the purposive or judgmental type. It was therefore justified to decide on who to interview based on the data needs of the research. It is recognised that such interviewees do not constitute a sample that is large enough to represent the whole population but information obtained through such interviews provided a substantial body of information on the health situation in the country. The focus of the interview questions was on the main types of diseases that affect the country's population, the manpower problems experienced in the country, health facility challenges in the country, trends in the country's health system and recommendations by the interviewees. Appendix B provides the detailed questions that were used to collect data on the health variables.

The use of face-to-face interviews in this study was underlain by a concern to promote dialogue and narration as a way of giving the respondents a "voice" to provide details and experiences about the spatial and temporal patterns of health in Zimbabwe. The method was useful to secure detailed information about the health system of the country that might have been difficult to gather through other methods of data collection such as questionnaires or observations. The face-to-face interview technique has the advantage of producing high response rates as opposed to other data-collection techniques such as telephone interviews or questionnaires sent by mail. In addition, the method provided an opportunity for the researcher to observe the non-verbal behaviour of respondents during the interview and correspondingly adjust his choice of language to be able to probe for details (Babbie, 1995: 305-308; Neuman, 2003:290; Cooper & Emory, 1995:270-290). The face-to-face interview approach was personal and enabled the interviewer to study the body language and facial expressions of the respondents which would have been missed out on, in a telephone interview or in a questionnaire. Like the case of the questionnaires, the choice of respondents to the interviews was based on purposive sampling. The aim was to engage people with detailed information about the health system of Zimbabwe. As indicated in Section 1.11.3.2 of Chapter 1, a total of 5 interviews were conducted with high ranking officials in the Ministry of Health and Child Welfare.

The use of both primary and secondary methods of data gathering has proved useful as such data are complementary. Even if all the required secondary data were available, it

was still necessary to gather some additional primary data in order to achieve a more detailed description and explanation of the spatial and temporal patterns of health in Zimbabwe. Published data provided the major source of information for the research but these were augmented by the primary data.

Whatever the merits and demerits associated with primary and secondary data collection methods, triangulation is inevitably significant in this research. Triangulation refers to eliciting information by means of a number of different devices in order to be more confident of its accuracy (Hannan, 2007: 2). The two main data collection methods (primary and secondary) are not repulsive of each other but should be combined to augment each other. Altrichter *et al.* (2008: 4) argues that triangulation gives a more comprehensive and balanced portrayal of the situation. The use of both data collection methods has a positive impact on the quality of this research.

4.3 Data sources

Secondary data were obtained from Zimbabwe National Statistical Agency (ZIMSTAT) and various Government Departments. This includes published reports of the 2002 population census data (Central Statistics Office 2004), published reports of the 1992 population census (Central Statistics Office, 1994), published reports from the Ministry of Health and Child Welfare (National Health Profile, 1994) and the published reports from the Ministry of Health and Child Welfare (National Health Profile, 2004). The data that were used to evaluate the evolution of the Zimbabwean health system was of a historical nature. Such data was not easy to obtain especially from primary sources.

The latest data that the Zimbabwe National Statistics Agency (ZIMSTAT) had for the required indicators are the 2002 census data. As indicated in Section 1.11.1, the census data used are outdated since another census was held in Zimbabwe in 2012 but it takes about two years before such data are published. At the time of doing this data analysis, the data for 2012 data were not yet available for use and it only became available just before this research was finalised. Unfortunately, the results came out after data analysis

has already been done. The results are available on the ZIMSTAT website (http://www.zimstat.co.zw).

The researcher is convinced that by combining the 2002 data with primary data, a successful description and explanation of the spatial and temporal patterns of health in Zimbabwe is possible. It was not easy to collect data of a historical nature (for objective number three) especially the 1992 data through primary methods. In this particular case, the researcher had to depend solely on secondary data.

As indicated in Section 1.11.1 of Chapter 1, primary data were obtained through interviews and questionnaires. This means that the interviewee and respondents to the questionnaires served as sources of primary data in this research. Primary data collected were needed for the assessment of the applicability of the Adapted Epidemiological Transition Model to the spatial health system of Zimbabwe, which is the third objective of the research. The primary data collected were on the following variables: the number of cancer cases recorded at the district hospital in a given year, number of cases of accidents and injured admitted in the district hospital per given year, number of cases of metabolic disorders recorded in the district hospital in a given year, number of cases of cardiovascular diseases recorded in the district hospital per given year, number of cases of autoimmune diseases recorded at the hospital in a given year

4.4 Indicators for spatial variation of health

In this section, the indicators that were used to describe the spatial patterns of health in Zimbabwe are discussed. The indicators are concerned with the first objective of the research and that is the examination of the spatial pattern of health (people's state of people health and health services) in Zimbabwe as it was in 2002. The discussion focuses on the justification for the choice of the particular indicator, how the data were collected, the correlation between the indicator and the level of the state of people's health and health services. The section begins with a discussion of the data needs. Indicators used by other researchers as well as indicators used for spatial patterns of health in the current research are also discussed.

4.4.1 Data needs

As indicated in Section 2.2 of Chapter 2, health involves the mental, social and physical well-being of an individual and not merely the absence of disease or infirmity. Health is thus a multidimensional concept. Health is thus attained through a combination of mental, physical and social well-being. Such a meaning of health has implications for the type of data that should be used to measure and examine the state of people's health and health services. The indicators that were used in this study to examine the spatial patterns of health in Zimbabwe took into account the multidimensional nature of the concept of health. Data that were concerned with the social environment of people, physical state as well as availability of healthcare services were collected in this research. Wold and Wold (2008: 65-67) maintain that data that can portray the social well-being of people are data that have to do with the social environment of people such as income of the individuals, education, social support and connectedness, prenatal care and social characteristics of parents. Wold and World (2008: 65-67) further maintain that data which can portray the health services to the people should be data related to accessibility of health resources to the people (the patients), time taken to travel to the nearest health centre, availability of the various health personnel and availability of the different types of medicines to the people (patients). It is necessary to collect and analyse data on the mental, physical and social conditions of people as well as the accessibility that the people (patients) have to the health resources if a successful examination of such people's health and health services is to be achieved.

4.4.2 Indicators used by other researchers

In the selection of the indicators for this research, there was consideration of the variables or indicators that were used by other researchers as well as availability of data on specific variables. The multi-dimensionality of health entails the use of many variables or indicators in the measurement of the state of people's health and provision of health services.

In research conducted by Marcus and Makanjuola (2011), a number of indicators were used to examine the spatial distribution of healthcare centres in Nasarawa State, North Central Nigeria for the period 2000 to 2009. The following indicators were used: number of health personnel in the state (doctors, pharmacists, nurses, laboratory technicians and radiographers), number of hospital beds/ population ratio, ratio of health care facilities to population, projections of future population growth and health care needs, government health expenditure per person and ratio of health personnel to population. The study by Marcus and Makanjuola (2011) focused on the provision of health services rather than the state of people's health.

Sutherland and Coyle (2009) used a range of indicators to compare the health conditions in the United Kingdom (of Wales, England, Scotland and Northern Ireland). The major findings from the research (cross-country analysis) by Sutherland and Coyle (2009) have been given in Section 3.8.1 in Chapter 3. One of the findings of Sutherland and Coyle (2009) is that, the health conditions in the United Kingdom are still worse than other European countries. Sutherland and Coyle (2009) further found that there is no logical pattern in which one region persistently performed better than any other and that there were few significant variations between each region. The indicators that were used are given in Table 4.1.

While there is some overlap in the areas the indicators relate to, generally the indicators in Table 4.1 relate to:

- life expectancy,
- National Health Service expenditure,
- staffing levels,
- level of activity per staff member (crude productivity),
- ambulance response time and waiting time,
- satisfaction with the National Health Service and
- per capita income

Table 4.1: Health indicators used in the analysis of quality of healthcare in the United Kingdom (Source: Adapted from Sutherland and Coyle, 2009)

National Health Service (NHS) expenditure per capita
Life expectancy at birth
Medical and dental staff per 1 000 population in England, Wales, Scotland and Northern Ireland
General practitioners per 1 000 population in Scotland, England, Wales and Northern Ireland
Nursing, midwifery and health visiting staff per 1 000 population
Management and support staff per 1 000 population
Total outpatient appointments per 1 000 population
Day cases per 1 000 population
Inpatient admissions per 1 000 population
Inpatient admissions per hospital medical and dental staff member
Day cases per hospital health and dental staff member
Outpatient appointments per nurse, midwifery and health visiting staff member
Inpatient admissions per nurse, midwifery and health visiting staff member
Day cases per nursing, midwifery and health visiting staff member
Proportion of the population waiting less than six months for day case or inpatient admission
Proportion of the population waiting less than three months for outpatient appointments
Proportion of emergency ambulance calls met within eight minutes
Proportion of the population indicating satisfaction with the general running of the NHS
Proportion of the population indicating satisfaction with care

Khang *et al.* (2004) in a study of health disparities in Korea identified a number of variables (indicators) that have influenced the pattern of health in that country. The variables or indicators were in four major categories namely: non-infectious diseases, infectious diseases, accidents and education. In terms of non-infectious diseases, it was

the prevalence of a number of diseases in the Korean population. The diseases were liver disease, cancer of the liver, cancer of the stomach, cancer of the lungs, diabetes mellitus, ischaemic heart disease, stomach cancer, diabetes mellitus, lower respiratory chronic diseases, pneumonia, and cancer of the colon. In terms of Infectious diseases, it was the prevalence of tuberculosis in the population. For accidents, it was the rate of occurrence of cerebrovascular and transport accidents. Finally, for education it was the level of educational attainment that was of concern. The study by Khang *et al.* (2004) focused on the state of people's health in Korea rather than on the provision of health services in that country.

Lehohla (2004) gave a report that provides a baseline picture of perceived indicators of the health status of people and utilisation of healthcare services in South Africa. The health indicators that are given in the report are, for example food household expenditure, disability level, medical aid accessibility, overcrowding and living conditions. In conjunction with other sources of information, this analysis assisted in tracking progress, inaccessibility and choice of health services and variations among different sections of the population. At a wider level, the report provides some idea of vulnerable groups relative access to and use of healthcare centres, hence groups that may be targeted by policy. It also provides indicators of socioeconomic and human development issues that can be targeted by integrated policy which will eventually influence the health conditions of the people.

A study by the Interagency Forum on Aging-Related Statistics (2008) made use of many indicators to measure and evaluate the state of people's health in the United States. The indicators are given in Table 4.2. The indicators were classified into those that were related to population issues, those related to economics, those that had to do with the health status of people and finally those that had to do with health risks and health care.

Table 4.2: Indicators used for the analysis of the state of people's health in the USA (Source: Adapted from Interagency Forum on Aging-Related Statistics, 2008: 62-63)

Population related indicators	Economics related indicators	Health Status related indicators	Health Risks and Behaviour related indicators	Health Care related indicators	Special Feature related indicators
-educational attainment -marital status -number of older Americans -racial and ethnic composition -living arrangements	-poverty -income -sources of income -participation rate in the labour market -overall household expenditures -accommodation problems	-life expectancy -death rate -chronic health conditions -sensory impairments - self-reported health condition -depressive symptoms -functional limitations	-vaccinations -diet quality -physical activity -obesity -cigarette smoking -air quality - use of time	- use of healthcare services -expenditures on healthcare -drug prescription -health insurance sources - out-of-pocket health care expenditures - sources of payment for healthcare services, - utilisation of home nursing -residential services - personal assistance	- literacy - health literacy

4.4.3 Indicators for spatial distribution of the state of people's health

As alluded to in the previous section, people's health and disease are determined by various physical, social and economic environments. Indicators which measure the socioeconomic and physical conditions that influence health were therefore included in the measurement of the state of people's health. While there are many indicators of health that can be used, the choice of indicators was influenced by what other researchers have used as indicated in Section 4.4.2. Data were also not available for some of the indicators the researcher would have wanted to include in the analysis, for example, illiteracy rate, percentage of people with full access to clean water and the incidence rate of malaria. A

detailed explanation of the meaning and justification of each indicator is provided in this section.

Table 4.3: Indicators used for the analysis of the spatial patterns of health in Zimbabwe (Source: Compiled by researcher, 13-01-2013)

Indicator Name	Description of indicator
A01	Maternal mortality rate per 100 000 people
A02	Percentage of people living in shacks
A03	Underweight for ages 0-4years by district (% below line)
A04	Crude death rate
A05	Infant mortality rate
A06	Life Expectancy
A07	Unemployment Rate
A08	Married women as a percentage
A09	Percentage of population without any toilet facility
A10	Measles incidence rate
A11	Diarrhoea incidence rate
A12	Dysentery incidence rate

In order to describe and explain the spatial patterns of health in Zimbabwe (the first objective of the research) specific indicators for which data were available for the whole country were identified. Table 4.3 gives a list of the indicators that were used to examine the spatial patterns of health (the state of people's health and health services) in Zimbabwe as it was in 2002. The indicators are; the number of hospitals per district, the density of health care centres per district, the number of doctors per district, the number of qualified nurses per district, the number of clinics per district, the number of hospital beds per district, maternal mortality rate per 100 000 people, infant mortality rate, measles incidence rate per 100 000 people, diarrhoea incidence rate per 1 000 people and

dysentery incidence rate per 1 000 people. The list includes the indicators that were used to achieve objective one.

The indicators (in Table 4.3) are described below with some motivation of why they were used and the sources from which data were obtained. Before the indicators were analysed for the description of the spatial patterns the correlation of each of the indicators with general health conditions is clarified. Some indicators tend to covary negatively with general health while others covary positively. Indicators are positively related to general health (they covary positively) if they move in the same direction as general health. That means that the higher the value of an indicator the higher the level of general health. When indicators are inversely or negatively related to general health they move in opposite directions. That means that the lower the value of an indicator the higher the level of general health. The values of indicators can only be transformed into an index value if all the indicators vary in the same direction. If there is a negative correlation between the general level of health and a specific indicator, the reciprocal of all the values of that indicator must be calculated before the simple index can be calculated. The inverse (reciprocal) of a variable is calculated to ensure that all indicators or variables vary in the same direction.

- Maternal mortality rate per 100 000 people (A01)

Griffiths (1996) used maternal mortality rate as an indicator to demarcate health regions in Britain. It is justified to use maternal mortality to demarcate the health regions because poor provision of health services can lead to death of women as a result of pregnancy or pregnancy related causes. When mothers have good health, their maternal mortality is likely to be low. This means that maternal mortality covaries negatively with the state of people's health. Maternal mortality is a good indicator of health because when the women die this is normally due to some existence of some disease or poor health conditions.

The Central Statistics Office (2004) defines maternal mortality as deaths which occur to woman of child-bearing ages and are caused by problems during the time of pregnancy and child birth, as well as mortalities occurring within 42 days of a pregnancy termination,

if such mortalities were birth related. Maternal mortality ratio is the number of deaths from maternal causes per 100 000 live births. High maternal mortality rate implies a poor health system in a district. The maternal mortality rate figures were gathered from the Central Statistics Office (2004) published census reports and are contained in Table 7.4 of the report for each administrative unit.

- Percentage of people living in shacks (A02)

According to Musanga (2009: 74) a shack is a dwelling that fails to meet basic conditions for human habitability that include security, peace and dignity. Shacks are not conducive for good health. Shacks lack basic sanitation, sufficient space and other important attributes of a healthy shelter (Musanga, 2009: 74). The characteristics of the shacks given by Musanga (2009: 74) mean that shacks are not good shelter from a health point of view. They can negatively impact on the health of the individual. It is acknowledged in this study that shacks can be found in both rural and urban areas of Zimbabwe. Living in shacks can be used as an indicator of health. The proportion of people living in shacks refers to the number of people per 100 people living in shacks. Living in shacks has a negative correlation with the state of people's health and health services. The percentages of people living in shacks were obtained from Table 8.2 of the Central Statistics Office (2004) census reports for each administrative unit.

- Underweight for ages 0-4years by district (% below line) (A03)

Waaler, (1984) indicates that being underweight causes increased mortality at rates comparable to that seen in morbidity of obese people. The implication of such a statement is that underweight is a health problem. Underweight can thus be used as an indicator of health. In this particular case, if there is high incidence of underweight in children it is a sign that the health of such a population would not be good.

Underweight for ages 0-4 years refers to the percentage of children (0-4 years of age) who do not meet the mass threshold. When children do not meet the mass threshold, it is a sign that the status of health among the children in that community is poor. This

therefore implies that underweight has a negative correlation with the state of people's health and health services. Data for this indicator were collected from Table 4.1.2 of Ministry of Health and Child Welfare (2007) published health reports.

- Crude death rate (A04)

This refers to the number of deaths for every one thousand of the population per year. The fact that such a death rate is crude means that it is not age-specific or gender specific. Poor state of health of people and poor health services result in a high crude death rate. Crude death rate is therefore an indicator of health of a population. Crude death rate has a negative correlation with the state of people's health and health services. The death rate figures dealt with in this research were collected from the Central Statistics Office (2004) published reports and are contained in Table 7.3 of the census report for each administrative unit.

- Infant mortality rate (A05)

This indicator is closely related to crude death rate. As alluded to under crude death rate, dying of any kind and particularly of infants (one year old and less) is a sign that the health of that infant or the parents may not be good. Infant mortality rate is therefore an indicator of health. A high infant mortality rate implies poor health and low infant mortality rate is on the other hand an indicator of good health. Infant mortality rate has a negative covariance with the state of people's health and health services. Infant mortality rate refers to the total number of deaths of children who are one year and below out of 1 000 born alive. The Infant mortality rate figures used in this research were gathered from the Central Statistics Office (2004) published census reports and are contained in Table 7.1(a) of the report for each administrative unit.

- Life Expectancy (A06)

The current research is not a pioneer in using life expectancy as an indicator of health. A study conducted by Raleigh and Kiri (1997) used life expectancy as an indicator of health and the researchers have managed to show a striking positive correlation between life

expectancy and good health. Life expectancy is the average age at which people die. Such an average is determined by the age at which the majority of the people die. The death of people depend on how well their health and health services are. Life expectancy is therefore an indicator of health. If the state of people's health and health services are good, life expectancy is expected to be high but if the state of people's health is poor and health services are in bad condition, then life expectancy is likely to be low. The indicator has got a positive covariance with the state of people's health. The figures used here were gathered from the Central Statistics Office (2004) published census reports and are available in Table 7.5 of the census report for each administrative area.

- Unemployment Rate (A07)

Studies conducted by Drever and Whitehead (1995) and Macintyre (1998) have proved that there is a significant relationship between poor health and material deprivation. Related studies by Davey and Hart (2002) and Judge and Paterson (2002) argues that income levels during early childhood, adolescence, and adulthood are all independent forecasters of who develops and eventually succumbs to disease. Wilkins *et al*. (2002) support these views by indicating that in Canada almost a quarter of excess premature years of life lost (mortality prior to age 75) can be ascribed to low levels of income level among some citizens in Canada. Unemployed people generally have low incomes. Such low incomes limit their access to health resources and other resources that are essential for good health such as food, clothing, shelter and other requirements of a healthy life. This implies that the unemployment rate is an indicator of health. Unemployment is a situation where the labour supply exceeds the demand for labour. Unemployment rate figures used in this research were gathered from the Central Statistics Office (2004) published census reports and are contained in Table 5.12 of the census report for each administrative area. The unemployment rate is calculated by dividing the number of unemployed persons aged 15 years and above by the economically active population in that age group. Communal farm workers were included in the unemployment rate for the figures used. Unemployment rate correlates negatively with health.

- Married women as a percentage total women population (A08)

The Interagency Forum on Aging-Related Statistics (2008) has used marital status as an indicator in the study of the health of older Americans. Marriage can be a useful indicator of wellbeing. The wellbeing of an individual implies a number of life attributes that point to good health. Marital status can therefore be used as an indicator of health and has a positive covariance with health.

Married women as a percentage refers to the number of women who are 15 years and above who are married per 100 such women. The percentage of married women figures dealt with in this research were gathered from the Central Statistics Office (2004) published census reports and are contained in Table 1.4 of the report for each administrative unit. This indicator covaries positively with health.

- Percentage of population without any toilet facility (A09)

Greed (2006: 128) maintains that one of the main means of transmission of many classic diseases and many urinary, vaginal and anal infections is from human faeces. The toilet is therefore a variable that determines the state of people's health. Lack of toilet facilities implies less hygiene. People without toilets can use the bush and other open spaces to dispose the faeces and urine which pollute the environment, for example water bodies. Diseases are easily transmitted that way. Lack of toilets is therefore an indicator of poor health. The percentage of people without toilet facilities has a negative covariance with health. The percentage of population without any toilet facility refers to the number of persons without any toilet facility expressed as a percentage of the total population. The figures used in this research were gathered from the Central Statistics Office (2004) published census reports and are available in Table 8.7 of the report for each administrative area.

- Disease incidence rate (A10, A11, A12)

The high incidence of diseases in a population is an indication of poor health of that population. Such a high incidence rate of diseases may be because of the existence of the disease causing conditions as well as poor health services. Incidence of diseases refers to the frequency of occurrence of selected diseases in the population. The selected diseases in this research are measles, diarrhoea, and dysentery. When there is high incidence of a disease, the health system of the region would be poor but when there is a low incidence, the health system of the region would be better. This implies that this indicator correlates negatively with the health of Zimbabwe. Data for the disease incidence indicators were gathered from the Ministry of Health and Child Welfare (2007) published reports. The data are contained in Table 4.3.8 (for measles) and in Table 4.6.6 (for diarrhoea) of the report.

The data gathered on the indicators of the state of people's health are given in Appendix C1. The data collected on the state of people's health as described in Section 4.4.3 are analysed and discussed in Chapter 5. The analysis and discussion of such data are intended to show the nature of the state of people's health as well as how such health varies spatially in Zimbabwe.

4.5 Demarcation of health regions

According to Conyers (2001: 23), a region is a unit of geographical space demarcated for a specific purpose. Thus regions are usually demarcated according to specific criteria and for a particular purpose. Geographers and regional scientists normally recognise three types of regions namely, homogeneous, polarised and administrative (Conyers, 2001: 23). The homogeneous region is one that is uniform in nature. The polarised region is one which has functional interdependence and coherence of parts when defined on the basis of particular criteria. Conyers (2001: 24) maintains that while the homogeneous region is defined on the basis of characteristics and the polarised one on the basis of the way it functions, the administrative one is defined on the basis of the purpose for which it is used.

The fact that such health regions are demarcated for health planning purposes means that they fall under the category of administrative type. The demarcated regions can differ depending on the variables used, the number of variables used and the specific purpose of the demarcation. In order to attain a representative view of health conditions in a region, it is important that a number of variables, characterising health development, be used to demarcate health regions. Researchers using objective variables to demarcate development regions, usually identify a relatively large number of variables to characterise the level of development. In this research, the purpose of the demarcation of the clusters (health regions) is to demonstrate the unevenness in service provision in Zimbabwe.

There are different types of indicators that can be used to demarcate health regions. The indicators can be social, mental or physical since health is a multidimensional phenomenon. It is not often practically feasible for a researcher to use all possible indicators in a particular study (demarcation of some health regions) due to constraints such as data unavailability. In demarcating health regions in the United Kingdom, Griffith (1996) used the following variables (indicators); number of hospital medical staff in general medicine per 10 000 population, number of hospital beds per given population, distance travelled to hospital, infant mortality rate, maternal mortality rate, unemployment rate and the number of people per accommodation room. In another study in the USA, State of Georgia Public Health (2008) demarcated health regions in Georgia on the basis of the following variables (indicators); percentage of families living below the poverty datum level, unemployment rate as percentage, mean family income, percentage of owner occupied homes, percentage with less than grade 9 education, percentage linguistically isolated, age-adjusted mortality rate, accessibility of healthcare services, shortage of healthcare professional by sector (primary care, mental health, dental health), proportion of healthcare available for uninsured people (safety net clinics) and emergency room and hospitalisation disparities. Weights ranging from A to D were assigned to the indicators depending on the importance attached to the indicators. After attaching such weights, composite indices were calculated and on the basis of these, Georgia State was demarcated into health regions.

As indicated in Section 1.5 of Chapter 1, objective two deals with demarcation of health regions in Zimbabwe. The choice of indicators used in the current research has been influenced by the consideration of indicators used by other researchers in the demarcation of health regions. The researchers include Marcus and Makanjuola (2011) and Sutherland and Coyle (2009). The availability of data was also a determining factor because a particular variable may be appropriate but data for such a variable may not be available. Data were not available at administrative district level for some of the indicators the researcher wanted to include in the analysis. For example, data for amounts of pharmaceuticals used, drug varieties and incidence rates of diseases that are common in the country, such as malaria, would have improved the analysis. Table 4.4 is a list of the indicators that were used for the demarcation of the country (Zimbabwe) into health regions (to achieve objective two). Despite the lack of data on important indicators or variables, the researcher is convinced that the variety of indicators used is acceptable for the demarcation of the country (Zimbabwe) into health regions (to achieve objective two).

Table 4.4: Indicators used for the demarcation of Zimbabwe into health regions (Source: Compiled by researcher, 13-01-2013)

Indicator Name	Description of indicator
B01	The number of hospitals per district
B02	The number of clinics per district
B03	The density of health care centres per district
B04	The number of doctors per district
B05	The number of qualified nurses per district
B06	The number of hospital beds per district
B07	Maternal mortality rate per 100 000 people
B08	Infant mortality rate
B09	Measles incidence rate per 100 000 people
B10	Diarrhoea incidence rate per 1 000 people
B11	Dysentery incidence rate per 1 000 people

Unpublished data on the indicators (number of hospitals per district, number of clinics per district, number of hospital bed) per district, number of doctors per district, number of qualified nurses per district and the number of hospital beds per district) were obtained from Ministry of Health and Child Welfare. This data are unpublished because the Ministry believes that if the information is accessed by the public it can expose the government's unfairness in the allocation of health resources. The researcher was granted special permission by the Permanent Secretary of the Ministry of Health and Child Welfare to access the data from a special report called HCW0812. The data gathered on the indicators of the provision of health services for the country are given in Appendix D1.

Data were analysed through the use of the cluster analysis method. Minitab Software package was used to perform the analysis. Administrative districts were assigned to clusters depending on their levels of provision of health services. After assigning the administrative districts to the clusters, a cartographic representation was done to show the spatial variation of the provision of health services in the country. A detailed explanation of how data were used to demarcate health regions will be given in Chapter 5.

The indicators that are used in the analysis of objective one and also used for the analysis of objective two are; maternal mortality rate, infant mortality rate, measles incidence rate per 100 000 people, diarrhoea incidence rate per 1 000 people and dysentery incidence rate per 1 000 people. The motivation for using these and other indicators in the demarcation of health regions is discussed below:

- The number of hospitals per district (B01)

Hospitals are the centres that provide medical care services. The number of hospitals per district is a determining factor of the quality and nature of health in that district. Districts with more hospitals are therefore better positioned to offer better health care services. There is a positive covariation between the number of hospitals in a district and the status of health of the district. It is against this background that the number of hospitals per district has been used as an indicator for the demarcation of health regions in this research.

- The number of clinics per district (B02)

Clinics are smaller health service centres than hospitals in Zimbabwe. They are comparatively lower order service centres than hospitals. Despite their smaller size, they also provide health services to the population of Zimbabwe. There is a positive correlation between the number of clinics in a district and the status of health of the district. Data were collected on the number of clinics per district in order to achieve the demarcation of Zimbabwe into health regions.

- The density of health care centres per district (B03)

According to the Ministry of Health and Child Welfare (2004: 56), healthcare centres include hospitals, clinics and rural health centres. Healthcare density refers to the number of such healthcare centres per given area of the district. Since healthcare density is the ratio of the number of healthcare centres to the area of the district, it means there is an indication of how far people travel to get health care from their nearest health care centre. It is therefore an effective measure of the provision of health services in a country.

- The number of doctors per district (B04)

Sikosana (2000: 8) argued that health workers are key determinants of the success or failure of health systems. The performance of a healthcare system is influenced by availability of doctors, competence of the doctors and skills mix and motivation of the doctors. Mudyarabikwa and Mbengwa (2006) used percentages of nurses in rural versus urban areas in the evaluation of health disparities in Zimbabwe. The doctors provide the health services to the patients. It is therefore expected that if the district has more doctors, the status of health in that district is likely to be better. The number of doctors per district was therefore chosen as an indicator for the demarcation of health regions in Zimbabwe. There is a positive covariance between the number of doctors per district and the health status of the district. Data were collected on the number of doctors per district for the demarcation of health regions.

- The number of qualified nurses (B05)

Mudyarabikwa and Mbengwa (2006) used percentages of nurses in rural versus urban areas in the evaluation of health disparities in Zimbabwe. The nurses, like the doctors provide health services to the patients. It is therefore expected that if the district has a high number of nurses, the status of health in that district is likely to be good. The number of nurses per district was therefore chosen as an indicator for the demarcation of health regions in Zimbabwe. Like in the case of the doctors, there is a positive covariance between the number of nurses per district and the health status of the district. Data were collected on the number of nurses per district for the demarcation of health regions.

- The number of hospital beds per district (B06)

The number of hospital beds is normally an indication of the size of the hospital. Big hospitals or higher order hospitals normally serve a bigger sphere of influence and a bigger population. The implication of this is that the quantity of beds in the hospital per district can be a reliable indicator of the conditions of health in a health region. Data were therefore collected on the number of hospital beds in a district for the demarcation of health regions of Zimbabwe.

- Maternal mortality rate per 100 000 people (B07)

This indicator was also used to determine the spatial distribution of the state of peoples health (objective one of the research). The details of data and a full description were given on pages 112 and 113 in this chapter.

- Infant mortality rate (B08)

Infant mortality rate can be used for the demarcation of health regions. Griffiths *et al.* (1999) for example, used infant mortality rate as an indicator to demarcate health regions. This indicator was also used for objective one. The details of data and their description were given on page 114.

- Disease incidence rate (B09, B10, B11)

The incidence of diseases in a population is an indication of the level of health service provision. Incidence of diseases refers to the frequency of occurrence of selected diseases in the population. When there is a high incidence of a disease, the health system of the region would be poor but when there is low incidence, the health system of the region would be better. This implies that the indicator has a negative covariance with health. The selected diseases in this research are measles, diarrhoea, and dysentery. Data for the disease indicators were gathered from the Ministry of Health and Child Welfare (2007) published reports. The data are contained in Table 4.3.8 (for measles) and in Table 4.6.6 (for diarrhoea) of the report.

4.6 Data for the demarcation of the administrative districts according to the phases of the Adapted Epidemiological Transition Model

To achieve the third objective of the research, administrative districts were linked to the different phases of the adapted epidemiological transition model. The objective is about the application of the Adapted Epidemiological Transition Model to the spatial health system of Zimbabwe as it was in 2002 and an evaluation of the extent to which that model applies. Data were gathered on the indicators and are given in Table 4.5. Both secondary and primary data were collected in respect of the indicators in that table. Indicators C06 to C11 have already been used for other objectives. These indicators were not sufficient for the demarcation of the administrative districts according to the phases of the adapted epidemiological transition model. Primary data were therefore required to complement the secondary sources. It was necessary to collect primary data (for indicators C01 to C05 given in Table 4.5) so that more data on diseases could be obtained that were needed for the demarcation of the country according to the adapted transition model. The questionnaires used to collect the data were highly laborious but there was no other option because the third objective of the research could not be achieved without such data.

Indicators C06 to C11 in Table 4.5 were described in terms of their meaning and how they covary with health in a country in Section 4.4.3. Indicators C01 to C05 are basically concerned with the frequency at which certain diseases occur in the population. They can be described with reference to how disease incidence rate was described in the same section (Section 4.4.3).

Table 4.5: Indicators used in demarcating the administrative districts according to the phases of the adapted epidemiological transition model (Source: Compiled by researcher, 13-01-2013)

Indicator Name	Description of indicator
C01	Number of cases of cancer recorded at the district hospital in a given year
C02	Number of cases of accidents and injured admitted in the district hospital per given year
C03	Number of cases of metabolic disorders recorded in the district hospital in a given year
C04	Number of cases of cardiovascular diseases recorded in the district hospital per given year
C05	Number of cases of autoimmune diseases recorded at the hospital in a given year
C06	Maternal mortality rate per 100 000 women
C07	Life expectancy
C08	Percentage of population without toilet facilities
C09	Measles incidence rate per 100 000 people
C10	Diarrhoea incidence rate per 1 000 people
C11	Dysentery incidence rate per 1 000 people

As alluded to in that section, the incidence of diseases in a population is an indication of the level of health conditions of people and the provision of health services. When there is a high frequency of a disease, the health system of the region would be poor but when there is a low incidence, the health system of the region would be better. Put in another way, high frequency implies negative covariance between that indicator and health while low frequency implies positive covariance between the indicator and health. The data gathered on the selected indicators needed for demarcation of the country's spatial health system according to the Adapted Epidemiological Transition Model is contained in Appendix E1.

4.7 Data on evolution of the health system

In order to evaluate the evolution of the health system in Zimbabwe a comparative approach was used. The evaluation of the evolution is the purpose of objective 4 of the research. The data were collected from the Central Statistics Office (1984) published census report, Central Statistics Office (1994) published census report, Central Statistics Office (2004) published census reports, Ministry of Health and Child Welfare (1994) published National Health Profile, Ministry of Health and Child Welfare (2004) published National Health Profile. The same indicators used in 1982 were also used in 1992 and 2002. Data were collected on those indicators in order to compare the health conditions (state of health of people and health services) of the country in 1992 and 2002. It was necessary to use the same indicators for all the periods (years) because if different sets of indicators were used, comparison would not have been possible. Data for the examination of the evolution of the country's health system (for objective four) were therefore obtained through published (secondary) census and health reports.

The critical task in the choice of the indicators was to identify indicators where data were consistently available in both the 1990s and 2000s otherwise comparison was not going to be possible. The indicators on which such data were collected for the two different periods are given in Table 4.6. The country's health system combines state of health of people and the provision of health services. It is for this reason that the indicators which

are given in Table 4.6 are those that can measure the state of health of people and the provision of health services. These types of indicators have been used before (in objectives one and two) although in the present situation the data for the indicators were also collected for the 1990s. The indicator type is still the same but data collected are different and it is for this reason that the indicator names have been changed as given in Table 4.6. The different indicators given in Table 4.6 are not described in the current section because they have already been discussed in Section 4.4.3. The data gathered on the indicators needed for the examination of the evolution of Zimbabwe's health system are given in Appendices F1 and F4.

Table 4.6: Indicators used for the analysis of the evolution of health in Zimbabwe (Source: Compiled by researcher, 13-01-2013)

Indicator Name	Description of indicator
D01	Maternal mortality rate per 100 000
D02	Percentage of people living in shacks
D03	Underweight of ages 0-4years by district (% below line)
D04	Crude death rate
D05	Infant mortality rate per 1 000 live births
D06	Percentage of people with toilet facilities
D07	Measles incidence rate per 100 000 people
D08	Diarrhoea incidence rate per 1 000 people
D09	Dysentery incidence rate per 1 000 people
D10	Number of hospitals per district
D11	Number of clinics per district

The information from interviews was also used in Chapter 6 of the research to evaluate the evolution (from the 1990s) of the health situation in the country. Question seven of the interview guide was particularly important in this regard. The information gathered through this question enabled the researcher to do further evaluation of the evolution of the health system of the country.

4.8 Problems in data collection

It is acknowledged that more and different indicators could have been used in order for a more accurate examination of the health situation in Zimbabwe. Information on some important health indicators is either totally unavailable or if there is data available it is often incomplete and outdated. Such lack of data is in keeping with Bureau for Economic Research, Co-operation and Development's (1979:11) remark that there is a dearth of statistical information on most developing countries. Zimbabwe like other developing countries, experiences such lack of data. The challenge in the current research was that essential data on some identified indicators were not available at district level but at provincial level. It was therefore not possible to use such indicators since the spatial unit of analysis in this research was the district (as indicated in Section 1.10 of Chapter 1). As indicated in Sections 4.4.3 and 4.5, data were not available at district level for some of the indicators the researcher would have wanted to include in the analysis. This is for example data for number of pharmaceuticals, drug varieties, incidence rate of diseases that are common in the country such as malaria and percentage of people with full access to water.

The other problem during data collection was that some of the data from the Ministry of Health and Child Welfare was regarded as highly confidential or sensitive and permission to get such data was only granted by the Permanent Secretary of the Ministry. Such bureaucracy was a challenge in this research as it caused delays in the researcher's access to the data and subsequent analysis of the data.

In spite of the fact that there were problems in data collection as discussed in the preceding paragraph, the researcher believes that these challenges were successfully overcome. Sufficient data on the indicators were obtained. Both qualitative and quantitative data analysis methods are used in the description and explanation of the spatial patterns in Zimbabwe and to demarcate the country into health regions.

4.9 Conclusion

As alluded to in Sections 4.4.3, 4.5 and 4.6 there are many indicators that can be used for the analysis of the spatial patterns of health of a country. The existence of such indicators is one thing and the availability of data on such indicators is another. A researcher may come up with a comprehensive list of indicators for the demarcation of health regions but experience problems in obtaining data on some of those indicators. This is often particularly the case in many developing countries. In this chapter, the selection of suitable indicators of health and the collection of data for the identified indicators, in order to achieve the first four objectives of the research, was described and discussed.

The next chapter focuses on data analysis and interpretation. The analysis and interpretation is aimed at achieving the first three objectives of the research. Composite index analysis is performed to achieve the first objective of the research which deals with the analysis of the spatial patterns of health in Zimbabwe. Composite indexing is also used to achieve the third objectives of the research in which the Adapted Epidemiological Transition Model is applied to the spatial health system of Zimbabwe. Cluster analysis is used to achieve the second objective of the research which is to demarcate the country into health regions. Both qualitative and quantitative data analysis methods are used in chapter five to facilitate the description and explanation of the spatial patterns in Zimbabwe and to demarcate health regions in the country.

CHAPTER 5

SPATIAL DISTRIBUTION OF HEALTH

5.1 Introduction

The current chapter deals with data analysis. Data gathering as discussed in Chapter 4 would be fruitless if such gathering is not subjected to effective analysis. Effective data analysis is a function of the techniques and methods used in the process. Data analysis in the current chapter focused on the first three objectives of the research which are: to examine the spatial patterns of health (state of people's health), to demarcate the health service provision of the spatial health system of the country into clusters based on minimum difference, and to demarcate the administrative districts according to the adapted epidemiological transition model. Data that deal with the spatial variation in health (people's levels of health) are analysed first. Such analysis was intended to achieve objective one. The composite index method was used as the method of data analysis and a map is given to depict the spatial variation in the state of people's health. To achieve objective two of the research that entails the demarcation of regions according to levels of health service provision, data were analysed through the use of cluster analysis. Administrative districts were grouped into clusters depending on their levels of health service provision. To achieve the third objective of the research, cluster analysis was performed on the indicators of health, but in this case, mainly different kinds of diseases. After such cluster analysis, the administrative districts were assigned to different phases of the adapted epidemiological transition model.

5.2 Data Analysis

There are many methods of data analysis in geography. In the present research however, composite indexing was used to achieve the first objective of the research (to examine the state of people's health). Cluster analysis method was used to achieve the second objective (to demarcate the administrative regions according to the level of provision of

health services). Cluster analysis was again used to achieve the third objective of the research (to demarcate the districts according to the Adapted Epidemiological Transition Model). The use of composite indexing and cluster analysis in geography are not uncommon. Researchers who have used cluster analysis with some success include Harmse (2004), Baker (2010) and Long *et al.* (2010). Conyers (2001) used the composite index method to examine the socioeconomic development of the Zimbabwean space economy.

5.2.1 Spatial distribution of the state of people's health

To achieve the examination of the spatial distribution of health (state of people's health and health services) in Zimbabwe as it was in 2002, the collected data were organised and analysed. The indicators used were many due to the fact that health is a multidimensional phenomenon. As indicated in Section 4.4.3 of Chapter 4, the indicators that were used to examine the spatial patterns of health in Zimbabwe were: A01 Maternal mortality rate, A02 Percentage of people living in shacks, A03 Underweight for ages 0-4years by district (% below line), A04 Crude death rate, A05 Infant mortality rate, A06 Life Expectancy, A07 Unemployment Rate, A08 Married women as a percentage, A09 Percentage of population without any toilet facility, A10 Measles incidence rate, A11 Diarrhoea incidence rate and A12 Dysentery incidence rate as summarised in Table 4.3.

5.2.1.1 Simple indices

The data that were collected on the identified indicators has different units of measurement and some of it was collected at different times. To make the data comparable and compatible, it became necessary to convert the indicators into indices. Rogerson (1989) defines an index as a ratio of the observed value to the denominator that is a standard base number, such as the average of the observed values. After the simple indices for the indicators were calculated, composite indices were then calculated.

The first step in the calculation of the indices is to organise the indicator values. In the present chapter the indicator values were organised according to the alphabetical order of

the names of the administrative districts (spatial units of analysis). In the case where the indicator had a negative covariance with health (refer to page 112) the reciprocal of the indicator (variable) was calculated first before calculating the indices. The reciprocal is obtained by dividing the indicator value into 1. The calculated reciprocals for indicators that have negative covariance with health are given in Appendix C2. Because the values obtained in this way were frequently very small, the researcher facilitated the computation by multiplying each of the values by a constant which was 100. For instance, the reciprocal for Beitbridge in respect of indicator A01 is therefore (1/906.3)100 = 0.11. All other reciprocals given in C2 were calculated in the same way.

Once the indicator values were organised and the reciprocals for indicators that had negative covariance with health calculated, the indices were then calculated using the following formula.

IA1=100 (OA1)/base number.
Where IA1 = the index for indicator
OAI = the observed value for the indicator A
Base = the base number used as a standard. In this case it is the average of the organised indicator values.

To calculate the index value of A10 Measles incidence rate for Beitbridge for example, the researcher proceeded as follows: IA10= (10/58.92)100=17.0. All other indicators of health for the administrative districts of Zimbabwe were calculated in the same way. Table 5.1 shows the results of simple indices calculated for four districts of Zimbabwe using four selected indicators.

A01 Maternal mortality rate per 100 000 women of child bearing age (Covariance with health is negative)
A02 Percentage of people living in shacks (Covariance with health is negative)
A03 Underweight children between 0-4 years (Covariance with health is negative)
A04 Crude death rate (Covariance with health is negative)

The calculation for all districts of the country using the complete list of identified indicators is given in Appendix C3.

Table 5.1: Indicators, Reciprocals and Indices calculated for four selected districts in Zimbabwe (Source: Compiled by researcher 27-05-2013)

	Indicators				Reciprocals				Indices			
	A01	**A02**	**A03**	**A04**	**AO1!**	**A02!**	**A03!**	**A04!**	**IAO1**	**IA02**	**IA03**	**IA04**
Beitbridge	906.3	4.4	4.4	14.9	0.1	23.0	22.73	6.7	110.3	28.3	129.1	122.3
Bikita	1196.9	3.1	3.7	18.8	0.1	32.3	27.0	5.3	83.5	39.8	153.6	96.6
Bindura	1051.6	3.7	4.1	16.8	0.1	26.8	24.69	5.9	95.1	33.1	140.3	107.9
Binga	704.4	1.0	10.7	13.1	0.1	102.0	9.346	7.7	142.0	125.8	53.1	139.1

As indicated in Section 1.14 of Chapter 1, all the indicators of health had equal weight in the measurement of health. It is true that indicators do not necessarily carry the same weight in reality but there is the challenge of achieving accuracy in attaching the weights. Attaching weights can lead to problems of overweighting some indicators and underweighting others. Becker *et al.* (1987) are among some of the scholars who are sceptical of the merit of weighting of indicators. Becker *et al.* (1987: 567) argue that weighting of indicators can create problems because it is not easy to determine how the researcher should proceed weighting some indicators over numerous others. There is no single method that can be used to attach such weights. The same indicator weighed differently can produce totally different patterns. To avoid the controversies surrounding the attachment of weights to indicators, indicators were treated equally in the current study. No weights were attached to the indicators

5.2.1.2 Composite indices

The composite index method is achieved through some empirical aggregation of a number of variables (Babbie 1995:161-175). According to Babbie (1995:156), composite indices are those measurement efforts that require amalgamation of various factors into one factor. In other words, composite indices incorporate numerous social, political and economic aspects of health in the measurement of the level of health of a region. They are basically quantitative insofar as the indices are all presented in numerical format. Booysen (2002:115) however maintains that composite indices are prone to subjectivity despite the relative objectivity of the methods employed in composite indexing.

The different simple indices for each particular spatial unit (administrative district) were combined into one value called the composite index. This particular value gives the overall level of the state of people's health. The composite index is sometimes called the overall index. The composite index is essentially the geometric mean of the simple indices. The geometric mean is a type of average, which indicates the central tendency of a set of observations by using the product of their values (unlike the arithmetic mean which uses their sum). The geometric mean of a data set ($x_1 . x_2 . x_3 . . . x_n$) is given by: Geomean = $\sqrt[n]{x_1 . x_2 . x_3 . . . x_n}$. For example, the geometric mean of three numbers, say 2, 4 and 8, is the cube root of their product; that is $\sqrt[3]{2 . 8 . 4}$ = 4. In this research, the Geomean was calculated using the Geometric mean function (formula) (which is available in Microsoft Excel). The function for the calculation of geomean available in Microsoft Excel is, =*GEOMEAN* ($X_1 : X_2$ ***....***X_n) where X_n is the cell number containing the index value of the respective observed indicator. Table 5.2 shows the examples of calculated composite indices for selected districts in Zimbabwe. When the calculated composite index value is high it means that the health conditions in that district are good. On the other hand, the low composite index value means that the health conditions are poor. The calculated composite indices are given in Appendix C3.

Table 5.2: Simple and composite indices for the three selected districts in Zimbabwe (Source: Compiled by researcher, 27-05-2013)

	Indicators												**Composite indices**
	IAO1	**IA02**	**IA03**	**IA04**	**IA05**	**IA06**	**IA07**	**IA08**	**IA09**	**IA10**	**IA11**	**IA12**	**OCIH**
Beitbridge	110.3	28.3	129.1	122.3	86.9	99.0	70.8	93.1	3.1	17.2	132.2	194.1	**62.9**
Bikita	83.5	39.8	153.6	96.6	87.7	95.5	133.1	91.5	3.6	171.5	55.1	59.1	**68.2**
Bindura	95.1	33.1	140.3	107.9	87.3	100.7	92.4	92.3	3.4	31.2	77.8	90.6	**61.0**

5.2.1.3 Cartographic representation of results and discussion

The data for the composite indices of the overall state people's of health as it was in 2002 was arranged from low to high values (in Appendix C3) and class intervals were created on the basis of quartile values. Quartiles divided the data into four equal parts. The formulae 1(n+1)/4 (for the lower quartile or first boundary), 2(n+1)/4 (for the semi quartile or second boundary) and 3(n+1)/4 (for the upper quartile or third boundary) were used to calculate the quartiles. Data were, therefore, grouped into four classes. Using the data in Appendix C3 on the calculated composite indices, the lower quartile lies on the 15.5th position. That position is halfway between the values 60.6 and 60.8 giving a value of 60.7. The semi-quartile lies on the 31.0th position and gives a value of 67.7. Finally the upper quartile lies on the 46.5th position. That position is halfway between the values 75.0 and 75.8 giving a value of 75.4. Classes were then created on the basis the calculated quartiles (see the legend to Figure 5.1). The classes of data created were used to generate the map, Figure 5.1 that shows the spatial variation of the state of people's health in Zimbabwe.

In order to display the results of analysis on the map (Figure 5.1) quartiles were used. To explain the results of the analysis, the researcher makes reference to conditions in the physical environment as well as the influence of urban centres in Zimbabwe. The main urban centres of Zimbabwe are included in Figure 5.1 and Figure 1.2 in Chapter 1 gives the relief regions of the Zimbabwe. The main urban areas (labelled in the map) have been included in the map because of their effect on the spatial distribution of people's health in the country. Names of all the major urban centres are also included in the map. The symbols representing the urban areas are presented as polygons on the location of the urban centre in Zimbabwe. The maps were generated in Arcview, Geographical Information System (GIS) software.

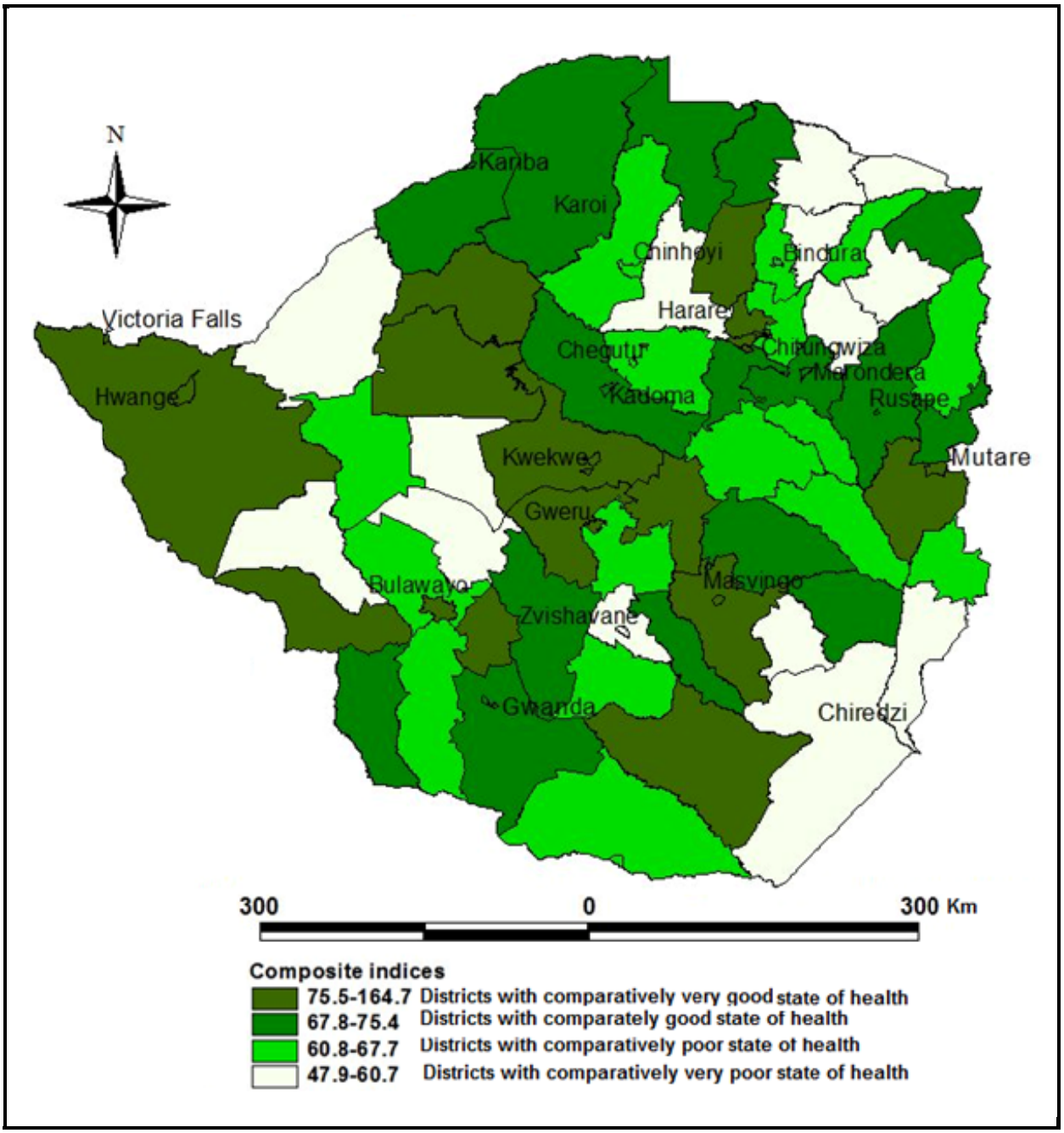

Figure 5.1: Spatial distribution of the state of people's health in 2002 (Source: Computer generated field data, 27-05-2013)

When nutrition is improved in a population, problems such as diseases related to undernourishment normally decrease and, consequently, health improves. When people's

standard of living improves, health usually improves. This view is in agreement with a number of studies (Roemer, 1997, Phillips, 2006 and WHO, 2010) which have shown the existence of a positive correlation between health and income. This is because with the higher incomes and more economic resources as a result of improved agriculture, such people can access better healthcare facilities and consequently experience less poverty related diseases. The relatively cool climate reduces the proliferation of disease causing microorganisms. On the other hand, individuals living in the districts that are in hotter and drier regions of the country, generally experience lower levels of health status. When a district continuously experiences dry conditions, development of agriculture and related economic activities is retarded. This generally makes the standard of living as well as the status of health of residents of the particular district low. The districts that are comparatively hotter and drier and where people experience lower levels of health status are generally found in the south-eastern lowveld and the north Western lowveld of the country. These regions include Chiredzi and Binga district.

In Zimbabwe, urban centres are generally concentrated along the central watershed. The influence of urban areas on the state of people's health is noticeable. Districts such as Harare, Masvingo, Chitungwiza, Gweru, Mutare, Kwekwe and Bulawayo can be used to support the view that urban centres have a positive impact on people's health status. As shown in Figure 5.1, such districts are also found along the central watershed and are among those where people's health status is comparatively good. These districts are either entirely urban or contain urban centres in them. Some of the districts may not necessarily be entirely urban or have major urban centres in them but are close to urban centres. The urban influence is discernible in such districts. Examples in this category include Marondera, Chirumanzi, Kadoma, Marondera, Seke, Mutasa, Gutu and Umzingwane.

On the other hand, individuals in districts that are purely rural such as Lupane, Mutoko, Umguza, Murehwa and Nkayi generally experience low level of health status. Growth points do not have a clear positive influence on the health pattern of Zimbabwe. This is because the growth points are found in almost every rural district in the Zimbabwe (Conyers, 2001: 182) but according to Figure 5.1 generally the districts have poor health

conditions. Small towns like growth points also have a small positive influence on the health conditions in the districts. As depicted in Figure 5.1, rural districts such as Beitbridge, Zvishavane and Chiredzi although having urban areas in them, the towns too small to bring about a positive influence on people the state of health.

According to Conyers (2001: 109), the core region of Zimbabwe is generally composed of urban areas of while rural areas generally constitute the peripheral regions of that country. People living in urban districts (the core) and in districts having or located close to the urban centres, therefore, generally experience higher living standards and have more access to better infrastructure (including healthcare infrastructure). The interview responses from the National Health Director of the Ministry of Health and Child Welfare also confirmed that the provision of health services and the state of people's health are generally better in urban areas compared to the rural areas. The impact of urban centres to the health system of a country resulting in the rural-urban contrast in health is not something unique to Zimbabwe. Numerous studies have confirmed that even in other countries, people living in urban areas have better conditions of health compared to their rural counterparts. The studies include those conducted by WHO (2006), WHO (2008a), Montgomery (2009), and Li and Wei (2010). The general consensus in these studies is that the health conditions of people living in rural areas are generally poor as compared to those of people living in urban areas.

The state of people's health is unbalanced in Zimbabwe, as depicted in Figure 5.1. It is evident from the map that the spatial distribution of the state of people's health in Zimbabwe in 2002 was significantly influenced by the physical environment. The influence of the physical environment on health should not come as a surprise because as discussed in Section 3.6.1 of Chapter 3, the physical environment is a major determinant of health. The location of the urban areas is also another factor influencing the state of people's health. The distribution of the state of people's health is not easily explained simply as a relationship between a particular factor and health but is a complex interplay between health and various factors. There is a complex interaction of different health variables to produce a particular spatial health pattern.

5.3 Demarcation of regions

In order to demarcate regions (to achieve objective two), the cluster analysis method was used. The second objective deals with the demarcation the spatial economy into a hierarchy of health regions as they were in 2002. Clustering or cluster analysis is the process of assigning a set of objects into groups (called clusters) so that the objects in the same group are more similar (in some way or another) to each other than to those in other groups. Romesburg (2004: 2) defines a cluster as a mathematical grouping of objects with similar descriptions. In this research, a cluster is defined as a group of the similar elements gathered together. In the case of administrative districts in Zimbabwe, the districts in the same cluster are basically similar to each other and they are dissimilar to those belonging to other clusters. Data on the calculated simple indices for indicators on the provision of health services in the districts were entered into the Minitab spreadsheet. Using a combination of Complete Linkage method and Manhattan similarity measure in Minitab 17 Statistical software (2010) administrative districts were demarcated into clusters depending on the level of the provision of health services they offer.

In the current research, hierarchical clustering was used to organise administrative districts into a hierarchical structure. More specifically, divisive clustering was used. As indicated in Section 1.11.2.1 of Chapter 1, divisive clustering begins with the whole and successively proceeds to divide it into smaller clusters. In this procedure, administrative districts are initially treated as if they are part of a single large cluster, then they are divided into smaller and smaller clusters. In order to achieve such clustering, data were collected on the indicators. Cluster analysis arranges the objects and groups them into clusters. To standardise the variables, indicators were converted into simple indices as described in Section 5.2.1.1. The calculated simple indices on the provision of health services for the country are given in Appendix D2. The procedure of calculating the simple indices was discussed in Section 5.2.1.1. Data on the simple indices were then analysed through cluster analysis as described in the preceding paragraph. The Minitab 17 Statistical software (2010) was used to perform the cluster analysis and classify the administrative districts according to the level of provision of health services.

Divisive algorithms were used to divide the whole set (the original full set of administrative districts) into successively smaller clusters. A combination of Complete Linkage method and Manhattan similarity measure in the (Minitab 17 Statistical software, 2010) were used. The Complete Linkage method (often called the furthest neighbour rule) which clusters objects based on the maximum distance between them was used. Manhattan similarity measure uses the sum of the absolute differences in value for any variable. The formula for computation of the Manhattan similarity measure is given by: $||a - b||_1 = \sum_i |a_i - b_i|$. Where a and b represents values of the variables. In this research they are values of the same variable for example 01 maternal mortality rate in different districts. The formula was not used manually since the calculations were done in the Minitab spreadsheet. Using the sum of absolute differences (Manhattan distance), instead of Euclidean distance, had the advantage that it decomposed into the contributions made by each variable. For the Euclidean distance, it was necessary to decompose the squared distance. The use of the combination of complete linkage method and Manhattan similarity measure was more appealing than other measures in the Minitab 17 Statistical software (2010) because the clusters created were clearly distinct, particularly on the dendrograms that were generated by the Minitab worksheet. As discussed in Section 1.11.2.1 of Chapter 1, a dendrogram is a branching diagram that represents the relationships of similarity among a group of entities.

To analyse data in the Minitab worksheet, codes rather than names of the administrative were needed. In other words, the use of the Minitab worksheet does not allow for the use of names of the administrative districts for the generation of the dendrograms. It was therefore necessary to allocate codes to each and every administrative district. The codes allocated to administrative districts do not have some particular meaning but were based on the alphabetical arrangements of the districts. The codes were merely for identity of the administrative districts they represented. Once the codes were allocated, it was possible to use the Minitab worksheet to generate the dendrograms and health clusters. Table 5.3 gives the various codes that were allocated to the respective administrative districts.

Table 5.3 Administrative District and Codes (Source: Computer generated field data, 27-05-2013)

District	Code	District	Code	District	Code
Beitbridge	1	Gutu	22	Mount Darwin	42
Bikita	2	Gwanda	23	Mudzi	43
Bindura	3	Gweru	24	Murehwa	44
Binga	4	Harare	25	Mutare	45
Bubi	5	Hurungwe	26	Mutasa	46
Buhera	6	Hwange	27	Mutoko	47
Bulawayo	7	Hwedza	28	Mwenezi	48
Bulilima	8	Insiza	29	Nkayi	49
Centenary	9	Kadoma	30	Nyanga	50
Chegutu	10	Kariba	31	Rushinga	51
Chikomba	11	Kwekwe	32	Seke	52
Chimanimani	12	Lupane	33	Shamva	53
Chipinge	13	Makonde	34	Shurugwi	54
Chiredzi	14	Makoni	35	Tsholotsho	55
Chirumanzi	15	Mangwe	36	Umguza	56
Chitungwiza	16	Marondera	37	UMP	57
Chivi	17	Masvingo	38	Umzingwane	58
Gokwe North	18	Matobo	39	Zaka	59
Gokwe south	19	Mberengwa	40	Zvimba	60
Goromonzi	20	Mazowe	41	Zvishavane	61
Guruve	21				

5.3.1 Indicators

The indicators that were used to demarcate health regions (to achieve objective two) are given in Table 4.4 of Chapter 4. The objective deals with the demarcation the spatial

economy into a hierarchy of health regions as they were in 2002. As shown in Table 4.3 in Chapter 4, some of the indicators used to achieve objective one (the state of people's health) were also used for objective two. Data for indicators described in Section 4.5 and Table 4.4 were used to calculate simple indices for each administrative area in Zimbabwe (using the same procedure as in the previous section). Clustering of districts was done using these simple indices for each district. It was not necessary to calculate the composite indices because by using the Minitab software simple indices were appropriate for the demarcation of the country into health regions. The data in Appendix C3 were used to cluster the districts.

5.3.2 Clusters

Data were analysed to produce clusters as discussed in Section 5.3. The purpose of such analysis is to achieve the second objective of the research which deals with the demarcation the spatial economy into a hierarchy of health regions as they were in 2002.

The administrative districts of Zimbabwe were grouped into four clusters based on their health conditions. The demarcated clusters represent the health regions of Zimbabwe. The researcher is convinced that the four clusters demarcated in Zimbabwe were enough for the meaningful analysis of health conditions and the provision of health services in particular. The clusters are presented in tables as well as in dendrograms. Once the clusters are presented, a discussion follows in which the researcher attempts to explain the spatial pattern of health distribution of clusters in Zimbabwe. To explain the results of the analysis, the researcher makes reference to conditions in the physical environment as well as the influence of urban centres in Zimbabwe.

5.3.2.1 Districts in Cluster B1

There are only two administrative districts in Cluster B1 as shown in Figure 5.2. The districts are Bulawayo (7) and Harare (25). The administrative districts are purely urban in nature and they are the largest cities in Zimbabwe with Harare being the capital city. The districts are spatially small but socially, economically and politically they dominate the spatial system of Zimbabwe. Chazireni (2003) demarcated these administrative districts

as the core region of Zimbabwe. The occurrence of such districts in the core region of the country implies that the socio-economic conditions in such districts are much better when compared to other districts in the country. Health, being a component of development, is inevitably equally much better in these districts as compared to other districts in Zimbabwe.

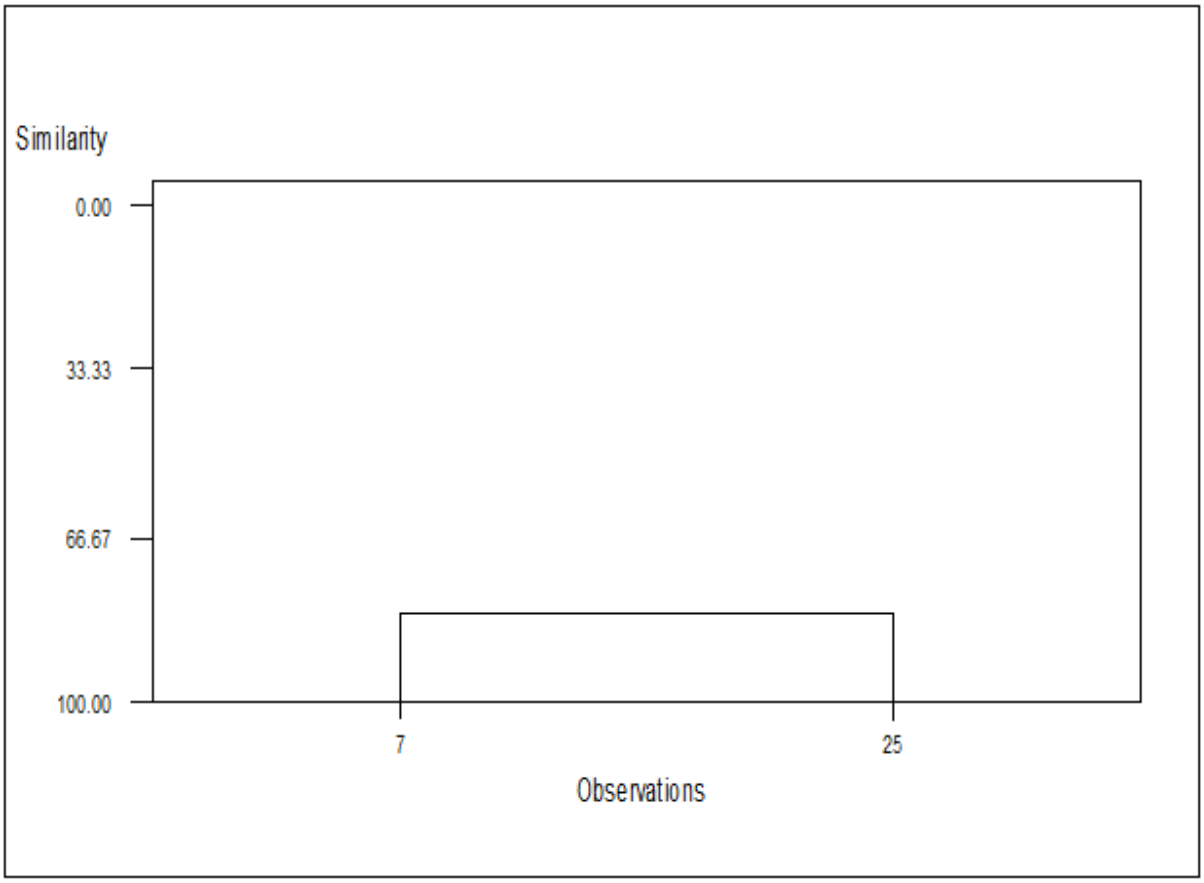

Figure 5.2: Administrative districts in cluster B1 (Source: Computer generated field data, 27-05-2013)

The interview with Dr. K. Madzinga (K. Madzinga, personal communication, 28 February, 2012) shed more light on why the service provision is comparatively very good in Harare and Bulawayo. It was indicated during the interview that those cities (Harare and Bulawayo) have the biggest referral hospitals in the country. This is not surprising as Harare and Bulawayo are the biggest and the most developed core regions in Zimbabwe.

It was further indicated during the interview that the referral hospitals are the best equipped in terms of human resources, medicines and other essential health resources in the country. The hospitals deal with serious health/ medical conditions that cannot be managed at the district and even provincial hospitals. Patients with serious medical conditions are referred to the very large hospitals.

The presence of such big hospitals in these administrative districts can, to a large extent, be used to explain why the Cluster B1 administrative districts have the best health conditions in the country. In addition to the presence of the big hospitals in those administrative districts, the fact that these are big cities means that the education, water supplies, employment conditions, transport services and other infrastructural facilities are much better compared to other districts in the country and this has a positive impact on health variables in those administrative districts.

5.3.2.2 Districts Cluster B2

There are four administrative districts in Cluster B2. The districts are Gweru (24), Mutare (45), Masvingo (38) and Chitungwiza (16). The districts in Cluster B2 are shown in Figure 5.3. These administrative districts also have big cities in them. In fact, the names of the cities are the same as the names of the administrative districts. Administrative districts in Cluster B2, unlike districts in Cluster B1, are not wholly urban in nature. Some parts of the districts are rural areas. Chazireni (2003) demarcated these administrative districts as belonging to the upward transitional region of Friedmann's (1966) model of development regions.

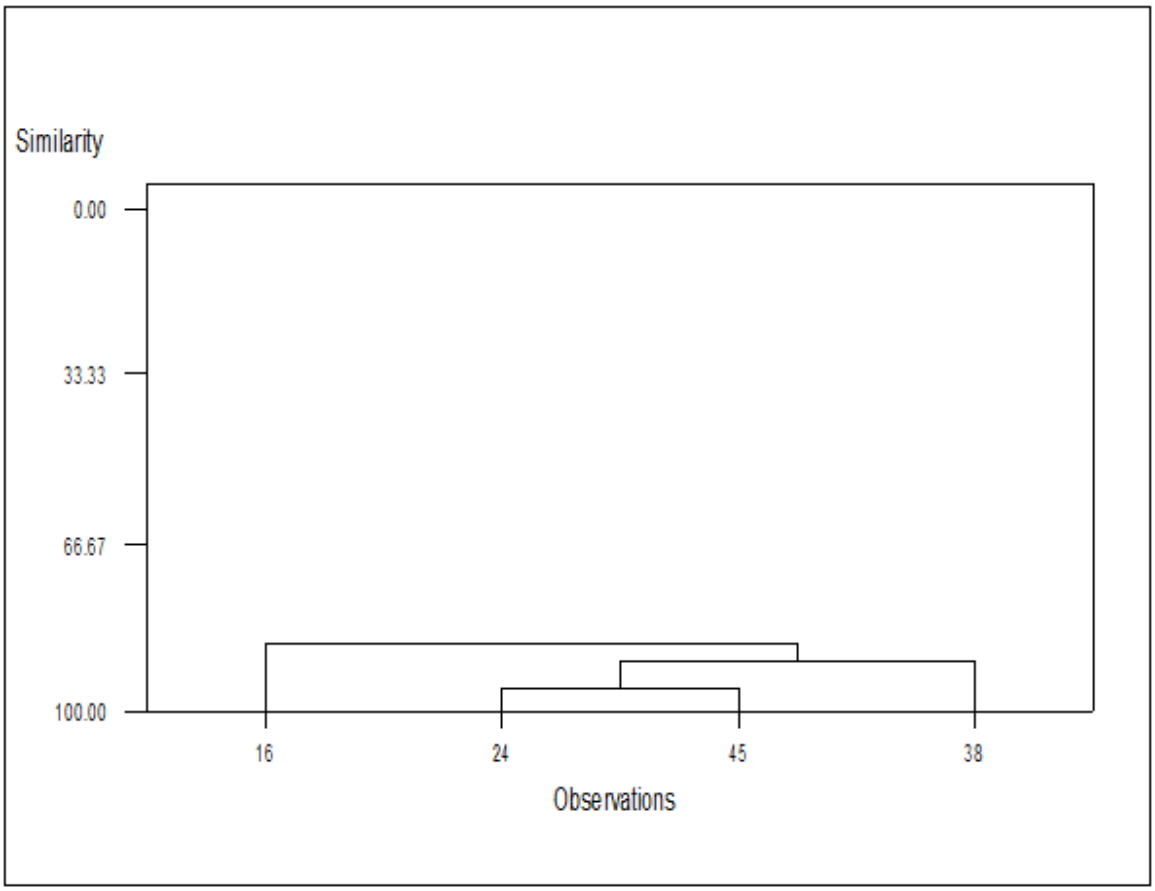

Figure 5.3: Administrative districts in cluster B2 (Source: Computer generated field data, 27-05-2013)

The cities in these districts have provincial hospitals. The existence of such big hospitals in the districts is a significant factor in positively influencing the health conditions in such regions. Although the health conditions in these administrative districts are not as good as those in Cluster B1, they are quantitatively much better than those in the districts in clusters B3 and B4. Conyers (2001:109) indicated that urban centres of Zimbabwe are generally found in the core region while rural areas generally constitute the peripheral region of the country. The cities in Cluster B2 districts play a crucial role in socio-economic development of regions in which they occur and which consequently influenced health conditions in the Cluster B1 districts. The cities, with their social and economic infrastructure, have served as engines of health development in the districts. The

interview responses with Dr. K. Madzinga (K. Madzinga, personal communication, 28 February, 2012), basically support the view that such districts have relatively better health services because of the bigger provincial hospitals in them. The relatively easier accessibility of the provincial hospital to the people in the district means that health complications can receive quicker attention than in districts in Cluster B3 and B4.

5.3.2.3 Districts in Cluster B3

The districts in Cluster B3 are given in Figure 5.4 and in Table 5.4. The codes that were allocated to each district are shown in a separate column in the table. Some of the districts in Cluster B3 have urban centres in them. The centres, however, are generally too small to have a significant positive impact on the overall health conditions in the districts where they are found.

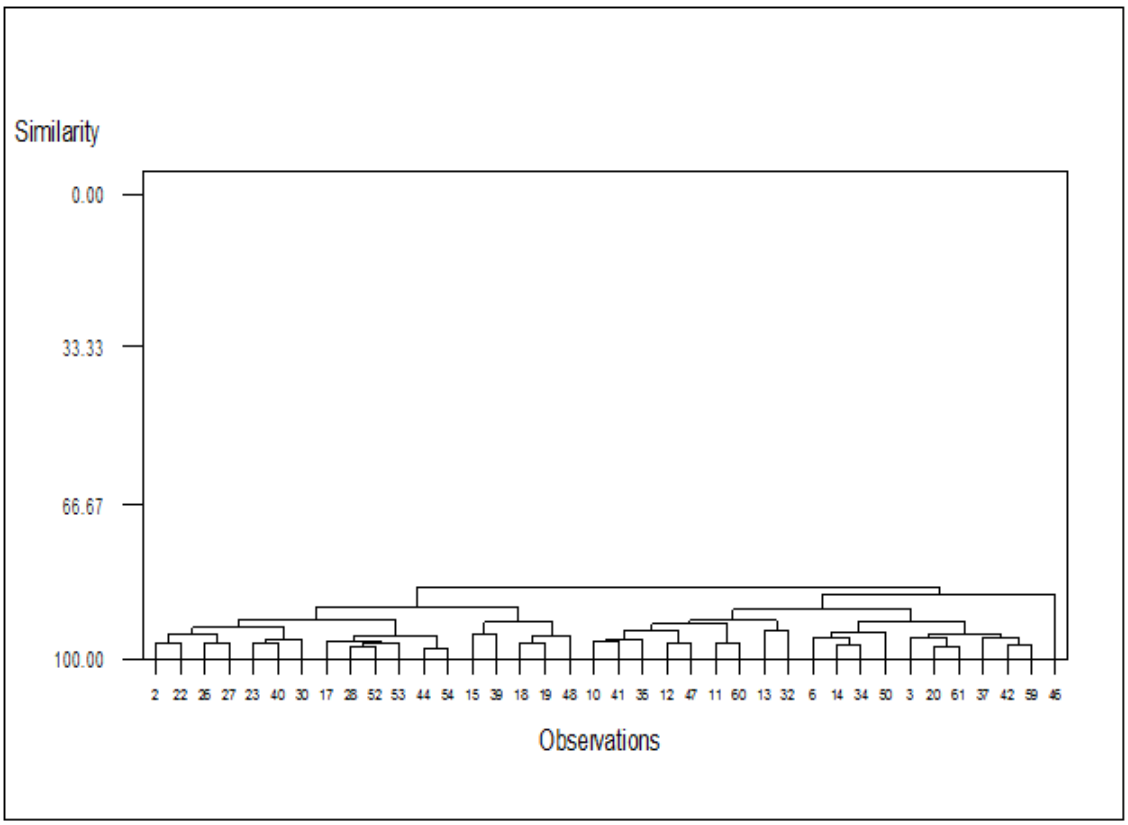

Figure 5.4: Administrative districts in cluster B3 (Computer generated field data, 27-05-2013)

Table 5.4: Districts in Cluster B3 (Source: Computer generated field data, 27-05-2013)

District	Code	District	Code
Bikita	2	Kwekwe	32
Bindura	3	Makonde	34
Buhera	6	Makoni	35
Chegutu	10	Marondera	37
Chikomba	11	Matobo	39
Chimanimani	12	Mberengwa	40
Chipinge	13	Mount Darwin	41
Chiredzi	14	Murehwa	43
Chirumanzi	15	Mutoko	45
Chivi	17	Mutasa	46
Gokwe North	18	Mwenezi	47
Gokwe south	19	Nyanga	49
Goromonzi	20	Seke	51
Gutu	22	Shamva	52
Gwanda	23	Shurugwi	53
Hurungwe	26	Zaka	58
Hwange	27	Zvimba	59
Hwedza	28	Zvishavane	60
Kadoma	30		

The provision of health services in Cluster B3 administrative districts is relatively poor. The districts are all located in the downward transitional regions of the national space economy (Chazireni 2003). Kwekwe district is however an exception as it has been located in the upward transitional region of Zimbabwe. This implies that the conditions of life of the people residing in Cluster B3 administrative districts are still at a low level of development and this impacts negatively on health. The relatively easier accessibility of some of the administrative districts to cities such as Bulawayo, Gweru, Mutare and

Masvingo can be used to explain why Cluster B3 districts are on average better than Cluster B4 ones.

The interview with Dr. K. Madzinga (K. Madzinga, personal communication, 28 February, 2012) shed more light on why the service provision is comparatively very good in Harare and Bulawayo. It was indicated during the interview that those cities (Harare and Bulawayo) have the biggest referral hospitals in the country. This is not surprising as Harare and Bulawayo are the biggest and the most developed core regions in Zimbabwe. It was further indicated during the interview that the referral hospitals are the best equipped in terms of human resources, medicines and other essential health resources in the country. The hospitals deal with serious health/ medical conditions that cannot be managed at the district and even provincial hospitals. Patients with serious medical conditions are referred to the very large hospitals.

5.3.2.4 Districts in Cluster B4

The administrative districts in Cluster B4 are shown in Table 5.5 and Figure 5.5. Cluster 4 administrative districts are generally found in the most remote regions of the country. They are generally in the northern, western and southern border areas of the country. Access to the country's major urban health services from those Administrative districts is generally limited.

During the interview discussions with Dr. D. Gwinji (D. Gwinji, personal communication, 13 March, 2012), it was indicated that some administrative districts in the country are highly inaccessible due to the nature of the roads and, in some cases, there are no roads. Transporting patients, health workers and even drugs remains a serious challenge in such places. Dr. Gwinji further indicated that districts such as Binga, Bubi, Mangwe and Ufumbamarambapfungwe (UMP) are problem districts as they frequently experience disease outbreaks such as cholera. The districts are in the rural (periphery) part of Zimbabwe and this means that they rely on primary economic activities that do not generate sufficient income for the people to significantly improve their living conditions.

Cluster 4 districts are mainly concentrated in the western region of the country in Midlands and Matabeleland provinces.

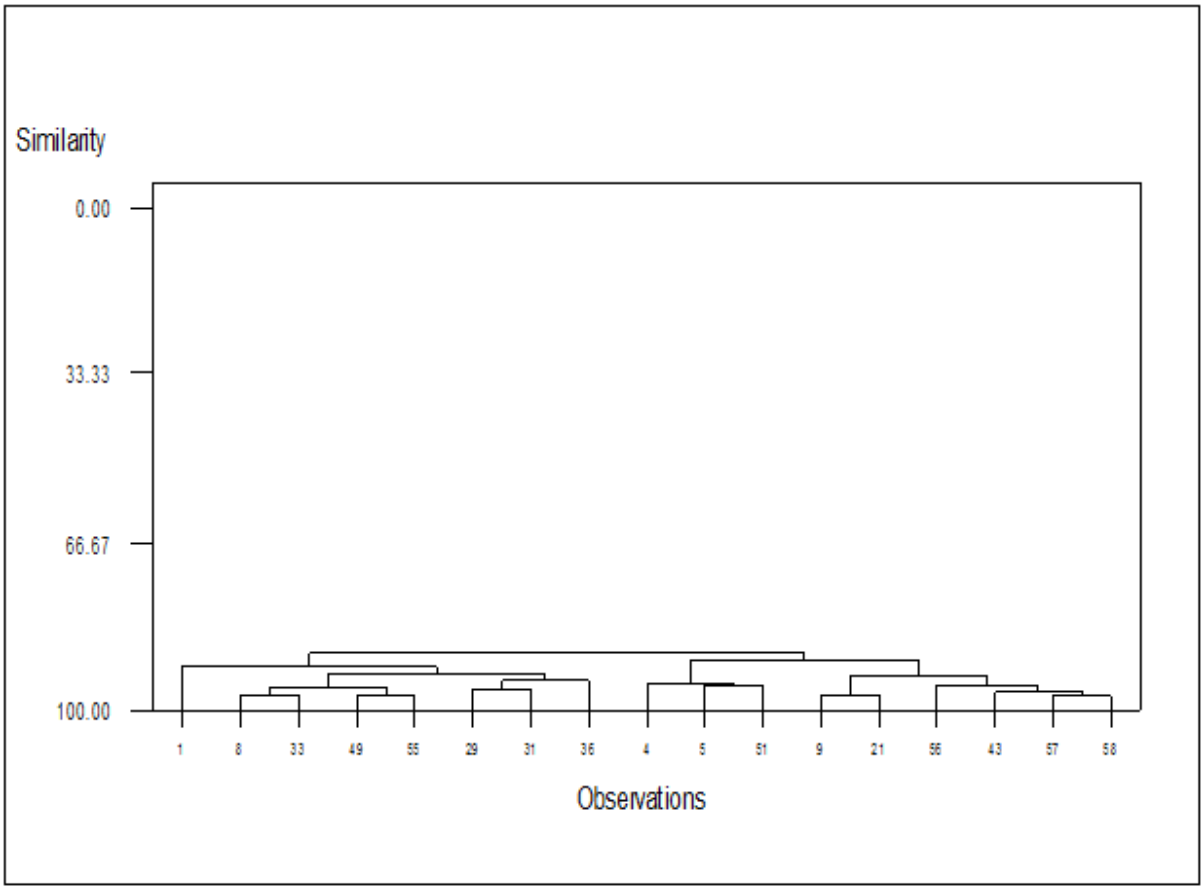

Figure 5.5: Administrative districts in cluster B4 (Source: Computer generated field data, 27-05-2013)

Districts in Cluster B4 are generally in the dry region of Zimbabwe. The agriculture upon which such people are relying is not doing well given the dry conditions in those regions. This makes the standard of living low, thus having negative implications on health. Unlike Cluster B3 districts with poor health, Cluster B4 districts are very poor (marginally poorer).

5.3.2.5 The combined dendrogram for the four clusters

Figure 5.6 depicts the distribution of the administrative districts in the four clusters. This is the dendrogram that combines all four dendrograms into one. Clusters spread out from a common point like branches of a tree being propagated from the trunk of the tree. The branches of the dendrogram marked in red in Figure 5.6 lead to administrative districts in Clusters B3 and B4. It is therefore noticeable from Figure 5.6 that Zimbabwe is characterised as a health system that is grossly unequal. It is one where there is a significantly smaller part of the spatial health system experiencing good health in a sea of poor health for the rest of the spatial health system.

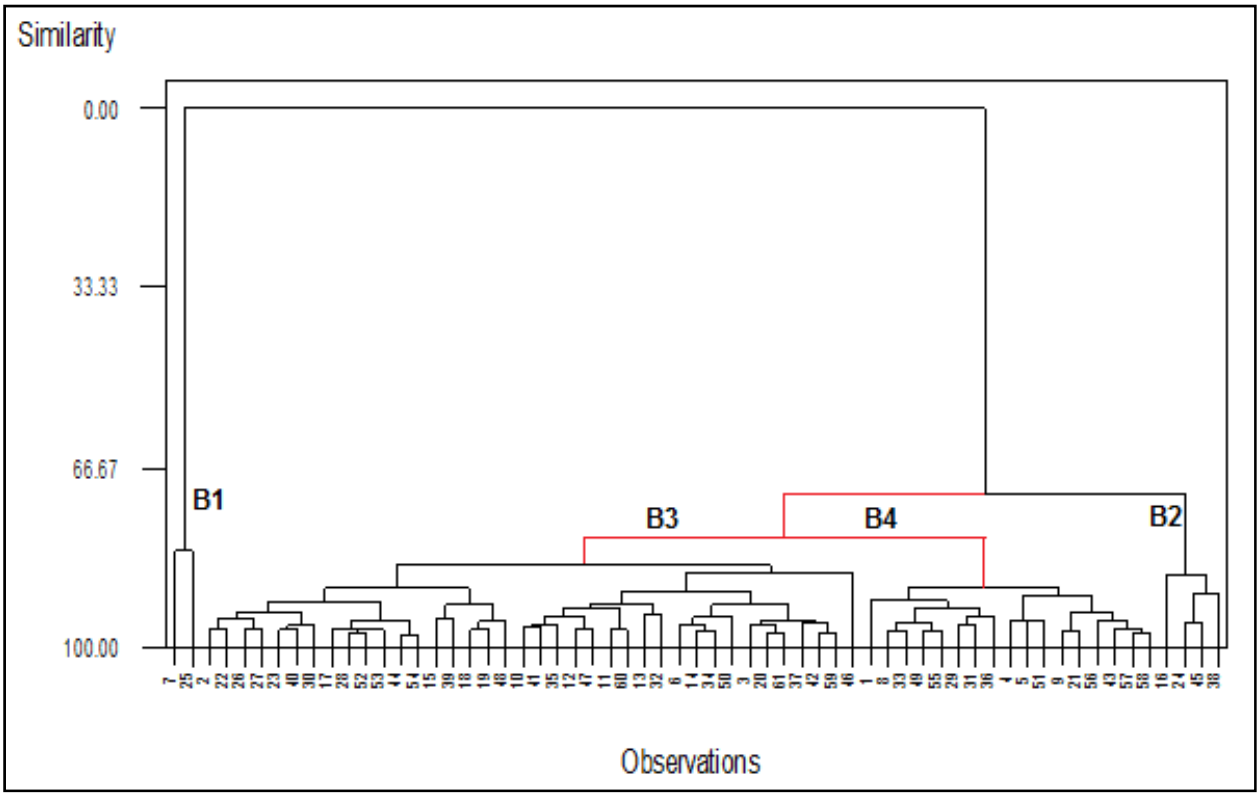

Figure 5.6: Combined dendrogram of all districts clustered in various clusters (Source: Computer generated field data, 27-05-2013)

The Cluster B3 and B4 districts given in Figure 5.6 constitute about 90% of the Zimbabwean administrative districts. This implies that the spatial health system of Zimbabwe is generally poor. This is not surprising as studies by Conyers (2001) have pointed out the existence of socio-economic development inequalities in Zimbabwe

The spatial pattern of health as depicted in Figure 5.6 is to a large extent, a mirror image of the spatial pattern of socio-economic development. This is in agreement with Chazireni's (2003) observation that health is a major component of development. Like many other developing countries, Zimbabwe experiences inequality in socio-economic conditions, of which health is part of such conditions.

5.3.2.6 Cartographic representation of the Health regions in Zimbabwe

Figure 5.7 shows the spatial distribution of administrative districts of demarcated health clusters in the country. It is evident from Figure 5.7 that districts which have the highest and second highest level of provision of health services are generally concentrated along the central axis of the country (which extends from the east to the south-western part of the country). The central axis constitutes the highveld of the country. Administrative districts with poor provision of health services are concentrated in the western, northern and southern parts of the country. The southern and the northern parts constitute the lowveld of the country. As indicated in Section 5.4.5, the majority of the districts have poor provision of health services. As the map actually depicts, the spatial pattern of the provision of health services in Zimbabwe is one of a small enclave with good health service surrounded by a sea of a multitude of districts with poor provision of health services.

A number of explanations can be given to account for such a pattern of provision of health services. It is evident in Figure 5.2 that the distribution of urban centres has greatly influenced the spatial pattern of provision of health services in Zimbabwe. In Figure 5.7 the main urban areas are indicated on the map. It emerges from that map that urban centres (labelled in the map), particularly cities, have led to improved the provision of health services in the respective districts where they are located. Infrastructure (including

health infrastructure) is more developed in the urban centres. Therefore, it is not amazing to see that districts which are wholly urban such as Harare and Bulawayo have the best provision of health services in the country. The spatial pattern of health in Zimbabwe is, therefore, considerably affected by the distribution of the main urban areas (labelled in the map) in the country.

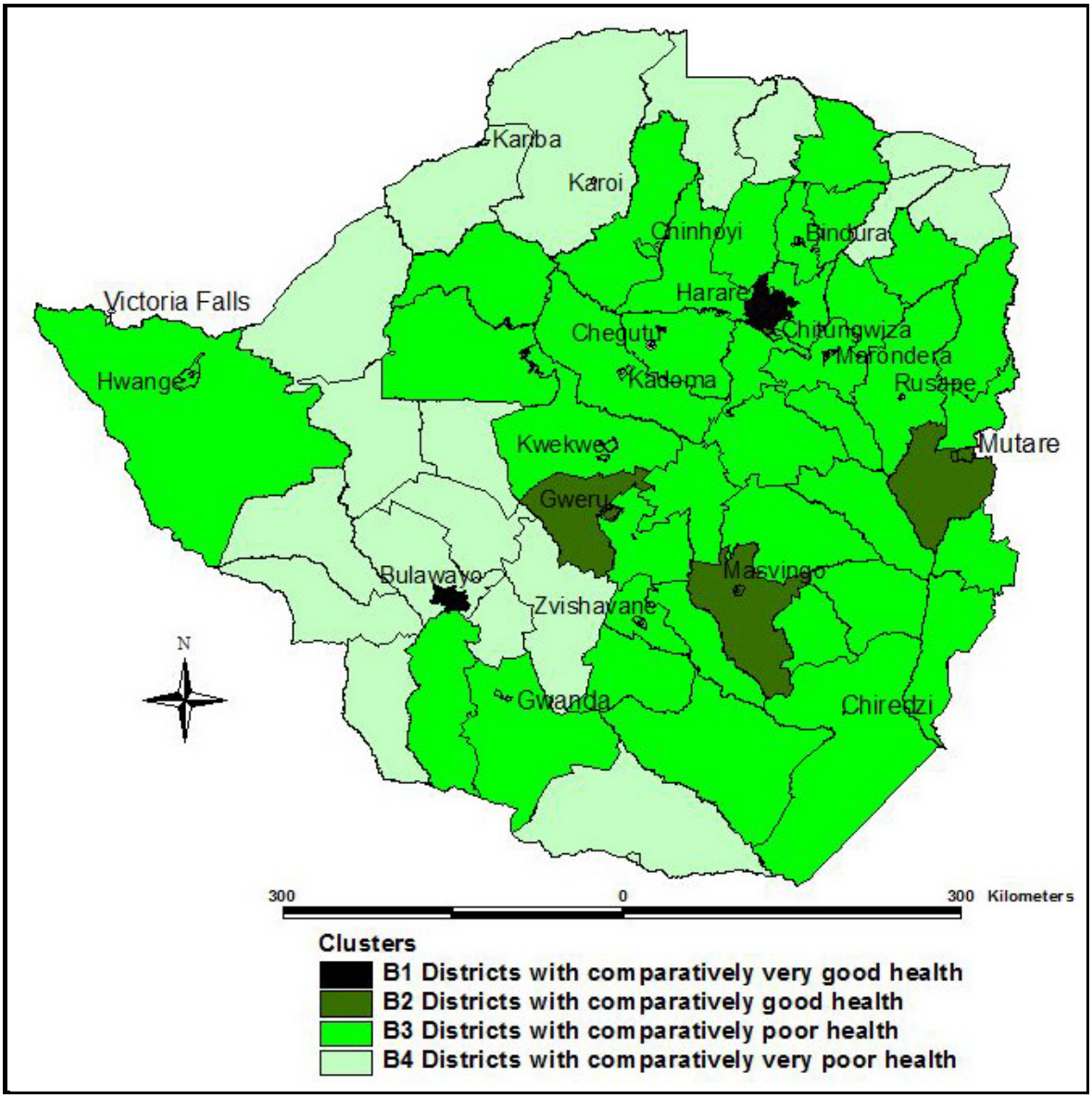

Figure 5.7: Health regions in Zimbabwe (Source: Computer generated field data, 27-05-2013)

According to Musanga (2009: 49), the central part of the Zimbabwe is relatively wet with a cool climate. The wet climate, in contrast to the drier lowveld of the country, stimulates agriculture and related activities. The cool and wet climate of the central highveld of the country (Figure 1.2 in Chapter 1) can therefore be taken as a stimulus for the comparatively good provision of health services of that region. On the contrary, the lowveld of the country which is dry and hot, experience poor provision of health services. During the interview with the National Health Director, it was indicated that government doctors and experienced nurses are unwilling to be deployed to the remote South East, and the Zambezi lowveld of the country, citing the extreme summer heat and prevalence of mosquitoes as serious problems in those regions.

5.4 The Adapted Epidemiological Transition Model

The third objective of the research is to demarcate the districts according to the Adapted Epidemiological Transition Model. The Epidemiological Transition Model postulated by Omran in 1971 and updated in 1983 (Omran, 2005) was explained in Section 2.6.1 in Chapter 2. Before this model could be applied to Zimbabwe it was slightly adapted. The adapted model does not differ much from the original 1971 and the updated 1983 models. The changes in the Adapted Epidemiological Transition Model are to the features of phase two of Omran's 1971 and 1983 models. As indicated in Section 2.3, the terms endemic, epidemic and pandemic do not mean the same thing. In Omran's 1971 and 1983 models phase two emphasises pandemics but in the Adapted Epidemiological Transition Model all forms of morbidity, endemics, epidemics and pandemics are included. The different phases of the Adapted model and justification for the change in the name of the second phase of the model are discussed below.

- **Pestilence and Famine**

There is no change to this phase. Both the name, as well as the features of this phase as given by Omran (1971, 1983) in Section 2.6.1, remain useful in the Adapted Epidemiological Transition Model. In the Zimbabwean context, such features are still

observable in some parts of the country and there is, therefore, no need to change the features of the model.

- **Receding Pestilence and Famine**

This is the phase where the name has been changed. It is not only in the current research where the name of this phase has created problems. Wolleswinkel-van den Bosch (1998: 11) critiques the name "receding pandemics" by arguing that the naming of this phase refers to pandemics, but not all epidemics were pandemics. The researcher further maintained that even during the time of Omran, cholera, for instance, was a pandemic, but many other infectious diseases that played an important role in mortality decline were endemic diseases, for instance, tuberculosis, acute respiratory diseases and dysentery. Pestilence in the first phase of the model implies that endemics, epidemics and pandemics exist in that phase. The problem in Omran's (1971, 1983) model is that in the second phase of that model, the researcher makes use of receding pandemics as if pestilence refers to pandemics only. Far from that, pestilence includes endemics, epidemics and even pandemics. It is against this background and in agreement with these characteristics that the name of this phase has been changed in the current research and also why the name used is the Adapted Epidemiological Model.

- **Degenerative and human diseases**

Just like in the first phase of the model, there is no change to this phase. The name as well as the features of this stage as given by Omran (1971, 1983) in Section 2.6.1 of Chapter 2, remains useful in the Adapted Epidemiological Transition Model. In the Zimbabwean context, such features are still observable in some parts of the country and there is therefore no need to change the features of the model.

5.5 The demarcated health regions according to the Adapted Epidemiological Transition Model

Another cluster analysis was conducted on the data in Appendix E3 to achieve the third objective of the research. The third objective of the research is about applying the

Adapted Epidemiological Transition Model to the spatial health system of Zimbabwe as it was in 2002 and evaluating the extent to which that model applies. While cluster analysis performed for objective two, which deals with the demarcation the spatial economy into a hierarchy of health regions as they were in 2002, generated four clusters, the analysis for objective three aims to produce three clusters. Three clusters were chosen because the idea was to find out if the generated three clusters would match the three phases of the Adapted Epidemiological Transition Model. As was done in Section 5.3 of the current chapter, during the demarcation of clusters according to the provision of health services, a combination of complete linkage method and Manhattan similarity measure in the Minitab 17 Statistical software (2010) were used and Clusters C1, C2 and C3 were generated. After the administrative districts were demarcated into the three clusters, the clusters were linked to the different ages of the Adapted Epidemiological Transition Model to show where each of the three clusters belong in ages of the Model. In linking the clusters to the different ages of the transition model, some judgment was made by the researcher on the extent to which the characteristics of the ages of the model and those of the cluster match. As discussed in Section 2.6.1.1 of Chapter 2, when Dirwai (2002) examined the health disparities in Zimbabwe, he concluded that the spatial economy of the country was at different phases of the transition model. The argument in the current study is that the administrative districts of Zimbabwe are at different phases of the Adapted Epidemiological Transition Model. Put in another way, the districts are at different times in the ages of the model.

As indicated in the previous section, the Adapted Epidemiological Transition Model has three phases namely: the phase of pestilence and famine, the phase of receding pestilence and famine and the phase of degenerative and man-made diseases. The linking of the health clusters of Zimbabwe to three phases of the Adapted Epidemiological Transition Model is discussed below:

- **The phase of Pestilence and Famine**

Administrative districts in clusters C3 are categorised as belonging to the phase of pestilence and famine phase of the Adapted Epidemiological Transition Model. The

districts are given in dendrogram Figure 5.8, Table 5.6 and the map in Figure 5.11. The districts are generally rural in nature. Generally, drought and consequent famine are predominant as the subsistence farming upon which they depend does not apply modern farming methods such as irrigation. The famine has negative ripple effects on diseases.

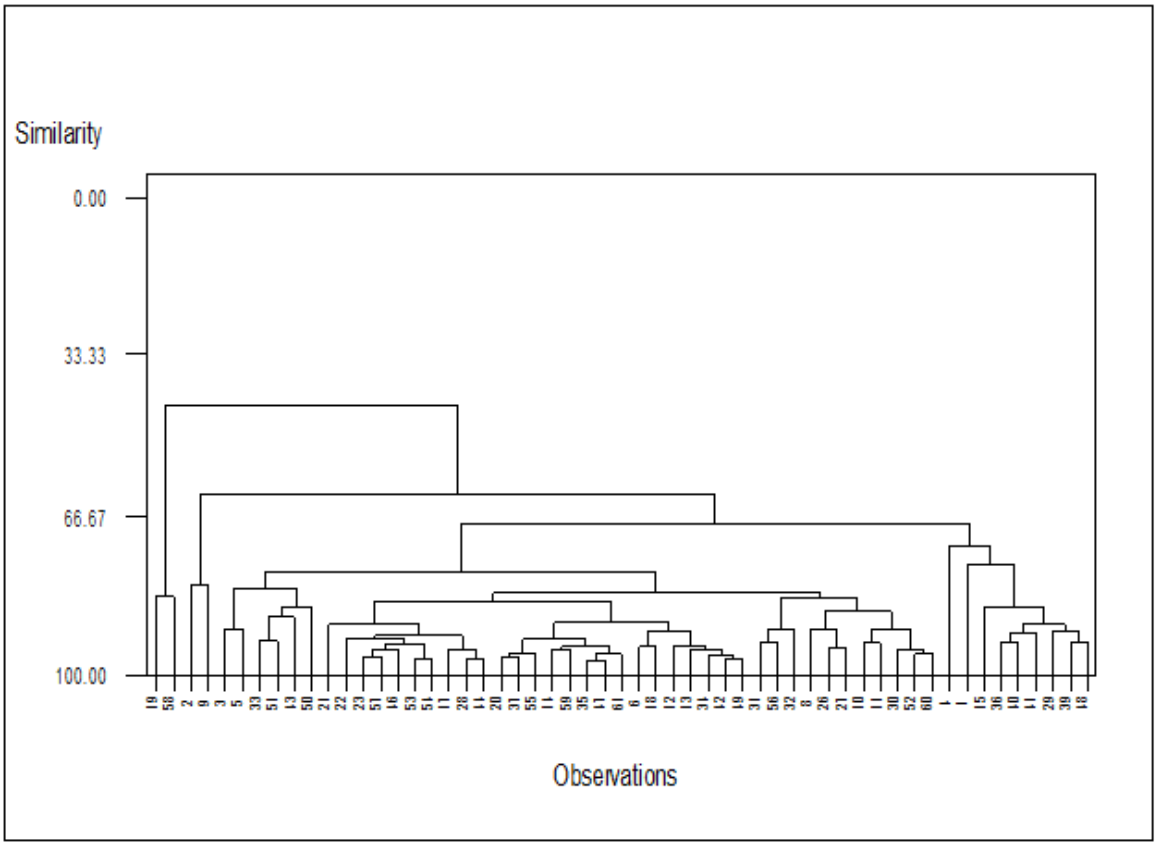

Figure 5.8: Administrative districts in the phase of pestilence and famine (Source: Computer generated field data, 27-05-2013)

Data from primary and secondary sources indicate that infant mortality is generally high in such administrative districts and this has led to relatively low life expectancy. Clinics are not within easy walking distance. But even where there are such clinics, important medicines are generally lacking. The clinics are also inadequately staffed. Such a scenario has led to frequent epidemic outbreaks such as cholera, dysentery and malaria in many of the districts.

Table 5.6: Districts demarcated in the phase of pestilence and famine (Source: Computer generated field data, 27-05-2013)

District	Code	District	Code
Beitbridge	1	Gokwe South	19
Bikita	2	Insiza	29
Bindura	3	Kwekwe	32
Binga	4	Makoni	35
Bubi	5	Mangwe	36
Buhera	6	Matobo	39
Centenary	9	Mazowe	40
Chegutu	10	Mberengwa	41
Chikomba	11	Mount Darwin	42
Chimanimani	12	Mudzi	43
Chipinge	13	Murehwa	44
Chiredzi	14	Mutasa	46
Chirumanzi	15	Mutoko	47
Chivi	17	Mwenezi	48
Gokwe North	18	Nkayi	49
Goromonzi	20	Nyanga	50
Guruve	21	Rushinga	51
Bulilima	8	Seke	52
Gutu	22	Shamva	53
Gwanda	23	Shurugwi	54
Hurungwe	26	Tsholotsho	55
Hwange	27	Umguza	56
Hwedza	28	UMP	57
Kadoma	30	Umzingwane	58
Kariba	31	Zaka	59
Lupane	33	Zvimba	60
Makonde	34	Zvishavane	61
Marondera	37		

The characteristics of the health system of the administrative districts in Cluster C3 are to a large extent similar to those of the age of pestilence and famine in Omran's 1971 model of the Epidemiological Transition Model. As described in Section 2.6.1 of Chapter 2, health variables such as low life expectancy, high infant mortality rates, famine, epidemic outbreaks (pestilence) are characteristic of the phase of pestilence and famine phase of Omran's Epidemiological Transition Model. Such features are also found in the administrative districts in Cluster C3. Administrative districts in Cluster C3 of Zimbabwe have a lot in common with the first phase of Omran's model. Figure 5.8 Table 5.6 give the districts demarcated as belonging to the age of pestilence and famine. Administrative districts in Cluster C3 were categorised as belonging to the phase of pestilence and famine of the Adapted Epidemiological Transition Model.

One noticeable feature about these districts is that there are so many. There are 55 districts in Age of pestilence and famine and they constitute 90.2% of the administrative districts of Zimbabwe. A very large proportion of the administrative districts in Zimbabwe, therefore, have poor health conditions. This bears testimony to the fact that Zimbabwe is a developing country and, therefore, a larger proportion of its spatial economy, would inevitably manifest low levels of socio-economic development, of which health is a component. What has emerged from this study concurs with Conyers's (2001) research findings that the larger proportion of its spatial economy is a peripheral region. The health conditions in such a periphery do not deviate from the poor socio-economic conditions of the other regions in the periphery.

- **The Age of Receding pestilence and famine**

Administrative districts in Cluster C2 were categorised as belonging to the age of receding pestilence and famine in the Adapted Epidemiological Transition Model. The districts are; Gweru (24), Mutare (45), Masvingo (38) and Chitungwiza (16). As alluded to in Section 5.7, these administrative districts have some cities in them. The name of the city is the same as the name of the administrative district. It seems, members of this Cluster have broken away from the mainstream absolute periphery and are therefore experiencing an upward trend in their development. As health is a component of development, it does not

deviate from the upward trend in development. Figure 5.9 is a dendrogram showing the administrative districts that are in the age of receding pestilence and famine.

Secondary data together with responses from questionnaires showed that the health in these regions is improving. Mortality rates are progressively declining. The decline is accelerating and the frequency epidemic peaks decreases. The average life expectancy is now above 45 years. Population growth is now fast in those regions and is indeed exponential. Causes of death are no longer predominantly communicable diseases but others such as chronic diseases and accidents are beginning to emerge.

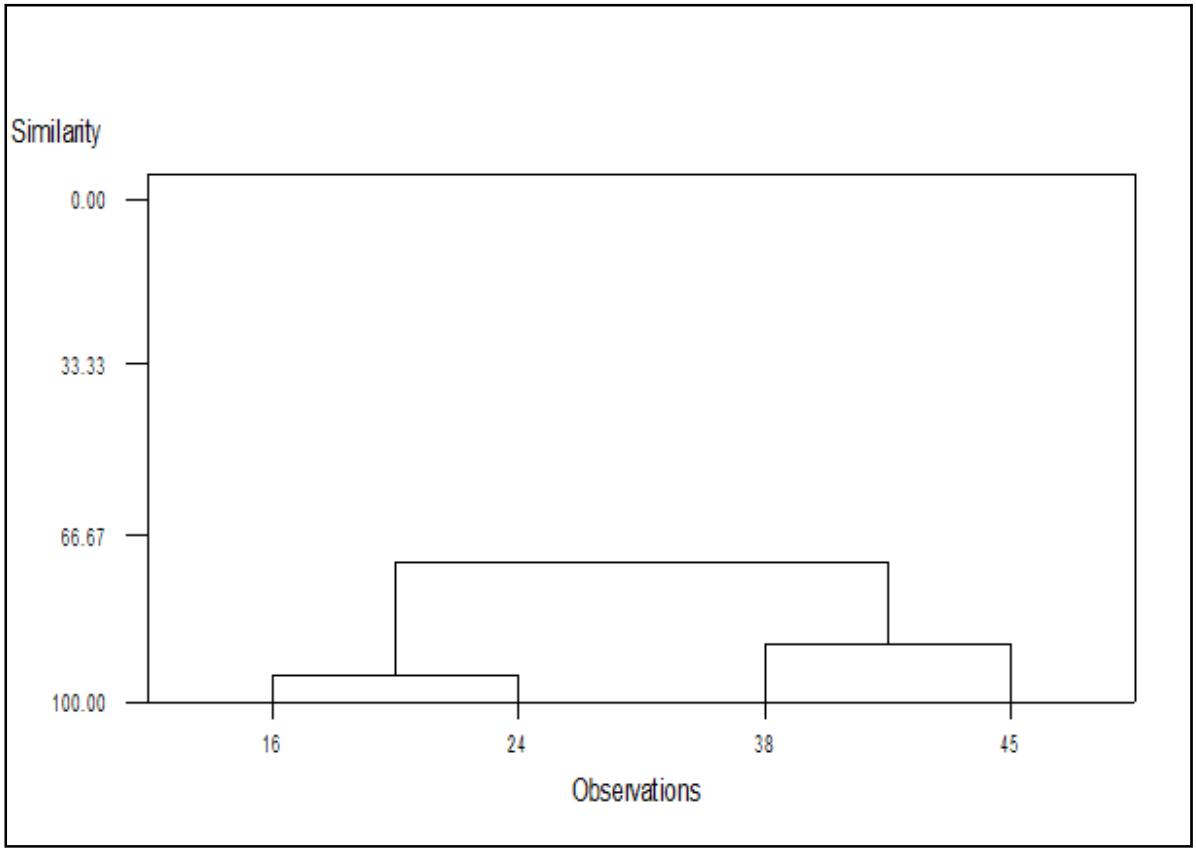

Figure 5.9: Administrative districts in the phase of receding pestilence and famine (Source: Computer generated field data, 27-05-2013)

In spite of the minor deviations from Omran's 1971 Epidemiological Transition Model, the main features of the administrative districts in Cluster C2 are the same as those of the age of receding pandemics in the model. As alluded to in Section 2.6.1 of Chapter 2, the second phase in Omran's 1971 model involves improvements in medicine and the substantial development of a healthcare system. Such advancement in medicines is a key factor in causing the receding of pestilence hence their decline in frequency. Evidence from collected data indeed shows that members of Cluster C2 experience a significant recession in the frequency of pandemics.

- **The Age of Degenerative and Human Diseases**

Figure 5.10 is a dendrogram showing the administrative districts that are in the phase of man-made and degenerative diseases. Administrative districts in Cluster C1 are categorised as belonging to the phase of man-made and degenerative diseases of the Adapted Epidemiological Transition Model. The secondary data together with responses from the questionnaires reflected that infectious diseases are no longer the major cause of death but degenerative and man-made causes such as accidents and injuries as well as non communicable diseases such as cancers have become predominant. Mortality levels have drastically fallen as the health system has significantly improved and fertility levels have also fallen as the qualitative aspects of child-bearing come to the fore.

The administrative districts in Cluster C1 are Bulawayo (7) and Harare (25). As indicated in Section 2.6.1 of Chapter 2, the epidemiological transition takes place when a country goes through the process of modernisation and development from being a less developed to being a developed country. The same can be said about regions (administrative districts) in a country. Administrative districts in Cluster C1 being basically the biggest cities of Zimbabwe (Harare and Bulawayo) are the developed regions in the country. In fact they constitute the core region of Zimbabwe. As cities they have better infrastructure and industrial development. Such developments have spillover effects into the health sector as this is interconnected with other components of development. Both the disease and the non disease variable of health have changed and, generally, the health system is now quite good. In spite of the minor deviations from Omran's 1971 Epidemiological

Transition Model, the main features of the administrative districts in Cluster C1 are the same as those in the age of man-made and degenerative diseases.

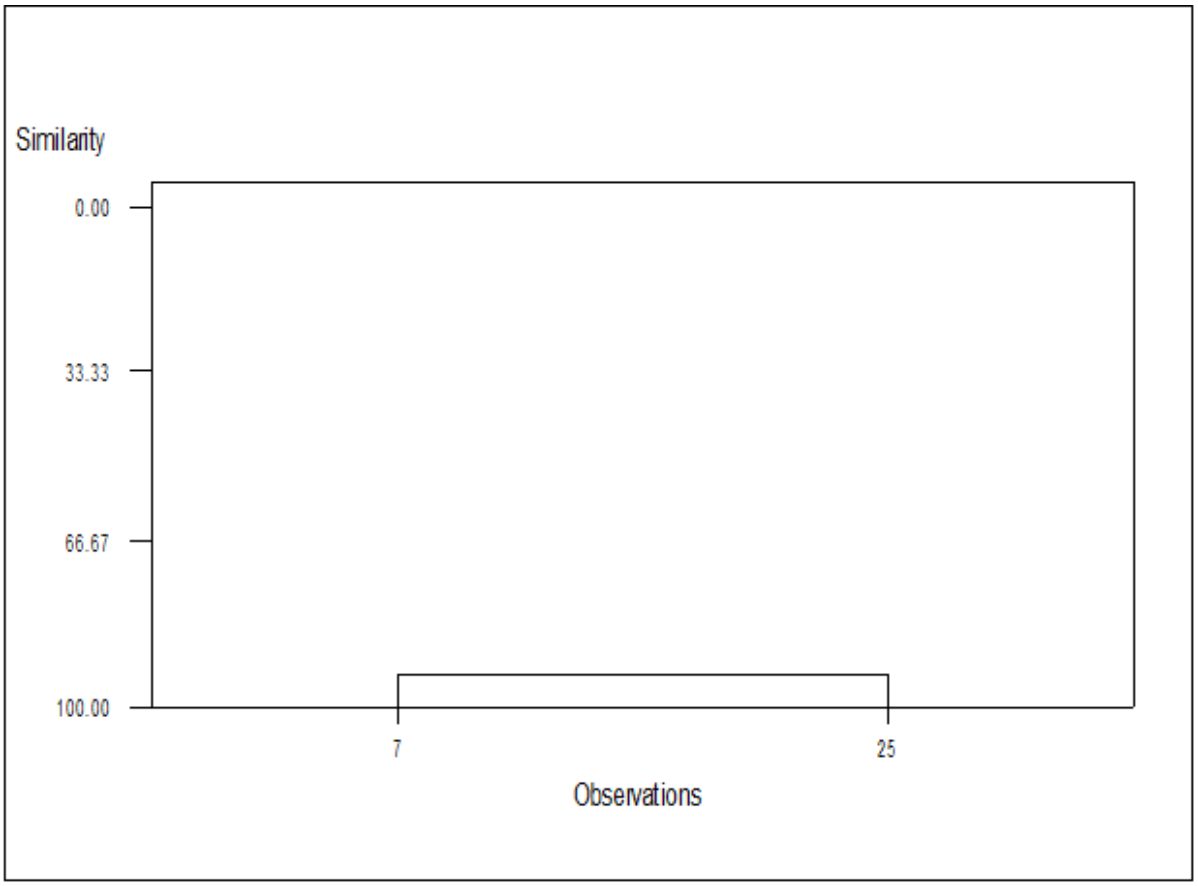

Figure 5.10: Districts demarcated in the phase of degenerative and man-made diseases (Source: Computer generated field data, 27-05-2013)

5.6 Cartographic representation of the phases of the Adapted Epidemiological Transition Model and discussion

It is clear in Figure 5.11 that the administrative districts of Zimbabwe are at different phases of the Adapted Epidemiological Transition Model. The choropleth map (Figure 5.11) depicts how the administrative districts in the different phases of the model are spatially distributed across the country. On that map, all urban areas are shown next to the name of the urban centres, symbols or polygons have been inserted whose size

depends on the size of the area of the urban centre. The districts in the phase of degenerative and man-made diseases are very few and they are all found along the central axis of the country. They are districts that are wholly urban and they are the biggest cities of the country (Bulawayo and Harare).

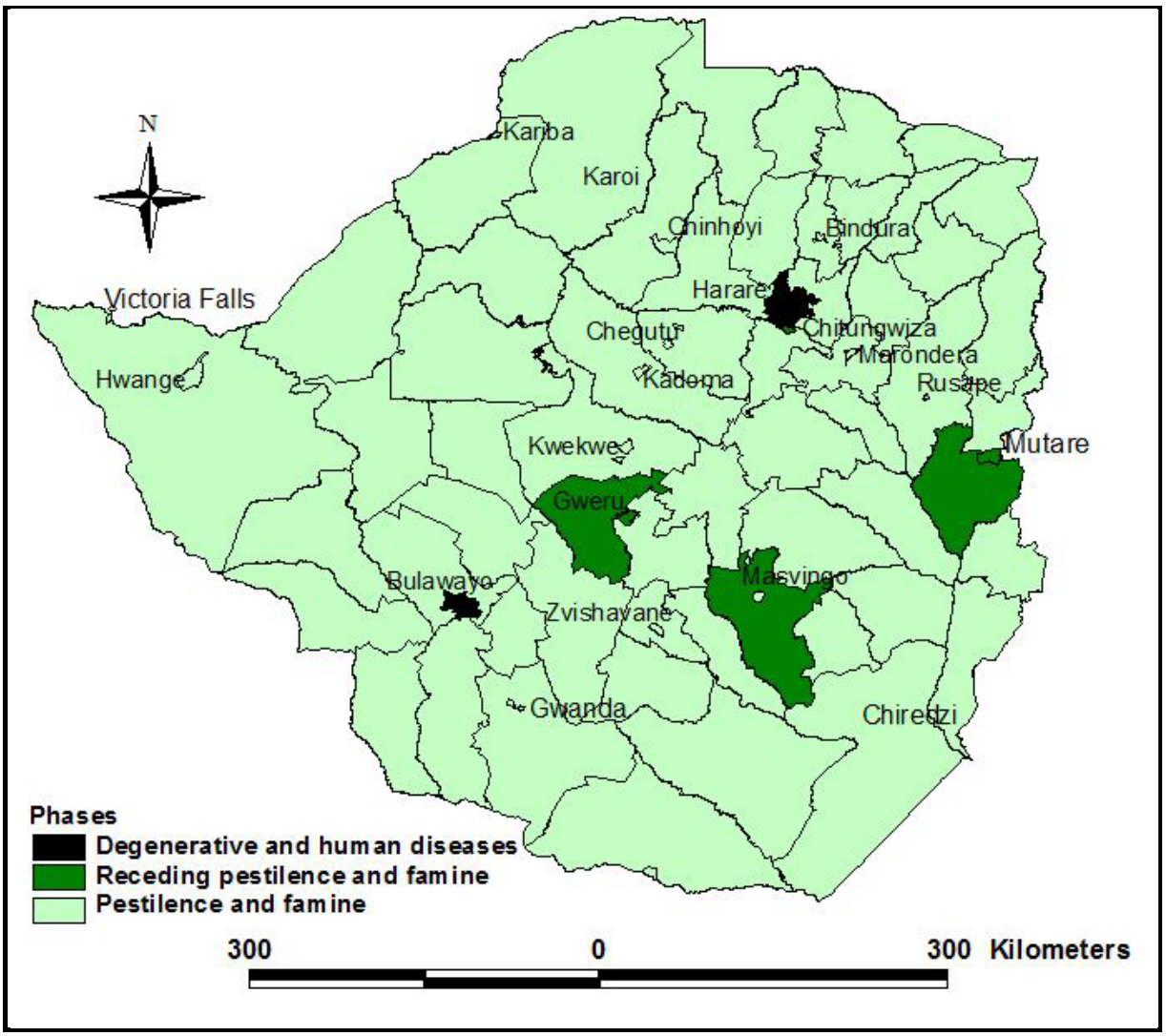

Figure 5.11: Application of the Adapted Epidemiological Transition Model on the Zimbabwean spatial health system (Source: Computer generated field data, 27-05-2013)

The phase of receding pestilence and famine has got yet another small number of administrative districts. They are just four. The choropleth map (Figure 5.11) shows that all the districts in this category are also concentrated in the central axis of the country. The districts that belong to the phase of receding pestilence and famine have big cities in them. They are not wholly urban but the cities are indeed big. It can be assumed that the cities have influenced the receding of the pestilence and famine. Such an assumption is justified because the four big cities in Zimbabwe are the ones that are experiencing the decline in the pestilence and famine.

It is clear from Figure 5.11 that most of the administrative districts in the country are demarcated in the phase of pestilence and famine. The few districts along the central axis are surrounded by a multitude of districts where famine and infectious disease are rampant. Information gathered through the interview with the permanent Secretary of the Ministry of Health and Child Welfare indicated that Zimbabwe is facing a serious challenge of infectious diseases both endemic and epidemic, and in some cases, pandemic. The map (Figure 5.11) shows how severe the problems of pestilence and famine are in the country. The administrative districts that are in the phase of pestilence and famine are found in the lowveld of the southern and northern parts of the country. The fact that the districts in the pestilence and famine age are abundant in the country means that they could even be found in the central axis of the country.

The interview with Dr. K. Garai, and Dr. S. Rupaya (K. Garai, and S. Rupaya personal communication, 20 March, 2012), confirmed what came out from the questionnaire and secondary data (from which Figure 5.11 was produced). According to Dr. Garai and Dr. Rupaya, infectious and nutrition related diseases are causing serious problems to the country's health system in general. The reports by the Doctors concur with WHO's (2010, 7) findings that infectious diseases, perinatal and maternal conditions and nutritional deficiencies constitute 78% of Zimbabwe's disease burden. Non-communicable conditions and Injuries only have 15% and 7% respectively. The permanent secretaries also agreed that on record, infectious diseases constitute the greatest part of the country' disease burden, especially in the rural areas. During the interview the permanent Secretary,

however, added that the “predominance of infectious diseases should be taken with care because the poor people in the rural areas of Zimbabwe may equally face the challenge of chronic, non-communicable diseases but may not come to the clinic or hospital. What seems to make such people quickly report cases of infectious diseases is that normally such diseases are characterised by a relatively sudden onset of symptoms that are usually severe”. The implication of this scenario is that there are lots of unreported cases of non-infectious diseases such as cancers, high blood pressure and degenerative diseases. But such people just live with the disease. The current research has made use of the reported cases of diseases and the conclusions made are based on such information.

In rural areas and apparently the majority of the administrative districts of the country in Zimbabwe, infectious diseases remain a persistent threat. Analogous to the notion of “dual economy” used to explain unbalanced socioeconomic development between the urban and rural areas, “epidemiological polarisation” has emerged within the same country because of growing disparities between geographical regions (urban and rural) and social classes. It can be argued that such disparities of the state of people’s health are not confined to the urban-rural division. For instance, the protracted epidemiological transition can also be manifested more in the disease burden of poorer urban slum-dwellers compared to their far more wealthy urban counterparts. The basis of such health inequalities is largely dependent upon the fact that there is a positive correlation between development (economic prosperity) and health, as alluded to Phillips (2006) and WHO (2010).

5.7 Conclusion

The use of the composite index method to determine the state of people’s health and the cluster analysis to demarcate health regions in Zimbabwe proved to be successful. As indicated in Section 1.10 of Chapter 1, the spatial unit of analysis in this research is the administrative district. One major problem experienced was, however, that some important data that were required were not available as secondary data at the level of administrative districts. For example, data on key communicable diseases such as

malaria and cholera that frequently and negatively impact on the health system of Zimbabwe is not available at district level. This scenario is, however, not surprising because the secondary data collected during the census were not specifically intended for health research but are general socio-economic variables of the economy. Despite such challenges on secondary data, the available data provided sufficient indicators to give an indication of the spatial variation in the levels of health in Zimbabwe.

It can be concluded from the interpretation of the results in the current chapter that an uneven spatial distribution of the state of people's health exists in Zimbabwe. Equally so, there exists a highly unbalanced system in the provision of health services in the country. Such an unequal pattern of health (both in the state of people's health and provision of health services) can be ascribed to the different levels of social and economic development in the country. The current unequal pattern of health in Zimbabwe has been evolving over the years, in line with the transitions in the socio-economic development of the country. The next chapter (Chapter 6) will therefore examine and analyse the temporal evolution of the spatial health economy of Zimbabwe. The study of the past conditions of the health system of Zimbabwe as well as the current conditions would enable the researcher to extrapolate and predict the future trends in the country's health system.

CHAPTER 6

TEMPORAL ANALYSIS OF THE ZIMBABWEAN HEALTH SYSTEM

6.1 Introduction

Health systems in most countries have undergone changes over the past few decades. These systems are, therefore, not static. Dynamic change is an inherent feature of such systems. This happens in both developing and developed countries. Zimbabwe's health system is not spared from such a general global trend. Administrative districts in Zimbabwe have experienced some dramatic changes and in some cases even traumatic. The state of people's health and the provision of health services in the administrative districts have undergone some significant amount of change. Such changes are both positive (improvement) and negative (decline). The basis of the changing pattern is the interplay of economic, political, physical and social factors.

In this chapter the evolution of the health system of Zimbabwe is examined and in the process an attempt is made to give explanations for the patterns of the evolution. To ensure that the data for the different years were comparable, simple and composite indices were calculated for each spatial unit of analysis (the administrative districts). It was from the calculated indices that the pattern of change was explained. Making use of the calculated composite indices for 1992 and 2002 the trend of change was depicted on a graph and discussed. To achieve the intended goal of the chapter, the following aspects are addressed: data analysis (indicators, simple indices and composite indices), spatial distribution of results, projection of the trends, and evolution of the health economy of Zimbabwe.

6.2 Data analysis

As indicated in Section 5.2 of Chapter 5 of this research, there are many methods of data analysis in geography. In Chapter 5, the composite index method and cluster analysis

were used in the analysis of data. In the present chapter, however, only composite indices were used to achieve the third objective of the research, that is, to analyse the evolution of the country's health system (state of people's health and provision of health services). Simple indices were calculated for both 1992 and 2002 data.

Administrative districts which experienced improvement in health (state of people's health and provision of health services) were categorised separately from those that experienced some decline in health (state of people's health and provision of health services). The criterion used to categorise the districts (into those that improved and those that declined) was based on the calculated composite indices. Such categorisation of the administrative districts was done to reveal the districts which experienced improvement and those that experienced decline in health (state of people's health and provision of health services). In order to come to the conclusion that a particular administrative district experienced a decline in health conditions, the calculated composite index for 2002 should be lower than the one calculated for 1992. On the other hand, if the district experienced an improvement in the health conditions, the composite index for 2002 should be higher than that for 1992. Such categorisation of the administrative districts was done to reveal the districts which experienced improvement and those that experienced decline in health (state of people's health and provision of health services).

6.2.1 Indicators

In order to make a detailed examination of the evolution of the health system of Zimbabwe, various indicators were used. The indicators used to determine the temporal variation of health in the country during the period 1992-2002, are given in Table 4.6 of Chapter 4. The indicator values are provided in Appendices F1 and F4. The indicators are not described in the current chapter because they were discussed in Sections 4.4 and 4.5 of Chapter 4.

Despite the challenge of lack of data before the 1990s, the decision was made that the period of assessing the evolution, which is a decade, is long enough for a meaningful

analysis of the evolution of the country's health system. Secondary data on the identified indicators for the period from 1992 to the present were available for comparative analysis

6.2.2 Simple Indices

The calculated simple indices are given in Appendix F3 (for 1992 health data) and Appendix F6 (for 2002 health data). The calculation of the simple indices was done in the same way data for objective 1 were analysed and the calculation was done as described in Section 5.2.1.1 of Chapter 5. The calculation of simple indices for evaluation of the evolution of the health system between 1992 and 2002 was done in Microsoft Excel spreadsheet. The function for the calculation of the simple index used in the Microsoft spreadsheet is, =*SUM(Cell with observed indicator value 4/cell with base number)*. The base number used in the calculations was the average of the indicator values for all the districts in respect of a particular indicator. During the calculation of the simple indices, some of them were too small that when put to one decimal places the answer turned out to be zero. To avoid such a problem, all simple indices were manipulated by multiplying them by 100. The calculated simple indices for the 1992 and 2002 data are given in Appendices F3 and F6 respectively.

6.2.3 Composite Indices

In the calculation of composite indices for evaluation of the evolution of the health system between 1992 and 2002, Microsoft Office Excel spreadsheet was used instead of the Minitab package to calculate the composite indices. As indicated in Section 5.2.1.2 of Chapter 5, the function for the calculation of the composite index available in the spreadsheet is =*GEOMEAN* $(X_1 : X_2 \ldots X_n)$. Where X_n is the cell number containing the index value of the respective observed indicator value. Like in the case of calculation of simple indices, some of the values of composite indices were too small that when put to one decimal places the answer turned out to be zero. To avoid such a problem, all simple indices were manipulated by multiplying them by 100. The calculation of composite indices was done to ensure that each spatial unit (administrative district) would have one value in order to facilitate the comparison of administrative districts in terms of their overall

health conditions. The calculated composite indices of health data for the years 1992 and 2002 are given in Appendix F7.

6.3 Distribution of urban centres in Zimbabwe

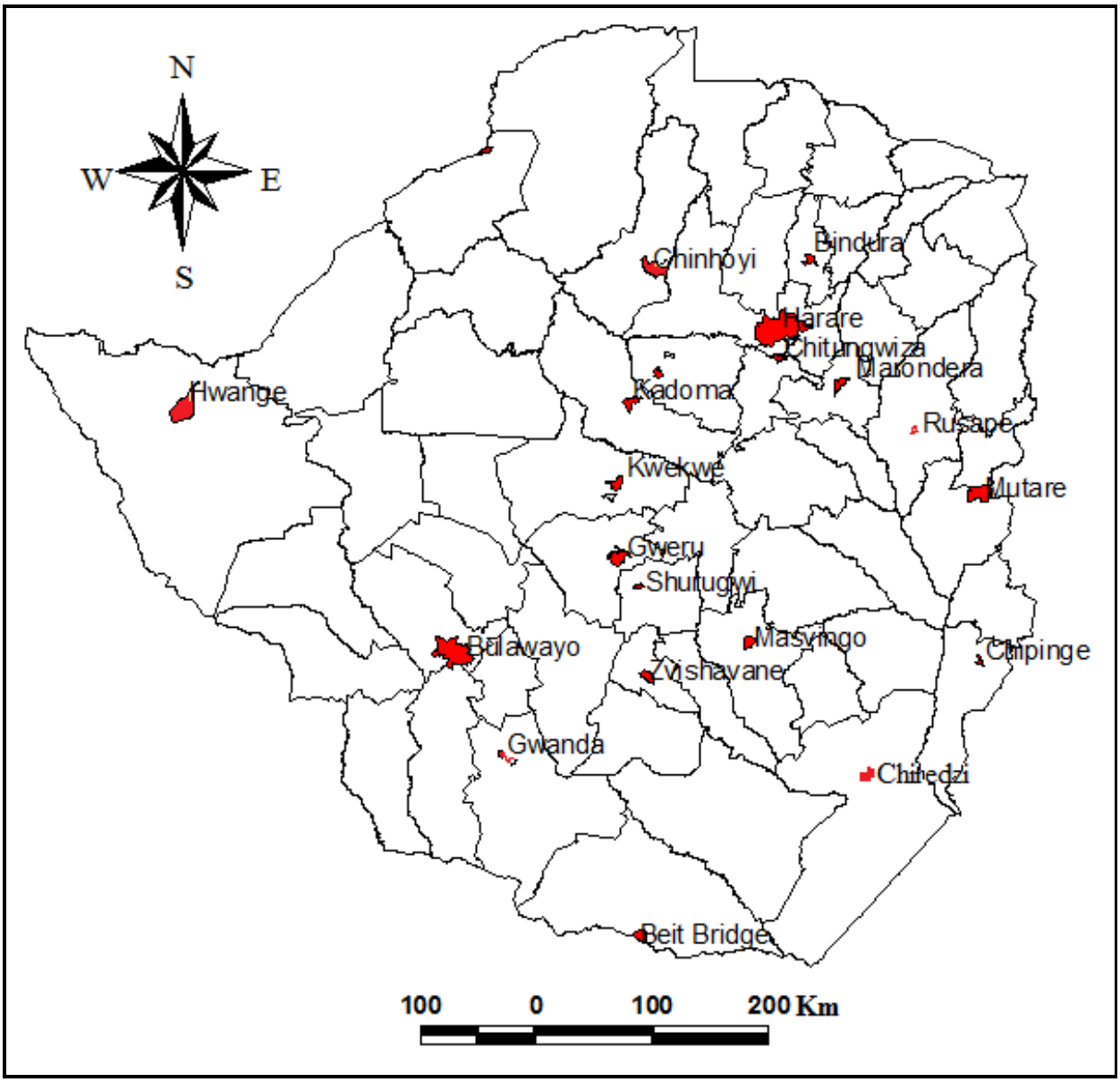

Figure 6.1: Urban centres in Zimbabwe (Source: Adapted from Musanga, 2009)

Figure 6.1 depicts the distribution of urban centres in Zimbabwe. The distribution of urban centres in Zimbabwe has been used to explain the results of analysis in this chapter and that is why such a map has been included. In Figures 5.1, 5.7 and 5.11 of Chapter 5, urban areas were included in the maps but in this chapter, an attempt was made to include the urban centres in Figure 6.2 and the maps turned out to be clumsy therefore a separate map was created in Figure 6.1. It was necessary to present the maps in Figure 6.2 side by side so as to make their comparison easier but the maps turned out to be small. In Figure 6.1, the urban centres are mainly concentrated along the central axis, the highveld of Zimbabwe that stretches from the south eastern to the eastern and areas close to the north eastern part of the country. The map showing the high and the lowveld of Zimbabwe is given in Figure 1.2 of Chapter 1. Figures 1.2 and 6.1 are used to explain the results of analysis in this chapter.

6.4 Spatial Patterns of the health system

The maps in Figure 6.2 depict the spatial pattern of health (state of people's health and provision of health services) in Zimbabwe in 1992 and 2002. Simple indices and composite indices were calculated as indicated in Sections 6.2.2 and 6.2.3. First, simple indices given in appendices were calculated from indicator values. Once the simple indices were generated, composite indices were then calculated. In order to display the results of analysis on the map, Figure 6.2, quintiles were used. To explain the results of the analysis, the researcher makes reference to conditions in the physical environment as well as the influence of urban centres in Zimbabwe. The main urban centres and relief regions of Zimbabwe are given in Figures 6.1 and 1.2 respectively. The data for the composite indices of health conditions in Zimbabwe as they were in 1992 and 2002 was ranked from low to high values (in Appendix F7) and class intervals were established on the basis of quintile values. Initially, an attempt was made to use equal interval scale or geometric scale but that led to empty classes as such techniques ignore data distribution. Quintiles were there chosen because they take into account data distribution.

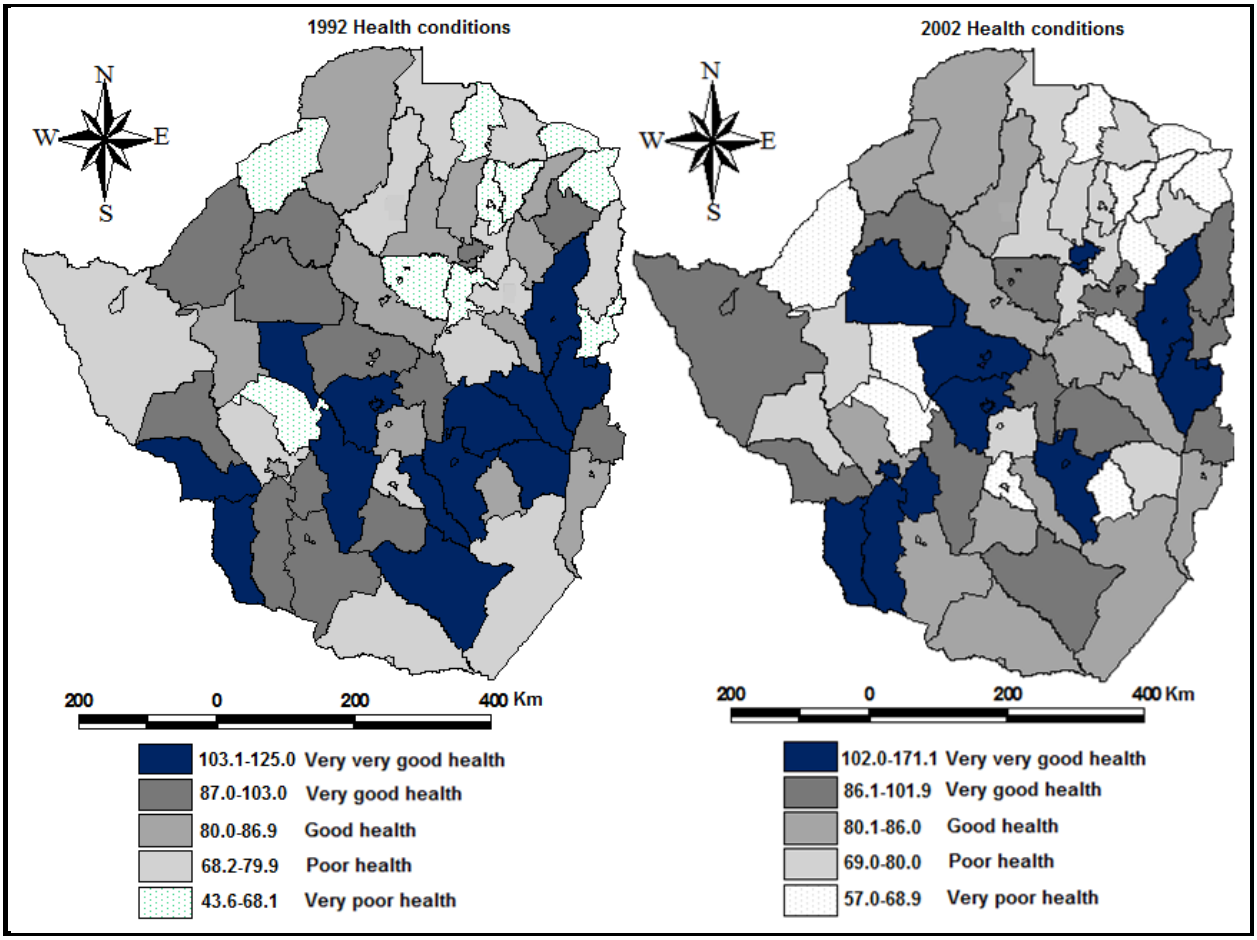

Figure 6.2: Spatial patterns of health (state of people's health and the provision of health services) in 1992 and 2002 in Zimbabwe (Source: Computer generated field data, 27-06-2013)

Quintile values divided data into five equal parts. In other words each class contains 20% of the observations (administrative districts). To calculate the quintiles, the formulae 1(n)/5 (for the first quintile or first boundary), 2(n)/5 (for the second quintile or second boundary) 3(n)/5 (for the third quintile or third boundary) and 4(n+1)/5 (for the fourth quintile or fourth boundary) were used. There were four boundaries and data were therefore put into five classes. Using the data in Appendix F7 on the 1992 calculated composite indices, the first quintile lies on the 12.2th position. That position is on the value of 68.1. The second quintile is on the 24.4th position and gives a value of 79.9. The third quintile is on 36.6th position and the value of composite index corresponding to that is 86.8. Finally the fourth

quintile lies on the 48.8th position. That position gives a value of 103.0. As for the 2002 calculated composite indices in Appendix F7, the lower quintile lies on the 12.2th position. That position is on the value of 68. The second quintile is on the 24.4th position and gives a value of 77.2. The third quintile is on 36.6th position and the value of composite index corresponding to that is 85.9. Finally the fourth quintile lies on the 48.8th position. That position gives a value of 101. 9.

Making use of the calculated quintiles, classes were created (see the legend to Figure 6.1). The created classes of data were used to generate the maps, Figure 6.1 that shows the spatial variation of health conditions in Zimbabwe as they were in 1992 and 2002. All the urban centres in the country are given in Figure 6.1. They are important in the explanation of the results of analysis in this chapter. It is clear from the map that in 1992, poor health conditions prevailed in the northern, north eastern, northern and the southern districts. These parts of the country generally have comparatively poor health conditions. The zone of poor health in the northern administrative districts is almost contiguous. The other part of poor health conditions is found in extreme southern and some western part of Zimbabwe. There are also isolated districts in the central axis of the country that have poor health.

Administrative districts that have shown comparatively good health conditions are concentrated along the central axis of the country. That central axis stretches from the eastern part of the country to the south western part of the country. The region south of the central axis with districts such as Mwenezi and Gwanda, though not really part of the central axis, are also experiencing comparatively good health. The regions of administrative districts with comparatively good health, according to the map (Figure 6.2) are non contiguous. The pattern is, however, almost contiguous but there are isolated districts of poor health conditions that intermittently feature among the region of comparatively good health making it, overall, non contiguous.

As discussed in Sections 5.2.1.3 and 5.5 of Chapter 5, both the urban influence and the physical environment show signs of having some impact on the pattern of health conditions given the spatial pattern displayed on the map. In Section 5.2.1.3, the influence

of those factors is discussed from the perspective of the state of people's health while in Section 5.3.3.6 the discussion is from the perspective of the provision of health services. The main urban areas are concentrated along the central axis of Zimbabwe as shown in Figure 6.1. At the same time districts that generally have good and very good health are also concentrated along the central axis of the country. There is therefore reasonable ground to argue that the health system of Zimbabwe is influenced by presence of urban areas.

The explanation for such spatial pattern of health conditions can be attributed to conditions in the physical environment and distribution of urban centres in Zimbabwe, Figure 1.2. As alluded to in Section 5.2.1.3 of Chapter 5, Musanga (2009: 49) indicated that the middle and the highveld regions of Zimbabwe relatively have high rainfall and a cool climate. This implies that conditions in the physical environment affect the spatial pattern of health in Zimbabwe. The current study is not the first to confirm that the physical environment affects human health. As indicated in Section 3.6.1 of Chapter 3, Roemer (1997) and Kjellstrom (2007) observed that the physical environment affects health. Urban centres are also concentrated along the middle and highveld of the country. The emerging trend is that the presence of urban areas and a wet cool climate positively also influences health.

In 2002, the spatial pattern of health (state of people's health and provision of health services) in the country is different from the 1992 pattern. This is confirmed by the choropleth map (Figure 6.2). According to the map, the administrative districts with poor health are concentrated in the southern, the south eastern, the western (excluding Hwange) and the north-eastern part of the country. The region formed by the administrative districts with poor health is not contiguous on the map; intermittent emergence of districts with different health conditions is experienced here and there. In terms of administrative districts with comparatively good health, they are, like in the 1992 spatial pattern, concentrated along the central axis, but with a northerly orientation. The region is still not contiguous like in the 1992 spatial pattern. The districts with comparatively good health have manifested a northerly shift. If projections were to be

made based on the current trend, it is expected that more districts with good health would be found in the northern part of the country.

The centre of gravity for administrative districts with comparatively good health has moved northwards, compared to the 1992 spatial pattern. The other striking feature of the 2002 spatial pattern is depicted on the legends of the two maps that show the class ranges in the form of composite indices for both maps. The upper quintile class for the 2002 map has bigger values than that for 1992. This is evidence to show that health conditions (state of people's health and provision of health services) in some of the administrative districts of Zimbabwe reached a higher level in 2002 than in 1992. The spatial health system of the country is no doubt evolving.

The maps in Figures 6.2 give the spatial patterns in the periods 1994 and 2004 respectively, without actually showing which districts experienced an improvement and which ones experienced decline. A district may have a high composite index throughout the period, and indication of good health, but such index may be decreasing over the period which is a manifestation of declining health conditions. Chiredzi district, in the southern part of the country, for example, had health conditions that were comparatively poor throughout the period but the district was improving as shown in Figure 6.3. To depict which administrative districts improved and which ones declined in the health conditions, the data were presented in Table 6.1 and on a map (Figure 6.3). In order to understand the evolution of the health system, the spatial pattern in Figure 6.3 must be used with the spatial patterns presented in Figures 6.1.

Data on conditions of health in the different administrative districts as they evolved in the period from 1992 to 2002 were analysed. The results of analysis are given in Table 6.1. Table 6.1 gives the categorisation of the administrative districts into those that had a positive shift and those that had a negative shift. Conditions of health in the different administrative districts were not static. Some districts experienced a positive shift or improvement in health conditions (improvement in the state of people's health and the provision of health services) while others have experienced a negative shift or a decline in

Table 6.1: Evolution of health in the administrative districts (Source: Compiled by researcher, 27-06-2013)

Districts that improved (Positive shift)	Districts that declined (Negative shift)
Bindura	Beitbrigde
Bulawayo	Bikita
Centenary	Binga
Chegutu	Bubi
Chikomba	Buhera
Chiredzi	Bulilima
Chirimuhanzu	Chimanimani
Chitungwiza	Chipinge
Gokwe North	Chivi
Gokwe South	Gutu
Goromonzi	Gwanda
Guruve	Hwedza
Gweru	Inzisa
Harare	Lupane
Hurungwe	Makoni
Hwange	Mangwe
Kadoma	Masvingo
Kariba	Mazowe
Kwekwe	Mberengwa
Makonde	Mount Darwin
Marondera	Mudzi
Matobo	Murehwa
Mutare	Mutoko
Mutasa	Mwenezi
Nyanga	Nkayi
Seke	Rushinga
Shamva	Shurugwi
Umguza	Tsholotsho
Umzingwane	UMP
Zvimba	Zaka
	Zvishavane

health conditions (a decline in the state of people's health and the provision of health services).

Table 6.1 gives the administrative districts that experienced improvement in health conditions and those that experienced decline in health conditions (both the state people's health and the provision of health services). It is evident from Table 6.1 that the administrative districts which experienced improvement were less than those that showed a decline. This seems to be in direct contradiction with what is reflected in Section 6.5 and particularly Figure 6.4. By calculating the composite indices for both the districts with some improvement and those reflecting a decline, it emerged that those that showed improvement have a bigger overall composite index than those that experienced a decline.

The data in Table 6.1 is mapped in Figure 6.3 so that the spatial distribution of the districts in Zimbabwe is portrayed. The data used to determine if districts improved or declined are derived from Appendix F5 of the current research. The appendix has the calculated composite indices for both 1992 and 2002. The determination of the decline or improvement in health conditions of the administrative districts is achieved by finding out if the composite indices were improving or falling over the years from 1992 to 2002. This clearly shows parts of the country that experienced improvement and those which experienced a decline.

Districts that showed improvement in the state people's health and the provision of health services are concentrated from the central to the northern parts of the country. Some of the districts that also showed improvement in the state of people's health and provision of health services are around the major cities of Bulawayo and Mutare. There are also isolated districts that showed improvement, notably Chiredzi and Hwange. On the other hand, districts that showed decline in the state of people's health and provision of health services over the years are mainly found in the southern and western parts of the country. There is also a narrow strip of districts that starts from the south, stretching to the north eastern part of the country. This narrow strip of districts has experienced a decline in the state of people's health and provision of health services over the years.

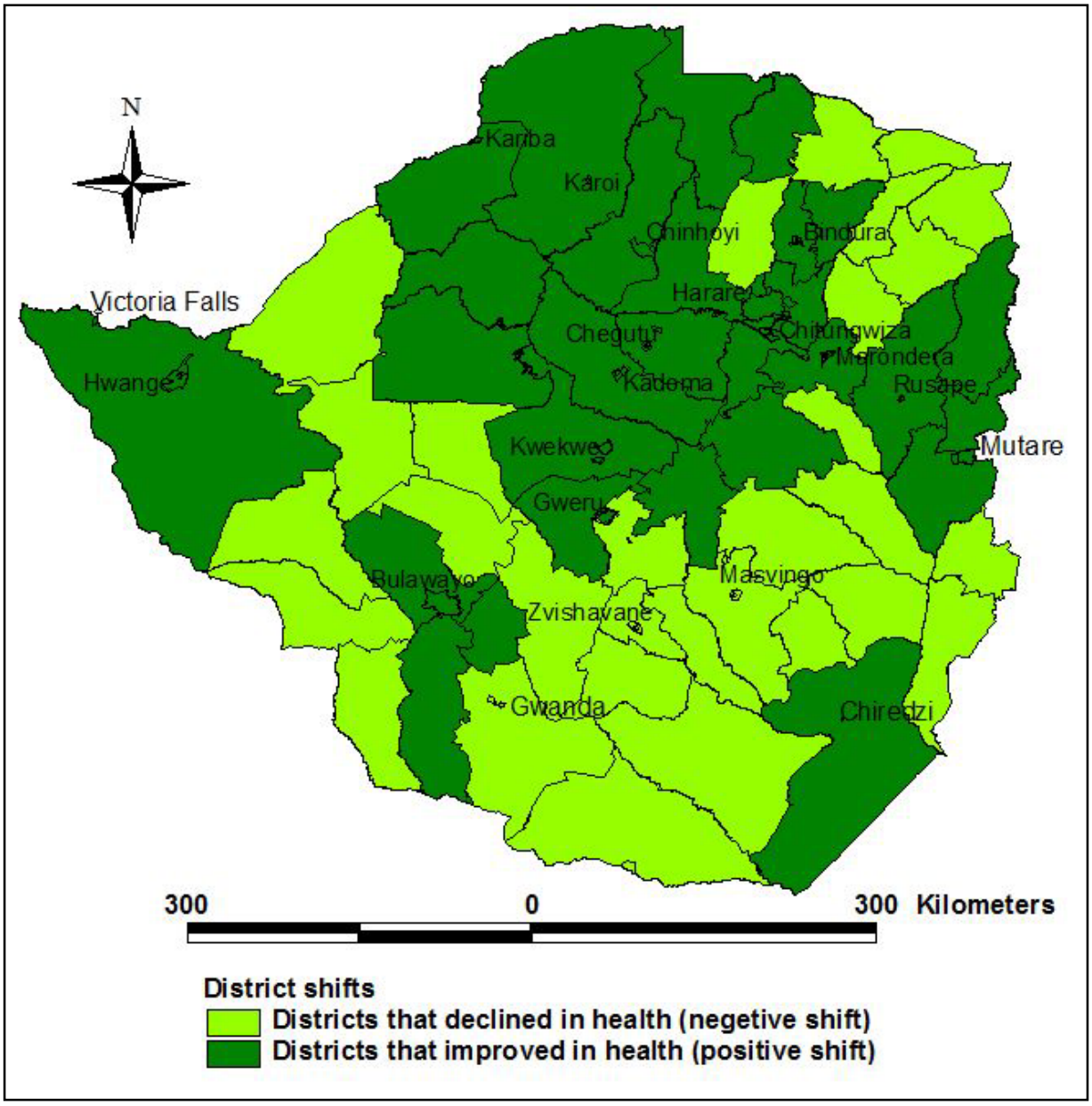

Figure 6.3 Administrative districts that have declined in health and those that have improved in health (Source: Computer generated field data, 27-06-2013)

A striking feature of the pattern of distribution of both the districts in Zimbabwe that have experienced improvement and those that have experienced a decline in health is a

tendency of nearby districts to have similar health conditions. This is in keeping with Tobler's (1970: 11) first law of geography which indicates that: everything is related to everything else, but things that are near are more related than those are far apart. The tendency is manifested in the map in Figure 6.3. Districts that have experienced improvement are generally close to each other while those that have experienced decline are also found near each other.

Various explanations can be suggested for the spatial distribution of the districts that experienced improvement or in the state of people's health and provision of health services. Figure 1.2 in Chapter 1 shows the distribution of relief regions and Figure 6.1 depicts the distribution of urban centres in Zimbabwe. Figure 6.3 shows that administrative districts that experienced improvement are mainly found where most of the urban areas of Zimbabwe are found. The urban influence is clearly noticeable from the map. The influence of Harare as the capital city of Zimbabwe and other urban areas in the country is, for example, visible on the map. The administrative districts stretching from the central to the northern part of the country that manifest improvement in the state of people's health and the provision of health services are largely close to Harare and other urban centres such as Gweru and Chitungwiza, Bindura, Kwekwe and Chinhoyi. Districts that contain these urban areas have inevitably shown an improvement in the state of people's health and provision of health services. The urban influence is also noticeable around Bulawayo and Mutare. The districts around these cities have experienced improvement in the state of people's health and provision of health services. It is also interesting to notice that Chiredzi and Hwange are small towns and the districts that contain such towns have also registered improvement in the state of people's health and provision of health services.

Apart from the urban influence, it can also be suggested that the relief and hence the climate of Zimbabwe has a major influence on the health of people in Zimbabwe. The map, Figure 1.2 in Chapter 1 shows the distribution of relief regions and urban centres in Zimbabwe. The central part of the country together with the extreme eastern part of the country constitutes the highlands of the country. The highlands of Zimbabwe experience a cool climate. This is in keeping with the principles of atmospheric physics that at a higher

level, temperatures are lower. Average temperatures on the highveld range from 12°C - 13°C in winter to 24°C in summer. On the lowveld, the temperatures are normally from 18°C-19°C in winter to 30°C and above in summer (Musonzi, 2008:22). The cool climate discourages the proliferation of pathogens. Administrative districts in the central and extreme eastern part of the country have generally experienced an improvement in health conditions. This means that the presence of urban centres which is positive to health has been augmented by the influence of a cool climate in the highlands of Zimbabwe. On the other hand, the decline in health conditions of some administrative districts that are located in the lowveld such as Beitbridge, Mwenezi, Gwanda and Binga can be attributed to the extremes of high temperatures (refer to Section 3.6.1). The linkage between temperature and health is not peculiar to Zimbabwe. Studies that have been done use a variety of data sets, time periods, populations, temperature exposure variables, and statistical models, but mostly found that temperature extremes lead to significant reductions in health, generally leading to higher mortality (Kunkel *et al*. 1999; Kovats & Hajat 2008, Deschenes and Greenstone 2011).

The districts that have shown a decline in the state of people's health and provision of health services are generally those that are predominantly rural in nature. What emerges from this study confirms the results obtained by Conyers (2001) that rural districts in Zimbabwe are poorer than their urban counterparts. As indicated in Section 5.2.1.3 of Chapter 5, Conyers (2001: 109) indicates that urban areas of Zimbabwe basically make up the core while peripheral regions are generally found in the rural part of that country. Rural districts are generally poorer and their health conditions consequently poorer than the urban ones. The close linkage between health and wealth has been stressed by Pritchett and Summers (1996) who explored the causal connection between the two phenomena and concluded that wealthier countries are healthier ones. Wealthier regions are in a better position (with their more resources) to provide more health resources to the population.

6.5 Evolution of the health economy of Zimbabwe

As alluded to in the introduction to the current chapter, health systems of different economies the world over, evolve. Zimbabwe's health system is not an exception to this general trend. To achieve the examination and explanation of the evolution of Zimbabwe's health system (state of people's health and provision of health services), data on the identified variables for 1992 and 2002 Census and 1994 and 2004 National Health Profile were used. Means of composite indices for 1992 and 2002 were calculated. The composite index values for 1992 and 2002 are given in Appendix F7. The means were calculated so that the general conditions for the whole country in the years could be appreciated. They were useful in the comparison the health conditions in Zimbabwe between 1992 and 2002. The calculated means of composite indices were then used to produce the bar graph (Figure 6.4). A trend line, the red line on top of the bars, was also included in the graph to so as to show the general pattern of change of health conditions during the period. The trend line was chosen in displaying the results of analysis on the evolution of the country's health system because it makes it much simpler to visualise current values and to predict other values that are not represented in the data. Figure 6.4 shows the results of analysis on the health conditions as they were in 1992 -2002.

It emerged from the calculated means that during the period from 1992 to 2002, the health system of Zimbabwe underwent minimal change. The mean composite index for 1992 was 85 while for that for 2002 was 86.1. The mean composite index for 1992 was therefore lower than that of 2002. On average, the districts showed some positive change in the period from 1992 to 2002. The positively sloped trend line in Figure 6.4 is a clear indication that as time passed, the health conditions in the country were improving. There was some improvement in the health system (state of people's health and provision of health services) of the country during the stated period. The small gradient of the trend line in Figure 6.4 is a cause for concern; it confirms that the improvement in the health system of the country was, indeed, small.

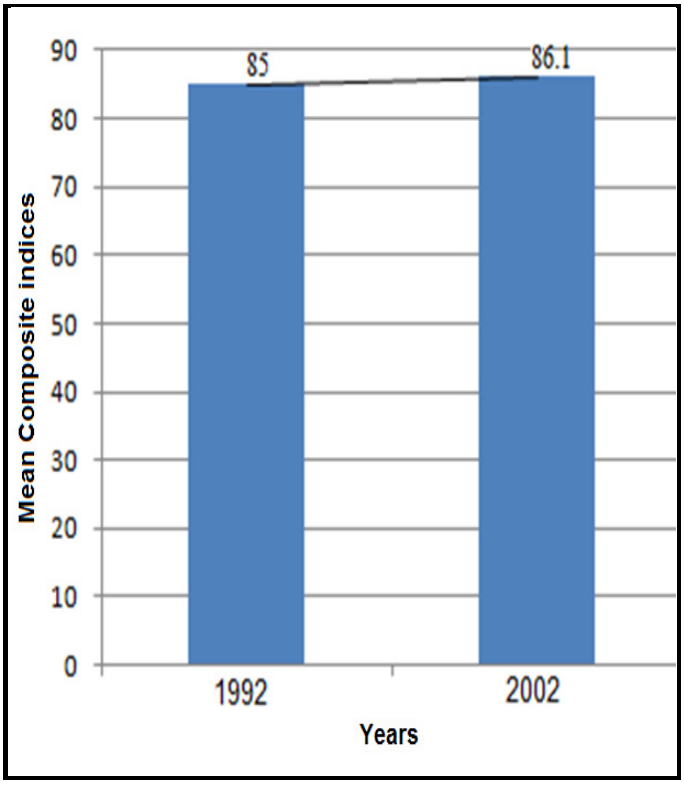

Figure 6.4 Health Conditions in Zimbabwe in 1992 and 2002 (Source: Computer generated field data, 27-06-2013)

Almost everybody in society needs to make some sort of forecast at some points in their life. Forecasting is the use of historic data to determine the direction of future trends. Most of those made by ordinary individuals in their private lives are probably made subconsciously, or at least informally. Researchers are obliged to make more explicit forecasts of events or situations to improve the accuracy of the prediction process. Depending on who is making the forecast, therefore, and the nature of the forecasts being made, the methods used will vary from extremely simple extrapolations based on past experience to very detailed forecasts based on computer models described by hundreds of equations. In the current study, trend line was used in forecasting or projection of future trends.

In order to project the trends in Zimbabwe's health system, prevailing trends can be used (see Figure 6.4). A trend line was plotted on top of the bars to show changes through time. As indicated in the preceding paragraph, the trend line shows that over the years from 1992-2002, health conditions were improving in Zimbabwe. If such a trend line is projected, it will continue sloping upwards. Even without using models of forecasting, it can be inferred from such a pattern that the years beyond 2002 should have a higher composite index. This implies that conditions of health in the administrative districts of Zimbabwe are improving in the post 2002 period. The assumption here is that there is no shift in the rate of change. In reality, rate of change may not necessarily be static due to socio-economic and political change in the country. Despite such a minor shortcoming in the model, it can be very useful to portray the pattern of health in the immediate past, at present and even to predict the likely trend in the future of Zimbabwe.

The general interpretation made from the results of analysis given in Figure 6.4 is that there has been an improvement in health (state of people's health and provision of health services) in Zimbabwe. This seems to be in direct contradiction with what is portrayed in Section 6.4 and more particularly, Table 6.1. In that section, slightly more districts have shown a decline in health conditions than those that have shown improvement. By computing the composite indices for both categories of administrative districts (those that have experienced decline and those that have experienced improvement) it emerged that a small number of districts had large overall composite indices. It can therefore not be disputed that overall, the health conditions of the country experienced improvement.

There can be various explanations for such an evolution of the country's health system. One major explanation that can be advanced to account for such evolution rests in the linkage between development and health. As alluded to by Conyers (2001: 109), health is a component of development. Generally, when a country develops, more resources are made available to the health sector. According to Central Statistics Office (2004), Zimbabwe had an average GDP growth rate of about 1.2% per annum. The economic development of the country during that period was positive. This implies that as the country was experiencing more economic development, more health resources were

becoming available for improvement of the country's health system. The improvement in Zimbabwe's health system, though small, is therefore in keeping with improvement in economic development of the country. It is not surprising that during that period (from 1992 to 2002), provision of health services and state of people's health were improving in the country as more and more health resources were available in the country. People's socio-economic conditions of life were improving which means less disease and health problems were being experienced as time was passing.

Generally, the findings from the interview discussions support what emerged from the quantitative analysis of data. According to the Permanent Secretary with the Ministry of Health and Child Welfare, the health conditions of the country are improving. The National Health Director also agreed with the Permanent Secretary with the Ministry of Health and Child Welfare. The National Health Director indicated that when economic development occurs in the country there are ripple effects in different sectors of the economy and the health sector is no exception. The views of the National Health Director are based on the idea that health and development are inextricably related. In other words as the country experiences economic development, health improves. Such linkage between health and development has been supported by other scholars as discussed in Section 3.3 of Chapter 3.

6.6 Conclusion

The composite index method was used for the analysis of data in the current chapter. It is clear from such analysis of the data that Zimbabwe's health system is not static, but rather dynamic. The various administrative districts of the country have experienced change over time in their conditions of health (both people's state of health and the provision of health services). Some districts experienced improvement while others have experienced decline in their conditions of health. It has also emerged from the analysis of the data in the chapter that slightly more administrative districts experienced a decline compared to those that experienced an improvement. Overall, Zimbabwe's health conditions (both people' sate of health and the provision of health services) improved during the period 1992-2002.

The ideal situation is to have the health conditions for all the administrative districts of the country improving. It has emerged from discussion in Section 6.4 of the current chapter that this is not the case. The gap in health inequalities are widening among the administrative districts. Policies or strategies are, therefore, needed to reduce such a gap and attempt to improve the general conditions of health in the country. The next chapter (Chapter 7) deals with strategies or policies for spatial development of health in Zimbabwe.

CHAPTER 7

SYNTHESIS, RECOMMENDATIONS AND CONCLUSION

7.1 Introduction

Zimbabwe is a developing country within southern Africa and its health system, like that other developing countries, is characterised by an unbalanced spatial distribution in health. The major objective of the current research was to analyse the temporospatial dimension of health in Zimbabwe. The cluster analysis method and the composite index method were used to analyse the data. Composite indexing was used to determine people's levels of health as well as to analyse the evolution of the country's health system. The data on the indicators was measured in different units, for example life expectancy in years, mortality rate in deaths per 1 000 of population and so on. Composite indices were used because they are means or averages of ratios and there are no units for them. Cluster analysis was used during the demarcation of the country into health regions according to the levels of health service provision. As quantitative technique, cluster analysis has the advantage that classes can be created with limited bias. In Chapter 1, the introduction, it was mentioned that most national systems show a spatially unbalanced pattern of health. In Chapter 2, concepts, models and policies of health were discussed. In Chapter 3 relevant review of literature pertaining to the health situation in both developed and developing countries, taking a comparative approach, was provided. Chapter 4 dealt with data gathering while Chapters 5 and 6 dealt with data analysis. Chapter 5 deals with spatial patterns of health while Chapter 6 deals with the temporal patterns of health in Zimbabwe.

This chapter deals with the examination of strategies for spatial development of health and provides a summary of the main findings of the research from the

data analysis performed. The chapter also discusses the contribution of the research to the discipline of geography. The study endeavours to demonstrate that the research has made a unique contribution to the literature and geography as a discipline. In the conclusion to this chapter, answers to the research questions that were raised in Section 1.6 of Chapter 1 are revisited.

7.2 Contribution of the research to geography as a discipline

As alluded to in the introduction to Chapter 1 of this study, health is an important component of human life. The current study is important because it fills a knowledge gap in the literature on the geography of health and particularly on the Zimbabwean spatial health system. As indicated in Section 1.7 of Chapter 1, Dirwai (2002: 31) asserts that research on the spatial aspects of health in Zimbabwe has been piecemeal. There is much going unnoticed in the country's health system and this has serious negative implications on health policy formulation in Zimbabwe. Despite the fact that most of the analysis in the current study is based on 2002 health data, the research makes a meaningful contribution to the literature on the Zimbabwean health system. There is a knowledge gap in terms of temporospatial aspects of health in Zimbabwe and the current research contributes in closing this gap. While the research makes a meaningful contribution to the literature on the Zimbabwean health system, such knowledge can be inductively applied to situations in other countries particularly developing ones. The results from this analysis may not only benefit policy makers in Zimbabwe but even others in other countries.

The study has a methodological contribution to the discipline of geography through the use of triangulation (mixing of methods or sets of data). Within geographical research in general, and medical research in particular, until quite recently quantitative data analysis held sway, mirroring the dominance of a positivist approach to research (Gatrell, 2002: 87). The implication of this

statement is that medical geographers were depending too much on quantitative approaches. In the current research, both qualitative and quantitative approaches have been used. Although it is acknowledged that the contribution of the qualitative approach was small in this study, there was some application of the approach as interviews were conducted and results discussed. In a way, the research serves to encourage some geographers and health geographers to use both the quantitative and qualitative methodologies. The study serves to shed more light on the value of triangulation and eclecticism in research for those health geographers who still subscribe to the traditional, old methods of dichotomising approaches in research even in circumstances where it is not supposed to be so.

This study also makes a significant contribution to theory. One benefit of the Epidemiological Transition Model, used in this research, is its scope. Brown (2010: 530) observed that early epidemiological models concentrated on the host, causative agent and environment. Emphasis was on temperature, moisture and other climatic variables but they failed to take into account the broader socio-economic and political factors that affect health. Application of a model such as the Epidemiological Transition Model is therefore important in the analysis of the health system of a country. It is acknowledged that Omran's (1971) model and even the later versions have been adopted in several geographic and health-related studies but there has been no comprehensive application of the Epidemiological Transition Model in African countries from a geographical perspective. Agyei-Mensah (2010: 882) noted that, with few exceptions, such as references in the edited volume of Jamison *et al.* (2006) on disease and mortality in sub-Saharan Africa, there has been little application of the model to the African context. The application of the model in an African context and in Zimbabwe in particular from a geographical perspective should be a welcome development to geography as a discipline. While the research has certainly increased the existing literature on the application of the model in an African context, it is also

valuable in stimulating other geography researchers to be more concerned and critical about the application of the model in an African context.

The other theoretical contribution of the research is the application of an adapted version of the Epidemiological Transition Model. As was explained in Section 5.4 in Chapter 5, before this model could be applied to Zimbabwe it was slightly adapted. Although the adapted model does not differ much from the original 1971 and the updated 1983 models, the adaptation of the model constitutes a significant theoretical contribution in this research. The justification for adapting the model is discussed in Section 5.4 in Chapter 5.

7.3 Findings of the research

The findings from the primary research concern the outcomes from the data analysis performed in this research. Data analysis in the research was conducted in accordance with the five objectives of the research. The research objectives, as given in Section 1.5 of Chapter 1, are concerned with the state of people's health, demarcation of health regions in Zimbabwe, assessment of the evolution of the country's health system, application of the Adapted Epidemiological Transition Model to Zimbabwe and recommendations of policies and strategies for the country. In this section, an indication will also be given of how the research findings and answers to research questions link with research that has been done and that was reviewed in the literature review (Chapters 2 and 3).

7.3.1 Variation in the spatial distribution of the state of people's health in Zimbabwe

The first research question asked how the spatial pattern of health in terms of state of people's health and disease as well as health care (health services) varied in Zimbabwe in 2002. The results from the analysis make it clear that the

state of people's health is uneven in Zimbabwe. People in some districts have comparatively good health but in other districts their health conditions are poor. This is not surprising because, as alluded to in Section 5.2.1.3, socio-economic development and particularly health in the spatial economy of Zimbabwe is uneven. The variation in the composite index of health is really an indication that state of people's health in Zimbabwe is highly unequal. The composite index value for the district with the highest score (Bulawayo district) is 3.4 times larger than that of the district with the lowest score (Bubi district). Such internal variation in health is not acceptable. Diseases and infectious ones in particular can easily diffuse (due to the presence of a steep diffusion gradient) from one part of the country to the other. As discussed in Section 5.2.1.3 of Chapter 5, the explanation for such variation is multi-factorial in nature. Musanga (2009: 49) observed that the middle and the highveld region of Zimbabwe have high rainfall and a cool climate. Climate, distance from urban areas and level of development of the districts are among the main factors that are used to explain the variation. In districts with a high level of development people have greater access to health services, better nutrition and are less vulnerable to diseases and particularly the infectious ones. In terms of climate, the high amount of precipitation is favourable for agriculture which improves the living standard of the people. With better standard of living, such people's health is improved. The cool climate inhibits the rapid proliferation of pathogens (disease causing microorganisms). Urban areas have more and better health resources. Nearness to such places has positive impact on people's health.

The findings from the primary research (analysis of data) concur with what emerged from the literature review in Section 3.3 of Chapter 3 concerning the first objective of the research (dealing with the spatial pattern of people's health status). The state of people's health is highly unequal. In Section 3.3 of Chapter 3, it emerged that the burden of disease is not evenly distributed in Zimbabwe. Some countries or regions bear a greater burden of the disease than others. This

was indicated by Dirwai (2002: 32) as he noted that the country's health system is characterised by inequalities. People in the different administrative districts of Zimbabwe have different conditions of health. People in some administrative districts experience less morbidity and disability than in other districts. This also confirms the assumption that there is spatial variation in the state of people's health in Zimbabwe which has been set out in Section 1.3 of Chapter 1. It is also alluded to by ECONEX (2009: 2) that people in poor regions/countries experience high morbidity, high mortality and high disability as reflected by the high DALYs. This means that, overall, their conditions of health are poor. In other words, the findings from the primary research (data analysis) in Chapter 5 are in agreement with ECONEX (2009: 2). As indicated in the current section, analysis of data indicates that the bulk of the people (in most of the administrative districts) in Zimbabwe in a poor state of health.

7.3.2 Variation in the spatial pattern of the provision of health services in Zimbabwe

The second research question was on the existence of a hierarchy of health regions with similar patterns of health service provision in Zimbabwe in 2002. The demarcation of administrative districts into health regions according to the provision of health services was objective two of the research. The country was successfully demarcated into health regions based on the provision of health services. It emerged in Section 5.3 that the demarcated health regions were not uniform in size (did not contain the same number of administrative districts). One health region or cluster has 47 administrative districts. This constitutes 77% of the total number of the administrative districts in the country. The fact that only a few districts in Zimbabwe have good health implies that the overall health conditions of the country as a whole are poor. This is not surprising as Zimbabwe is a developing country and the findings confirm ideas of Phillips (2006) and WHO (2010)'s that health and development (income) have a positive correlation.

As indicated in Section 3.4 of Chapter 3, health inequalities in service provision are common in developing countries. Section 5.3 of Chapter 5 demarcated Zimbabwe into health regions that reveal severe disparities in the spatial health system of the country.

The use of both composite indexing and cluster analysis proved to be effective in this study. The composite index method was used in data analysis in the current research. In Chapter 5, composite indexing was used in the determination of the state of people's health. Specifically, it was used to calculate the indices for all the districts in order to determine the state of people's health in the districts. Composite indexing was also used in Chapter 6 to determine the indices of the districts for the years 1992 and 2002. Cluster analysis was used for the demarcation of health regions in the country. It was assumed in Section 1.3 of Chapter 1 of the current research that spatial inequalities exist in the country's health system. The wide variation in the calculated indices as well as the existence of clear cut cluster from composite index and cluster analysis respectively, clearly confirms such spatial inequalities.

Studies by Coombes (2005) and Chudi (2010) all point to the fact that overall, the provision of health services the world over is highly unequal. It also emerged from the data analysis in Section 5.3 that the level of provision of health services in a region positively covaries with the level of development of that region. The findings from data analysis in Chapter 5 confirm this. It emerged from Chapter 5 that the provision of health services in Zimbabwe is highly unequal. Such inequality according to the primary research is in concurrence with the level of development of the different regions (administrative districts) in the country. The findings from data analysis indicate that overall, administrative districts with an urban orientation have better provision of health services than those with a rural orientation.

7.3.3 Application of the Adapted Epidemiological Transition Model to the Zimbabwean spatial health system

The third objective of the research was to apply an Adapted Epidemiological Transition Model to the spatial health system of Zimbabwe in 2002 and to evaluate the extent to which the model applies to the country. It was not feasible to apply the model in its original form without adapting it. The reasons for adapting the model were discussed in Section 5.4 of Chapter 5. It is noted in that section that the problem in Omran's (1971, 1983) model is that in the second phase receding pandemics is used as if pestilence refers to pandemics only. Pestilence includes endemics, epidemics and even pandemics. In the Adapted Epidemiological Transition Model all forms of morbidity, endemics, epidemics and pandemics are included in the second phase.

In Section 5.6 of Chapter 5, cluster analysis was used to demarcate clusters of districts and then these clusters were linked to the different stages of the Adapted Epidemiological Transition Model. The model was used to show that the administrative districts in Zimbabwe are at different stages of health development. Data analysis in Chapter 5 has shown that the Adapted Epidemiological Transition model can be applied to the spatial health system of Zimbabwe. It is acknowledged (as indicated in Section 1.14) that the study suffers the challenge of lack of data on some critical indicators. Variables such as GDP per capita per district and prevalence rate per district of some diseases, for example malaria, cholera and HIV/AIDS per district that significantly influence the health pattern of Zimbabwe is either unavailable or if available, it is normally incomplete and outdated. Despite challenges regarding data on some of the indicators, the variables used were sufficient to make the application of the model possible with success. The existence of a scenario where administrative districts are at different phases of the Adapted Epidemiological Transition Model also serves to confirm that health conditions in Zimbabwe are highly unequal. The fact

that the country's health system is improving (from what emerged from the discussion in Section 6.5 of Chapter 6 in the current research) means that there is a significant amount of hope that with time, the administrative districts in the phase of pestilence and famine will graduate to the phase of degenerative and man-made diseases.

It emerged in that section that some of the districts are at the phase of pestilence and famine while others are at the phase of receding pestilence and famine and finally others are at the age of man-made and degenerative diseases. The Adapted Epidemiological Transition Model was applied to the Zimbabwean health system with a reasonable degree of success.

7.3.4 Changes in health conditions in Zimbabwe: 1992 to 2002

As indicated in Section 1.5, the analysis of the evolution of the Zimbabwean health system is the fourth objective of the research. It was also assumed in Section 1.3 that the country's health system was evolving. It emerged from the analysis of the data in Chapter 6 that over the years the spatial health system of the country has been changing. Overall, the country's health system has experienced some improvement. Over the period from 1992 to 2002, the health system of Zimbabwe was showing improvement. The trend line (Figure 6.2) has shown that the health system was improving from 1992 to 2002.

The other major finding in relation to the evolution of the health system of the country is that there were some internal variations in the nature of the evolution of the health system of the country. While the country as a whole experienced improvement in health, not all administrative districts were moving at the same pace. Some administrative districts experienced improvement in health while others experienced some decline in health. The discussion in Section 6.3 and map in Figure 6.3 clarifies that while some administrative districts experienced

improvement in the state of people's health and provision of health services others experienced some decline. Overall, districts in the northern part of the country comparatively experienced more improvement than those in the southern part. On the other hand, districts that showed a decline in the state of people's health and provision of health services over the years are mainly found in the western and southern parts of the country.

Lee (2003) showed that the health situation in the world is evolving (Section 3.5) and the analysis in this research has confirmed this. Countries' health systems are not static. Two major aspects emerged in the literature review regarding the nature of the change. One of the aspects is that the direction of change in the health systems is generally one of improvement. Data analysis in Chapter 6 is, however, not totally in agreement with the findings that emerged from the literature review. It emerged from the findings in Chapter 6 that in Zimbabwe there are more districts that experienced some decline than districts that experienced an improvement in the health conditions. Although the number of administrative districts that experienced decline is more, they are almost the same in quantity to those that showed improvement. The other aspect is that, as a health system evolves, the pattern of diseases changes. The existence of Omran's (1971) Epidemiological Transition Model serves to support the idea that patterns of diseases in regions evolve. The application of the Adapted Epidemiological Transition Model to the spatial health system of Zimbabwe as discussed in Section 5.6 was successful. This serves as further evidence that the patterns of diseases change with time.

7.4 Recommended health improvement policies and strategies for Zimbabwe

The last objective of the research is to investigate available strategies for spatial development planning and policies that are suitable for spatial development

planning of health in Zimbabwe. Some general policies for spatial development of health were discussed in Section 2.7 but the question is which of these strategies and policies are available and can be recommended for the spatial development planning of health in Zimbabwe in particular. In this section some of the policies that can be used to improve of health in Zimbabwe are discussed and recommendations are made.

The proposed strategies do not only aim to reduce inequalities in health among regions in the country but are aimed at the uplifting of health in general. The first part of this section deals with recommending of new policies and strategies that should be applied to the Zimbabwean health system. Some elements of such strategies may be evident in the health system but overall the adoption of such policies are piecemeal or too little to the extent they are deemed to be new policies/strategies for Zimbabwe. The second part of the section deals with the proposed adjustments of the policies and strategies that are already in use in the country. Not all strategies that are already in use in Zimbabwe deserve such adjustments but only those that have failed to have significant positive impact in the improvement of the health system of the country.

7.4.1 New policies and strategies

According to current study, the policies and strategies recommended in this section are deemed to be new. The policies and strategies are; telemedicine, national health insurance, appropriate referral system and appropriate blending of public and private sector in the provision of health services.

7.4.1.1 Telemedicine

It may not be easy to increase healthcare facilities in the rural areas of Zimbabwe mainly because of limited financial resources. As indicated by WHO (2008a: 10)

the country is going through considerable social and economic challenges and the health sector is not spared. The use of telemedicine can help to improve the situation. “Telemedicine can be defined as any provision of medical care over distance, typically utilizing information communications technologies (phone, internet, audio/video transmission) to coordinate patients with physicians, or physicians with consultants” (Chazireni and Harmse, 2013: 9). Information Communications Technologies (ICTs) can provide virtual access to services and, therefore, can reduce the need for patients to physically access the health facility for service. The Internet, in particular, enables people to conduct various activities and access services without physical travel, lessen barriers due to lowered physical accessibility (Kenyon and Lyons, 2008). In rural parts of Zimbabwe, ICTs, particularly telemedicine, can be used in improving the accessibility of healthcare services without requiring physical access to the healthcare facility. Challenges such as, poor quality rural healthcare, inadequate training of health staff or too few service locations are minimised. A vital benefit discussed here is the role of communication in reducing the need for travel, thereby reducing the disparity in healthcare services and level of expertise in the peripheral region of Zimbabwe.

Certain medical fields can implement telemedical approaches in their services, such as in health education materials offered by health insurers online, or radiologists communicating interpretations of scans via email or networked databases. These innovations allow healthcare facilities that may have low capacity of funding in-house specialty staff to offer specialty services to a wide range of patients using their limited resources and manpower. By implementing telemedicine and allowing more services to be conducted remotely and cheaply, this may be able to improve the way rural residents in Zimbabwe obtain healthcare. Given the shortage of physicians in rural parts of Zimbabwe as alluded to in Section 5.3.3.6, technologies which allow urban physicians to effectively aid rural residents will help address some of the inequalities between

urban and rural areas. Telemedicine may be a useful option in Zimbabwe where patients are travelling from faraway places such as Chipinge, Chiredzi and other remote areas of the country to the major referral hospitals in Harare and Bulawayo. A broad range of teleconsulting technologies can be used to improve patients' access to the desired healthcare services.

If Zimbabwe implements the telemedicine health strategy, it would not be the first country to use such a strategy. According to Takahashi (2010: 234) the Japanese government commenced the use of telemedicine in 1996 in line with its deregulation policies. According to the same researcher, nowadays there is extensive use of telemedicine including teleradiology (involving the use of X-rays or medical imaging in the diagnosis and treatment of diseases) and telepathology (disease diagnosis involving communication on chemicals and cells in blood, sputum, bone marrow, tissues and urine). Japan indeed is making use of cutting edge technology in its telemedicine for the benefit of its citizens. Takahashi (2010: 238) further indicates that, before long, Japan hopes to introduce a virtual hospital in cyberspace (space created by the worldwide networking of computer systems).

It must however be stressed that Japan is a developed country with a good information infrastructure and the implementation of telemedicine in Zimbabwe may be problematic. Zimbabwe does not have the required ICT infrastructure in place. Progress has been made in the deployment and uptake of ICT in the country but much more commitment is needed from Government in terms of an institutional framework and ICT policy.

7.4.1.2 National health insurance policy

It is suggested that a Commission of Inquiry be appointed by the Government of Zimbabwe to analyse the present crisis in the medical aid society and to consider alternative options such as the National Health Insurance system. The National

Health Insurance system was discussed in general in Section 2.6.3.4. The commission must involve all interested stakeholders, including employers, employees, health professional, existing medical aid societies, and existing health insurance organisations. The Commission should investigate the suitability and economic viability of a National Health Insurance system within the context of the Zimbabwean health system and recommend a comprehensive plan for the implementation of the National Health Insurance System if enough consensus available on this option. A number of alternative options for such a National Health Insurance should be assessed by the commission, namely, a single, government-run scheme, a single privately managed scheme, or one where the existing medical aid schemes act as the regulating organisations with a pool of revenue for financial risk management. Through the National Health Insurance System, the Ministry of Health and Child Welfare should ensure access to high-quality and reasonably priced health services for all citizens of Zimbabwe. The main objective of such a scheme should be to set up the necessary funding and healthcare service provision mechanisms that will create an effective, fair and sustainable healthcare system.

The establishment of the National Health Insurance System in Zimbabwe can have terrible effects if it is not carefully planned. People in rural areas may fail to be part of such schemes. “Rural regions are the most needy, (in terms of health care) but people there have lower incomes, poorer health, higher percentages of elderly, fewer local medical practitioners and lower rates of insurance yet they may not be included in such schemes” (US Congress, 1996: 4). The result is that the gap in health conditions between rural and urban areas in the country may widen. To prevent such a problem, poor people and the elderly (mostly staying in the rural areas) should be given assistance or a subsidy by government to join such a scheme. If implemented properly, such a policy would generally improve the state of people’s health and the general provision of health services as well

as narrow the rural-urban gap in health since the poor and elderly who are mainly in the rural area are assisted.

Zimbabwe would not be the first country to use the National Health Insurance Scheme. Numerous countries have successfully used the National Health Insurance Policy in their health sectors. According to Nelson (2009: 2), the National Health Insurance is mandatory to all people residing in Switzerland (within three months of staying or being born in the country). International civil servants, members of permanent missions and their family members are however exempted from the mandatory health insurance. They are, however, free to apply to join the Swiss health insurance system, within six months of staying in the country. The national health insurance scheme covers the costs of treatment and hospitalisation of the insured person. Japan is also another example of a country that has put into operation the National Health Insurance policy with some considerable degree of success. According to Ito (2004: 617), the whole population of Japan is registered in a compulsory national health insurance irrespective of employment and residence, called "Health-insurance-for-all." For senior people aged 70 years or older, there is the "Elderly Health Insurance" which has been set up within each health organisation in order to for such people to be given additional healthcare services at old age. The relative financial conditions are not the same among the different health insurance organisations and, therefore, to ensure fairness, financial adjustments are done. The medical fee is set for all the processes and products that are paid by the health insurance which sets the prices. The same fee schedule is used in both the private sector and government healthcare facilities (Ito, 2004: 617).

7.4.1.3 Appropriate referral system

The Ministry of Health and Child Welfare (1984a:13) noted that, in planning for equity in health, the healthcare system is supposed to provide a chain of

progressively more sophisticated facilities so that patients with more complex conditions can be referred up the hierarchy of the healthcare service centres. There are numerous challenges that are experienced in the way the Zimbabwean referral process functions. According to the Ministry of Health and Child Welfare (2008: 83), because many Zimbabweans perceive that primary care facilities lack supplies, staff, and ability to provide services, they seek primary care even at referral hospitals. Osika *et. al.* (2010: 15) reiterates the same point by indicating that during the past 10 years the referral system in Zimbabwe has stopped working, with numerous patients seeking primary care at all facility levels due to geographical convenience. There is no efficient referral system in Zimbabwe. The result is that some patients by-pass their local healthcare centre and put more services pressure on the higher healthcare centre, particularly the Provincial hospital.

The situation described above calls for serious government intervention to improve the functioning of the hospital referral system in the country. Patients who bypass the lower level health facilities should, depending on their health conditions, be appropriately advised to go back to the lower level centres. This would help relieve the pressure on the referral centres. To ensure the smooth functioning of the referral system, the Zimbabwe government should make sure that the clinics and district hospitals have satisfactory resources so that patients do not take decisions of rushing to the referral hospitals. By so doing, the problem of spatial health disparities currently being experienced in the country would be lessened.

7.4.1.4 Appropriate public and private sector mix

Sanders and Carver (1985) observe that, for many countries, the existence of a large private sector delivering healthcare services results in severe distortions. Zimbabwe is no exception. According to the Ministry of Health and Child Welfare

(2010: 10) the government of Zimbabwe provides 44% of service by value and bears 51% of national health costs. On the other end, the private sector is providing 33% of the services by value and bears only 17% of costs and these are being raised through medical aid societies. In 1982, the government subsidised this sector by US$1.5m (Ministry of Health and Child Welfare, 2010: 11). The private sector normally serves a small population of the urban elite but they inflate their annual healthcare expenditure per capita compared to the national average of US$1. This is also the group which experiences the lowest estimated infant mortality.

Given the wide range of distortions and challenges brought about by the private sector, it is suggested that a policy be put in place to control and reduce the activities of the private practitioners. There should also be more and more programmes to monitor the activities of government doctors in respect of private practice, to limit the growth of private medical facilities at the institutional level and to prevent the use of state facilities without charge by private doctors. It is recommended that direct subsidies should be reduced and taxes increased if private delivery of health care is to be reduced. This is in keeping with the idea of Kutzin (1994: 3) that there should be an appropriate blending of public and private health services. As a merit, good health care and primary care in particular must be accessible to everyone who needs it. Ideally, this is achievable if it is supplied by the state free of charge. The government of Zimbabwe should take significant steps to fund and boost its public health sector functionality levels. This does not, however, mean that the private sector should be removed. The private sector should complement the public sector. The public sector can not solely satisfy the diverse health care needs of the country because this has serious financial implications which the fragile economy cannot sustain. As Kutzin (1994: 5) observes, the private sector, may not prefer to supply health services with strong primary health care components such as immunisation, because private demand for them is normally weak. For this reason such

healthcare services are better provided by the government. Private demand is likely to be high in the tertiary health care sector (specialised consultative care) and in that regard there can be significant provision for private sector operations.

7.4.2 Proposed adjustments of existing policies and strategies

The existing policies and strategies that are discussed in this section are: alternative or complementary medicine, reduction of rural-urban discrepancy, transport improvement, participatory approach and alcohol and drug abuse.

7.4.2.1 Complementary or Alternative Medicine

Complementary or alternative medicine strategy was discussed in general in Section 2.7.5. Chazireni and Harmse (2013: 12) observed that this strategy is already being used in Zimbabwe to improve the people's health. The argument in this section is that there should be some adjustment to the existing state of practice of complementary medicines in Zimbabwe if the strategy is to be more beneficial to the health system of the country. It is essential for the Zimbabwean government to consider the broader use and more incorporation of traditional medicine into their formal national healthcare systems. There is also need for the establishment of an enabling environment for exploiting the contribution of complementary medicine. This includes organising and linking all the relevant stakeholders local, national and global as the practice is worldwide. It is important to improve structures of traditional medicine through examination of the established systems and with the participation of the relevant stakeholders, emphasizing on promoting the best practices of traditional medicine. The use of complementary medicines is vital because they are usually less expensive. Patients who can not afford some conventional medicines particularly those that are too expensive should be encouraged to access complementary medicines. A study conducted by Khayesi (2011: 6) has shown that such medicines and

particularly herbal ones have minimal side effects. “Organisational requirements include the establishment of a national multidisciplinary body responsible for the coordination of traditional medicine; formulation of a policy and legal framework; allocation of adequate resources; development of regulations for the local production and rational use of traditional medicines and protection of intellectual property rights” (Chazireni and Harmse, 2013:13).

Complementary treatment can be used in harmony with conventional treatment because while the conventional type focuses on the actual illness, the complementary one takes a holistic approach. Gumede (1990:154) points out that the traditional approach is holistic; it addresses the human experience of disease, while the modern doctor attempts to heal the “affected part”. In addition, traditional healing has a dichotomous role: it is designed to promote the well-being of the individual and to maintain the continuity of the way in which society functions (Karim *et al*. 1994:5). Many practitioners of complementary medicine therefore deal with the "whole person," or holistic, approach to treatment. Holistic or "wholistic" healing addresses all aspects of the individual and not just the physical part where manifested illnesses are most apparent. Holistic treatment is not planned to function as a band-aid or a onetime fix. It is an ongoing process of discovery in search of additional truth and eventually; living better, being healthier, and striving for wholeness. The practitioners may take more than an hour enquiring about lifestyle, nature of illness, and background of the patient. This makes many patients feel more confident about the treatment with more trust in the practitioner giving the treatment itself, and the condition.

The strategy of complementary and alternative medicine has been implemented in China with a considerable degree of success. Traditional Chinese medicine (TCM) is one of the oldest surviving traditions which began as a means of maintaining good health and disease treatment in Chinese societies has been adopted recently by other ethnic groups worldwide (Chan, 2005: 10),

Complementary treatments are appealing to a number of people, and may feature in a variety of services that the Chinese National Health Systems organisations provide. “The most common therapies used in China are: acupuncture, aromatherapy, chiropractice, homeopathy, massage, clinical hypnotherapy and herbal medicines. Judging from the list of therapies in the Traditional Chinese Medicine system, it emerges that the system is both diagnostic and pharmacological (relating to optimal use of medicinal drugs). The use of herbs in the Traditional Chinese Medicine system is tailored to the individual patient” (Chazireni and Harmse, 2013: 13). .

Complementary medicine has also been implemented in highly developed countries such as the United States of America. Numerous nation-wide researches employing probability sampling have found that approximately 40–45% of the adult population had used complementary therapy to deal with a health problem in the year 2001 (Ni *et al*., 2002: 354). Coleman (2007: 211) maintains that most native American healing practices use music, dancing, and praying in order to join together human beings with Mother Earth and to calm down evil powers responsible for the health problem. Coleman (2007: 211) further indicates that different techniques are used including cleansing (purification of the patient of any evil), evocation (inviting healing spirits to help the patient), identification (spiritual union of the patient with the powers that heal), Freedom (liberation of the patient from the illness), and disbursement (release of the healing powers that have made the person well). Many of the above rituals employ the use of a healer, considered to possess special powers that can bring about healing by balancing the various forces within the patient. Many cultures besides the native Americans employ medicine men with implementation of many of the procedures. The acceptance of complementary medicines in large economies such as the United States of America and China, apart from it being a natural endowment, supports the view that developing countries such as

Zimbabwean can equally benefit from the use of the strategy with some reasonable degree of success.

7.4.2.2 Reduction in rural-urban disparities in the provision of health services

As it has emerged from data analysis in Chapter 5, there is a discrepancy in the provision of health services between urban and rural areas in Zimbabwe. Such disparities in the provision of health services have severe negative effects on the health system of the country. Inequalities are undesirable because diseases, particularly infectious ones can easily be transmitted from one region to another, for example from rural to urban areas. It is therefore recommended that in the provision of health services, rural areas get more resources than the urban counterpart in order to bring about equity in health conditions. This will also serve to narrow the gap between the health systems of rural and urban areas in the country.

As indicated in Section 3.5 of Chapter 3, the distribution of both public and private health staff is uneven, in favour of urban centres particularly Harare and Bulawayo. Such a situation can not be allowed to continue and suitable strategies should be introduced to reduce the disparities. What is appropriate are policies that are pro-rural or needs-based and they can be implemented by putting a cessation on expansion of staffing levels in urban areas and while at the same time prioritizing rural areas and small towns. Assigning low level healthcare facilities in both rural and urban areas to provide more primary healthcare services potentially releases health workers from Central Hospitals in urban areas for redeployment to the rural areas. In line with WHO (2010) recommendation, a broad range of mechanisms can be executed to improve the retention of healthcare staff in remote and rural areas. It is recommended in the current research that these mechanisms be also used in Zimbabwe to reduce the

spatial disparities in the distribution of health workers in the country. The mechanisms fall under four classes: education, economic incentives, regulation and personal and professional support. In the class of education, it is suggested that students from rural areas should be given first priority when enrolling them in universities and health colleges for training or studying for the health and health related qualifications. Such students are already adapted to survive in the rural environment and so they can have little challenges in staying and working in rural areas after completing their education and training. It is also suggested that health professional colleges should be placed outside major urban centres. This is essential to ensure that the graduates from such colleges would have adapted to the rural environment and so would be have limited challenges to work in the rural areas. The curriculum of health education should also wherever possible reflect the needs of rural areas.

Some regulatory interventions is also necessary if the health conditions of rural areas are to progress. A mandatory rural service can be introduced. Such a mandatory service can be for a specific period of, for instance one year for those who have just completed the training. Such a mechanism will help to increase the number of health personnel in rural areas. A related mechanism in this regard is to ensure that different types of health workers are deployed to the rural area.

In the category of professional and personal support, better living conditions should be provided, as should be a safe and supportive working environment. Outreach and career development programmes are also needed as part of professional support. These serve as on-the-job health worker development programmes. It is also necessary to consider the various challenges that the health worker faces by virtue of working in the rural areas. These include lack of proper roads and transport and long travel distances to shopping centres. To compensate for such challenges, appropriate financial incentives should be provided to the rural health workers. Satellite or medium level service provision

and shopping malls built in rural areas on a public-private partnership programme would also considerably address this problem on a transformative parameter.

There is substantial amount of evidence supporting practical viability of the mechanism of staff retention, particularly health workers in remote and rural areas. For example, in Mali, WHO (2010: 33) observes that junior doctors who were supported by professional associations remained in rural areas for an average period of four years but the retention period was less for those doctors who did not have such support. WHO (2010: 33) further indicates that such support ranged from economic incentives to professional and personal development.

Such a policy would help to considerably narrow the rural-urban gap in the distribution of health personnel in Zimbabwe. The lack of incentives in rural areas makes it difficulty to attract health workers to the rural areas. The Ministry of Health and Child Welfare of Zimbabwe may, however, not have enough capacity to resolve the rural-urban disparities in the provision health services because of limited financial resources and that other relevant development policies fall under the responsibility of other government ministries. Staff retention in the rural areas therefore needs a multi-sectoral (across ministries) solution.

7.4.2.3 Transport Policy on health

In Section 3.7.1.1, which deals with the policies and strategies that are being used in Zimbabwe, transport was not discussed as a separate policy. It was discussed as part of Health-Care Building Programme and infrastructure development. Transport has been isolated from that section because it is arguably the one component that has experienced little improvement as part of the broad health improvement strategy. This is because of the high transport

costs (when transport is available), as well as the lack of public transport due to poor roads (most of them being gravel roads) and unreliable fuel supply.

The role of transport services in health improvement was discussed in Section 3.7.1 as a form of infrastructural development that is important for the development of provision of health services in developing countries. Transport services are essential to any healthcare system the world over. According to the Ministry of Health and Child Welfare (2008: 89), progress in the provision of health services is difficult to achieve without an efficient transport system in Zimbabwe. The transport is not only essential for the movement of the patients but also for the delivery of health resources and transportation of health staff. The Ministry of Health and Child Welfare (2008: 87) observed that a substantial number of people living far away from healthcare facilities in rural areas of Zimbabwe are using wheel barrows and scotch carts to ferry the patients to the facilities. The transport crisis is more severe in the rural areas of the country than in the urban and this worsens the healthcare disparities between two regions.

It is recommended in this study that because of the significance and centrality of health in the lives of people, the solution to ambulance problems requires that the Central government urgently injects financial resources for the acquisition of the vehicles. Mobile clinics can be another feasible solution as it is easier and cheaper for the services to be moved to where patients stay rather than to wait for many people to travel to the health facility when transport is a problem. When the transport situation is improved, access to health services by people in the rural areas of Zimbabwe would improve and this serves to lessen the spatial disparities in the provision of health services in the country.

7.4.2.4 Participatory approach

The participatory approach is not new to the Zimbabwe health system. As alluded to in Section 3.7.1, the introduction of the Village Health Worker programme in 1981 is sufficient evidence to demonstrate government's commitment towards enhancing community participation and involvement in improving health and the quality of life of the people. It is, however, acknowledged that much more needs to be done by the government to enhance more participation of local communities in the improvement of their health. In fact the focus should no longer be on mere participation but implementation of a broad-based participation in the process of health improvement. It is also the government that is best placed to coordinate (through an incentive system) activities of various groups aimed at health improvement. This is in line with Robinson and Gordon's (1997) proposal of the idea of synergy in the provision of healthcare services and funding depicts how the various stakeholders in the communities can make a meaningful contribution to the process of health improvement in a coordinated manner. The concept of synergy (mutual reinforcement) of the various stakeholders in the process of health development requires cooperation in the determination, production and funding of the particular health services. The other dimensions of this participatory process that are recommended for the government of Zimbabwe include decentralisation and allocation of responsibilities in decision-making on health matters and contractual engagements between the health ministries and the private sector, among others.

Using approaches and interventions such as Behaviour Change Communication (BCC), people can be authorised to identify, stipulate and access quality skilled healthcare through mobilisation of community resources. Individuals and communities have a significant part to play in improving the healthcare systems that influence their living. "Active participation of the community enhances self-

reliance, ownership and sustainability of key actions" (Chudi, 2010: 3). The government should establish an environment in which these interventions of collaboration and active participation can develop. The important point here is that health improvement should be viewed as a highly participatory process by all appropriate stakeholders in Zimbabwe.

7.4.2.5 Tobacco and alcohol misuse

Campaigns on the control of tobacco and alcohol misuse in Zimbabwe are on-going. WHO (2005: 3) indicates that numerous studies conducted have shown that the problems of alcohol and drug abuse are increasing. In the past, Zimbabwe was believed to be a transit state for illegal drugs or substances, currently it is no longer the case as the drugs are now consumed locally. It is worrisome that little concern is being directed towards the risk factors associated with lifestyle diseases, such as excessive alcohol consumption and tobacco use (Ministry of Health and Child Welfare, 2009: 66). Tobacco smoking is among the biggest cause of avoidable diseases and a major source of health disparity. Children whose parents smoke are more likely to develop lung diseases and other conditions such as ear problems and asthma than children of whose parents do not smoke.

It is suggested in the current study that tobacco advertising and promotion should be eliminated; and that mass media and educational initiatives should used to discourage smoking. It is further suggested that strategies which reduce alcohol-related diseases, including measures which at least maintain the real cost of alcohol be strictly observed and the current piecemeal approach to the execution of such strategies be abandoned. The government and other appropriate stakeholders should strengthen people's ability to recognise self-created problems, notably alcoholism, sexually transmitted infections, affluence-related ill health and road traffic accidents.

The strategy of focusing on the reduction of alcohol and drug abuse has been applied effectively in other countries, for example, in Thailand. According to Wibulpolprasert and Pengpaibon (2003:4), the Rural Doctors Society and Foundation in Thailand has had several positive impacts on the profile and effects of rural health but apart from such support, the society has also vigorously supported public health movements, such as a national drug policy, an essential drugs list and tobacco control.

7.5 Recommendations for further studies

As indicated in Chapter 4, the census is a major source of secondary data for the current research. The fact that there was another census conducted in Zimbabwe in 2012 means that as soon as the census reports are published, further research should be done using more recent data (of 2012). At the time data collection and analysis for of this study was done, ZIMSTAT officials indicated that the 2012 census data was still being processed and could not be availed for the purpose of this research. The data for 2012 is however now available on the website of ZIMSTAT (http://www.zimstat.co.zw/).

It is acknowledged in the current research that the application of composite indexing and cluster analysis was successful. Regions were demarcated and patterns of the state of people's health in Zimbabwe were examined without any major challenge. It is, however, believed that a more accurate analysis of the health situation in the country could have been obtained if weighting of the indicators and principal component analysis were applied. In future, research on the health situation in Zimbabwe (both the state of people's health and provision of health services) should endeavour to use either principal component analysis or data with weights attached to it. This will enable a more accurate examination of the health situation of the country. As indicated in Section 1.14, this would

remove the exaggerated effects of variables that have a relatively small influence on the health of the country.

More indicators on both the state of people's health and the provision of health services could have been included but as indicated in Chapter 4, there is a general shortage of data on many health indicators in Zimbabwe. Despite the general lack of data on some crucial indicators, the data that were available on the selected indicators was sufficient for a successful analysis of the temporospatial dimension of Zimbabwe. Further research using more variables will however prove if this is indeed true.

Another recommendation for further study is that research (data collection and analysis) should be done with proper timing. The fact that the major source of the data for research at national level is secondary data and more precisely census data and that the country's census is normally held every ten years means that the collection and analysis of the data must be done immediately after the publication of the census data. In the present situation, it was not feasible to suspend the analysis of the data for two to three years to wait for the published data. Although the impact of outdated census data was minimised by the use of other data sources such as the national health profile and primary data it would be wise if a follow up analysis using the 2012 data is done within the next year or two.

Bernier & Clavier (2011) claims that the political determinants of health do not get due consideration and that there is a growing demand for better insights into public policy analysis in health research because public policies both inside and outside the health domain have a significant impact on population health and health inequalities. Limited attention was paid in this research to the role of the government or the ruling political party in health issues or to the strategic agenda which the Government may have to address the distorted and failing health

system in many parts of the country. It is acknowledged that research at country level should take note of the prevailing socio-political situation and the government's response to address challenge. An analysis of the impacts of political allegiances and electoral clientelism in the different regions of Zimbabwe would have added strength to the analysis of the spatial patterns but the researcher tried to maintain a rather apolitical and unbiased position with regard to political matters. Further research in terms of the impacts or influences of local and national politics on the spatial aspects of health in Zimbabwe should therefore be done.

Another avenue of research that can be pursued links to the factors influencing both the spatial and temporal dimensions of health in the country. The main aim of this research was to investigate the spatial pattern of health and changes in spatial patterns over time. Some explanations for these patterns were provided in Chapters 5 and 6 but the main focus was not to identify the reasons (drivers or factors influencing temporospatial health dimensions) why the specific patterns are manifested. Research into the causes behind the current spatial pattern of health in Zimbabwe need to done and such research should focus on natural as well as soico-economic and cultural factors.

7.6 Main Conclusion

The aim of the study was to examine the temporal and the spatial patterns of health (both the state of people's health and provision of health services) in Zimbabwe. The conclusions drawn from this study supported the assumptions made; that there is temporospatial variation in health in terms of the state of people's health and provision of health services in Zimbabwe, the Adapted Epidemiological Transition Model can be applied to the spatial health system of Zimbabwe, and new policies or strategies can be put in place and existing health policies can be adjusted to improve the health system of the country. The

findings of this research also supported findings from the research that was reviewed in Chapters 2 and 3. The research conforms many of the findings of Dirwai (2002), thus emphasising the urgency for improving the health conditions of Zimbabwe and reducing the spatial healthcare disparities of the country.

From the summary of findings and discussion in Chapter 5 it can be concluded that severe inequalities exist in Zimbabwe's spatial health system. The state of people's health and the provision of health services which together constitute the health conditions of the country are not the same across the country's administrative regions. Basically, the urban areas have comparatively good health conditions compared to their rural counterparts in Zimbabwe It can also be concluded that health regions can be successfully demarcated using cluster analysis. By using multivariate analysis (Cluster analysis in particular) distinct clusters were successfully created and health regions demarcated.

Not only can it be concluded that there is inequality in health conditions but that the state of people's health and that the quality of service provision is generally poor in Zimbabwe. The other major conclusion made is that the temporal dimension of health in Zimbabwe was successfully examined. The use of composite indexing in Chapter 6 was successful and as indicated in Section 7.3 of this chapter, it was possible to determine the patterns of change of the country's health system. Overall, some administrative districts experienced a decline while others experienced improvement in health but the country as a whole experienced some improvement. It can therefore be concluded from the study that the health system of Zimbabwe is not a static but rather a dynamic phenomenon. The administrative districts have evolved over time in terms of their conditions of health.

Finally, the application of the Adapted Epidemiological Transition Model to the spatial health system of Zimbabwe was to a large extent successful.

Administrative districts were linked to the different phases of the Adapted Epidemiological Transition Model without any significant challenges. By extension therefore, it can be concluded that Omran's (1971) model and even the later versions (with some minor modifications where necessary) can be effectively applied in an African context with a significant degree of success.

Various recommendations were made, based on the findings of the research, to improve the health system of the country and to reduce the spatial inequalities in the spatial health system of the country through the application of policies and strategies for spatial development of health in Zimbabwe. Various strategies or policies were recommended (in the current chapter), that can be used to improve the health system of the country. The policies and strategies address the poor conditions of health (both the state of people's health and the provision health services) in Zimbabwe. The policies and strategies mainly focus on the improvement of the general state of health within the poor health system of the country and on the reduction of health inequalities. The strategies and policies discussed in this chapter deal with the introduction of a national health insurance policy, introduction of a transport policy on health, cultivating a participatory approach in the health system of the country, the mixing of modern medicine with the African traditional medicine, a proposal to reduce the rural-urban discrepancy in the state of people's health and health provision, the strengthening of the country's health referral system, limiting the uncontrolled expansion of the private sector in the health system of the country.

The list of suggested policies and strategies summarised in the current section should not be taken to give the impression that the health system of Zimbabwe has inequality only between the core region (urban areas) and the peripheral region (rural areas) of the country. This is far from being true. There is also some significant amount of inequality within the core regions (urban districts) themselves. Equally, there is also a significant amount of inequality within the

periphery (rural districts).The application of the policies and strategies as manifested in Section 7.4.1.2 caters for both inequalities between the core (urban districts) and the periphery (rural districts) as well as intra-core and intra-periphery inequalities.

It is hoped that if such policies and strategies are implemented, the health system of the country will improve. As indicated in Section 1.2 of Chapter 1, the country has been undergoing severe economic and political turmoil for the decade 2002-2012. It can only be hoped that the economic and political situation will continue to improve in Zimbabwe over the next few years and that there will be an opportunity to perhaps apply some of these recommendations to the Zimbabwean health system.

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APPENDICES

APPENDIX A: QUESTIONNAIRE FOR SAMPLE SURVEY

Name of District hospital_____

Distrct_____

Rank of respondent in the ministry of health and child welfare _____

1. How many cases of cancer were recorded in the district hospital in the past 12 months?

2. How many cases of accidents and injuries were recorded in the district hospital in the past 12 months?

3. How many cases of metabolic disorders (obesity, diabetes, cholesterol, gallstones, renal stones, osteoporosis, gout) in the district hospital in the past 12 months?

4. How many cases of cardiovascular diseases (chronic heart disease, stroke, essential hypertension, deep vein thrombosis, pulmonary embolism, pelvic phleboliths, varicose veins) where recorded in the district hospital in the past 12 months?

5. How many cases of auto-immune were recorded in the district hospital in the past 12 months?

6. For how long have you worked at the hospital?

APPENDIX B: INTERVIEW GUIDE

1. For how long have been working for the department of health?
2. Which regions (districts) in the country have high incidence of such diseases and which ones have low incidence?
3. What challenges in terms of health facilities and manpower resources are being experienced by the Ministry of health and Child Welfare of Zimbabwe?
4. Which regions (districts) in the country are most affected by such problems and which ones are experiencing less of those problems?
5. What other health challenges are being experienced in the department and what spatial patterns do they display in the country?
6. What trends have been reflected in Zimbabwe's health situation since 1980?
7. What recommendations do you suggest for the spatial development of Zimbabwe's health system?

APPENDIX C1: Indicators of state of people's health

	INDICATORS											
	AO1	A02	A03	A04	A05	A06	A07	A08	A09	A10	A11	A12
Beitbridge	906.3	4.4	4.4	14.9	76.7	57	7.9	28.9	51.7	10	24.4	1.4
Bikita	1196.9	3.1	3.7	18.8	76	55	4.2	28.4	45.2	1	58.5	4.6
Bindura	1051.6	3.7	4.1	16.8	76.4	58	6.1	28.6	48.4	5.5	41.5	3
Binga	704.4	1	10.7	13.1	64.2	56	10.1	30.9	83.3	9	43.6	13.3
Bubi	1619.4	2	11.2	19.2	52.6	64	9.3	30.7	67	8	43.6	10.5
Buhera	788	2.9	4.9	15.7	72.6	53	4.7	28.7	56.7	2	53.2	5.5
Bulawayo	1013.8	0.3	3.2	13.9	44.5	64	25.3	32.7	0.1	1	22	1
Bulilima	2048.1	0.7	7.9	21.8	48.4	63	7.9	21.8	63	3	26.8	0.4
Centenary	829	1.9	8.2	15.8	74.4	51	3.9	35.9	40.5	1	54.7	9.1
Chegutu	1438.5	1.3	8.1	18.8	61.4	59	5.9	28.9	51.8	2	40.8	4.8
Chikomba	2109.3	1.3	5.8	22	66.8	57	9.8	30.5	30.9	1.1	53.5	5
Chimanimani	985.2	1	8.2	17	59.4	55	5.5	30.4	12.7	4	50.9	11.6
Chipinge	1140.9	2.2	6.4	16.1	81.8	48	9.5	30.6	26.5	9	47.7	5.5
Chiredzi	1140.9	2.2	6.4	16.1	81.8	53	9.5	30.6	26.5	9	47.7	5.5
Chirimuhanzu	1286.4	1.5	6.3	21.2	69.4	58	4.6	30.8	48.5	1.1	55.2	1.3
Chitungwiza	725.6	0.6	2.5	13.1	61.2	62	20.1	35.8	0.1	1	32.5	1
Chivi	1469.9	1.3	2.1	20.7	62.9	57	4.7	27.8	52.9	1	39.6	9.6
Gokwe North	645.7	1.7	8.4	14.5	75.1	56	1.5	31.6	70.2	2	46	1.8
Gokwe South	999.7	1.3	4.1	16.2	85.8	57	2.3	31	67.1	2	4.8	1.6
Goromonzi	1173.7	2.4	6.3	19.4	78.8	60	9.4	35.6	20	3	47	3.7
Guruve	1047.1	1.3	4.1	20.3	86	52	4.1	34.1	43.8	1	38	6.1
Gutu	1248.4	1.5	3	20	65	55	4.3	29.3	41.3	1	56.5	6.5
Gwanda	1147.8	1.4	3.6	20.2	75.5	62	4.2	31.7	42.5	1	47.3	6.3
Gweru	1198.1	0.6	3.3	20.1	70.2	62	4.2	30.5	0.2	1	51.9	1.5
Harare	1172.9	0.4	3.4	20.1	72.9	64	4.2	31.1	0.1	1	49.6	1.4
Hurungwe	1326.9	1.8	7.7	20.3	68.7	60	7.7	33.5	47.9	1	24.9	4.5
Hwange	1249.9	1.1	5.6	20.2	70.8	60	6	32.3	24	1	37.2	3
Hwedza	1910.2	2	7.5	22.6	71.2	58	6.2	31.4	33.2	1	61.4	5.2
Inziza	1141.9	5	5.3	19.6	66.1	61	4	28.2	39.2	2	30.6	1.5
Kadoma	1526	1.9	6.4	21.1	68.7	57	5.1	29.8	36.2	1.5	46	3.4
Kariba	1334	3.4	5.9	20.3	67.4	58	4.6	29	37.7	1.8	38.3	2.4
Kwekwe	995.5	0.9	5.9	19	58	58	14.8	33.4	1.2	1.9	37.2	4.7
Lupane	1289.7	1.2	7.7	20.8	58.2	48	1.6	26.4	77.1	5	26	6.8
Makonde	1032.3	0.9	2.2	15.3	66.3	56	11.8	36	51.5	5	64.6	5.6
Makoni	1485.9	0.4	6	21.3	69	58	7.4	30.4	33.5	5	40.1	4.3

	AO1	A02	A03	A04	A05	A06	A07	A08	A09	A10	A11	A12
Mangwe	871	1.2	10.2	15.2	34.8	57	7.4	22.7	42.1	3	32.3	1.9
Marondera	1178.5	0.8	8.1	18.3	51.9	60	7.4	26.5	37.8	4	36.2	3.1
Masvingo	1024.7	0.9	9.2	16.7	43.4	61	7.4	24.6	0.7	3.5	34.3	2.5
Matobo	1203	3	8.5	19.5	50	56	11.7	25	48.3	1	30.3	1.9
Mazowe	1236.0	2.3	8.7	16.1	86. 9	55	7	26	4	1	32	2
Mberengwa	1355.8	1.6	7	21.9	79.4	56	3.9	27.6	57.9	2	33.7	3.3
Mount Darwin	1145.2	1.6	6.8	19.6	72.7	57	5	33.8	37.5	4	45.4	8.3
Mudzi	1952.6	3	9	22.8	83.3	57	7.7	30.2	49.2	2	38.4	5.3
Murehwa	1502.2	1.6	9.5	23.3	78.3	58	8.7	31.2	39.5	1	71.7	4.7
Mutare	1727.4	0.4	9.3	23	80.8	61	8.2	30.7	0.6	1.5	55.1	1.5
Mutasa	759.4	1.3	8.2	17.8	90.5	58	6.5	31.2	9.6	1.1	62.6	6.5
Mutoko	1413.5	1.2	10	20.5	75.8	58	6.9	31.1	43.2	3	46.9	8.2
Mwenezi	876.4	1.2	3.6	17.8	79.1	53	5.4	29.9	58.3	1	52	2.2
Nkayi	998.9	1.3	7.5	22	66.9	58	4.4	26.3	79.5	4	36.3	7.3
Nyanga	586.3	3.2	8.6	14.1	60	56	2.5	31	27.8	7	61.9	3.6
Rushinga	1209.1	0.6	7.8	17.4	69.9	54	1.9	32.7	49.4	10	96.1	18
Seke	1767.9	1	9.5	20.9	65.7	61	9.5	35.3	25.2	1	49.6	4.6
Shamva	1179.5	2.2	10	21	100.4	55	7.7	34.3	26.8	1	65	11.1
Shurugwi	1473.7	1.6	9.8	21	83.1	59	8.6	34.8	26	1	57.3	7.9
Tsholotsho	1290.5	1.8	10.5	22.7	60.5	61	11.3	24.1	63.9	4	38.1	3.9
Umguza	927.4	1.2	6.6	14.6	55.1	60	20.5	32	45.8	2	40	3.9
UMP	1175.8	1.6	8.3	20.9	70	56	6.8	32.4	47.2	1.1	45.9	5.2
Umzingwane	1180.9	1.6	6.9	19.3	53.5	59	17.6	28.4	29.9	2	3.5	0.4
Zaka	1491.1	2.9	3.7	20.1	76.5	57	4.5	27.9	72.5	8	52.4	7.3
Zvimba	1561.8	4.4	8	18.7	85.2	59	14.5	37.7	28.7	1	46.9	5.1
Zvishavane	1526.4	3.7	5.9	19.4	80.9	58	9.5	32.8	50.6	4.5	49.7	6.2

APPENDIX C2: Reciprocals for indicators that have negative covariation with state of people's health

	A01!	A02!	A03!	A04!	A05!	A07!	A09!	A10!	A11!	A12!
Beitbridge	0.11	22.73	22.73	6.71	1.30	12.66	1.93	10.00	4.10	71.43
Bikita	0.08	32.26	27.03	5.32	1.32	23.81	2.21	100.00	1.71	21.74
Bindura	0.10	27.03	24.39	5.95	1.31	16.39	2.07	18.18	2.41	33.33
Binga	0.14	100.00	9.35	7.63	1.56	9.90	1.20	11.11	2.29	7.52
Bubi	0.06	50.00	8.93	5.21	1.90	10.75	1.49	12.50	2.29	9.52
Buhera	0.13	34.48	20.41	6.37	1.38	21.28	1.76	50.00	1.88	18.18
Bulawayo	0.10	333.33	31.25	7.19	2.25	3.95	1000.00	100.00	4.55	100.00
Bulilima	0.05	142.86	12.66	4.59	2.07	12.66	1.59	33.33	3.73	250.00
Centenary	0.12	52.63	12.20	6.33	1.34	25.64	2.47	100.00	1.83	10.99
Chegutu	0.07	76.92	12.35	5.32	1.63	16.95	1.93	50.00	2.45	20.83
Chikomba	0.05	76.92	17.24	4.55	1.50	10.20	3.24	90.91	1.87	20.00
Chimanimani	0.10	100.00	12.20	5.88	1.68	18.18	7.87	25.00	1.96	8.62
Chipinge	0.09	45.45	15.63	6.21	1.22	10.53	3.77	11.11	2.10	18.18
Chiredzi	0.09	45.45	15.63	6.21	1.22	10.53	3.77	11.11	2.10	18.18
Chirimuhanzu	0.08	66.67	15.87	4.72	1.44	21.74	2.06	90.91	1.81	76.92
Chitungwiza	0.14	166.67	40.00	7.63	1.63	4.98	1000.00	100.00	3.08	100.00
Chivi	0.07	76.92	47.62	4.83	1.59	21.28	1.89	100.00	2.53	10.42
Gokwe North	0.15	58.82	11.90	6.90	1.33	66.67	1.42	50.00	2.17	55.56
Gokwe South	0.10	76.92	24.39	6.17	1.17	43.48	1.49	50.00	20.83	62.50
Goromonzi	0.09	41.67	15.87	5.15	1.27	10.64	5.00	33.33	2.13	27.03
Guruve	0.10	76.92	24.39	4.93	1.16	24.39	2.28	100.00	2.63	16.39
Gutu	0.08	66.67	33.33	5.00	1.54	23.26	2.42	100.00	1.77	15.38
Gwanda	0.09	71.43	27.78	4.95	1.32	23.81	2.35	100.00	2.11	15.87
Gweru	0.08	166.67	30.30	4.98	1.42	23.81	500.00	100.00	1.93	66.67
Harare	0.09	250.00	29.41	4.98	1.37	23.81	1000.00	100.00	2.02	71.43
Hurungwe	0.08	55.56	12.99	4.93	1.46	12.99	2.09	100.00	4.02	22.22
Hwange	0.08	90.91	17.86	4.95	1.41	16.67	4.17	100.00	2.69	33.33
Hwedza	0.05	50.00	13.33	4.42	1.40	16.13	3.01	100.00	1.63	19.23
Inziza	0.09	20.00	18.87	5.10	1.51	25.00	2.55	50.00	3.27	66.67
Kadoma	0.07	52.63	15.63	4.74	1.46	19.61	2.76	66.67	2.17	29.41
Kariba	0.07	29.41	16.95	4.93	1.48	21.74	2.65	55.56	2.61	41.67
Kwekwe	0.10	111.11	16.95	5.26	1.72	6.76	83.33	52.63	2.69	21.28
Lupane	0.08	83.33	12.99	4.81	1.72	62.50	1.30	20.00	3.85	14.71
Makonde	0.10	111.11	45.45	6.54	1.51	8.47	1.94	20.00	1.55	17.86

	A01!	A02!	A03!	A04!	A05!	A07!	A09!	A10!	A11!	A12!
Makoni	0.07	250.00	16.67	4.69	1.45	13.51	2.99	20.00	2.49	23.26
Mangwe	0.11	83.33	9.80	6.58	2.87	13.51	2.38	33.33	3.10	52.63
Marondera	0.08	125.00	12.35	5.46	1.93	13.51	2.65	25.00	2.76	32.26
Masvingo	0.10	111.11	10.87	5.99	2.30	13.51	142.86	28.57	2.92	40.00
Matobo	0.08	33.33	11.76	5.13	2.00	8.55	2.07	100.00	3.30	52.63
Mberengwa	0.07	62.50	14.29	4.57	1.26	25.64	1.73	50.00	2.97	30.30
Mount Darwin	0.09	62.50	14.71	5.10	1.38	20.00	2.67	25.00	2.20	12.05
Mudzi	0.05	33.33	11.11	4.39	1.20	12.99	2.03	50.00	2.60	18.87
Murehwa	0.07	62.50	10.53	4.29	1.28	11.49	2.53	100.00	1.39	21.28
Mutare	0.06	250.00	10.75	4.35	1.24	12.20	166.67	66.67	1.81	66.67
Mutasa	0.13	76.92	12.20	5.62	1.10	15.38	10.42	90.91	1.60	15.38
Mutoko	0.07	83.33	10.00	4.88	1.32	14.49	2.31	33.33	2.13	12.20
Mwenezi	0.11	83.33	27.78	5.62	1.26	18.52	1.72	100.00	1.92	45.45
Nkayi	0.10	76.92	13.33	4.55	1.49	22.73	1.26	25.00	2.75	13.70
Nyanga	0.17	31.25	11.63	7.09	1.67	40.00	3.60	14.29	1.62	27.78
Rushinga	0.08	166.67	12.82	5.75	1.43	52.63	2.02	10.00	1.04	5.56
Seke	0.06	100.00	10.53	4.78	1.52	10.53	3.97	100.00	2.02	21.74
Shamva	0.08	45.45	10.00	4.76	1.00	12.99	3.73	100.00	1.54	9.01
Shurugwi	0.07	62.50	10.20	4.76	1.20	11.63	3.85	100.00	1.75	12.66
Tsholotsho	0.08	55.56	9.52	4.41	1.65	8.85	1.56	25.00	2.62	25.64
Umguza	0.11	83.33	15.15	6.85	1.81	4.88	2.18	50.00	2.50	25.64
UMP	0.09	62.50	12.05	4.78	1.43	14.71	2.12	90.91	2.18	19.23
Umzingwane	0.08	62.50	14.49	5.18	1.87	5.68	3.34	50.00	28.57	250.00
Zaka	0.07	34.48	27.03	4.98	1.31	22.22	1.38	12.50	1.91	13.70
Zvimba	0.06	22.73	12.50	5.35	1.17	6.90	3.48	100.00	2.13	19.61
Zvishavane	0.07	27.03	16.95	5.15	1.24	10.53	1.98	22.22	2.01	16.13
AVERAGE	**0.09**	**83.5**	**17.7**	**5.4**	**1.50**	**18.3**	**67.26**	**58.92**	**3.11**	**37.94**

APPENDIXC3: Calculated simple and composite indices (CI) on the state of people's health of the different administrative districts

	SIMPLE INDICES												
	IA01	IA02	IA03	IA04	IA05	IA06	IA07	IA08	IA09	IA10	IA11	IA12	CI
Bulawayo	110	399	177	133	150	111	21.6	107	1486	170	147	264	**164.3**
Chitungwiza	153	200	226	141	109	108	27.2	117	1486	170	99.3	264	**158.0**
Harare	94.7	299	166	92.1	91.4	111	130	102	1486	170	65	188	**154.2**
Gweru	92.7	200	171	92.1	95	108	130	100	743	170	62.2	176	**139.3**
Mutare	64.3	299	60.7	80.5	82.5	106	66.6	101	248	113	58.5	176	**104.0**
Masvingo	108	133	61.4	111	154	106	73.8	80.7	212	48.5	94	106	**99.8**
Gokwe South	111	92.1	138	114	77.7	99	238	102	2.2	84.9	672	165	**96.1**
Umzingwane	94.1	74.8	81.8	96	125	102	31	93.1	5	84.9	922	660	**94.7**
Kwekwe	112	133	95.7	97.5	115	101	36.9	110	124	89.4	86.7	56.1	**91.6**
Hwange	88.9	109	101	91.7	94.2	104	91.1	106	6.2	170	86.7	88	**79.9**
Gokwe North	172	70.4	67.2	128	88.8	97.2	364	104	2.1	84.9	70.1	147	**79.4**
Mwenezi	127	99.8	157	104	84.3	92	101	98	2.5	170	62	120	**78.1**
Bulilima	54.3	171	71.5	84.9	138	109	69.2	71.5	2.4	56.6	120	660	**77.2**
Chirimuhanzu	86.4	79.8	89.6	87.4	96.1	101	119	101	3.1	154	58.4	203	**75.6**
Mutasa	146	92.1	68.9	104	73.7	101	84.1	102	15.5	154	51.5	40.6	**74.8**
Guruve	106	92.1	138	91.2	77.5	90.3	133	112	3.4	170	84.9	43.3	**74.0**
Gwanda	96.8	85.5	157	91.7	88.3	108	130	104	3.5	170	68.2	41.9	**73.8**
Mangwe	128	99.8	55.4	122	192	99	73.8	74.4	3.5	56.6	99.9	139	**73.5**
Gutu	89	79.8	188	92.6	103	95.5	127	96.1	3.6	170	57.1	40.6	**72.5**
Chivi	75.6	92.1	269	89.5	106	99	116	91.1	2.8	170	81.5	27.5	**72.1**
Inziza	97.3	23.9	107	94.5	101	106	137	92.5	3.8	84.9	105	176	**71.8**
Hurungwe	83.7	66.5	73.3	91.2	97	104	71	110	3.1	170	130	58.6	**69.0**
Marondera	94.3	150	69.7	101	129	104	73.8	86.9	3.9	42.4	89.1	85.1	**68.6**
Seke	62.8	120	59.4	88.6	102	106	57.5	116	5.9	170	65	57.4	**68.5**
Kariba	83.3	35.2	95.7	91.2	98.9	101	119	95.1	3.9	94.3	84.2	110	**68.1**
Makoni	74.8	299	94.1	86.9	96.6	101	73.8	99.7	4.4	34	80.4	61.4	**68.0**
Bikita	92.8	38.6	153	98.5	87.7	95.5	130	93.1	3.3	170	55.1	57.4	**67.9**
Centenary	134	63	68.9	117	89.6	88.5	140	118	3.7	170	59	29	**67.8**
Kadoma	72.8	63	88.2	87.8	97	99	107	97.7	4.1	113	70.1	77.6	**67.6**
Matobo	92.4	39.9	66.4	95	133	97.2	46.7	82	3.1	170	106	139	**67.5**
Chimanimani	113	120	68.9	109	112	95.5	99.4	99.7	11.7	42.4	63.4	22.7	**66.7**
Mberengwa	82	74.8	80.7	84.6	84	97.2	140	90.5	2.6	84.9	95.7	80	**66.3**
Nyanga	190	37.4	65.7	131	111	97.2	219	102	5.3	24.3	52.1	73.3	**66.3**
Umguza	120	99.8	85.6	127	121	104	26.7	105	3.2	84.9	80.6	67.7	**66.0**
UMP	94.5	74.8	68	88.6	95.2	97.2	80.4	106	3.1	154	70.3	50.7	**65.1**

	IA01	IA02	IA03	IA04	IA05	IA06	IA07	IA08	IA09	IA10	IA11	IA12	CI
Makonde	108	133	257	121	101	97.2	46.3	118	2.9	34	49.9	47.1	**64.8**
Chikomba	52.7	92.1	97.4	84.2	99.8	99	55.8	100	4.8	154	60.3	52.8	**64.5**
Chegutu	77.2	92.1	69.7	98.5	109	102	92.6	94.8	2.9	84.9	79.1	55	**64.4**
Goromonzi	94.7	49.9	89.6	95.5	84.6	104	58.1	117	7.4	56.6	68.6	71.3	**64.3**
Lupane	86.2	99.8	73.3	89	115	83.3	342	86.6	1.9	34	124	38.8	**64.3**
Buhera	141	41.3	115	118	91.8	92	116	94.1	2.6	84.9	60.6	48	**64.0**
Hwedza	58.2	59.9	75.3	81.9	93.6	101	88.1	103	4.5	170	52.5	50.7	**62.7**
Beitbridge	123	27.2	128	124	86.9	99	69.2	94.8	2.9	17	132	188	**62.6**
Shurugwi	75.4	74.8	57.6	88.2	80.2	102	63.5	114	5.7	170	56.3	33.4	**61.8**
Bindura	106	32.4	138	110	87.3	101	89.6	93.8	3.1	30.9	77.7	88	**60.7**
Mount Darwin	97	74.8	83	94.5	91.7	99	109	111	4	42.4	71.1	31.8	**60.4**
Murehwa	74	74.8	59.4	79.5	85.1	101	62.8	102	3.8	170	45	56.1	**60.3**
Nkayi	111	92.1	75.3	84.2	99.7	101	124	86.2	1.9	42.4	88.9	36.1	**59.0**
Zvimba	71.1	27.2	70.6	99	78.2	102	37.7	124	5.2	170	68.8	51.7	**58.4**
Shamva	94.2	54.4	56.5	88.2	66.4	95.5	71	113	5.5	170	49.6	23.8	**57.9**
Mutoko	78.6	99.8	56.5	90.3	88	101	79.2	102	3.4	56.6	68.8	32.2	**57.2**
Rushinga	91.9	200	72.4	106	95.4	93.8	288	107	3	17	33.6	14.7	**56.1**
Chiredzi	97.4	54.4	88.2	115	81.5	92	57.5	100	5.6	18.9	67.6	48	**55.2**
Chipinge	97.4	54.4	88.2	115	81.5	83.3	57.5	100	5.6	18.9	67.6	48	**54.7**
Mudzi	56.9	39.9	62.7	81.2	80	99	71	99	3	84.9	84	49.8	**54.5**
Tsholotsho	86.1	66.5	53.8	81.6	110	106	48.4	79	2.3	42.4	84.7	67.7	**54.1**
Zaka	74.5	41.3	153	92.1	87.1	99	121	91.5	2	21.2	61.6	36.1	**52.1**
Binga	158	120	52.8	141	104	97.2	54.1	101	1.8	18.9	74	19.8	**51.9**
Zvishavane	72.8	32.4	95.7	95.5	82.4	101	57.5	108	2.9	37.7	64.9	42.6	**51.4**
Bubi	68.6	59.9	50.4	96.5	127	111	58.8	101	2.2	21.2	74	25.1	**47.9**

APPENDIX D1: Indicators and Reciprocals for indicators with negative covariation with the provision health services

	B01	B02	B03	B04	B05	B06	BO7	B07!	B08	B08!	B09	B09!	B10	B10!	B11	B11!
Beitbridge	1	19	2	2	108	122	906	0.1	77	1.3	10	10.0	24	4.2	1.4	71.4
Bikita	4	21	5	2	162	280	1197	0.1	76	1.3	1	100.0	59	1.7	4.6	21.7
Bindura	2	25	12	5	159	230	1052	0.1	76	1.3	5.5	18.2	42	2.4	3	33.3
Binga	3	13	1	2	84	280	704	0.1	64	1.6	9	11.1	44	2.3	13	7.7
Bubi	1	10	2	1	70	109	1619	0.1	53	1.9	8	12.5	44	2.3	11	9.1
Buhera	4	28	6	4	164	290	788	0.1	73	1.4	2	50.0	53	1.9	5.5	18.2
Bulawayo	8	34	51	196	1824	2544	1014	0.1	45	2.2	1	100.0	22	4.5	1	100.0
Bulilima	2	13	3	1	98	205	2048	0.0	48	2.1	3	33.3	27	3.7	4.4	22.7
Centenary	1	11	3	2	91	116	829	0.1	74	1.4	1	100.0	55	1.8	9.1	11.0
Chegutu	5	40	8	3	192	402	1439	0.1	61	1.6	2	50.0	41	2.4	4.8	20.8
Chikomba	5	28	7	5	190	366	2109	0.0	67	1.5	1.1	90.9	54	1.9	5	20.0
Chimanimani	6	21	8	4	162	320	985	0.1	59	1.7	4	25.0	51	2.0	12	8.3
Chipinge	4	48	10	7	201	315	1141	0.1	82	1.2	9	11.1	48	2.1	5.5	18.2
Chiredzi	4	38	4	4	174	298	1141	0.1	82	1.2	9	11.1	48	2.1	5.5	18.2
Chirimuhanzu	5	18	5	4	148	249	1286	0.1	69	1.4	1.1	90.9	55	1.8	1.3	76.9
Chitungwiza	4	38	10	15	327	1654	726	0.1	61	1.6	1	100.0	33	2.5	1.1	90.9
chivi	3	16	5	2	136	215	1470	0.1	63	1.6	1	100.0	40	2.5	9.6	10.4
Gokwe North	3	17	2	3	140	197	646	0.2	75	1.3	2	50.0	46	2.2	1.8	55.6
Gokwe South	2	18	4	2	133	200	1000	0.1	86	1.2	2	50.0	48	2.1	1.6	62.5
Goromonzi	3	23	10	3	180	265	1174	0.1	79	1.3	3	33.3	47	2.1	3.7	27.0
Guruve	1	20	3	1	117	130	1047	0.1	86	1.2	1	100.0	38	2.6	6.1	16.4
gutu	6	30	5	3	171	347	1248	0.1	65	1.5	1	100.0	57	1.8	6.5	15.4
Gwanda	3	30	4	4	146	402	1148	0.1	76	1.3	1	100.0	47	2.1	6.3	15.9
Gweru	5	47	9	8	315	1600	1198	0.1	70	1.4	1	100.0	52	1.9	1.5	66.7
Harare	7	37	47	234	2194	2600	1173	0.1	73	1.4	1	100.0	50	2.0	1.4	71.4
Hurungwe	4	28	2	2	158	298	1327	0.1	69	1.4	1	100.0	25	4.0	4.5	22.2
Hwange	4	34	1	5	167	301	1250	0.1	71	1.4	1	100.0	37	2.7	3	33.3
Hwedza	2	14	6	1	90	203	1910	0.1	71	1.4	1	100.0	61	1.6	5.2	19.2
Inziza	4	12	2	2	99	178	1142	0.1	66	1.5	2	50.0	31	3.2	1.5	66.7
Kadoma	3	23	3	4	148	503	1526	0.1	69	1.4	1.5	66.7	46	2.2	3.4	29.4
Kariba	3	16	2	1	128	206	1334	0.1	67	1.5	1.8	55.6	38	2.6	2.4	41.7
Kwekwe	4	46	6	5	225	604	996	0.1	58	1.7	1.9	52.6	37	2.7	4.7	21.3
Lupane	2	11	2	2	83	167	1290	0.1	58	1.7	5	20.0	26	3.8	6.8	14.7

	B01	B02	B03	B04	B05	B06	BO7	B07!	B08	B08!	B09	B09!	B10	B10!	B11	B11!
Makonde	3	34	4	5	160	199	1032	0.1	66	1.5	5	20.0	65	1.5	5.6	17.9
Makoni	6	48	7	5	190	234	1486	0.1	69	1.4	5	20.0	40	2.5	4.3	23.3
mangwe	3	12	3	3	90	188	871	0.1	35	2.9	3	33.3	32	3.1	1.9	52.6
Marondera	3	21	7	3	160	278	1179	0.1	52	1.9	4	25.0	36	2.8	3.1	32.3
Masvingo	5	45	7	6	302	1255	1025	0.1	43	2.3	3.5	28.6	34	2.9	2.5	40.0
Matobo	5	12	4	3	104	238	1203	0.1	50	2.0	1	100.0	30	3.3	1.9	52.6
Mazowe	3	24	4	3	106	222	1220	0.1	77	1.3	1.5	66.7	42	2.4	11	9.1
Mberengwa	6	31	8	4	196	255	1356	0.1	79	1.3	2	50.0	34	2.9	3.3	30.3
Mount Darwin	2	21	5	4	130	244	1145	0.1	73	1.4	4	25.0	45	2.2	8.3	12.0
Mudzi	1	21	5	1	162	125	1953	0.1	83	1.2	2	50.0	38	2.6	5.3	18.9
Murehwa	2	26	8	2	195	213	1502	0.1	78	1.3	1	100.0	72	1.4	4.7	21.3
Mutare	7	40	8	8	335	1520	1727	0.1	81	1.2	1.5	66.7	55	1.8	1.5	66.7
Mutasa	6	45	19	5	182	267	759	0.1	91	1.1	1.1	90.9	63	1.6	6.5	15.4
Mutoko	5	22	7	4	192	276	1414	0.1	76	1.3	3	33.3	47	2.1	8.2	12.2
mwenezi	2	20	2	2	145	278	876	0.1	79	1.3	1	100.0	52	1.9	2.2	45.5
Nkayi	3	12	3	3	91	189	999	0.1	67	1.5	4	25.0	36	2.8	7.3	13.7
Nyanga	5	24	5	5	175	299	586	0.2	60	1.7	7	14.3	62	1.6	3.6	27.8
Rushinga	2	10	5	3	89	234	1209	0.1	70	1.4	10	10.0	96	1.0	18	5.6
Seke	2	15	7	3	162	306	1768	0.1	66	1.5	1	100.0	50	2.0	4.6	21.7
Shamva	2	15	6	3	126	301	1180	0.1	100	1.0	1	100.0	65	1.5	11	9.1
Shurugwi	3	27	8	3	180	298	1474	0.1	83	1.2	1	100.0	57	1.8	7.9	12.7
Tsholotsho	3	17	3	1	93	330	1291	0.1	61	1.6	4	25.0	38	2.6	3.9	25.6
Umguza	1	20	4	1	94	194	927	0.1	55	1.8	2	50.0	40	2.5	3.9	25.6
UMP	1	18	7	1	160	124	1176	0.1	70	1.4	1.1	90.9	46	2.2	5.2	19.2
Umzingwane	1	15	6	1	155	112	1181	0.1	54	1.9	2	50.0	3.5	2.2	4.4	22.7
zaka	2	22	8	3	160	289	1491	0.1	77	1.3	8	12.5	52	1.9	7.3	13.7
Zvimba	7	35	7	6	180	341	1562	0.1	85	1.2	1	100.0	47	2.1	5.1	19.6
Zvishavane	3	25	11	3	181	367	1526	0.1	81	1.2	4.5	22.2	50	2.0	6.2	16.1
Average	**3.5**	**24.7**	**7**	**10.4**	**218**	**416**	**1229**	**0.1**	**69**	**1.5**	**3**	**59**	**45.1**	**2.35**	**5.2**	**30**

APPENDIX D2: Calculated simple indices for indicators on the provision health services in the districts

	IB01	IB02	IB03	IB04	IB05	IB06	IB07	IB08	IB09	IB10	IB11
Beitbridge	28.8	77.1	28.5	19.3	49.6	29.3	126.0	86.8	16.9	177.4	239.2
Bikita	115.1	85.2	71.3	19.3	74.4	67.3	95.4	88.0	169.4	72.2	72.8
Bindura	57.5	101.4	171.0	48.2	73.0	55.3	108.5	88.0	30.8	101.4	111.6
Binga	86.3	52.7	14.3	19.3	38.6	67.3	162.1	104.4	18.8	96.8	25.8
Bubi	28.8	40.6	28.5	9.6	32.2	26.2	70.5	126.1	21.2	96.8	30.4
Buhera	115.1	113.6	85.5	38.5	75.3	69.7	144.8	91.6	84.7	80.4	60.9
Bulawayo	230.2	137.9	726.9	1888.8	837.9	611.6	112.6	148.5	169.4	193.6	334.9
Bulilima	57.5	52.7	42.8	9.6	45.0	49.3	55.7	139.3	56.5	157.7	76.1
Centenary	28.8	44.6	42.8	19.3	41.8	27.9	137.7	90.3	169.4	77.4	36.8
Chegutu	143.9	162.2	114.0	28.9	88.2	96.6	79.3	109.6	84.7	103.9	69.8
Chikomba	143.9	113.6	99.8	48.2	87.3	88.0	54.1	99.8	154.0	78.9	67.0
Chimanimani	172.6	85.2	114.0	38.5	74.4	76.9	115.9	113.3	42.3	83.5	27.9
Chipinge	115.1	194.7	142.5	67.5	92.3	75.7	100.0	81.5	18.8	88.7	60.9
Chiredzi	115.1	154.1	57.0	38.5	79.9	71.6	100.0	81.5	18.8	88.7	60.9
Chirimuhanzu	143.9	73.0	71.3	38.5	68.0	59.9	88.8	96.9	154.0	77.4	257.6
Chitungwiza	115.1	154.1	142.5	144.5	150.2	397.7	157.2	109.6	169.4	106.5	304.5
chivi	86.3	64.9	71.3	19.3	62.5	51.7	77.6	106.1	169.4	106.5	34.9
Gokwe North	86.3	68.9	28.5	28.9	64.3	47.4	176.7	89.1	84.7	92.6	186.1
Gokwe South	57.5	73.0	57.0	19.3	61.1	48.1	114.1	77.7	84.7	88.7	209.3
Goromonzi	86.3	93.3	142.5	28.9	82.7	63.7	97.2	84.6	56.5	90.6	90.5
Guruve	28.8	81.1	42.8	9.6	53.7	31.3	109.0	77.7	169.4	112.1	54.9
gutu	172.6	121.7	71.3	28.9	78.6	83.4	91.5	102.8	169.4	74.7	51.5
Gwanda	86.3	121.7	57.0	38.5	67.1	96.6	99.4	88.0	169.4	90.6	53.2
Gweru	143.9	190.6	128.3	77.1	144.7	384.7	95.3	95.5	169.4	81.9	223.3
Harare	201.4	150.1	669.9	2255.0	1007.9	625.1	97.3	91.6	169.4	85.2	239.2
Hurungwe	115.1	113.6	28.5	19.3	72.6	71.6	86.0	96.9	169.4	170.3	74.4
Hwange	115.1	137.9	14.3	48.2	76.7	72.4	91.3	94.1	169.4	115.1	111.6
Hwedza	57.5	56.8	85.5	9.6	41.3	48.8	59.8	94.1	169.4	69.8	64.4
Inziza	115.1	48.7	28.5	19.3	45.5	42.8	99.9	101.3	84.7	137.4	223.3
Kadoma	86.3	93.3	42.8	38.5	68.0	120.9	74.8	96.9	112.9	92.6	98.5
Kariba	86.3	64.9	28.5	9.6	58.8	49.5	85.6	99.8	94.1	112.1	139.5
Kwekwe	115.1	186.6	85.5	48.2	103.4	145.2	114.6	115.2	89.1	115.1	71.3
Lupane	57.5	44.6	28.5	19.3	38.1	40.2	88.5	115.2	33.9	163.8	49.3
Makonde	86.3	137.9	57.0	48.2	73.5	47.8	110.6	101.3	33.9	65.5	59.8

	IB01	IB02	IB03	IB04	IB05	IB06	IB07	IB08	IB09	IB10	IB11
Makoni	172.6	194.7	99.8	48.2	87.3	56.3	76.8	96.9	33.9	106.5	77.9
mangwe	86.3	48.7	42.8	28.9	41.3	45.2	131.0	191.0	56.5	133.1	176.3
Marondera	86.3	85.2	99.8	28.9	73.5	66.8	96.8	128.5	42.3	118.3	108.0
Masvingo	143.9	182.5	99.8	57.8	138.7	301.7	111.4	155.4	48.4	125.3	134.0
Matobo	143.9	48.7	57.0	28.9	47.8	57.2	94.9	133.7	169.4	142.0	176.3
Mazowe	86.3	97.3	57.0	28.9	48.7	53.4	99.3	93.6	111.0	86.8	50.5
Mberengwa	172.6	125.7	114.0	38.5	90.0	61.3	84.2	84.6	84.7	125.3	101.5
Mount Darwin	57.5	85.2	71.3	38.5	59.7	58.7	99.7	91.6	42.3	94.6	40.3
Mudzi	28.8	85.2	71.3	9.6	74.4	30.1	58.4	80.5	84.7	112.1	63.2
Murehwa	57.5	105.5	114.0	19.3	89.6	51.2	76.0	85.7	169.4	59.1	71.3
Mutare	201.4	162.2	114.0	77.1	153.9	365.4	66.1	82.5	112.9	77.4	223.3
Mutasa	172.6	182.5	270.8	48.2	83.6	64.2	150.4	73.5	154.0	67.6	51.5
Mutoko	143.9	89.2	99.8	38.5	88.2	66.4	80.7	88.0	56.5	90.6	40.8
mwenezi	57.5	81.1	28.5	19.3	66.6	66.8	130.3	84.6	169.4	81.9	152.2
Nkayi	86.3	48.7	42.8	28.9	41.8	45.4	114.3	99.8	42.3	118.3	45.9
Nyanga	143.9	97.3	71.3	48.2	80.4	71.9	194.8	111.4	24.2	68.7	93.0
Rushinga	57.5	40.6	71.3	28.9	40.9	56.3	94.4	95.5	16.9	44.4	18.6
Seke	57.5	60.8	99.8	28.9	74.4	73.6	64.6	101.3	169.4	85.2	72.8
Shamva	57.5	60.8	85.5	28.9	57.9	72.4	96.7	66.8	169.4	65.5	30.4
Shurugwi	86.3	109.5	114.0	28.9	82.7	71.6	77.4	80.5	169.4	74.7	42.4
Tsholotsho	86.3	68.9	42.8	9.6	42.7	79.3	88.4	109.6	42.3	112.1	85.9
Umguza	28.8	81.1	57.0	9.6	43.2	46.6	123.1	121.5	84.7	106.5	85.9
UMP	28.8	73.0	99.8	9.6	73.5	29.8	97.1	95.5	154.0	92.6	64.4
Umzingwane	28.8	60.8	85.5	9.6	71.2	26.9	96.6	123.8	84.7	93.7	76.1
Zaka	57.5	89.2	114.0	28.9	73.5	69.5	76.6	86.8	21.2	81.9	45.9
Zvimba	201.4	142.0	99.8	57.8	82.7	82.0	73.1	78.6	169.4	90.6	65.7
Zvishavane	86.3	101.4	156.8	28.9	83.1	88.2	74.8	82.5	37.6	85.2	54.0

APPENDIX E1: Indicators on selected diseases and health conditions in the districts

	C01	C02	C03	C04	C05	C06	C07	C08	C09	C10	C11
Beitbridge	12	31	12	10	11	906	57	51.7	10	24.4	1.4
Bikita	11	33	8	7	3	1197	55	45.2	1	58.5	4.6
Bindura	22	70	34	12	12	1052	58	48.4	5.5	41.5	3
Binga	7	16	36	23	12	704	56	83.3	9	43.6	13.3
Bubi	13	58	33	11	7	1619	64	67	8	43.6	10.5
Buhera	33	56	45	22	10	788	53	56.7	2	53.2	5.5
Bulawayo	170	400	112	177	45	1014	64	0.1	1	22	1
Bulilima	43	34	34	18	5	2048	63	63	3	26.8	4.4
Centenary	33	38	34	7	4	829	51	40.5	1	54.7	9.1
Chegutu	47	44	41	13	16	1439	59	51.8	2	40.8	4.8
Chikomba	56	32	30	15	12	2109	57	30.9	1.1	53.5	5
Chimanimani	67	23	35	22	18	985	55	12.7	4	50.9	11.6
Chipinge	44	22	30	18	10	1141	48	26.5	9	47.7	5.5
Chiredzi	33	45	41	33	8	1141	53	26.5	9	47.7	5.5
Chirimuhanzu	23	17	34	20	17	1286	58	48.5	1.1	55.2	1.3
Chitungwiza	74	67	62	56	17	726	62	0.2	1	32.5	4.1
Chivi	33	27	45	34	7	1470	57	52.9	1	39.6	9.6
Gokwe North	41	24	38	26	8	646	56	70.2	2	46	4.8
Gokwe South	34	28	22	24	8	1000	57	67.1	2	4.8	1.6
Goromonzi	34	33	33	33	12	1174	60	20	3	47	3.7
Guruve	18	21	31	27	6	1047	52	43.8	1	38	6.1
Gutu	37	24	18	34	13	1248	55	41.3	1	56.5	6.5
Gwanda	45	33	27	33	7	1148	62	42.5	1	47.3	6.3
Gweru	70	56	56	56	17	1198	62	0.2	1	51.9	2.5
Harare	188	622	100	155	62	1173	64	0.1	1	49.6	1.4
Hurungwe	26	34	34	22	5	1327	60	47.9	1	24.9	4.5
Hwange	30	38	36	18	4	1250	60	24	1	37.2	3
Hwedza	41	27	44	21	11	1910	58	33.2	1	61.4	5.2
Inziza	23	41	36	17	8	1142	61	39.2	2	30.6	1.5
Kadoma	52	72	27	23	13	1526	57	36.2	1.5	46	3.4
Kariba	32	41	23	34	5	1334	58	37.7	1.8	38.3	2.4
Kwekwe	33	41	24	37	6	996	58	1.2	1.9	37.2	4.7
Lupane	25	28	22	22	7	1290	48	77.1	5	26	6.8
Makonde	40	24	31	24	8	1032	56	51.5	5	64.6	5.6

	C01	C02	C03	C04	C05	C06	C07	C08	C09	C10	C11
Makoni	36	41	27	31	11	1486	58	33.5	5	40.1	4.3
Mangwe	18	23	30	12	10	871	57	42.1	3	32.3	1.9
Marondera	34	56	31	34	9	1179	60	37.8	4	36.2	3.1
Masvingo	62	42	51	42	16	1025	61	0.7	3.5	34.3	3.5
Matobo	22	34	20	17	12	1203	56	48.3	1	30.3	1.9
Mazowe	21	22	31	23	18	887	62	44	2	44	2
Mberengwa	27	24	28	18	11	1356	56	57.9	2	33.7	3.3
Mount Darwin	33	33	30	23	9	1145	57	37.5	4	45.4	8.3
Mudzi	32	21	13	17	6	1953	57	49.2	2	38.4	5.3
Murehwa	56	26	40	22	7	1502	58	39.5	1	71.7	4.7
Mutare	66	88	57	51	17	1727	61	0.6	1.5	55.1	1.5
Mutasa	43	35	33	34	9	759	58	9.6	1.1	62.6	6.5
Mutoko	37	45	26	30	12	1414	58	43.2	3	46.9	8.2
Mwenezi	24	30	33	18	8	876	53	58.3	1	52	2.2
Nkayi	33	24	34	23	11	999	58	79.5	4	36.3	7.3
Nyanga	37	22	40	18	5	586	56	27.8	7	61.9	3.6
Rushinga	41	28	22	28	6	1209	54	49.4	10	96.1	18
Seke	43	63	23	34	15	1768	61	25.2	1	49.6	4.6
Shamva	35	62	31	45	8	1180	55	26.8	1	65	11.1
Shurugwi	31	54	33	38	11	1474	59	26	1	57.3	7.9
Tsholotsho	24	33	24	32	10	1291	61	63.9	4	38.1	3.9
Umguza	22	45	27	38	4	927	60	45.8	2	40	3.9
UMP	37	28	26	32	11	1176	56	47.2	1.1	45.9	5.2
Umzingwane	38	34	37	31	10	1181	59	29.9	2	3.5	5.4
Zaka	37	26	28	38	9	1491	57	72.5	8	52.4	7.3
Zvimba	38	54	38	23	11	1562	59	28.7	1	46.9	5.1
Zvishavane	44	45	44	32	17	1526	58	50.6	4.5	49.7	6.2
AVERAGE	**40.3**	**53.1**	**34.8**	**31**	**11.4**	**1224**	**57.7**	**39.6**	**2.98**	**44.4**	**5.19**

APPENDIX E2: Reciprocals of indicators that negatively covary with the selected diseases and health conditions in the districts

	C01!	C02!	C03!	C04!	C05!	C06!	C08!	C09!	C10!	C11!
Beitbridge	8.3	3.2	8.3	10.0	9.1	0.1	1.9	10.0	4.1	71.4
Bikita	9.1	3.0	12.5	14.3	33.3	0.1	2.2	100.0	1.7	21.7
Bindura	4.5	1.4	2.9	8.3	8.3	0.1	2.1	18.2	2.4	33.3
Binga	14.3	6.3	2.8	4.3	8.3	0.1	1.2	11.1	2.3	7.5
Bubi	7.7	1.7	3.0	9.1	14.3	0.1	1.5	12.5	2.3	9.5
Buhera	3.0	1.8	2.2	4.5	10.0	0.1	1.8	50.0	1.9	18.2
Bulawayo	0.6	0.3	0.9	0.6	2.2	0.1	1000.0	100.0	4.5	100.0
Bulilima	2.3	2.9	2.9	5.6	20.0	0.0	1.6	33.3	3.7	22.7
Centenary	3.0	2.6	2.9	14.3	25.0	0.1	2.5	100.0	1.8	11.0
Chegutu	2.1	2.3	2.4	7.7	6.3	0.1	1.9	50.0	2.5	20.8
Chikomba	1.8	3.1	3.3	6.7	8.3	0.0	3.2	90.9	1.9	20.0
Chimanimani	1.5	4.3	2.9	4.5	5.6	0.1	7.9	25.0	2.0	8.6
Chipinge	2.3	4.5	3.3	5.6	10.0	0.1	3.8	11.1	2.1	18.2
Chiredzi	3.0	2.2	2.4	3.0	12.5	0.1	3.8	11.1	2.1	18.2
Chirimuhanzu	4.3	5.9	2.9	5.0	5.9	0.1	2.1	90.9	1.8	76.9
Chitungwiza	1.4	1.5	1.6	1.8	5.9	0.1	500.0	100.0	3.1	24.4
Chivi	3.0	3.7	2.2	2.9	14.3	0.1	1.9	100.0	2.5	10.4
Gokwe North	2.4	4.2	2.6	3.8	12.5	0.2	1.4	50.0	2.2	20.8
Gokwe South	2.9	3.6	4.5	4.2	12.5	0.1	1.5	50.0	20.8	62.5
Goromonzi	2.9	3.0	3.0	3.0	8.3	0.1	5.0	33.3	2.1	27.0
Guruve	5.6	4.8	3.2	3.7	16.7	0.1	2.3	100.0	2.6	16.4
Gutu	2.7	4.2	5.6	2.9	7.7	0.1	2.4	100.0	1.8	15.4
Gwanda	2.2	3.0	3.7	3.0	14.3	0.1	2.4	100.0	2.1	15.9
Gweru	1.4	1.8	1.8	1.8	5.9	0.1	500.0	100.0	1.9	40.0
Harare	0.5	0.2	1.0	0.6	1.6	0.1	1000.0	100.0	2.0	71.4
Hurungwe	3.8	2.9	2.9	4.5	20.0	0.1	2.1	100.0	4.0	22.2
Hwange	3.3	2.6	2.8	5.6	25.0	0.1	4.2	100.0	2.7	33.3
Hwedza	2.4	3.7	2.3	4.8	9.1	0.1	3.0	100.0	1.6	19.2
Inziza	4.3	2.4	2.8	5.9	12.5	0.1	2.6	50.0	3.3	66.7
Kadoma	1.9	1.4	3.7	4.3	7.7	0.1	2.8	66.7	2.2	29.4
Kariba	3.1	2.4	4.3	2.9	20.0	0.1	2.7	55.6	2.6	41.7
Kwekwe	3.0	2.4	4.2	2.7	16.7	0.1	83.3	52.6	2.7	21.3
Lupane	4.0	3.6	4.5	4.5	14.3	0.1	1.3	20.0	3.8	14.7
Makonde	2.5	4.2	3.2	4.2	12.5	0.1	1.9	20.0	1.5	17.9

	C01!	C02!	C03!	C04!	C05!	C06!	C08!	C09!	C10!	C11!
Makoni	2.8	2.4	3.7	3.2	9.1	0.1	3.0	20.0	2.5	23.3
Mangwe	5.6	4.3	3.3	8.3	10.0	0.1	2.4	33.3	3.1	52.6
Marondera	2.9	1.8	3.2	2.9	11.1	0.1	2.6	25.0	2.8	32.3
Masvingo	1.6	2.4	2.0	2.4	6.3	0.1	142.9	28.6	2.9	28.6
Matobo	4.5	2.9	5.0	5.9	8.3	0.1	2.1	100.0	3.3	52.6
Mazowe	4.8	4.5	3.2	4.3	5.6	0.1	2.3	50.0	2.3	50.0
Mberengwa	3.7	4.2	3.6	5.6	9.1	0.1	1.7	50.0	3.0	30.3
Mount Darwin	3.0	3.0	3.3	4.3	11.1	0.1	2.7	25.0	2.2	12.0
Mudzi	3.1	4.8	7.7	5.9	16.7	0.1	2.0	50.0	2.6	18.9
Murehwa	1.8	3.8	2.5	4.5	14.3	0.1	2.5	100.0	1.4	21.3
Mutare	1.5	1.1	1.8	2.0	5.9	0.1	166.7	66.7	1.8	66.7
Mutasa	2.3	2.9	3.0	2.9	11.1	0.1	10.4	90.9	1.6	15.4
Mutoko	2.7	2.2	3.8	3.3	8.3	0.1	2.3	33.3	2.1	12.2
Mwenezi	4.2	3.3	3.0	5.6	12.5	0.1	1.7	100.0	1.9	45.5
Nkayi	3.0	4.2	2.9	4.3	9.1	0.1	1.3	25.0	2.8	13.7
Nyanga	2.7	4.5	2.5	5.6	20.0	0.2	3.6	14.3	1.6	27.8
Rushinga	2.4	3.6	4.5	3.6	16.7	0.1	2.0	10.0	1.0	5.6
Seke	2.3	1.6	4.3	2.9	6.7	0.1	4.0	100.0	2.0	21.7
Shamva	2.9	1.6	3.2	2.2	12.5	0.1	3.7	100.0	1.5	9.0
Shurugwi	3.2	1.9	3.0	2.6	9.1	0.1	3.8	100.0	1.7	12.7
Tsholotsho	4.2	3.0	4.2	3.1	10.0	0.1	1.6	25.0	2.6	25.6
Umguza	4.5	2.2	3.7	2.6	25.0	0.1	2.2	50.0	2.5	25.6
UMP	2.7	3.6	3.8	3.1	9.1	0.1	2.1	90.9	2.2	19.2
Umzingwane	2.6	2.9	2.7	3.2	10.0	0.1	3.3	50.0	28.6	18.5
Zaka	2.7	3.8	3.6	2.6	11.1	0.1	1.4	12.5	1.9	13.7
Zvimba	2.6	1.9	2.6	4.3	9.1	0.1	3.5	100.0	2.1	19.6
Zvishavane	2.3	2.2	2.3	3.1	5.9	0.1	2.0	22.2	2.0	16.1
AVERAGE	**3.4**	**3.0**	**3.4**	**4.5**	**11.6**	**0.1**	**58.0**	**58.8**	**3.1**	**28.2**

APPENDIX E3: Calculated simple indices on the selected diseases and health conditions in the districts

	IC01	IC02	IC03	IC04	IC05	IC06	IC07	IC08	IC09	IC10	IC11
Beitbridge	24.9	10.8	24.4	22.1	7.8	12.5	9.9	0.3	1.7	13.2	25.3
Bikita	27.1	10.2	36.5	31.6	28.6	9.5	9.5	0.4	17.0	5.5	7.7
Bindura	13.6	4.8	8.6	18.4	7.2	10.8	10.1	0.4	3.1	7.8	11.8
Binga	42.6	20.9	8.1	9.6	7.2	16.1	9.7	0.2	1.9	7.4	2.7
Bubi	23.0	5.8	8.9	20.1	12.3	7.0	11.1	0.3	2.1	7.4	3.4
Buhera	9.0	6.0	6.5	10.1	8.6	14.4	9.2	0.3	8.5	6.1	6.5
Bulawayo	1.8	0.8	2.6	1.3	1.9	11.2	11.1	172.4	17.0	14.7	35.5
Bulilima	6.9	9.9	8.6	12.3	17.2	5.5	10.9	0.3	5.7	12.1	8.1
Centenary	9.0	8.8	8.6	31.6	21.5	13.7	8.8	0.4	17.0	5.9	3.9
Chegutu	6.3	7.6	7.1	17.0	5.4	7.9	10.2	0.3	8.5	7.9	7.4
Chikomba	5.3	10.5	9.7	14.8	7.2	5.4	9.9	0.6	15.5	6.0	7.1
Chimanimani	4.5	14.6	8.4	10.1	4.8	11.5	9.5	1.4	4.3	6.3	3.1
Chipinge	6.8	15.2	9.7	12.3	8.6	9.9	8.3	0.7	1.9	6.8	6.5
Chiredzi	9.0	7.4	7.1	6.7	10.7	9.9	9.2	0.7	1.9	6.8	6.5
Chirimuhanzu	13.0	19.7	8.6	11.1	5.1	8.8	10.1	0.4	15.5	5.9	27.3
Chitungwiza	4.0	5.0	4.7	4.0	5.1	15.6	10.7	86.2	17.0	9.9	8.7
Chivi	9.0	12.4	6.5	6.5	12.3	7.7	9.9	0.3	17.0	8.2	3.7
Gokwe North	7.3	14.0	7.7	8.5	10.7	17.6	9.7	0.2	8.5	7.0	7.4
Gokwe South	8.8	12.0	13.3	9.2	10.7	11.4	9.9	0.3	8.5	67.3	22.2
Goromonzi	8.8	10.2	8.9	6.7	7.2	9.7	10.4	0.9	5.7	6.9	9.6
Guruve	16.6	16.0	9.4	8.2	14.3	10.8	9.0	0.4	17.0	8.5	5.8
Gutu	8.1	14.0	16.2	6.5	6.6	9.1	9.5	0.4	17.0	5.7	5.5
Gwanda	6.6	10.2	10.8	6.7	12.3	9.9	10.7	0.4	17.0	6.8	5.6
Gweru	4.3	6.0	5.2	4.0	5.1	9.5	10.7	86.2	17.0	6.2	14.2
Harare	1.6	0.5	2.9	1.4	1.4	9.7	11.1	172.4	17.0	6.5	25.3
Hurungwe	11.5	9.9	8.6	10.1	17.2	8.6	10.4	0.4	17.0	13.0	7.9
Hwange	9.9	8.8	8.1	12.3	21.5	9.1	10.4	0.7	17.0	8.7	11.8
Hwedza	7.3	12.4	6.6	10.5	7.8	5.9	10.1	0.5	17.0	5.3	6.8
Inziza	13.0	8.2	8.1	13.0	10.7	9.9	10.6	0.4	8.5	10.6	23.7
Kadoma	5.7	4.7	10.8	9.6	6.6	7.4	9.9	0.5	11.3	7.0	10.4
Kariba	9.3	8.2	12.7	6.5	17.2	8.5	10.1	0.5	9.5	8.4	14.8
Kwekwe	9.0	8.2	12.2	6.0	14.3	11.4	10.1	14.4	9.0	8.7	7.5
Lupane	11.9	12.0	13.3	10.1	12.3	8.8	8.3	0.2	3.4	12.4	5.2
Makonde	7.5	14.0	9.4	9.2	10.7	11.0	9.7	0.3	3.4	5.0	6.3

	IC01	IC02	IC03	IC04	IC05	IC06	IC07	IC08	IC09	IC10	IC11
Makoni	8.3	8.2	10.8	7.1	7.8	7.6	10.1	0.5	3.4	8.1	8.3
Mangwe	16.6	14.6	9.7	18.4	8.6	13.0	9.9	0.4	5.7	10.0	18.7
Marondera	8.8	6.0	9.4	6.5	9.5	9.6	10.4	0.5	4.3	8.9	11.4
Masvingo	4.8	8.0	5.7	5.3	5.4	11.1	10.6	24.6	4.9	9.4	10.1
Matobo	13.6	9.9	14.6	13.0	7.2	9.4	9.7	0.4	17.0	10.7	18.7
Mazowe	14.2	15.2	9.4	9.6	4.8	12.8	10.7	0.4	8.5	7.3	17.7
Mberengwa	11.1	14.0	10.4	12.3	7.8	8.4	9.7	0.3	8.5	9.6	10.8
Mount Darwin	9.0	10.2	9.7	9.6	9.5	9.9	9.9	0.5	4.3	7.1	4.3
Mudzi	9.3	16.0	22.5	13.0	14.3	5.8	9.9	0.4	8.5	8.4	6.7
Murehwa	5.3	12.9	7.3	10.1	12.3	7.6	10.1	0.4	17.0	4.5	7.5
Mutare	4.5	3.8	5.1	4.3	5.1	6.6	10.6	28.7	11.3	5.9	23.7
Mutasa	6.9	9.6	8.9	6.5	9.5	14.9	10.1	1.8	15.5	5.2	5.5
Mutoko	8.1	7.4	11.2	7.4	7.2	8.0	10.1	0.4	5.7	6.9	4.3
Mwenezi	12.4	11.2	8.9	12.3	10.7	12.9	9.2	0.3	17.0	6.2	16.1
Nkayi	9.0	14.0	8.6	9.6	7.8	11.4	10.1	0.2	4.3	8.9	4.9
Nyanga	8.1	15.2	7.3	12.3	17.2	19.4	9.7	0.6	2.4	5.2	9.9
Rushinga	7.3	12.0	13.3	7.9	14.3	9.4	9.4	0.3	1.7	3.4	2.0
Seke	6.9	5.3	12.7	6.5	5.7	6.4	10.6	0.7	17.0	6.5	7.7
Shamva	8.5	5.4	9.4	4.9	10.7	9.6	9.5	0.6	17.0	5.0	3.2
Shurugwi	9.6	6.2	8.9	5.8	7.8	7.7	10.2	0.7	17.0	5.6	4.5
Tsholotsho	12.4	10.2	12.2	6.9	8.6	8.8	10.6	0.3	4.3	8.5	9.1
Umguza	13.6	7.4	10.8	5.8	21.5	12.2	10.4	0.4	8.5	8.1	9.1
UMP	8.1	12.0	11.2	6.9	7.8	9.7	9.7	0.4	15.5	7.0	6.8
Umzingwane	7.9	9.9	7.9	7.1	8.6	9.6	10.2	0.6	8.5	92.3	6.6
Zaka	8.1	12.9	10.4	5.8	9.5	7.6	9.9	0.2	2.1	6.2	4.9
Zvimba	7.9	6.2	7.7	9.6	7.8	7.3	10.2	0.6	17.0	6.9	7.0
Zvishavane	6.8	7.4	6.6	6.9	5.1	7.4	10.1	0.3	3.8	6.5	5.7

APPENDIX F1: Indicators calculated from 1992 health data

	D01	D02	D03	A04	D05	D06	D07	D08	D09	D10	D11
Beitbridge	429	2.79	8.9	10.1	65	57.3	9.1	53.2	13.1	1	19
Bikita	280	0.64	6.4	10.4	75	62.3	3.2	54.1	14.9	4	18
Bindura	488	2.94	7.1	13.1	65	21.7	44.7	60.6	15.9	2	22
Binga	264	1.93	18.5	7.9	71	83.9	14	17	11.9	2	13
Bubi	401	2.53	13.5	8.1	37	61	24.6	38	22.2	1	10
Buhera	431	0.37	6.3	13.3	86	72.9	6	38.4	12.3	3	24
Bulawayo	241	2.3	2.2	6.7	47	0.4	18.9	20.9	10.7	12	32
Bulilima	205	1.27	9.4	9.1	40	67	9.8	17.2	9.1	2	13
Centenary	652	1.74	11	18.3	97	53.5	12.9	90.1	23.7	1	11
Chegutu	476	5.65	7.8	9.4	63	20.8	40.8	54.2	11.2	4	37
Chikomba	668	0.78	5.9	11.6	62	34.3	68.8	66.9	17.2	5	27
Chimanimani	346	1.63	7.5	10.4	76	19.3	5.9	34.7	11.3	5	21
Chipinge	466	0.78	9.2	12.9	109	26	16	48.5	13.3	4	46
Chiredzi	460	5.54	5.5	10.4	87	32.5	30.8	54.7	12.2	3	34
Chirimuhanzu	496	2.01	6.1	10.2	57	42.6	2.3	35.2	11.7	4	16
Chitungwiza	546	18.62	2.4	7.9	60	0.1	30.3	51	5.1	4	34
Chivi	488	0.31	3.4	10.4	64	55.9	2.6	40.9	8	3	14
Gokwe North	347	1.35	7.8	10.3	80	81.9	13.6	32.2	10.7	3	16
Gokwe South	398	1.39	7.9	10.3	84	88	13.7	33	10.9	2	36
Goromonzi	296	1.65	7	8.9	63	36.8	51.9	71.6	16.6	2	22
Guruve	539	1.25	8.2	18.5	88	58.3	14	50.7	16.1	1	18
Gutu	205	0.51	3.6	10.4	76	35.7	17.7	48.8	10	5	27
Gwanda	259	2.88	7.9	7.8	46	27.1	10.7	39.9	7.8	2	29
Gweru	312	1.64	3.5	7.8	51	24.3	8.2	47	7	4	44
Harare	575	7.38	3.3	6.1	55	5.6	10.6	19.2	6.4	6	37
Hurungwe	619	2.3	6.3	11.9	76	65	30.4	34.8	10.1	3	27
Hwange	317	2.11	9.2	6.7	49	24.7	40.1	90	9.5	4	34
Hwedza	479	2.45	5.7	11.2	66	49.8	9.7	33.1	8.1	2	14
Inziza	223	3.23	7.2	8.8	41	36.6	2.2	34.4	9.5	4	11
Kadoma	367	8.27	7.1	8.6	71	24.3	4.1	53.5	9.1	3	22
Kariba	377	10.7	6.8	9.2	81	34.6	60.6	52.2	25	3	16
Kwekwe	226	4.58	3.1	10.1	65	31	13.1	28.9	8	4	45
Lupane	382	1.9	10.9	7.7	44	85.7	12	33.6	20.7	2	11
Makonde	403	2.71	8.3	9.4	403	52	17.9	47	10.6	3	34

	D01	D02	D03	A04	D05	D06	D07	D08	D09	D10	D11
Makoni	476	0.81	6.3	11.3	64	46.2	22.7	31.9	10.7	6	47
Mangwe	207	1.27	9.4	9.2	42	67.9	9.9	17	10	2	12
Marondera	470	3.77	4.9	10.3	63	21.3	51.6	50.1	8.8	3	21
Masvingo	329	1.55	4.5	8.4	68	20.3	2.4	47.2	8.9	5	43
Matobo	347	1.46	12.6	9.4	29	47.8	36.3	29.1	8.7	5	12
Mazowe	404	1.71	8.2	9.7	68	28.4	17.4	52.5	14	4	32
Mberengwa	316	2.26	10.4	11.1	63	64.1	7.2	41.2	8.1	6	30
Mount Darwin	672	2.07	7.6	14.8	71	53.7	9.4	41.1	9.3	2	21
Mudzi	529	7.27	9.2	12	70	71.3	12.1	52	9	1	21
Murehwa	362	1.28	6.8	11.1	69	59.6	18.5	51	9.4	2	25
Mutare	437	2.93	6.2	10.6	76	23.2	5.6	17	7.6	7	38
Mutasa	501	1.68	8.5	10.9	83	17	87	75.4	15.8	5	45
Mutoko	262	0.65	8.1	10.8	59	56.5	42.8	38.1	8.9	5	22
Mwenezi	268	1.85	4.5	11.5	85	53.5	0.8	51.3	13.2	2	20
Nkayi	316	0.65	11.7	8.4	45	83.4	3.7	34	7.9	3	12
Nyanga	366	4.49	10.5	10	77	46.2	35.6	44	7	4	24
Rushinga	310	2.1	6.4	19.8	87	39.3	12	53.3	22.3	2	10
Seke	467	1.27	6.1	10.8	62	40.6	46.3	80.1	17.8	1	15
Shamva	665	3.33	7.1	16.2	87	40	39	48	14.7	2	15
Shurugwi	610	11.33	4.8	10.3	66	17.4	1.9	51.3	7.8	3	27
Tsholotsho	415	1.58	12.2	9.8	39	76.6	10.2	33	8	3	16
Umguza	325	5.2	8.2	8.8	51	31.2	7.4	32	7.4	1	20
UMP	638	2.73	7.8	11	63	66.8	1	60	23	1	17
Umzingwane	337	1.71	9.8	9.6	38	28.7	2.6	41.9	8.1	1	15
Zaka	510	0.65	5	10.6	70	69.9	32.4	56.6	22.1	2	21
Zvimba	710	4.04	6.8	9	74	41	21.1	43	11.7	6	35
Zvishavane	455	3.42	5.2	10.3	60	18.9	12.3	94.1	20.5	3	25

APPENDIX F2: Reciprocals of Indicators (for indicators which negatively covary with health) for 1992 health data

	D01!	D02!	D03!	D04!	D05!	D07!	D08!	D09!
Beitbridge	0.2	35.8	11.24	9.9	1.5	11	1.9	7.6
Bikita	0.4	156.3	15.6	9.7	1.3	31.3	1.8	6.7
Bindura	0.2	34	14.1	7.7	1.5	2.2	1.7	6.3
Binga	0.4	51.8	5.4	12.7	1.4	7.1	5.9	8.4
Bubi	0.2	39.5	7.4	12.4	2.7	4.1	2.6	4.5
Buhera	0.2	270.3	15.9	7.5	1.2	16.7	2.6	8.1
Bulawayo	0.4	43.5	45.5	14.9	2.1	5.3	4.8	9.3
Bulilima	0.5	78.7	10.6	11	2.5	10.2	5.8	11
Centenary	0.2	57.5	9.1	5.5	1	7.8	1.1	4.2
Chegutu	0.2	17.7	12.8	10.6	1.6	2.5	1.8	8.9
Chikomba	0.1	128.2	16.9	8.6	1.6	1.5	1.5	5.8
Chimanimani	0.3	61.3	13.3	9.7	1.3	16.9	2.9	8.8
Chipinge	0.2	128.2	10.9	7.8	0.9	6.3	2.1	7.5
Chiredzi	0.2	18.1	18.2	9.7	1.1	3.2	1.8	8.2
Chirimuhanzu	0.2	49.8	16.4	9.8	1.8	43.5	2.8	8.5
Chitungwiza	0.2	5.4	41.7	12.6	1.7	3.3	2	19.6
Chivi	0.2	322.6	29.4	9.7	1.6	38.5	2.4	12.5
Gokwe North	0.3	74.1	12.8	9.7	1.3	7.4	3.1	9.3
Gokwe South	0.3	71.9	12.7	9.7	1.2	7.3	3	9.2
Goromonzi	0.3	60.6	14.3	11.3	1.6	1.9	1.4	6
Guruve	0.2	80	12.2	5.4	1.1	7.1	2	6.2
Gutu	0.5	196.1	27.8	9.7	1.3	5.6	2	10
Gwanda	0.4	34.7	12.7	12.9	2.2	9.3	2.5	12.8
Gweru	0.3	61	28.6	12.8	2	12.2	2.1	14.3
Harare	0.2	13.6	30.3	16.5	1.8	9.4	5.2	15.6
Hurungwe	0.2	43.5	15.9	8.4	1.3	3.3	2.9	9.9
Hwange	0.3	47.4	10.9	14.9	2	2.5	1.1	10.5
Hwedza	0.2	40.8	17.5	8.9	1.5	10.3	3	12.3
Inziza	0.4	31	13.9	11.4	2.4	45.5	2.9	10.5
Kadoma	0.3	12.1	14.1	11.7	1.4	24.4	1.9	11
Kariba	0.3	9.3	14.7	10.9	1.2	1.7	1.9	4
Kwekwe	0.4	21.8	32.3	9.9	1.5	7.6	3.5	12.5
Lupane	0.3	52.6	9.2	13	2.3	8.3	3	4.8

	D01!	D02!	D03!	D04!	D05!	D07!	D08!	D09!
Makonde	0.2	36.9	12	10.6	0.2	5.6	2.1	9.4
Makoni	0.2	123.5	15.9	8.9	1.6	4.4	3.1	9.3
Mangwe	0.5	78.7	10.6	10.9	2.4	10.1	5.9	10
Marondera	0.2	26.5	20.4	9.7	1.6	1.9	2	11.4
Masvingo	0.3	64.5	22.2	12	1.5	41.7	2.1	11.2
Matobo	0.3	68.5	7.9	10.6	3.4	2.8	3.4	11.5
Mazowe	0.2	58.5	12.2	10.3	1.5	5.7	1.9	7.1
Mberengwa	0.3	44.2	9.6	9	1.6	13.9	2.4	12.3
Mount Darwin	0.1	48.3	13.2	6.8	1.4	10.6	2.4	10.8
Mudzi	0.2	13.8	10.9	8.4	1.4	8.3	1.9	11.1
Murehwa	0.3	78.1	14.7	9	1.4	5.4	2	10.6
Mutare	0.2	34.1	16.1	9.4	1.3	17.9	5.9	13.2
Mutasa	0.2	59.5	11.8	9.1	1.2	1.1	1.3	6.3
Mutoko	0.4	153.8	12.3	9.2	1.7	2.3	2.6	11.2
Mwenezi	0.4	54.1	22.2	8.7	1.2	125	1.9	7.6
Nkayi	0.3	153.8	8.5	11.9	2.2	27	2.9	12.7
Nyanga	0.3	22.3	9.5	10	1.3	2.8	2.3	14.3
Rushinga	0.3	47.6	15.6	5.1	1.1	8.3	1.9	4.5
Seke	0.2	78.7	16.4	9.2	1.6	2.2	1.2	5.6
Shamva	0.2	30	14.1	6.2	1.1	2.6	2.1	6.8
Shurugwi	0.2	8.8	20.8	9.7	1.5	52.6	1.9	12.8
Tsholotsho	0.2	63.3	8.2	10.3	2.6	9.8	3	12.5
Umguza	0.3	19.2	12.2	11.4	2	13.5	3.1	13.5
UMP	0.2	36.6	12.8	9.1	1.6	100	1.7	4.3
Umzingwane	0.3	58.5	10.2	10.4	2.6	38.5	2.4	12.3
Zaka	0.2	153.8	20	9.4	1.4	3.1	1.8	4.5
Zvimba	0.1	24.8	14.7	11.1	1.4	4.7	2.3	8.5
Zvishavane	0.2	29.2	19.2	9.7	1.7	8.1	1.1	4.9
AVERAGE	**0.3**	**65.9**	**15.9**	**10**	**1.6**	**14.8**	**2.6**	**9.4**

APPENDIX F3: Calculated simple Indices for 1992 health data

	ID01	ID02	ID03	ID04	ID05	ID06	ID07	ID08	ID09	ID10	ID11
Beitbridge	77.7	54.4	70.7	99	96.2	129.2	74.3	67.1	81.2	30.3	78.5
Bikita	119	237.1	98.3	96.5	83.3	140.5	211.1	66	71.4	121.2	74.4
Bindura	68.3	51.6	88.6	76.6	96.2	49	15.1	58.9	66.9	60.6	90.9
Binga	126.3	78.6	34	127.4	88	189.3	48.3	210.1	89.4	60.6	53.7
Bubi	83.1	60	46.6	123.8	168.9	137.8	27.5	94	47.9	30.3	41.3
Buhera	77.3	410.1	99.8	75	72.7	164.6	112.6	93	86.5	90.9	99.2
Bulawayo	138.3	66	285.9	149.3	133	0.9	35.8	170.9	99.4	363.6	132.2
Bulilima	162.6	119.5	66.9	109.9	156.3	151.2	68.9	207.6	116.9	60.6	53.7
Centenary	51.1	87.2	57.2	54.6	64.4	120.7	52.4	39.6	44.9	30.3	45.5
Chegutu	70	26.9	80.6	106.2	99.2	46.9	16.6	65.9	95	121.2	152.9
Chikomba	49.9	194.5	106.6	86	100.8	77.4	9.8	53.4	61.9	151.5	111.6
Chimanimani	96.3	93.1	83.9	96.5	82.2	43.6	114.5	102.9	94.1	151.5	86.8
Chipinge	71.5	194.5	68.4	77.8	57.3	58.7	42.2	73.6	80	121.2	190.1
Chiredzi	72.5	27.4	114.4	96.5	71.8	73.4	21.9	65.3	87.2	90.9	140.5
Chirimuhanzu	67.2	75.5	103.1	97.8	109.6	96.3	293.8	101.5	90.9	121.2	66.1
Chitungwiza	61.1	8.1	262.1	125.9	104.2	0.1	22.3	70	208.6	121.2	140.5
Chivi	68.3	489.5	185	96.5	97.7	126.1	259.9	87.3	133	90.9	57.9
Gokwe North	96.1	112.4	80.6	97.4	78.1	184.9	49.7	110.9	99.4	90.9	66.1
Gokwe South	83.8	109.2	79.6	97	74.4	198.6	49.3	108.2	97.6	60.6	148.8
Goromonzi	112.6	92	89.8	113	99.2	83.1	13	49.9	64.1	60.6	90.9
Guruve	61.8	121.4	76.7	54.1	71	131.5	48.3	70.4	66.1	30.3	74.4
Gutu	162.6	297.5	174.7	96.5	82.2	80.7	38.2	73.2	106.4	151.5	111.6
Gwanda	128.7	52.7	79.6	129	135.9	61.2	63.1	89.5	136.4	60.6	119.8
Gweru	106.8	92.5	179.7	127.9	122.5	54.8	82.4	76	152	121.2	181.8
Harare	58	20.6	190.6	165	113.6	12.6	63.7	186	166.2	181.8	152.9
Hurungwe	53.9	66	99.8	83.9	82.2	146.7	22.2	102.6	105.3	90.9	111.6
Hwange	105.2	71.9	68.4	148.6	127.6	55.7	16.8	39.7	112	121.2	140.5
Hwedza	69.6	61.9	110.3	89.4	94.7	112.4	69.7	107.9	131.3	60.6	57.9
Inziza	149.5	47	87.4	113.6	152.4	82.5	307.1	103.8	112	121.2	45.5
Kadoma	90.8	18.3	88.6	117	88	54.9	164.8	66.8	116.9	90.9	90.9
Kariba	88.5	14.2	92.5	108.7	77.2	78.1	11.1	68.4	42.6	90.9	66.1
Kwekwe	147.5	33.1	202.9	98.8	96.2	70	51.6	123.6	133	121.2	186
Lupane	87.3	79.9	57.7	130.4	142	193.3	56.3	106.3	51.4	60.6	45.5
Makonde	82.7	56	75.8	106	15.5	117.3	37.7	76	100.4	90.9	140.5

	ID01	ID02	ID03	ID04	ID05	ID06	ID07	ID08	ID09	ID10	ID11
Makoni	70	187.3	99.8	88.7	97.7	104.2	29.8	112	99.4	181.8	194.2
Mangwe	161	119.5	66.9	108.7	148.8	153.3	68.3	210.1	106.4	60.6	49.6
Marondera	71	40.3	128.4	96.9	99.2	48.2	13.1	71.3	120.9	90.9	86.8
Masvingo	101.5	97.9	139.8	119.8	91.9	45.9	281.5	75.7	119.5	151.5	177.7
Matobo	96.1	103.9	49.9	106.4	215.5	107.8	18.6	122.7	122.3	151.5	49.6
Mazowe	82.5	88.7	76.7	103.1	91.9	64.2	38.8	68	76	121.2	132.2
Mberengwa	105.5	67.1	60.5	90.3	99.2	144.7	93.8	86.7	131.3	181.8	124
Mount Darwin	49.6	73.3	82.8	67.6	88	121.2	71.9	86.9	114.4	60.6	86.8
Mudzi	63	20.9	68.4	83.5	89.3	160.9	55.8	68.7	118.2	30.3	86.8
Murehwa	92.1	118.6	92.5	90	90.6	134.6	36.5	70	113.2	60.6	103.3
Mutare	76.3	51.8	101.4	94.3	82.2	52.3	120.7	210.1	140	212.1	157
Mutasa	66.5	90.3	74	91.5	75.3	38.4	7.8	47.4	67.3	151.5	186
Mutoko	127.2	233.5	77.6	92.3	105.9	127.6	15.8	93.7	119.5	151.5	90.9
Mwenezi	124.4	82	139.8	87.3	73.5	120.8	844.6	69.6	80.6	60.6	82.6
Nkayi	105.5	233.5	53.8	119.5	138.9	188.4	182.6	105	134.7	90.9	49.6
Nyanga	91.1	33.8	59.9	100.3	81.2	104.3	19	81.2	152	121.2	99.2
Rushinga	107.5	72.3	98.3	50.5	71.8	88.7	56.3	67	47.7	60.6	41.3
Seke	71.4	119.5	103.1	92.3	100.8	91.7	14.6	44.6	59.8	30.3	62
Shamva	50.1	45.6	88.6	61.7	71.8	90.3	17.3	74.4	72.4	60.6	62
Shurugwi	54.6	13.4	131	96.7	94.7	39.3	355.6	69.6	136.4	90.9	111.6
Tsholotsho	80.3	96	51.6	102.6	160.3	173	66.2	108.2	133	90.9	66.1
Umguza	102.6	29.2	76.7	113.6	122.5	70.4	91.3	111.6	143.8	30.3	82.6
UMP	52.2	55.6	80.6	91.2	99.2	150.9	675.7	59.5	46.3	30.3	70.2
Umzingwane	98.9	88.7	64.2	104.2	164.5	64.7	259.9	85.2	131.3	30.3	62
Zaka	65.4	233.5	125.8	94.2	89.3	157.7	20.9	63.1	48.1	60.6	86.8
Zvimba	46.9	37.6	92.5	110.9	84.5	92.6	32	83.1	90.9	181.8	144.6
Zvishavane	73.3	44.4	120.9	97.3	104.2	42.8	54.9	38	51.9	90.9	103.3

APPENDIX F4: Indicators of health for 2002 data

	D01	D02	D03	A04	D05	D06	D07	D08	D09	D10	D11
Beitbridge	906.3	4.4	4.4	14.9	76.7	48.3	10	24.4	1.4	1	19
Bikita	1196.9	3.1	3.7	18.8	76	54.9	1	58.5	4.6	4	21
Bindura	1051.6	3.7	4.1	16.8	76.4	51.6	5.5	41.5	3	2	25
Binga	704.4	1	10.7	13.1	64.2	16.8	9	43.6	13.3	3	13
Bubi	1619.4	2	11.2	19.2	52.6	33	8	43.6	10.5	1	10
Buhera	788	2.9	4.9	15.7	72.6	43.3	2	53.2	5.5	4	28
Bulawayo	1013.8	0.3	3.2	13.9	44.5	99.9	1	22	1	12	33
Bulilima	2048.1	0.7	7.9	21.8	48.4	37	3	26.8	0.4	2	13
Centenary	829	1.9	8.2	15.8	74.4	59.5	1	54.7	9.1	1	11
Chegutu	1438.5	1.3	8.1	18.8	61.4	48.2	2	40.8	4.8	5	40
Chikomba	2109.3	1.3	5.8	22	66.8	69.1	1.1	53.5	5	5	28
Chimanimani	985.2	1	8.2	17	59.4	87.3	4	50.9	11.6	6	21
Chipinge	1140.9	2.2	6.4	16.1	81.8	73.5	9	47.7	5.5	4	48
Chiredzi	1140.9	2.2	6.4	16.1	81.8	48	9	47.7	5.5	4	38
Chirimuhanzu	1286.4	1.5	6.3	21.2	69.4	51.5	1.1	55.2	0.3	5	18
Chitungwiza	725.6	0.6	2.5	13.1	61.2	99.9	1	32.5	1	4	38
Chivi	1469.9	1.3	2.1	20.7	62.9	47.1	1	39.6	9.6	3	16
Gokwe North	645.7	1.7	8.4	14.5	75.1	29.8	2	46	0.5	3	17
Gokwe South	999.7	1.3	4.1	16.2	85.8	32.9	2	4.8	0.6	2	36
Goromonzi	1173.7	2.4	6.3	19.4	78.8	80	3	47	3.7	3	23
Guruve	1047.1	1.3	4.1	20.3	86	56.2	1	38	6.1	1	20
Gutu	1248.4	1.5	3	20	65	58.7	1	56.5	6.5	6	30
Gwanda	1147.8	1.4	3.6	20.2	75.5	57.5	1	47.3	6.3	3	30
Gweru	1198.1	0.6	3.3	20.1	70.2	99.8	1	51.9	1.5	5	47
Harare	1172.9	0.4	3.4	20.1	72.9	99.9	1	49.6	1.4	7	37
Hurungwe	1326.9	1.8	7.7	20.3	68.7	52.1	1	24.9	4.5	4	28
Hwange	1249.9	1.1	5.6	20.2	70.8	76	1	37.2	3	4	34
Hwedza	1910.2	2	7.5	22.6	71.2	66.8	1	61.4	5.2	2	14
Inziza	1141.9	5	5.3	19.6	66.1	60.8	2	30.6	0.3	4	12
Kadoma	1526	1.9	6.4	21.1	68.7	63.8	1.5	46	2.8	3	23
Kariba	1334	3.4	5.9	20.3	67.4	62.3	1.8	38.3	1.5	3	16
Kwekwe	1334	0.9	5.9	20.3	67.4	98.8	1.8	38.3	1.5	4	46
Lupane	1289.7	1.2	7.7	20.8	58.2	22.9	5	26	6.8	2	11
Makonde	1032.3	0.9	2.2	15.3	66.3	48.5	5	64.6	5.6	3	34

	D01	D02	D03	A04	D05	D06	D07	D08	D09	D10	D11
Makoni	1485.9	0.4	6	21.3	69	66.5	5	40.1	4.3	6	48
Mangwe	871	1.2	10.2	15.2	34.8	57.9	3	32.3	0.4	3	12
Marondera	1178.5	0.8	8.1	18.3	51.9	62.2	4	36.2	2.4	3	21
Masvingo	1024.7	0.9	9.2	16.7	43.4	99.3	3.5	34.3	1.4	5	45
Matobo	1203	3	8.5	19.5	50	51.8	1	30.3	0.3	5	12
Mazowe	1236	2.3	8.7	16.1	86.9	83.5	4	46.6	8.1	4	32
Mberengwa	1355.8	1.6	7	21.9	79.4	42.1	2	33.7	3.3	6	31
Mount Darwin	1145.2	1.6	6.8	19.6	72.7	62.5	4	45.4	8.3	2	21
Mudzi	1952.6	3	9	22.8	83.3	50.8	2	38.4	5.3	1	21
Murehwa	1502.2	1.6	9.5	23.3	78.3	60.5	1	71.7	4.7	2	26
Mutare	1727.4	0.4	9.3	23	80.8	99.4	1.5	55.1	1.5	7	40
Mutasa	759.4	1.3	8.2	17.8	90.5	90.5	1.1	62.6	6.5	6	45
Mutoko	1413.5	1.2	10	20.5	75.8	56.8	3	46.9	8.2	5	22
Mwenezi	876.4	1.2	3.6	17.8	79.1	41.7	1	52	2.2	2	20
Nkayi	998.9	1.3	7.5	22	66.9	20.5	4	36.3	7.3	3	12
Nyanga	586.3	3.2	8.6	14.1	60	72.2	7	61.9	3.6	5	24
Rushinga	1209.1	0.6	7.8	17.4	69.9	50.6	10	96.1	18	2	10
Seke	1767.9	1	9.5	20.9	65.7	74	1	49.6	4.6	2	15
Shamva	1179.5	2.2	10	21	100.4	73.2	1	65	11.1	2	15
Shurugwi	1473.7	1.6	9.8	21	83.1	74	1	57.3	7.9	3	27
Tsholotsho	1290.5	1.8	10.5	22.7	60.5	36.1	4	38.1	3.9	3	17
Umguza	927.4	1.2	6.6	14.6	55.1	54.2	2	40	3.9	1	20
UMP	1175.8	1.6	8.3	20.9	70	52.8	1.1	45.9	5.2	1	18
Umzingwane	1180.9	1.6	6.9	19.3	53.5	70.1	2	3.5	0.4	1	15
Zaka	1491.1	2.9	3.7	20.1	76.5	27.5	8	52.4	7.3	2	22
Zvimba	1561.8	4.4	8	18.7	85.2	71.3	1	46.9	5.1	7	35
Zvishavane	1526.4	3.7	5.9	19.4	80.9	49.4	4.5	49.7	6.2	3	25

APPENDIX F5: Reciprocals (for indicators which negatively covary with health) for 2002 health data

	D01!	D02!	D03!	D04!	D05!	D07!	D08!	D09!
Beitbridge	0.1	23	22.7	6.7	1.3	48.3	4.1	71.4
Bikita	0.1	32.3	27	5.3	1.3	54.9	1.7	21.7
Bindura	0.1	26.8	24.7	5.9	1.3	51.6	2.4	33.3
Binga	0.1	102	9.3	7.7	1.6	16.8	2.3	7.5
Bubi	0.1	49	8.9	5.2	1.9	33	2.3	9.5
Buhera	0.1	34.5	20.4	6.4	1.4	43.3	1.9	18.2
Bulawayo	0.1	333.3	31.3	7.2	2.2	99.9	4.5	100
Bulilima	0	144.9	12.7	4.6	2.1	37	3.7	250
Centenary	0.1	52.6	12.2	6.3	1.3	59.5	1.8	11
Chegutu	0.1	77.2	12.4	5.3	1.6	48.2	2.5	21.1
Chikomba	0	76.9	17.2	4.5	1.5	69.1	1.9	20
Chimanimani	0.1	97.1	12.2	5.9	1.7	87.3	2	8.6
Chipinge	0.1	45.9	15.6	6.2	1.2	73.5	2.1	18.2
Chiredzi	0.1	45.9	15.6	6.2	1.2	48	2.1	18.2
Chirimuhanzu	0.1	66.7	15.9	4.7	1.4	51.5	1.8	333.3
Chitungwiza	0.1	166.7	40	7.6	1.6	99.9	3.1	100
Chivi	0.1	76.9	47.6	4.8	1.6	47.1	2.5	10.4
Gokwe North	0.2	60.2	11.9	6.9	1.3	29.8	2.2	200
Gokwe South	0.1	76.9	24.4	6.2	1.2	32.9	20.8	166.7
Goromonzi	0.1	41.8	15.9	5.1	1.3	80	2.1	27
Guruve	0.1	76.9	24.4	4.9	1.2	56.2	2.6	16.4
Gutu	0.1	66.7	33.3	5	1.5	58.7	1.8	15.4
Gwanda	0.1	71.4	28.2	5	1.3	57.5	2.1	15.9
Gweru	0.1	166.7	30.5	5	1.4	99.8	1.9	66.7
Harare	0.1	250	29.3	5	1.4	99.9	2	71.4
Hurungwe	0.1	55.6	13	4.9	1.5	52.1	4	22.2
Hwange	0.1	90.9	18	5	1.4	76	2.7	33.9
Hwedza	0.1	50	13.3	4.4	1.4	66.8	1.6	19.2
Inziza	0.1	20.2	18.9	5.1	1.5	60.8	3.3	333.3
Kadoma	0.1	52.6	15.6	4.7	1.5	63.8	2.2	36.4
Kariba	0.1	29.2	17.1	4.9	1.5	62.3	2.6	65.6
Kwekwe	0.1	111.1	17.1	4.9	1.5	98.8	2.6	65.6
Lupane	0.1	84	13	4.8	1.7	22.9	3.8	14.7

	D01!	D02!	D03!	D04!	D05!	D07!	D08!	D09!
Makonde	0.1	111.1	45.5	6.6	1.5	48.5	1.5	17.9
Makoni	0.1	232.6	16.7	4.7	1.4	66.5	2.5	23.3
Mangwe	0.1	82.6	9.8	6.6	2.9	57.9	3.1	250
Marondera	0.1	122	12.3	5.5	1.9	62.2	2.8	42.6
Masvingo	0.1	111.1	10.9	6	2.3	99.3	2.9	72.7
Matobo	0.1	33.3	11.8	5.1	2	51.8	3.3	333.3
Mazowe	0.1	43.5	11.5	6.2	1.2	83.5	2.1	12.3
Mberengwa	0.1	61	14.3	4.6	1.3	42.1	3	30.3
Mount Darwin	0.1	64.5	14.7	5.1	1.4	62.5	2.2	12
Mudzi	0.1	33.2	11.1	4.4	1.2	50.8	2.6	18.9
Murehwa	0.1	62.5	10.5	4.3	1.3	60.5	1.4	21.3
Mutare	0.1	250	10.8	4.3	1.2	99.4	1.8	66.7
Mutasa	0.1	75.2	12.2	5.6	1.1	90.5	1.6	15.4
Mutoko	0.1	83.3	10	4.9	1.3	56.8	2.1	12.2
Mwenezi	0.1	83.3	27.8	5.6	1.3	41.7	1.9	45.5
Nkayi	0.1	76.9	13.3	4.5	1.5	20.5	2.8	13.7
Nyanga	0.2	31.2	11.6	7.1	1.7	72.2	1.6	27.8
Rushinga	0.1	172.4	12.8	5.7	1.4	50.6	1	5.6
Seke	0.1	96.2	10.5	4.8	1.5	74	2	21.7
Shamva	0.1	45.7	10	4.8	1	73.2	1.5	9
Shurugwi	0.1	61.9	10.3	4.8	1.2	74	1.7	12.7
Tsholotsho	0.1	55.6	9.5	4.4	1.7	36.1	2.6	25.6
Umguza	0.1	83.3	15.2	6.8	1.8	54.2	2.5	25.6
UMP	0.1	62.5	12	4.8	1.4	52.8	2.2	19.2
Umzingwane	0.1	61.3	14.5	5.2	1.9	70.1	28.6	250
Zaka	0.1	34.5	27	5	1.3	27.5	1.9	13.7
Zvimba	0.1	22.7	12.5	5.4	1.2	71.3	2.1	19.6
Zvishavane	0.1	27.4	17.1	5.2	1.2	49.4	2	16.1
AVERAGE	**0.1**	**82.6**	**17.6**	**5.4**	**1.5**	**60**	**3.1**	**60**

APPENDIX F6: Calculated simple Indices for 2002 health data

	ID01	ID02	ID03	ID04	ID05	ID06	ID07	ID08	ID09	ID10	ID11
Beitbridge	110.3	27.8	129.1	124.5	86.9	80	17.1	132.2	119	27.8	75.7
Bikita	83.5	39.1	153.6	98.4	87.7	90.9	170.9	55.1	36.2	111.1	83.7
Bindura	95.1	32.5	140.3	109.9	87.3	85.4	31.1	77.8	55.6	55.6	99.6
Binga	142	123.5	53.1	141.7	103.9	27.8	19	74	12.5	83.3	51.8
Bubi	61.8	59.3	50.7	96.3	126.7	54.6	21.4	74	15.9	27.8	39.8
Buhera	126.9	41.7	116	117.7	91.8	71.7	85.5	60.6	30.3	111.1	111.6
Bulawayo	98.6	403.6	177.6	133.2	149.8	165.4	170.9	146.6	166.7	333.3	131.5
Bulilima	48.8	175.5	71.9	84.9	137.6	61.3	57	120.4	416.7	55.6	51.8
Centenary	120.6	63.7	69.3	117.6	89.7	98.5	170.9	59	18.3	27.8	43.8
Chegutu	69.5	93.5	70.6	98.6	108.6	79.8	85.5	79.2	35.1	138.9	159.4
Chikomba	47.4	93.1	98	84.1	99.8	114.4	155.4	60.3	33.3	138.9	111.6
Chimanimani	101.5	117.5	69.3	108.7	112.2	144.5	42.7	63.4	14.4	166.7	83.7
Chipinge	87.7	55.5	88.8	114.7	81.5	121.7	19	67.6	30.3	111.1	191.2
Chiredzi	87.7	55.5	88.8	114.7	81.5	79.5	19	67.6	30.3	111.1	151.4
Chirimuhanzu	77.7	80.7	90.2	87.2	96.1	85.3	155.4	58.4	555.6	138.9	71.7
Chitungwiza	137.8	201.8	227.3	141	109	165.4	170.9	99.3	166.7	111.1	151.4
Chivi	68	93.1	270.6	89.3	106	78	170.9	81.5	17.4	83.3	63.7
Gokwe North	154.9	72.9	67.6	128.2	88.8	49.3	85.5	70.1	333.3	83.3	67.7
Gokwe South	100	93.1	138.6	114.4	77.7	54.5	85.5	672	277.8	55.6	143.4
Goromonzi	85.2	50.7	90.2	95.3	84.7	132.5	57	68.6	45	83.3	91.6
Guruve	95.5	93.1	138.6	91.3	77.5	93	170.9	84.9	27.3	27.8	79.7
Gutu	80.1	80.7	189.4	92.5	102.6	97.2	170.9	57.1	25.6	166.7	119.5
Gwanda	87.1	86.5	160.1	91.9	88.3	95.2	170.9	68.3	26.5	83.3	119.5
Gweru	83.5	201.8	173.5	92.2	94.9	165.2	170.9	62.2	111.1	138.9	187.3
Harare	85.3	302.7	166.5	92.1	91.5	165.4	170.9	65.1	119	194.4	147.4
Hurungwe	75.4	67.3	73.8	91.3	97.1	86.3	170.9	129.6	37	111.1	111.6
Hwange	80	110.1	102.3	91.7	94.2	125.8	170.9	86.6	56.5	111.1	135.5
Hwedza	52.4	60.5	75.8	81.9	93.6	110.6	170.9	52.5	32.1	55.6	55.8
Inziza	87.6	24.5	107.2	94.7	100.9	100.7	85.5	105.4	555.6	111.1	47.8
Kadoma	65.5	63.7	88.8	87.8	97.1	105.6	114	70.1	60.6	83.3	91.6
Kariba	75	35.3	97.1	91.1	99	103.1	97.7	84.2	109.3	83.3	63.7
Kwekwe	75	134.5	97.1	91.1	99	163.6	97.7	84.2	109.3	111.1	183.3
Lupane	77.5	101.7	73.8	89.2	114.5	37.9	34.2	124.1	24.5	55.6	43.8
Makonde	96.9	134.5	258.3	121.4	100.5	80.3	34.2	49.9	29.8	83.3	135.5

	ID01	ID02	ID03	ID04	ID05	ID06	ID07	ID08	ID09	ID10	ID11
Makoni	67.3	281.5	94.7	86.9	96.6	110.1	34.2	80.4	38.8	166.7	191.2
Mangwe	114.8	100.1	55.7	121.8	191.4	95.9	57	99.9	416.7	83.3	47.8
Marondera	84.9	147.6	70.1	101.4	128.4	103	42.7	89.1	70.9	83.3	83.7
Masvingo	97.6	134.5	62.1	110.7	153.7	164.4	48.8	94.2	121.2	138.9	179.3
Matobo	83.1	40.4	66.8	94.8	133.3	85.8	170.9	106.5	555.6	138.9	47.8
Mazowe	80.9	52.6	65.3	115.4	76.7	138.2	42.7	69.2	20.6	111.1	127.5
Mberengwa	73.8	73.8	81.2	84.7	84	69.7	85.5	95.7	50.5	166.7	123.5
Mount Darwin	87.3	78.1	83.6	94.3	91.7	103.5	42.7	71.1	20.1	55.6	83.7
Mudzi	51.2	40.2	63.1	81.4	80	84.1	85.5	84	31.4	27.8	83.7
Murehwa	66.6	75.7	59.8	79.5	85.1	100.2	170.9	45	35.5	55.6	103.6
Mutare	57.9	302.7	61.4	80.4	82.5	164.6	114	58.6	111.1	194.4	159.4
Mutasa	131.7	91	69.3	104.3	73.6	149.8	155.4	51.5	25.6	166.7	179.3
Mutoko	70.7	100.9	56.8	90.3	87.9	94	57	68.8	20.3	138.9	87.6
Mwenezi	114.1	100.9	157.8	103.8	84.3	69	170.9	62	75.8	55.6	79.7
Nkayi	100.1	93.1	75.8	84.1	99.7	33.9	42.7	88.9	22.8	83.3	47.8
Nyanga	170.6	37.7	66.1	131	111.1	119.5	24.4	52.1	46.3	138.9	95.6
Rushinga	82.7	208.7	72.8	106.4	95.4	83.8	17.1	33.6	9.3	55.6	39.8
Seke	56.6	116.4	59.8	88.7	101.4	122.5	170.9	65	36.2	55.6	59.8
Shamva	84.8	55.3	56.8	88.1	66.4	121.2	170.9	49.6	15	55.6	59.8
Shurugwi	67.9	75	58.3	88.4	80.3	122.5	170.9	56.3	21.2	83.3	107.6
Tsholotsho	77.5	67.3	54.1	81.7	110.2	59.8	42.7	84.7	42.7	83.3	67.7
Umguza	107.8	100.9	86.1	126.8	120.9	89.7	85.5	80.6	42.7	27.8	79.7
UMP	85	75.7	68.5	88.7	95.3	87.4	155.4	70.3	32.1	27.8	71.7
Umzingwane	84.7	74.3	82.3	95.9	124.7	116.1	85.5	921.7	416.7	27.8	59.8
Zaka	67.1	41.7	153.6	92.3	87.1	45.5	21.4	61.6	22.8	55.6	87.6
Zvimba	64	27.5	71	99.1	78.2	118	170.9	68.8	32.7	194.4	139.4
Zvishavane	65.5	33.2	97.1	95.6	82.4	81.8	38	65	26.9	83.3	99.6

APPENDIX F7: Composite indices for 1992 and 2002 health data

	Composite indices for 1992 data	Composite indices for 2002 data
Beitbridge	73.8	81.0
Bikita	109.9	77.9
Bindura	60.1	78.9
Binga	86.8	68.8
Bubi	66.0	57.0
Buhera	108.0	81.2
Bulawayo	83.8	171.1
Bulilima	105.7	99.0
Centenary	55.0	63.1
Chegutu	68.0	88.4
Chikomba	74.3	83.1
Chimanimani	91.6	86.8
Chipinge	83.8	85.2
Chiredzi	69.6	80.3
Chirimuhanzu	101.5	101.9
Chitungwiza	43.6	142.2
Chivi	125.0	81.3
Gokwe North	92.1	93.8
Gokwe South	93.7	120.1
Goromonzi	70.0	80.0
Guruve	68.1	73.4
Gutu	109.5	90.4
Gwanda	90.3	84.0
Gweru	111.2	119.6
Harare	89.5	125.8
Hurungwe	80.1	85.2
Hwange	78.5	96.5
Hwedza	84.5	65.8
Inziza	105.1	96.7
Kadoma	80.2	81.7
Kariba	55.3	82.3
Kwekwe	102.1	109.5
Lupane	82.6	69.8

	Composite indices for 1992 data	Composite indices for 2002 data
Makonde	71.5	94.8
Makoni	103.0	104.1
Mangwe	103.5	114.9
Marondera	68.3	96.3
Masvingo	115.3	123.3
Matobo	88.4	102.3
Mazowe	81.8	76.9
Mberengwa	102.7	86.0
Mount Darwin	79.6	73.1
Mudzi	67.3	59.8
Murehwa	86.4	68.8
Mutare	106.1	106.1
Mutasa	64.6	89.0
Mutoko	96.8	75.4
Mwenezi	109.2	86.4
Nkayi	115.4	68.8
Nyanga	75.3	88.8
Rushinga	66.4	63.6
Seke	62.3	73.6
Shamva	58.7	59.2
Shurugwi	82.3	70.8
Tsholotsho	96.1	73.8
Umguza	79.7	82.4
UMP	82.9	67.7
Umzingwane	90.7	117.4
Zaka	79.9	65.4
Zvimba	80.3	77.0
Zvishavane	69.2	68.6