

**ASSESSMENT OF INJECTION DEVICE SECURITY FOR THERAPEUTIC
SERVICES AT HEALTH CARE FACILITIES IN THE MPIGI DISTRICT OF
UGANDA**

by

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DECLARATION

I declare that **ASSESSMENT OF INJECTION DEVICE SECURITY FOR THERAPEUTIC SERVICES AT HEALTH CARE FACILITIES IN THE MPIGI DISTRICT OF UGANDA** is my own work and that all the sources that I have used or quoted have been indicated and acknowledged by means of complete references.

.....
SIGNATURE
(MR S BALYEJJUSA)

.....
DATE

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I am grateful to God for giving me the wisdom, knowledge and strength to complete this study.

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ABSTRACT

Unsafe and unnecessary injections are administered in many developing and transitional countries. Injection device security is recommended in order to improve injection safety. Injection device stock depletions have been reported to contribute to unsafe injection practices. Poor distribution of health products has been reported in many parts of Uganda including Mpigi district. As a way of improving injection safety, this study explored the challenges encountered in maintaining an effective distribution system.

A Cross-sectional, descriptive study of public and private-not-for-profit health care units in Mpigi district was conducted. 38 health care facilities were selected by stratified disproportionate sampling. Data on device security, the use of equipment and the distribution system were collected and analysed using descriptive statistics.

KEY CONCEPTS

Injection device security, distribution system, stock depletion, health care facility, therapeutic services, injection safety

DEDICATION

This study is dedicated to my parents whose values of hard work and humility will always be an inspiration

To my friends for their understanding and forbearance while I engaged in this study

Above all to GOD who opened the life gate for all sinners to be saved through Jesus Christ his Son

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List of abbreviations

AACN	American Association of Critical Care Nurses
AED	Academic Educational Development
CDC	Centre for Disease Control and Prevention
HBV	Hepatitis B Virus
HBC	Hepatitis C Virus
HC	Health Care Centre
HIV	Human Immunodeficiency Virus
JSI	Johns Snow Incorporated
LC	Municipality councils
LCV	District Council
MMIS	Making Medical Injections Safer Project
NGO	Non-government organization
PATH	Program for Appropriate Technology in Health
PEPFAR	President's Emergency Plan for AIDS Relief
PHC	Primary Health Care
SPSS	Statistical Package for Social Sciences
UN	United Nations
UNFPA	United Nations Population Fund
UNICEF	United Nations Children's Fund
USA	United States of America
UNISTAF	Uganda National Injection Safety Task Force
USAID	United States Agency for International Development
WHO	World Health organization

List of annexures

- Annexure A Permission form the Research and Ethics Committee of the Makerere University Medical School, Kampala, Uganda
- Annexure B Permission from the University of South Africa, Health Studies, Research and Ethics Committee
- Annexure C Permission requested and granted by the District Health Officer of the Mpigi district
- Annexure D Data collection instruments

CHAPTER 1

Orientation to the study

1.1 INTRODUCTION

The World Health Organization (WHO 2003a:1) recommends that injection device security is ensured in all health care facilities, including those delivering therapeutic services. Ensuring injection device security implies appropriate forecasting, financing, procurement and supply management so that injectable products, appropriate single dose diluents, single use injection devices for injection and reconstitution, and safety boxes are supplied in a timely manner in adequate quantities (WHO 2003a:1).

The application and success of this policy depends on a reliable distribution system for health care products (WHO 2003a:1). In Uganda, the distribution system for injectable medicines, syringes and safety boxes for the discarding of contaminated needles and syringes is disjointed. Injectable medicines are often singularly delivered to health care facilities without matching quantities of syringes and diluents. The poor distribution mechanisms combined with poor forecasting of requirements by managers of health care facilities hinder the realisation of injection device security in the districts (Ministry of Health of Uganda 2004:3).

This study assessed the level of injection device security for therapeutic services at health care facilities in the Mpigi district, in the light of the existing distribution system. Challenges in the distribution system for injection devices were investigated and recommendations made for the achievement of injection device security both in the district in which this study was conducted as well as beyond.

1.2 BACKGROUND TO THE STUDY

Providing medicines by means of injections is the most common health care procedure applied worldwide. According to Hutin, Hauri and Armstrong (2003:1075), in developing and transitional countries, some 16 thousand million injections are administered each

year. In addition, more than 90% of injections are given for therapeutic purposes while 5 to 10% are given for preventive purposes, including immunisation and family planning. According to Hutin et al (2003:1075), the majority of therapeutic injections in developing and transitional countries are often unnecessary and unsafe. In 2000, such unsafe injections were believed to have contributed to 30%, 41% and 5% of new infections of Hepatitis B Virus (HBV), Hepatitis C Virus (HCV) and Human Immunodeficiency Virus (HIV), respectively (WHO 2003a:1).

1.2.1 Injection safety

A safe injection is one that does not harm the recipient, does not expose the provider to any avoidable risks, and does not result in waste that is dangerous for the community (WHO 2000:1). Injection safety ensures that the existence of conditions required to provide safe injections and adherence to safe practices. Reliable and adequate supplies of single-use syringes, disposable reconstitution syringes, and the discarding of used material in approved safety boxes are necessary to ensure injection safety (WHO 2003a:1). It is the policy of the WHO that injectable medicine orders be “bundled” with the corresponding numbers of auto-disable syringes and the safety boxes used for their disposal so that contaminated needles and syringes and other sharps are not used again (WHO 2003a:1). To ensure effective and safe use of needles and syringes, an efficient stock management and distribution system needs to be developed so that injection safety equipment is continuously and sufficiently available in all health care facilities.

1.2.2 Uganda

1.2.2.1 Topography

Uganda is a landlocked country in east central Africa (see figure 1.1). It is bordered on the north by Sudan, on the east by Kenya, on the south by Tanzania and Rwanda, and on the west by the Democratic Republic of Congo. From being a British protectorate, Uganda gained independence in 1962, and became a fully independent member of the Commonwealth of Nations on October 6, 1962, and a republic in 1967. Uganda has an area of 241,038 sq km (93,065 sq mi), and the capital is Kampala.



Figure 1.1 Map of Uganda

(Gorta 2007)

The land surface in Uganda is diversified. About 85% of the country is an elevated plateau, draining into the centre to form Lake Kyoga. The main lowlands are located in the Rift Valley, which runs down the western side of Uganda, and contains Lakes Edward and Albert. In the west are the Ruwenzori Mountains on the southwest border with the Democratic Republic of the Congo. Uganda's highest mountain, Mount Rwenzori, with two peaks – Margherita Peak at 5,109 m (16,762 ft) and Mount Alexander at 5,105 m (16,750 ft) – is located there. There are also highlands on the eastern border with Kenya. The remainder of the country, about 5% of the area, comprises land at between 1,500 m and 2,000 m (4,900-6,560 ft), inland of Lake Victoria, containing some of the most heavily populated areas. Much of the south is forested, and most of the north is covered with savannah. Almost 20% of the area of Uganda is open water. The country includes Lakes George and Kyoga, and parts of Lakes Victoria, Edward, and Albert. These lakes and most of Uganda's rivers form parts of the basin of the upper River Nile, which leaves Lake Victoria and flows to Nimule on the Sudan frontier.

Despite being a tropical country lying along the equator, Uganda normally has a mild, equable climate, mainly because of its relatively high altitude. The temperature ranges from about 15.6° to 29.4° C (60° to 85° F). There are two distinct rainy seasons: March

to May, and September to November. The mean annual rainfall varies from some 760 mm (30 in) in the northeast to about 1,520 mm (60 in) near Lake Victoria.

Uganda's most important natural resource is its rich soil, which provides the basis for the diverse agricultural economy of the country. In addition, Uganda has exploitable deposits of gold, copper, cobalt, tin and tungsten, and rich fish resources in the lakes. Virtually all the country's power is produced by hydroelectricity, the plant on the Victoria Nile being of major importance.

Uganda has a wide variety of plant life, from the *mvuli* tree and elephant grass of the Uganda plateau to the dry thorn scrub, acacia, and euphorbia of the southwest. The country also provides a habitat for many animals, some of which are protected in national parks. The chimpanzee inhabits the rainforests, and some elephant, eland, and hartebeest, as well as lion and leopard, are found in the grasslands. Many wild animals were slaughtered during the Amin regime, but numbers are returning to former levels.

Despite its ideal climate, rich fauna and flora and potential for agriculture, Uganda is among the poorest African nations. Access to safe drinking water and sanitation services is limited, and cases of cholera have increased in recent years. The average life expectancy in Uganda is among the lowest in the world. Uganda's extreme poverty has led to significant damage to the country's environment. Civil unrest in the country during the 1970s and 1980s resulted in poor land conservation practices and rampant poaching. Since the mid-1980s, the political situation in Uganda has improved and poaching has been curbed. Soil erosion, overgrazing, and desertification continue. In order to provide more land for agricultural use, many forests have been cleared and wetlands drained. Of Uganda's forestland, 0.9 per cent (1990-1996) is destroyed each year, in part because 89 per cent (1995) of the country's energy requirements are met by burning wood.

Uganda is situated in an area of rich biodiversity, incorporating four vegetation regions. The country provides habitat for 992 bird species and 338 mammal species. About 9.6 per cent (1997) of the country's land is protected in parks or reserves. Uganda has ratified international agreements intended to protect biodiversity, endangered species, marine life, wetlands, and the ozone layer. The country has also signed treaties limiting

nuclear testing, chemical and biological weapons, and trade involving endangered animal species.

Almost all the inhabitants of Uganda are Black Africans. The official language is English; Swahili, Luganda and Luo are also spoken. About 70% of the people speak an indigenous language; they live in the southern half of the country and include the Baganda, Basoga, Banyoro, Nkole, and Toro ethnic groups. Most of the remaining people speak a Nilotic language; they live in the north and east, and include the Acholi, Lango, and Karamojong ethnic groups. In the late 1960s, Uganda also had a sizeable Asian population (741,000 of Indian and Pakistani origin in 1969). Idi Amin's expulsion of non-citizen Asians in 1972 led to all but about 4,000 leaving the country. Many returned during the 1990s.

Uganda has a population of 30,262,610 (2007 estimate). The country has an average population density of about 152 people per sq km (392 per sq mi). About 12 per cent of the population is urbanized. Average life expectancy in 2007 was about 50.8 years for men and 52.7 years for women.

Uganda is divided into ten provinces, which are subdivided into 80 districts and 154 counties. The counties are divided into sub-counties, which form the basic administrative units.

Health care services in Uganda were severely depleted by war and are currently being restored, as AIDS is a growing problem. A national programme to raise public awareness was set up. In 2004 there were 21,277 people per doctor and the infant mortality rate was 67 deaths per 1,000 live births in 2007. In 1990, 3.4 per cent of the country's GDP was spent on health care (Ministry of Health of Uganda 2002:1).

A mix of public and private providers provides health care services in Uganda (IHSD 2000:1). The public sector plays a key role. With decentralisation the districts have taken on responsibility for delivering district health care services, receiving grants from the Ministry of Health. The role of the Ministry of Health is now focused on providing technical support, supervision and monitoring, setting norms and standards, mobilising resources and donor coordination. Health services collapsed during the political unrest of the 1970s and for most of the 1980s. Since 1986, the political stability and economic

growth have led to significant improvements in the socio-economic status of the country and to the health care sector in particular (Ministry of Health of Uganda 2002:1). The 1993 Health Policy clearly sets out consolidation and rehabilitation as the main strategies (IHSD 2000:3).

1.2.2.2 The Mpigi district

This study was conducted in the Mpigi district of Uganda. Figure 1.2 provides a map of Uganda's 80 districts and indicates the location of Mpigi District (in red).

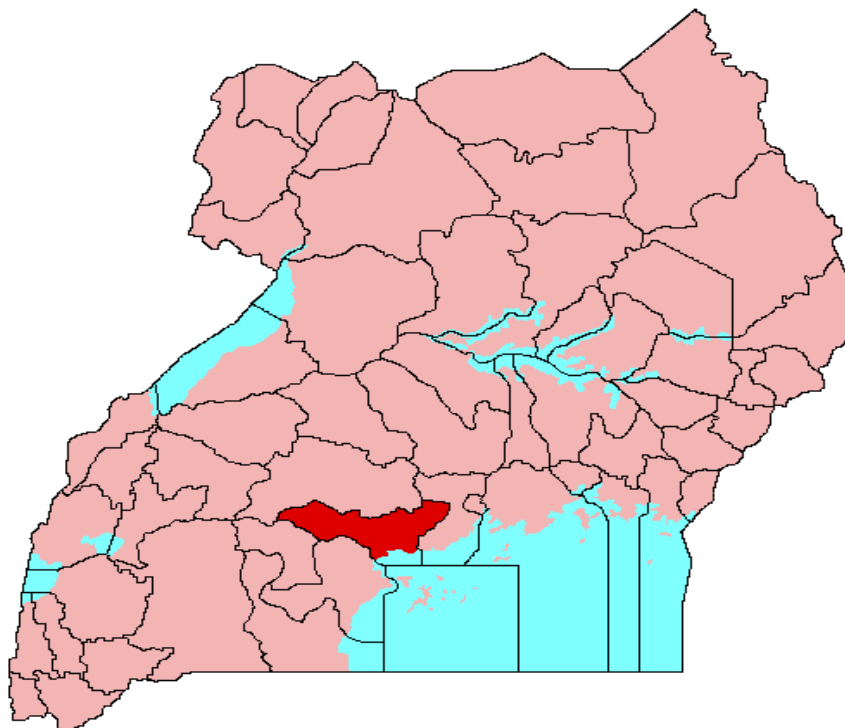


Figure 1.2 Map of Uganda showing the location of the Mpigi District

(Wikipedia 2006)

The Mpigi district is one of the 80 districts in Uganda. It borders the districts of Mubende in the North, Wakiso in the East, Kalangala and Masaka in the South and Sembabule in the West. The Mpigi district has over 414 757 people, 206 012 of whom are females and 208 745 are males. The major economic activity in the district is agriculture with food crops like sweet potatoes, beans, cassava, maize, bananas and groundnuts. Cash crops include coffee and cotton. Fruits and vegetables like tomatoes, onions and cabbage are grown in the district (Uganda Travel Guide 2007). The district is politically

divided into four sub-counties. The counties form the four sub districts of Butambala, Gomba, Mawokota South and Mawokota North, which provide health care. The health care system is aligned to the administrative structure (see table 1.1).

In the administrative structure, a district council (LC V) oversees the administrative functions of the district (UN Department of Economic and Social Affairs 2004:7). Aligned with this level is a district hospital at level V of the health care system. This is the highest level of the health care system in the district. Medical superintendents, who are medical officers and may be assisted by a number of medical officers, nurses, clinical officers and midwives, head the district hospitals. A district is subdivided into counties and municipalities or towns, depending on their size and other criteria set by the Ministry of Local Government. The administrative structure at the county, municipality or town level is the local council referred to as LC IV. Aligned with this level is a health care centre IV (HC IV), which forms the headquarters of a health care sub district. The HC IV supervises the operations of the lower level health care units, which belong to that county. A medical officer manages the health care facility at this level. It offers theatre services, maternity services, laboratory services, and inpatient and outpatient services. Every county, municipality or town is further subdivided into sub-counties or divisions, respectively, forming the lowest level local governments (LC III). At the sub-county level or division we find the healthcare facility level III (HC III) managed by a clinical officer. The HC III offers maternity, laboratory, and inpatient and outpatient services, but has no theatre or doctor. The sub-counties, and divisions are further subdivided into parishes and wards (LC II), respectively, which are. Aligned with the parishes and wards are the health care centres at level II (HC II). An enrolled nurse or midwife manages the HC IIs. This is the lowest level health care facility and it offers primary health care services. It offers no maternity, theatre, laboratory or inpatient services. The parishes and wards are further subdivided into villages (LC I), which are the lowest administrative units. The LC 1 level forms the village health teams, a team of local residents appointed to oversee the performance of the HC IIs in their community.

The LCV, some LCIV (municipality councils), and LC III are local governments, while the LC II and LC I are administrative units. Local governments in Uganda have legislative, financial and administrative powers. However, the administrative units largely have administrative roles.

Table 1.1 The Mpigi district health system structure

Administrative structure		
Description	Local council level	Corresponding health care structure
Parish	II	Health care centre II
Sub county	III	Health care centre III
County (sub-district)	IV	Health care centre IV
District	V	District/General hospital

Source: Ministry of Health of Uganda (2002:2)

There are 34 health care centres classified as Level II's (of which six are non-government organizations [NGOs]), 24 health care centre Level III's (of which eight are NGOs), and two government health care centre Level IV's. The district also has a government hospital in the town of Gombe with 104 beds and the Nkozi Hospital, an NGO with 90 beds.

1.2.3 Injection safety in Uganda

Studies in Uganda by Priotto, Ruiz and Kyobutungi (2003:54) and others found that there is a high rate of injection use and the proportion of infections caused by unsafe injections is believed to be high. A national cross-sectional survey of injection safety practices in health care facilities was conducted under the auspices of the Uganda National Injection Safety Task Force (UNISTAF) from June to July, 2003. The study indicated that one of the most prominent factors contributing to unsafe injection practices was the inadequate supply of injection materials, leading to the reuse of injection supplies without sterilisation. The majority (65%) of the surveyed facilities reported having experienced a shortage of disposable injection supplies in the twelve months prior to the survey. This was a serious issue, particularly in the therapeutic sector (Ministry of Health of Uganda 2004:3). Subsequent to the study, the Making Medical Injections Safer Project (MMIS) was formed to assist the Ministry of Health of Uganda to establish an environment where patients, health care workers, and communities are better protected from the medical transmission of HIV and other blood-borne pathogens (MMIS 2005:1).

1.2.4 Making medical injections safer

In 2004, as part of the United States of America's (USA) President's Emergency Plan for AIDS Relief (PEPFAR) focusing on countries with high HIV prevalence, John Snow Incorporated (JSI) and its subcontractors, Program for Appropriate Technology in Health (PATH), Academy for Educational Development (AED), and the Manoff Group, were awarded funds through the Centres for Disease Control and Prevention (CDC) and the United States Agency for International Development (USAID) to implement "Rapid Interventions to Decrease Unsafe Injections" in eleven countries. The project is commonly known as Making Medical Injections Safer (MMIS) (JSI 2005:1).

In Uganda, the MMIS project works with the Ministry of Health's logistics staff to strengthen the capacity of districts to effectively manage the selection, procurement and distribution of safe injection technologies as appropriate. Among other strategies, the project provides safe injection equipment and safety boxes for the discarding of medical contaminated waste to its project districts, of which the Mpigi district forms part. In general, the project is guided by the WHO's three-pronged approach to the implementation of injection safety in health care facilities (MMIS 2007:1).

1.2.5 WHO strategy for safe and appropriate use of injections

To prevent injection-associated transmission of blood-borne pathogens, injection frequency should be reduced and safe injection practices carried out on a regular basis. The WHO recommends a multidisciplinary three-pronged approach to reach these goals (WHO 2000:1):

- Provision of sufficient quantities of injection equipment and infection control supplies.
- Effective sharps waste management.
- Behaviour change among patients and health care workers to reduce injection overuse and implement safe practices.

1.2.6 Injection device distribution system in Uganda

The majority of medicines and equipment for government health care units are obtained from the National Medical Stores, an autonomous government agency charged with the procurement, storage and distribution of essential drugs and supplies to the public sector. The main source of funding for drugs is the money allocated by the central government to the districts for primary health care (PHC) activities. The missionary health care units source their drugs and supplies for the provision of health care from the Joint Medical Stores. When drugs and equipment are out of stock from the National Medical Stores, then public health care facilities are allowed to source from elsewhere.

The Ministry of Health of Uganda, through the National Medical Stores, supplies public health care facilities with syringes, injectable medicines and diluents through a pull system in which the respective unit managers in the various health care services order for their requirements. The National Medical Store also supplies MMIS project districts with single-use syringes and safety boxes for discarding contaminated waste such as used syringes and needles for the curative services on behalf of the project. All these items are delivered to district stores pre-packed according to the requisitions made by each health care unit. It is the responsibility of the respective district managers in health care services to arrange for transportation of these commodities from the district stores to the respective health care units. Distribution of commodities to districts by the National Medical Stores is intended to be carried out once every two months, but this is often not the case. Delays in delivering supplies from the district stores to the health units are common because of lack of functional vehicles, fuel or impassable roads to the rural health care units (MMIS. 2007:3). Delays in submitting requisitions for re-supply, incorrect forecasting and poor record-keeping at health care units often result in stock depletions at health care units. In spite of the availability of adequate quantities of injection devices at National Medical Stores, supervisory visits continue to show stock depletions at health care units, indicating a weakness in the distribution system (MMIS 2004:2).

This study was designed to assess injection device security at health care units in the study district in the light of its distribution system. The researcher wished to investigate and identify bottlenecks in the distribution system in the Mpigi District and make

recommendations for strategies for improvement to the managers of health care facilities for the enhancement of injection device security in Uganda.

1.3 RESEARCH PROBLEM

In 2004, the MMIS project was introduced with the main objective of assisting the Ministry of Health of Uganda to improve the injection safety and the management of contaminated health care waste (MMIS 2004:4). The pilot phase of the project was implemented in four districts, including the Mpigi district. One of the strategies employed by the project was to improve the logistics system to ensure full supply of injection commodities (MMIS 2004:5). Although the project has procured and freely distributed injection devices to districts through the National Medical Stores, stock depletions at health care units continue to be reported (MMIS 2005:31). In addition, injectable medicines are delivered to districts by National Medical Stores without matching quantities of diluents, syringes and safety boxes to discard contaminated waste such as needles and syringes (MMIS 2005:34). Safety boxes for use in the curative services are scarce and are only regularly availed by the MMIS project to its project districts. The National Medical Stores do not routinely supply safety boxes, yet they continue to supply syringes and needles to the MMIS project districts.

The National Medical Stores do not always deliver commodities to districts according to schedule. In addition, delays in delivery of commodities from the district stores to the health care units are also common. District staff often cite the lack of vehicles or breakdown of vehicles, lack of fuel or poor geographical terrain as factors that hamper timely delivery of supplies to the respective health care units. Although the MMIS project has contributed to the improvement of injection devices' availability at health care units by providing free syringes and safety boxes for discarding of used and contaminated medical waste, delays in submitting orders, incorrect forecasting, poor communication infrastructure and improper record-keeping regularly result in stock depletions at health care units (Mutungi 2007:4).

The poor distribution system within the districts and disjointed distribution system of the National Medical Stores create an environment in which injection device security cannot be ensured at all the health care units in the districts.

1.3.1 Research questions

The existence of a poor distribution system for injection devices raises the following research questions:

- What is the extent of the inadequacy of quantities of injectable medicines, diluents, single use injection devices and safety boxes supplied for therapeutic purposes at the health care facilities in the Mpigi district of Uganda?
- What are the factors that lead to stock depletion of injection devices at health care facilities in the Mpigi district?

1.3.2 Purpose and objectives of the study

The overall purpose of this study was to identify the challenges encountered in maintaining an effective distribution of injection devices to the Mpigi district. Based on the research findings, recommendations would be made for the improvement of the distribution system and for the enhancement of the levels of injection safety in Uganda.

The specific objectives were to:

- Determine whether health care facilities in the Mpigi district have sufficient quantities of injectable medicines, diluents, single use injection devices and safety boxes for therapeutic purposes.
- Investigate and identify the factors that lead to stock depletion of injection devices at health care facilities in the Mpigi district.

1.4 ASSUMPTIONS UNDERLYING THE STUDY

The following assumptions guided the study:

- Injection materials are not available in sufficient quantities at all health care facilities in the Mpigi district, thereby affecting the safety of injections negatively.
- There is a poor distribution system for injection materials in the study district, leading to frequent stock depletions of these materials at health care units.

1.5 SIGNIFICANCE OF THE PROBLEM

Safe injections have been known to save lives, but to achieve injection safety injection device security has to be ensured at health care facilities. According to the WHO (2003a:1), an effectively functioning distribution system is necessary to ensure injection device security. The MMIS has been working with the Ministry of Health of Uganda to implement injection safety interventions in selected districts through the supply of injection commodities. However, midterm evaluation of the project showed that there were a number of health care units reporting stock depletion of injection commodities due to delays in distribution of these commodities to user units (Mutungi 2007:4). When injection devices are not adequate, health care workers may be forced to improvise through unsafe practices like reusing syringes, using non-recommended diluents or improper disposal of used sharps, including used needles and syringes for injection, posing a risk to the health care workers, the patients and the community. Although stock depletions at health care facilities had been reported, the reasons for their occurrence had not been adequately studied. This study therefore investigated the challenges faced by district and health care unit managers in sustaining a good distribution system for injection devices. The study would make recommendations for improvements in the distribution system of health care commodities. Based on the findings of the study, managers at health care facilities in the Mpigi district and other districts in the country should be able to plan for an efficiently functioning distribution system and also make recommendations to the Ministry of Health of Uganda for the improvement of the distribution system of injection devices in the country.

1.6 DEMARCATION OF STUDY FIELD

Health care units in the Mpigi district in Uganda were sampled for inclusion in this study. The selected health care units in this district were of different levels of service, ranging from hospitals to health care centres. Health care units included in the study were either public or private not-for-profit NGO's. The participants in the study included the persons in charge of sub-districts' health care provision, storekeepers in health care facilities, persons in charge of health care units, injection providers and patients who had visited the selected health care units at the time of data collection. The study focused on the distribution and use of injectable medicines, diluents, syringes and safety boxes used

for the discarding of contaminated needles and syringes in the therapeutic services in the Mpigi district at the selected health care units.

1.7 CONCEPTUAL FRAMEWORK OF THE STUDY

The study focused on the assessment of injection device security and challenges to its achievement at health care facilities in the Mpigi district. Injection device security ensures safety of injections and therefore reduces the risk of medical transmission of blood borne diseases to patients through unsafe injections. In order to achieve injection device security, an efficiently functioning distribution system of injection materials must be in place.

To conceptualise injection device security, the Synergy Model (Kerfoot 2002:1) provides a viable model for managers who work in health care facilities to use as a basis for a professional practice. The core concept of the Synergy Model as described by the American Association of Critical care Nurses (AACN 2006:1) is that the needs of patients and families influence and drive the characteristics or competencies of a health care worker. The synergy results when the needs and characteristics of a patient, clinical unit or system are matched with a health care worker's competencies. The Synergy Model has three levels of outcomes of health care, derived from the following (Kerfoot 2002:1):

- the patient
- the health care worker
- the health care system

The manager in the health care facility must address all three areas in order to create excellence in patient care. The manager's obligation is to create the environment in which people can provide effective health care.

In this study, the patients' needs were viewed as avoidance of infections acquired through use of unsafe injections. The health care workers' competencies included skills to administer safe injections through the avoidance of re-use of syringes, proper forecasting of required injection commodities and ordering, timely reporting to higher levels and advocacy for timely and adequate supplies of commodities. The managers in

health care facilities then support the synergised care by developing the required infrastructure, providing and maintaining vehicles for delivery of supplies, providing fuel for running the vehicles, developing the communication infrastructure, recruitment and training of staff and supervision.

Kerfoot (2002:2) maintains that the synergy model is an excellent organisational framework to organise the work of the health care worker and the provision of effective and efficient patient care. This model describes the characteristics of the patient, the health care worker and the organisation within which the care is given. It provides a compelling picture of how patient care can be organised to provide a “safe passage” for the patient through the health care system. It also provides a framework for patient assessment, career advancement for the health care worker and the organising and structuring of work between departments (see chapter 2 for full discussion).

1.8 RESEARCH METHODOLOGY

Research methodology is the “application of all steps, strategies and procedures for gathering and analysing data in a research investigation in a logical and systematic way” (Burns & Grove 2001:26). The selection of a research methodology or strategy is the core of a research design and is probably the single most important decision the investigator has to make. The research methodology must include the research design, definition and selection of the population of interest, the definition of variables (characteristics of the individuals in this population), their status and relationships to one another, instruments for data collection and the procedure for data analysis (WHO 2001a:11).

1.8.1 Research design

Mouton (2001:55) defines a research design as “a plan or blue print of how one intends to conduct the research”. According to Burns and Grove (2001:223), the design “guides the researcher in planning and implementing the study in a way that is most likely to achieve the intended goal”.

A quantitative design was used to conduct this study. In this approach, a researcher uses deductive reasoning to generate hunches (hypotheses) that are tested in the real

world. The researcher applies a scientific approach to the study of a question by moving in a systematic fashion from the definition of a problem and the selection of concepts on which to focus, through the design of the study and collection of information, to the solution of the problem (Polit & Hungler 1995:12). The researcher also controls the study by imposing conditions on the research situation so that biases are minimised. Evidence in quantitative research is gathered according to a specified plan, using formal instruments to collect the needed information. The information gathered is quantitative implying that it is in the form of numeric information that can be analysed with statistical procedures (Polit & Hungler 1995:13).

This study gathered quantitative information on injection devices at health care units and the distribution system in the Mpigi district, using structured interviews and observations. The data was analysed, using statistical procedures, and inferences made as to the level of injection device security in the district and the challenges of the distribution system.

A health care facility-based observational, descriptive cross-sectional study was conducted, employing quantitative data collection methods. Scientific observation involves the systematic selection, observation and recording of behaviours, events, and settings relevant to the problem under investigation (Polit & Hungler 1995:364). In this study, selected behaviours and events related to injection commodities and their distribution system were observed and recorded. When a study is not structured formally as an analytical or experimental study, implying that it is not aimed specifically to test a hypothesis, it is called a descriptive study, and belongs to the observational category of studies (WHO 2001a:16). The purpose of descriptive studies is to observe, describe and document aspects of a situation as it naturally occurs, sometimes as a starting point for hypothesis generation or theory development (Polit & Hungler 1995:195-196).

Observations of injection devices and aspects of their distribution system were made, described and documented. Cross-sectional studies entail the collection of data on a cross-section of the population, which may comprise the whole population or a proportion (sample) of it (WHO 2001a:17). They provide a prevalent rate at a particular time (point prevalence) or over a period of time (period prevalence). In this study, data were collected from a sample of health care facilities in Mpigi district and the point

prevalence of injection device security at the facilities was determined during the specific period of data collection.

1.8.2 Population

According to Bryman (2001:85), a population is the “universe of units from which the sample is to be selected”. The study population of this study comprised all government and NGO health care facilities in the Mpigi district. The district has 47 government health care units and 15 NGO health care units.

1.8.3 Sample and sampling procedure

Bryman (2001:85) describes a sample as the “segment of the population that is selected for investigation”. The method of selection may be based on a probability or non-probability approach. A probability sample is one that has been selected using random selection so that each unit in the population has a known chance of being selected (Bryman 2001:85).

Probability sampling was used to select the sample for this study. The sampling unit was the health care facility. Depending on the level of service, the health care units in the Mpigi district are stratified as hospital, health care centre IV, health care centre III and health care centre II.

Based on this stratification of the health care units, stratified random selection was the sampling strategy employed. In stratified random sampling, the population is first divided into two or more strata or subgroups and then a predetermined number of sampling units selected from each subgroup to form the sample. This enhances representativeness of all strata of the sample (Polit & Hungler 1995:286). Since the membership of each stratum of health units was unequal, a disproportionate sampling design was used in order to obtain sufficient numbers of sampling units from each stratum and therefore sharpen the precision and representativeness of the final sample (Polit & Hungler 1995:288).

Due to the small number of hospitals (2) and health centre IVs (2) in the district, all the hospitals and health centre IVs were included in the study. The remainder of the health

units were selected from a list of health care centre IIIs and health care centre IIs by proportionate stratified random sampling.

Storekeepers, persons in charge of health care units, injection providers and patients at the sampled units were selected for interviews. Information on stock levels and stock management was obtained by reviewing stock cards, requisition and issue vouchers and physical counts at the selected facilities. This information was recorded on checklists.

1.8.3.1 Sample size estimation

The Mpigi district has 62 health care units that fall under the inclusion criteria for this study. Assuming simple random sampling, with injection device security achieved at 50% of the health care units, with a level of precision of $\pm 10\%$ and a confidence level of 95%, the sample size is calculated as 38 health care units (Creative Research Systems 2003:1). A total of 38 health units were therefore selected for the study. Random numbers were used to select health units from the list of health care centre IIIs and health care centre IIs. An additional 10% of the sample size units (4) were included in the selected health care units to compensate for possible non-respondents due to failure to reach some units during the data-collection period (Israel 2003:4).

1.8.4 Data-collection Instrument

In quantitative studies, research data are often collected according to a structured plan that indicates what information is to be gathered and how to gather it (Polit & Hungler 1995:310). Structured methods yield data that are relatively easy to quantify and analyse. Structured methods also impart objectivity to the data collected by eliminating bias due to the researcher's personal feelings or beliefs (Polit & Hungler 1995:311).

A structured interview schedule and structured observation of availability of injection commodities and challenges of the distribution system were used for this study. The interview schedule and the checklist for structured observations were developed from those used in similar studies by the WHO (2003c:121), the Ministry of Health of Uganda (2003:87) and the MMIS (2005:4) project in assessment of injection safety. Quick,

Rankin, Laing, and O'Connor's (1997:331) assessment guide was also consulted for the medicine distribution management.

A combination of open-ended and closed questions was used for the structured interview schedule to offset the strengths and weaknesses of each type of question (Polit & Hungler 1995:336). The structured interview schedule and structured observation checklist included questions on the following:

- availability of injection devices
- distribution infrastructure
- delivery schedules
- forecasting and ordering of injection devices
- record keeping and reporting
- communication
- use of injection devices

1.8.4.1 Reliability of the research instruments

Reliability refers to the degree of consistency or accuracy with which an instrument measures an attribute (Polit & Hungler 1995:433). Aspects of the concept of reliability that were important in this study were internal consistency and equivalence. An instrument is said to be internally consistent to the extent that all its subparts measure the same characteristic (Polit & Hungler 1995:415).

To assure reliability in this study, an effort was made to include only questions and observations that were relevant to the subject of investigation in order to enhance the reliability of the instrument.

Equivalence refers to the extent to which two different observers using the same instrument yield equivalent measurements of the same traits in the same people (Polit & Hungler 1995:416). Since observational methods were used in this study, there was a risk of observer error or bias. Careful training, development of clearly defined and non-overlapping categories and the use of a small number of categories enhanced the accuracy of observer ratings and classifications.

1.8.4.2 Validity of the research instruments

Validity refers to “the ability of an instrument to measure exactly what it is supposed to measure” (De Vos, Strydom, Fouche & Delpont 2002:167). Content validity, which is concerned with the sampling adequacy of the items for the construct that is being measured, was enhanced by using questions from various instruments that had been used in other similar studies. The instruments were also subjected to evaluation and approval by the study supervisors. A combination of observations and interviews was used to check the accuracy of responses from interviewees and therefore minimise bias (Brink & Wood 1998:299).

1.8.5 Data analysis

Data analysis entails the breakdown of data into constituent parts to obtain answers to research questions and to test research hypotheses (De Vos et al 2002:223). The Statistical Package for Social Sciences (SPSS 12) computer program, version 12, was used for data analysis. Descriptive statistics were used to analyse and interpret the data. These methods were used because this was a descriptive study that wished to describe the availability of commodities and challenges in their distribution at the respective health facilities. The proportion of health facilities where injection device security had been achieved was also determined.

1.8.6 Pre-testing of the research instrument

In a pilot study or pre-test, the research instruments are pre-tested on a small number of respondents who are comparable to the sample of correspondents but are not part of it (WHO 2001a:178). This ensures that errors of whatever nature can be rectified immediately at little cost. The instrument is then presented to the full sample after the necessary modifications (De Vos et al 2002:177).

The research instrument in this study was pre-tested on five health facilities in Mpigi district. Actual data were collected during the pre-testing and analysed carefully to ascertain whether or not they answered the research questions. The results of the pre-testing were used to refine the research instruments before use in the major study. Pre-

test facilities were excluded from the actual study and these results were not included in the statistics of the actual study.

1.9 DEFINITIONS OF TERMS

For the purposes of this study, the following terms were used as defined below: distribution system, health care facility, injection device security, stock depletion, and therapeutic services.

- **Distribution system**

Quick et al (1997:332) define a distribution system as a “system of administrative procedures, transport facilities, storage facilities, and user facilities through which supplies move from a central point to the user facilities”.

In this study, the distribution system referred to factors that enabled timely movement of sufficient quantities of injection commodities from the district store to the lower level health care units so that they could be accessible when required in the Mpigi district of Uganda.

- **Health care facility**

According to Hornby (2000:551), a health care facility refers to “a building where a group of doctors see their patients and where some local medical services have their offices”.

In this study, a health care facility referred to a building or group of buildings in the Mpigi district of Uganda where individuals seek preventative and curative health care services. These facilities included health care centres II and III and referral facilities, namely health centre IVs and hospitals in the Mpigi district.

- **Injection device security**

The WHO (2003a:1) defines injection device security as appropriate forecasting, financing, procurement and supply management so that injectable products, appropriate

single dose diluents, single use injection devices and safety boxes are available in adequate quantities.

In this study injection device security denoted the availability of adequate quantities of injectable medicines, diluents, single use injection devices and safety boxes for the discarding of contaminated needles and syringes at health care facilities in the Mpigi district at the time of the researcher's and/or research assistants' visit.

- **Stock depletion**

Quick et al (1997:333) define stock depletion as the complete absence of an item that is normally expected to be on hand.

In this study stock depletion referred to complete absence of any of the following respective items: injection medicines, diluents, single use syringes and needles and safety boxes for discarding contaminated needles and syringes at health care facilities in the Mpigi district.

- **Therapeutic services**

The word "therapeutic" refers to something "designed to help treat an illness" (Hornby 2000:1241), while the word "service" is defined as "a system that provides something that the public needs, organised by the government or a private company" (Hornby 2000:1075).

In this study therapeutic services referred to services provided at health care facilities to diagnose and/or treat diseases but excluded immunisation services and family planning services in the Mpigi district.

1.10 ETHICAL CONSIDERATIONS

Permission to conduct the study was sought from the Research and Ethics Committee of Makerere University Medical School, Kampala, Uganda, and the Ethics and Research Committee of the University of South Africa. In addition, permission to visit

the respective health units was sought from the District Health Officer of the Mpigi district.

The study was non-invasive, involving observation of participants and interviewing them. Written informed consent to participate in the interview was sought from the participants who were assured of anonymity and confidentiality. The benefits of the study were explained to all participants using a consent letter prior to their participation (Mouton 2001:239-247). See Annexures A, B and C for copies of permissions and introductory letter to participants. The ethical considerations followed in this study are discussed in chapter 3.

1.11 LIMITATIONS OF THE STUDY

Although measures were taken to minimise errors through the use of structured instruments and the training of data collectors, the data obtained was vulnerable to possible distortion and bias by the interviewer, interviewee and the observers. Unknown events happening during data collection might also have affected the results. Another limitation of the study was that Mpigi district is a peri-urban community, and therefore the results obtained could not necessarily be generalised to rural districts.

1.12 LAYOUT OF THE STUDY

This dissertation consists of five chapters.

Chapter 1 introduces the study area; the problem, and the purpose, objectives and research design and methodology of the study, and defines key terms.

Chapter 2 covers the literature review conducted for the study.

Chapter 3 discusses the research design and methodology.

Chapter 4 presents the data analysis and interpretation and results.

Chapter 5 discusses the conclusions and limitations of the study, and makes recommendations for practice and further research.

1.13 CONCLUSION

This chapter provided a short introduction to Uganda and the Mpigi district to orientate the reader to the context under study. The background to the problem under study; purpose, significance and objectives of the study, and the research design and methodology, including the population, sampling, data collection and data analysis were described. Key terms were defined and the ethical considerations were highlighted.

Chapter 2 discusses the review literature conducted for the study.

CHAPTER 2

Literature review

2.1 INTRODUCTION

Chapter 1 briefly described Uganda and the Mpigi district, the problem, purpose, aim and significance of the study, and the research design and methodology, and defined key terms used in the study. This chapter discusses the literature review conducted on injection safety and unsafe practices, the global burden of disease associated with unsafe injection practices, strategies used to ensure injection safety and injection device security, the distribution system, as well as the synergy model which was the conceptual framework for this study.

According to De Vos et al (2002:127), a literature review is aimed at contributing to a clearer understanding of the nature and meaning of the problem under study. A literature review is accomplished by a thorough and critical review of the existing information (WHO 2001a:148).

Mouton (2001:87) states that a review of existing literature is important to

- ensure that previous studies are not duplicated
- discover the most recent and authoritative theory on the subject
- find out the most widely accepted empirical findings in the field of study
- identify the available instrumentation that has proven validity and reliability

The literature review for this study covered injection safety, injection device security, the distribution system of injection devices and the synergy model. The review revealed the existing knowledge about these concepts and how they are related, research undertaken on these concepts, and instruments used in the study of these concepts.

2.2 INJECTION SAFETY

Injections are a skin piercing procedure performed with a syringe and needle to introduce a substance for prophylactic, curative, or recreational purposes and are the most common healthcare procedure worldwide (Kotwal, Priya, Thakur, Gupta, Kotwal & Seth 2004:334). In developing and transitional countries, some 16 thousand million injections are administered each year. More than 90% of injections are given for therapeutic purposes while 5 to 10% is given for preventive services, including immunisation and family planning (Hutin et al 2003:1075).

A safe injection is one that does not harm the recipient, does not expose the provider to any avoidable risks and does not result in waste that is dangerous for the community (WHO 2000:1). Injection safety ensures that the conditions required to provide safe injections exist and that safe practices are adhered to. When a patient receives an injection, it should be given because the patient needs it (implying that there is no other clinically appropriate treatment). An authorised and trained health care provider using a sterile needle and syringe that will not or cannot be reused should give it. Immediately after the injection, the syringe must be discarded in a puncture-proof receptacle (namely a safety box). When the safety box is full, it must be kept in a secure location until it can be safely destroyed in an environmentally-responsible manner by an authorised agent or in some cases by a health care worker who has been properly trained in health care waste management (Nersesian, Cesarz, Cochran, Mboyane & Schmidt 2004:1).

A reliable and adequate supply of single-use syringes, disposable reconstitution syringes and safety boxes is necessary to ensure injection safety (WHO 2003a:1). An efficient stock management and distribution system therefore needs to be developed to ensure continuous, sufficient availability of injection safety equipment in all health care facilities.

2.2.1 Unsafe injection practices

According to the WHO (2003a:1), the majority of therapeutic injections in developing and transitional countries are unnecessary and unsafe. An unsafe injection is one that harms the recipient, exposes the provider to an avoidable risk and results in waste that

is dangerous to the community. An unnecessary injection is one where oral alternatives are available, where the injected substance is inappropriate or harmful or where the symptoms or diagnoses do not warrant treatment by injection (Youwang, Guangping, Yu, Anqiang, Yong & Hongpin 2006:409).

According to Reeler (2000:135), injections are often given for the wrong indications, such as respiratory infections, diarrhoea, unspecified or undiagnosed fever, skin infections and urinary tract infections. Patients often prefer injections because they believe them to be “stronger” and “faster” than other forms of medication such as oral or rectal routes. Some patients also assume that doctors and nurses regard injections as the best treatment. In turn, doctors and nurses often over-prescribe injections because they believe that this best satisfies patients, even though patients are often open to alternatives. In addition, prescription of an injection sometimes allows the charging of a higher fee for service. Better communication between patients and providers can clarify such misunderstandings and help to reduce injection over-use (WHO 2002c:1).

According to Youwang et al (2006:413), unnecessary injections should be avoided. Not only would this decrease the administration of unsafe injections by over half, it would also reduce the transmission of blood-borne pathogens, save medical resources, and reduce the economic burden of patients.

The WHO-UNICEF-UNFPA (1999:1) in a joint statement on the use of auto-disable syringes in immunisation services reaffirmed that the re-use of syringes and needles places the general public at a high risk of disease and death. Furthermore, the use of safety boxes for the collection and disposal of used syringes, needles and other injection materials reduce the risk posed to health staff and the general public through contaminated needles and syringes.

According to Youwang et al (2006:409), syringes and needles are often rinsed by health carer workers in a pot of tepid water between injections. In some countries the proportion of injections given with syringes or needles re-used without sterilization is as high as 70%. Other unsafe practices, such as poor collection and disposal of contaminated injection equipment, expose health workers and the community to the risk of needle stick injuries. In some countries unsafe disposal of contaminated syringes and

needles can lead to re-sale on the black market endangering the communities through the spread of severe diseases (WHO 2002c:2).

According to Reeler (2000:135), injection administration and sterilization practices are unsatisfactory in many health care facilities because health care workers have insufficient knowledge of and insight into its dangers or because there is lack of equipment. In developing countries disposable syringes are often reused despite their intended purpose. The disposal of used syringes and needles presents a problem that increases the risk of transmitting diseases. Health care centres often dispose of used syringes and needles in nearby open pits, a practice which makes it possible for people to obtain and reuse the injection equipment.

Research on injection practices in the developing world has revealed rampant re-use of injection equipment and poor disposal of used sharps exposing millions of people to infection such as HIV, Hepatitis B virus and Hepatitis C virus (Simonsen, Kane, Zaffran & Kane 1999:789; Gisselquist 2006:536; Talaat, El-Oun, Kandeel, Abu-Rabei, Bandenschatz, Lohiniva, Hallaj & Mahoney 2003:234; Kermode, Holmes, Langkham, Thomas & Gifford 2005:423; Youwang et al 2006:407; Khan, Luby, Fikree, Karim, Obaid, Dellawala, Mirza, Malik, Fisher-Hoch & McCormick 2000:956).

In a study to quantify the prevalence of unsafe injections in the developing world, Simonsen et al (1999:795) found that more than 50% of all injections were administered with syringes and needles used on consecutive patients without sterilisation. The study also revealed that most developing countries did not have the necessary infrastructure for safe disposal of contaminated and used syringes, needles and other equipment.

In random surveys at public health care facilities throughout the Mwanza region in Tanzania between 1991 and 1993, Gisselquist (2006:536) reported that purportedly sterile syringes and needles had been contaminated at 22% to 44% of these facilities; sterilization and storage facilities for sterilized equipment were inadequate, and injection procedures were often unsafe, resulting in an increased transmission of HIV.

In Egypt, Talaat et al (2003:239) found a high frequency of the use of injections for therapeutic purposes among the general population and that injections were often prescribed and administered by untrained health care workers. In addition, the re-use

of syringes occurred, possibly contributing to blood-borne pathogen transmission in Egypt.

In a study on injection-related practices in two rural north Indian health care settings, Kermode et al (2005:426-7) found the practice of using one syringe repeatedly but changing the needle in both hospital and community based immunisation clinics, and some health care workers perceived this as a safe practice. The fact that nurses were withdrawing a small amount of medicine remaining in the needle and the syringe tip back into the syringe after removing the needle from the patient was of concern as blood cells could enter the syringe in this way. The same syringe with a new needle was subsequently used to draw up additional doses of medicine from multi-dose vials that could easily become contaminated. Furthermore, Kermode et al (2005:426-7) found that health care workers administering vaccines were frequently observed recapping needles following administering an injection. This is a dangerous practice as needle recapping is the most common cause of needle stick injury, which, in turn, is the most common cause of occupational infection with blood-borne viruses.

In a study on the status of injection services, knowledge and attitude of health care workers with regard to injection practices at health care facilities in the Jingzhou district of China, Youwang et al (2006:414) reported that 25 of the 28 unsafe injections found in the field were conducted for the drug allergy test without sterilizing the skin and the rest were due to the inappropriate sterilization or the re-use of syringes.

In evaluating the relationship between injections and viral hepatitis infections in a peri-urban community of Karachi, Pakistan, Khan et al (2000:959) found that 44% of patients aged at least 20 years who visited health care clinics were infected with the hepatitis C virus. The primary route of transmission was through injections with re-used, inadequately sterilized needles and syringes.

The WHO (2004:1) identifies the main factors contributing to transmission of blood borne pathogens through injections as

- the repeated use of syringes and needles
- overuse of therapeutic injections
- lack of awareness and knowledge of risks

- shortages of injection devices
- poor waste disposal practices
- lack of appropriate waste infrastructure

According to Kermode et al (2005:423), the reasons for unsafe injection practices in low-income countries are complex and include structural, economic and socio-cultural factors. In a study in rural northern India, Kermode et al (2005:423) found that the resource constrained circumstances of both patients and hospitals substantially influenced the safety of injection practices. Lack of knowledge was also relevant as there were limited opportunities for the health care workers to engage in professional development and consequently, the implementation of recommended changes was slow. Inadequate supplies of necessary equipment also accounted for unsafe practices (Kermode et al 2005:430).

Logez, Hutin, Sonda, Thuault and Holloway (2005:1) state that geographical factors may hinder access to supplies and affect injection practices. In Burkina Faso, the implementation of pharmaceutical depots next to public health care facilities increased geographical accessing of essential medicines and basic supplies, among which were syringes and needles, thereby contributing substantially to safer injection practices.

2.2.2 Global burden of disease associated with unsafe injection practices

According to Miller and Pisani (1999:808), unsafe injection practices are associated with substantial morbidity and mortality, particularly from hepatitis B and C and HIV infections. Unsafe injections are believed to have contributed to 30%, 41% and 5%, respectively, of new infections of Hepatitis B Virus (HBV), Hepatitis C Virus (HCV) and HIV in 2000 (WHO 2003a:1). According to the WHO (2002c:2), HBV is highly infectious and causes the highest number of infections. Unsafe injections account for 33% of new HBV infections in developing and transitional countries out of a total of 21.7 million people infected each year. Unsafe injections are the most common cause of HCV infection in developing and transitional countries, causing two million new infections each year and accounting for 42% of cases. Globally, nearly 2% of all new HIV infections are caused by unsafe injections with a total of 96 000 people infected annually. In South Asia, up to 9% of new HIV cases may be caused in this way. These inadvertently transmitted blood-borne diseases manifest some time after infection and

hence may not be appropriately accounted for. Annually, more than 1.3 million deaths are estimated to be due to unsafe injection practices (Miller & Pisani 1999:808).

2.2.3 Strategies used to ensure injection safety

According to Miller and Pisani (1999:809), more than 90% of medical injections are given outside immunisation programmes. Most are intended for curative purposes, and many are probably unnecessary. The pressure to provide injections comes from both patients and doctors. To prevent injection-associated transmission of blood-borne pathogens, injection frequency should be reduced and safe injection practices carried out on a regular basis. Reducing the demand for unnecessary injections and increasing the demand for sterile injections requires increased public awareness, health workers' training, and the provision of alternative oral medications. It may also be necessary to make structural changes in the health services provision to reduce incentives to provide injections (Miller & Pisani 1999:809).

Responding to the problem of unsafe injections requires a better understanding of where the problem lies. It is likely that the bulk of infection from injections arises from the re-use of contaminated injecting equipment. Auto-disable syringes (which cannot be re-used) would do much to cut down infection rates. Likewise, investments need to be made in the safe, convenient and effective disposal of injection equipment to avoid the spread of infection among health care workers and the public. In addition, greater priority should be given to support needle-less technology, such as aerosol or oral formulations (Miller & Pisani 1999:810).

According to Reeler (2000:141), anthropological research can contribute to a better understanding of why, how and when injections are administered and interventions should continuously be adapted to specific contexts in accordance with people's responses.

2.2.3.1 *The WHO strategy for safe and appropriate use of injections*

The WHO (2000:1) recommends a multidisciplinary three-pronged approach to the reduction of injection frequency and promotion of safe injection practices, namely:

- Provision of sufficient quantities of injection equipment and infection control supplies.
- Waste management of all sharps used for invasive procedures, including syringes and needles.
- Behaviour change among patients and health care workers to reduce injection overuse and implement safe practices.

2.2.3.1.1 Provision of equipment and supplies

Eradication of the re-use of syringes and needles without sterilisation requires continuous, sufficient availability of injection equipment and infection control supplies in all health care facilities. According to the WHO (2000:2), important activities include:

- selection of appropriate types of syringes and needles for curative care
- enforcement of international norms and standards by the national regulatory authority
- central bulk procurement of injection equipment and infection control supplies
- central management of storage
- efficient distribution system to ensure continuous, sufficient availability of injection equipment in all health care facilities nationally

2.2.3.1.2 Behaviour change

The WHO (2000:2) states that the foundation of the safe and appropriate use of injections is a behaviour change strategy targeting consumers as well as public, private and lay health care workers. According to the WHO (2000:1), important activities include

- developing a national communication and behaviour change strategy
- constructing and developing national standards for safe injection practices
- incorporating injection safety into minimum standards of care
- promoting safe technologies
- promoting rational use of injections

- addressing issues that could lead to poor injection practices, including attitudes, emotions, incentives, beliefs, power relationships, norms and health care systems' general administration

2.2.3.1.3 Management of sharps waste

The efficient, safe and environmentally-friendly management of contaminated waste is the only means of ensuring that disposable syringes and needles are not reused and that they do not lead to accidental needle stick injuries (WHO 2000:2). In this regard, the WHO (2000:2) emphasises that this includes

- formulating a waste management policy for all medical waste
- assessing the waste management system needs
- selecting appropriate waste disposal systems for all levels of health care facilities
- implementing a regulatory framework
- identifying the required human and financial resources to plan and implement the disposal of medical waste
- training and supervising all health care workers to ensure the effective and efficient disposal of medical waste

2.2.3.2 Using auto-disable syringes to prevent injection re-use

The Program for Appropriate Technology in Health (PATH) (2001:47) states that the re-use of injection equipment is responsible for most of the infections such as abscesses, skin infections and sepsis that result from injections. To prevent this, several new types of syringes have been designed to prevent re-use, including auto-disable syringes that automatically become disabled after one use. The WHO and its partners (WHO-UNICEF-UNFPA 1999:1) recommend the use of auto-disable syringes, “bundled” with the supply of vaccines in all mass immunisation campaigns, and also strongly advocate their use in routine immunisation programmes. According to Lloyd and Milstein (1999:1001), the auto-disable syringe prevents re-use and therefore helps to prevent transmission of blood-borne pathogens between patients. Lloyd and Milstein (1999:1001) add that auto-disable syringes contribute to safety predominantly in developing countries where the reuse of standard disposable syringes is widespread,

disposable systems are inadequate, and the resale of used medical equipment is common.

In situations where syringes are commonly re-used, the introduction of the auto-disable syringes necessitates an increase in the number of syringes purchased and a corresponding increase in expenditure. According to Hersh, Carr, Fitzner, Goodman, Mayers, Everts, Laurent, Larsen and Bilous 2003:S300), the auto-disable syringe does not significantly affect transmission between patients and health care workers attributable to accidental needle-stick injuries, nor does it present a lower risk of accidents in the community when incorrectly disposed of. However, it does prevent unauthorised packaging and resale after use (Cheng 2004:251).

2.2.3.3 *Holistic approach to injection safety*

Dicko, Oni, Gavinet, Kone, Pierre and Jacquet (2000:167) recommend a holistic approach to injection safety in which injection safety is approached together with nursing practices, social mobilisation and logistics. Figure 2.1 illustrates the holistic approach to injection safety, which consists of three interrelated components, namely nursing practice, social mobilisation and logistics.

Nursing practice is the source of ordering and managing injection supplies and equipment, the administration of safe injections and the reporting of adverse events following the administration of injections.

Social mobilisation includes the educating and supplying information to the public about the facts regarding administration of medicine through the means of injection as well as the elimination of unfounded beliefs about the injecting of medicines. It also includes informing the public about the transmission of diseases through injections that are re-used, and their rights to insist on sterile syringes and needles when being injected by authorised and trained health care workers.

Logistics include the timeliness in planning and ordering of injection devices, which should correlate with the supplied injectable medicines. Logistics also involves budgeting for injection devices and training, supporting and supervising health care workers responsible for commodity management.

Dicko et al (2000:167) maintain that only the combined effort of all parties will ensure that both health care workers and patients are sufficiently protected.

Companies that supply injection devices and equipment should be educated about safe injection practices so that improved strategies and technology can be developed. Social mobilisation teams should educate people and health care workers about injection overuse and promote the elimination of unnecessary injections (World Bank 2003:3).

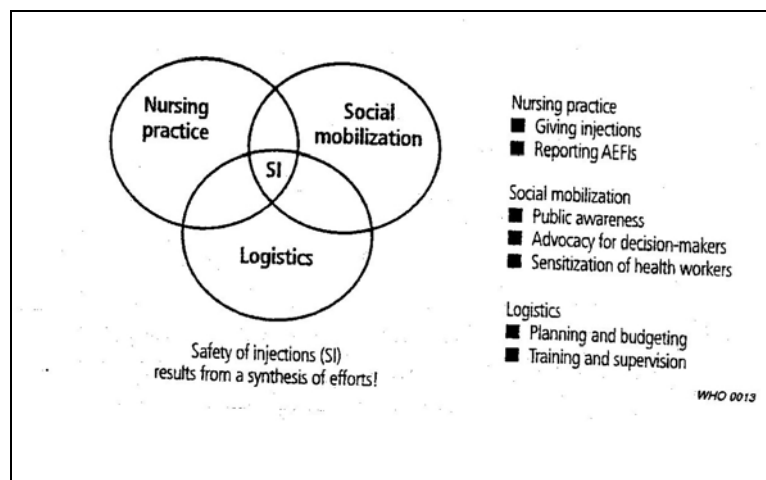


Figure 2.1 Holistic approach to injection safety

(Dicko et al 2000:167)

Dicko et al (2000: 167) contend that the logistics team should provide each health care facility with sufficient supplies of syringes and needles, boxes for the safe disposal of used materials, and fuel for burning contaminated sharps before burying them. Necessary training should be provided to all staff involved in these operations. This broader concept of injection safety should be fixed not only in the minds of providers, social mobilisation workers, and logisticians, but also in the minds of all stakeholders, including policy-makers, donors and the whole community.

Khan et al (2000:961) recommend that interventions should be addressed at the societal, practitioner and patient levels with an important long-term goal of preventing unnecessary injections. However, according to Reeler (2000:142), making a substantial reduction in the number of unnecessary injections might be impossible for many years

to come and it would be more useful to aim at reducing unsafe administration. Reeler (2000:142) is of the opinion that people may be more willing to take measures to ensure safety than to give up a potent symbol of optimal care.

2.2.4 Making medical injections safer project

In 2004, as part of the USA President's Emergency Plan for AIDS Relief (PEPFAR) focusing on countries with high HIV prevalence, JSI and its subcontractors, Program for Appropriate Technology in Health (PATH), Academy for Educational Development (AED), and the Manoff Group, were awarded funds through the Centre for Disease Control and Prevention (CDC) and the USA Agency for International Development (USAID) to implement "rapid interventions to decrease unsafe injections" in eleven countries (JSI 2005:1). The project is commonly known as Making Medical Injections Safer (MMIS).

According to JSI (2005:1), by the end of the five-year project (2009), MMIS together with its national counterparts in the project countries, which include Uganda, aims to have established an environment where patients, health care workers, and the community are better protected from the medical transmission of HIV and other blood-borne pathogens.

2.2.4.1 MMIS vision

The MMIS project works in eleven countries in Africa and the Caribbean in order to promote a world in which an optimal service is delivered. According to JSI (2005:1), the following measures are taken to ensure that the mission is fulfilled:

- In every health facility, trained health care workers administer drugs through injections which are necessary and which can be safely administered by using appropriate safe injection devices
- Health care waste, such as used syringes and needles, is efficiently managed using methods that are safe for the community and the environment

2.2.4.2 MMIS collaborations

To support the strategic vision and objectives of the project, the MMIS (JSI 2005:2) works with global, regional, and in-country partners to systematise approaches, build capacity, and sustain injection safety programmes. Collaboration with host nations is central to the MMIS efforts. Lasting success depends on leadership by government and private sectors and, ultimately, on local capacities for injection safety and health care waste management. According to the JSI (2005:2), the MMIS project works with countries to achieve sustainability through

- supporting governments in developing countries with national plans and policies
- working through national injection task forces
- promoting south-to-south exchanges of experience
- building partnerships at international and regional levels to foster collaboration

The task forces and partnerships provide a foundation for making improved injection safety a reality.

2.2.4.3 MMIS technical approaches

The MMIS project provides support for sustainable approaches for injection safety according to the JSI (2005:2), including:

- Training, support, and capacity building ensuring that only safe and necessary injections become a professional and social norm within the health care systems and among ancillary services personnel.
- Safe injection commodity management improving the availability of safe injection equipment (syringes with re-use prevention and/or needle stick injury prevention features and safety boxes for discarding contaminated waste such as syringes and needles and other sharps used for procedures).
- Advocacy and behaviour change establishing high quality services and reducing the risk of needle stick injuries among health personnel and reducing the administration of unnecessary injections.
- Sharps waste management establishing the most cost effective, practical and safe means of waste disposal in health care settings.

- Monitoring and evaluation of key constraints and opportunities along the path toward the overall goal of preventing new infections of HIV and hepatitis B and C.

2.2.5 The injection safety situation in Uganda

In Uganda, the Ministry of Health of Uganda (2004a:2) and Priotto et al (2001:60-61) found a high rate of injection use and a high proportion of infections caused by unsafe injections. A national cross-sectional survey of injection safety practices in health care facilities conducted by the Ministry of Health of Uganda (2004a:2) indicated that the most prominent factors contributing to unsafe injection practices included

- over-prescription of injections
- limited availability of guidelines for health workers on injection safety practices including needle stick injuries at all health care levels
- inadequate supply of injection materials, leading to the re-use of injection supplies without sterilisation
- inadequate facilities for sterilisation
- lack of adequate facilities for the collection and disposal of injection wastes

Furthermore, over 70% of the respondents received more than three injections per year, putting Uganda among the group of countries in the Sub-Saharan region with the highest use of injections. In addition, 65% of the surveyed facilities reported having experienced shortages of disposable injection supplies in the 12 months prior to the survey, particularly in the curative sector. This shortage was attributed to a less-than-optimal logistics system (including ineffective forecasting and distribution mechanisms). Improper management of health care waste was reported at 60% of the health care facilities (Ministry of Health of Uganda 2004a:3).

Subsequent to the study, the MMIS (2005:1) project was conducted in Uganda in 2005 to assist the Ministry of Health of Uganda to establish an environment where patients, health care workers, and communities are more efficiently protected from the medical transmission of HIV and other blood-borne pathogens via health care practices. Phase 1 of this project was initially implemented in the districts of Mpigi, Nebbi, Mbarara and Pallisa and thereafter, five more districts were subsequently added during each financial year. The main strategies of the MMIS (2007:1) project include

- working within the existing structures
- increasing the involvement of families and communities
- timeliness in the implementation of activities
- regular monitoring, supervision and evaluation of the implemented activities

The project's technical approach entails equipping health care workers with knowledge and skills in safe injection administration, management of injection commodities and appropriate health care waste management. Other approaches include changing the behaviours of health care workers and patients to enhance safe injection practices, ensuring the availability of safe injection equipment and supplies, and the development of health care waste management plans for the safe and appropriate management of waste at health care facilities (MMIS 2007:1).

In general, the MMIS project was guided by the WHO's (2000:1) three-pronged approach to the implementation of injection safety in health care facilities.

2.3 INJECTION DEVICE SECURITY

According to the WHO (2003a:1), in the curative health care sector, where 95% of all injections are provided, the concept of injection device security entails appropriate forecasting, financing, procurement and supply management so that the following items are available in adequate quantities:

- injectable products
- appropriate single dose diluents
- single use injection devices for the administration of drugs through injection and for the reconstitution of medicines
- safety boxes for the safe discarding of contaminated and used syringes and needles

According to Logez et al (2005:2), the common failure of health care systems to ensure adequate and sufficient supplies of injection devices may have a negative impact on injection safety. Logez, Hutin, Halloway, Gray and Horgerzeil (2004:1106) point out that the WHO's (2003d: 1-23) model list of essential medicines does not mention the need to

supply injection devices in quantities that match the supplies of essential injectable medicines, although 44% of these essential medicines are listed in injectable form. In addition, a system analysis conducted in 1995 by the logistics project of the WHO'S African Regional Office (AFRO) identified the failure to systematically fund sufficient supplies of injection devices, as part of immunisation services, to be a key determinant of the widespread re-use of syringes and needles in the absence of sterilization facilities (Dicko et al 2000:166). In a joint statement in 1999, the WHO, the United Nations Children's Fund (UNICEF) and the United Nations Population Fund (UNFPA) (WHO-UNICEF-UNFPA 1999:1) recommended that sufficient syringes and safety boxes used for disposal of sharps such as the contaminated syringes and needles should be supplied with consignments of vaccines to address the issue of insufficient supplies of injection devices for immunisation purposes. According to Logez et al (2005:2), this recommendation also applies to the curative services where the majority of injections are administered.

Nersesian et al (2004:5) emphasise that forecasting, financing, procurement and delivering products are the primary logistics elements for enhancing injection device security.

2.3.1 Forecasting injection device needs

Effective forecasting for injection devices requires an estimate of the number of anticipated injections to be administered. The number of doses of injectable preparations procured provides an estimate of the number of needles and syringes required since providers should generally have the same number of devices as doses for injection administration. Additional needles and syringes are also needed for reconstitution, which some injectable preparations require (Nersesian et al 2004:6).

Consumption data also inform forecasts because provider variation may alter the quantity and distribution of sizes of syringes needed. Consumption data is also useful information for the full supply of injection devices, particularly when logistical systems for essential drugs and medical devices are managed in separate systems. However, consumption data might be unreliable if injection devices have been under-supplied, as this would cause an underestimation of the number of injections administered during a specific period (Nersesian et al 2004:6).

Another method of forecasting requirements is the morbidity method. According to the WHO (2003c:11), this method uses estimates of the number of health care contacts, common disease incidences and current standard treatment guidelines. The method is based on the rationale that prescribing requires reliable morbidity data. It is most appropriate for calculating injection safety needs according to injectable medicines needs in new programmes and for comparing the actual use with theoretical needs. The morbidity method of forecasting needs may be unreliable if the health information system is not well developed or if morbidity statistics are not reliably reported. Morbidity-based forecasts may also be difficult in circumstances where many treatment modalities are employed. In this case, the substitution of treatments makes it particularly difficult to estimate the actual number of injection devices used (Nersesian et al 2004:6).

In practice, the best approach may include a combination of the consumption and morbidity methods. The consumption method may be used first to improve quantification in the short run and then the morbidity method could be applied progressively for each type of service, to allow prescribing standards to be reviewed and improved. Alternatively, initial estimates might be made by the morbidity method, to establish a base from which to start, and once this has been assured the consumption method can be introduced. The general approach is to calculate enough injection equipment according to each injectable medicine to be supplied for twelve months. An appropriate buffer stock at central level will ensure that supplies can be maintained if usage increases or if the delivery of orders is delayed (WHO 2003b:11).

2.3.2 Identifying financing

Another critical logistics element for ensuring commodity security is securing sufficient financing. The WHO (2003a:2) calls on “all donors and lenders who finance injectable products to also finance appropriate quantities of single-use injection devices, single dose diluents, safety boxes and the cost of sharps waste management”. There should be advocacy for sustainability of financing mechanisms for injection-safety related commodities provided both by donors and government. According to Nersesian et al (2004:7), it is critical to secure financing for the full supply of injection devices because of the budget constraints within the health sector of most developing countries.

2.3.3 Procuring injection devices

The current global safe injection strategy calls for single-use injection devices and safety boxes for every injection administered. According to Nersesian et al (2004:7), one of the major elements in supporting this strategy is coordinated procurement, which means procuring quantities of single-use injection devices to match the number of doses of injectable preparations procured. It also means procuring the corresponding number of safety boxes. Coordinated procurement is crucial to supporting commodity security for injection safety.

2.3.4 Supply management for injection devices

A critically important issue to consider about supply management (including distribution) for safe injection devices is how to provide the supplies in complementary quantities, also called bundling. According to the WHO-UNICEF-UNFPA (1999:4), bundling usually refers to distributing injectable products with an appropriate number of syringes, diluents (if needed), and safety boxes used for disposal of used sharps including contaminated syringes and needles, to ensure that every injection is given safely and the used syringe is disposed of safely. It is important to recognise that injection devices typically flow through existing supply management systems within countries. Nersesian et al 2004:8) maintain that strengthening the system and developing an effective supply management for injection safety devices requires a full understanding of the operation, strengths and weaknesses of the existing supply management systems.

2.4 INJECTION DEVICE DISTRIBUTION SYSTEM

Quick et al (1997:332) describe a distribution system as a system of administrative procedures, transport facilities, storage facilities, and user facilities through which supplies move from a central point to the user facilities. According to the WHO (2003a:1), the application and success of the policy of injection device security depends on a reliable distribution system for health products. In addition, Quick et al (1997:316) state that effective commodity distribution relies on effective system design and efficient management.

2.4.1 Goals of a distribution system

The primary management goal of an effective and efficient distribution system is to maintain a steady flow of supplies to facilities where they are needed while ensuring that resources are being used in the most effective way. According to Quick et al (1997:317), a well managed distribution system is a cost effective system and should contain the following characteristics:

- maintain a constant supply of commodities
- keep commodities in good conditions
- minimise losses due to spoilage and expiry
- rationalise commodity storage points
- use available transport as efficiently as possible
- reduce theft and fraud
- provide information for forecasting commodity needs

However, it is imperative that management should regularly monitor the cost and performance of the distribution system as important indicators of the health care system's operations (Quick et al 1997:317).

2.4.2 The distribution cycle

According to Quick et al (1997:317), the distribution cycle begins when the manufacturer or supplier dispatches commodities and ends when drug consumption information is reported back to the procurement unit. The major activities of the distribution cycle include procurement, port clearing, receipt and inspection, inventory control, storage, requisition of supplies, delivery, dispensing to patients and consumption reporting (see figure 2.2).

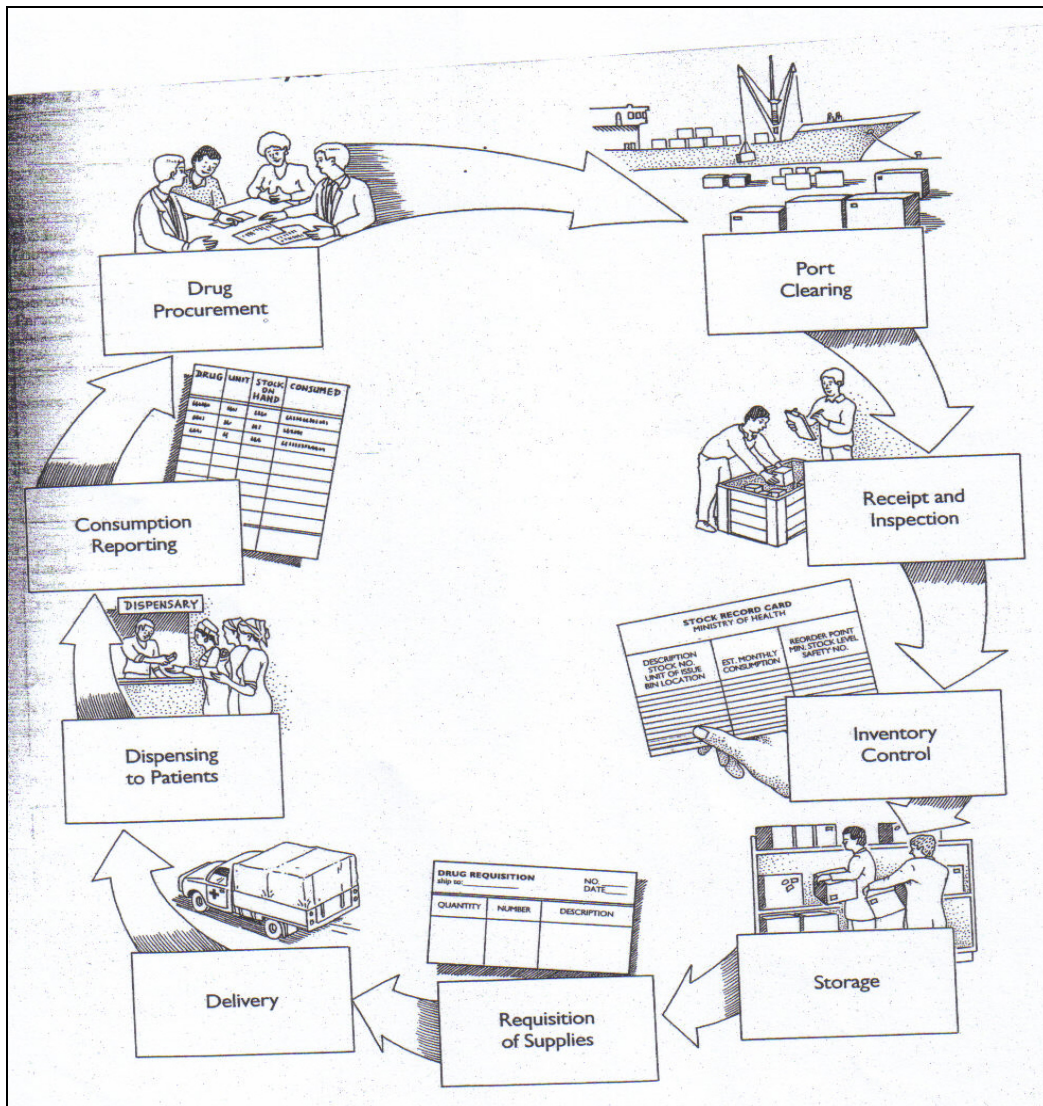


Figure 2.2: The distribution cycle

(Quick et al 1997:319)

2.4.2.1 Procurement

The distribution frequency intersects the procurement process at the point at which commodities are available for delivery to the health facilities (Quick et al 1997:317).

2.4.2.2 Port clearing

Unless injection devices are acquired locally or the international supplier takes responsibility for it, port clearing is the first step in making injection devices available for

distribution. Port clearing involves identifying shipments as soon as they arrive in port, processing all importation documents, completing any customs requirements, storing commodities properly until they leave the port, surveying the shipment for losses and signs of damage, and collecting the commodities as soon as they have been cleared (Quick et al 1997:317).

2.4.2.3 Receipt and inspection

Stores staff must carry out a complete inspection of every shipment as soon as it is received from the supplier. The shipment must be kept separate from other stock until this inspection has been completed. Inspectors should check for damaged and missing items and for compliance with the contract conditions concerning type of commodity, quantity, presentation, packaging and labelling.

2.4.2.4 Inventory control

Establishing and maintaining effective inventory records and procedures are the basis for coordinating the flow of commodities through the distribution system and the primary protection against theft and corruption. The inventory control system is used for requisitioning and issuing drugs, for financial accounting and for preparing the consumption and stock balance reports necessary for ordering re-supplies. An appropriate inventory management system should be adapted to suit the capacity and needs of personnel at all levels in the health program (Quick et al 1997:317).

2.4.2.5 Storage

Storage facilities range from large mechanised warehouses at the national level to small wooden boxes sitting in health centres or carried by community health workers. Proper location, construction, organisation, and maintenance of storage facilities help maintain device quality, minimise theft, and maintain regular supply to health facilities (Quick et al 1997:317).

2.4.2.6 Requisition of supplies

The forms and procedures for requisitioning are a key element of the inventory control system. The requisition system may be manual or computerised but designed to simplify distribution by facilitating inventory control, providing an audit trail for tracing the flow of supplies, assisting in financial accounting and listing commodities issued (Quick et al 1997:317).

2.4.2.7 Delivery

Injection devices may be delivered by warehouses or collected by health care facilities. Transport may involve air, water, railway, or on- and off-road vehicles. Transport managers should select methods of transportation carefully and schedule deliveries realistically and systematically, to provide punctual and economic service. Vehicle breakdown; availability of fuel, lubricants, and spare parts; seasonal variations in access routes; safety along specific supply lines, and other local factors must all be considered in transport planning (Quick et al 1997:318).

2.4.2.8 Dispensing to patients

The distribution process achieves its purpose when injection devices reach hospital wards, outpatient clinics, health care centres, or community health care workers and are appropriately prescribed and used (Quick et al 1997:317).

2.4.2.9 Consumption reporting

The closing link in the distribution cycle is the flow of information on consumption and stock balances backing up the distribution system for the procurement or requisition office for quantifying needs. If adequate inventory and requisition records are kept, compilation of reports should be straightforward (Quick et al 1997:318).

2.4.3 Basic design features of an injection device distribution system

Designing a distribution system requires systematic cost-effectiveness analysis and operational planning. Once the system is in place, regular performance monitoring is needed to ensure that the system functions as intended (Quick et al 1997:318). The major elements of a distribution system (as illustrated in figure 2.3) include the degree

of centralisation, distribution network, type of distribution system, re-supply intervals, storage, and movement of commodities to user facilities.

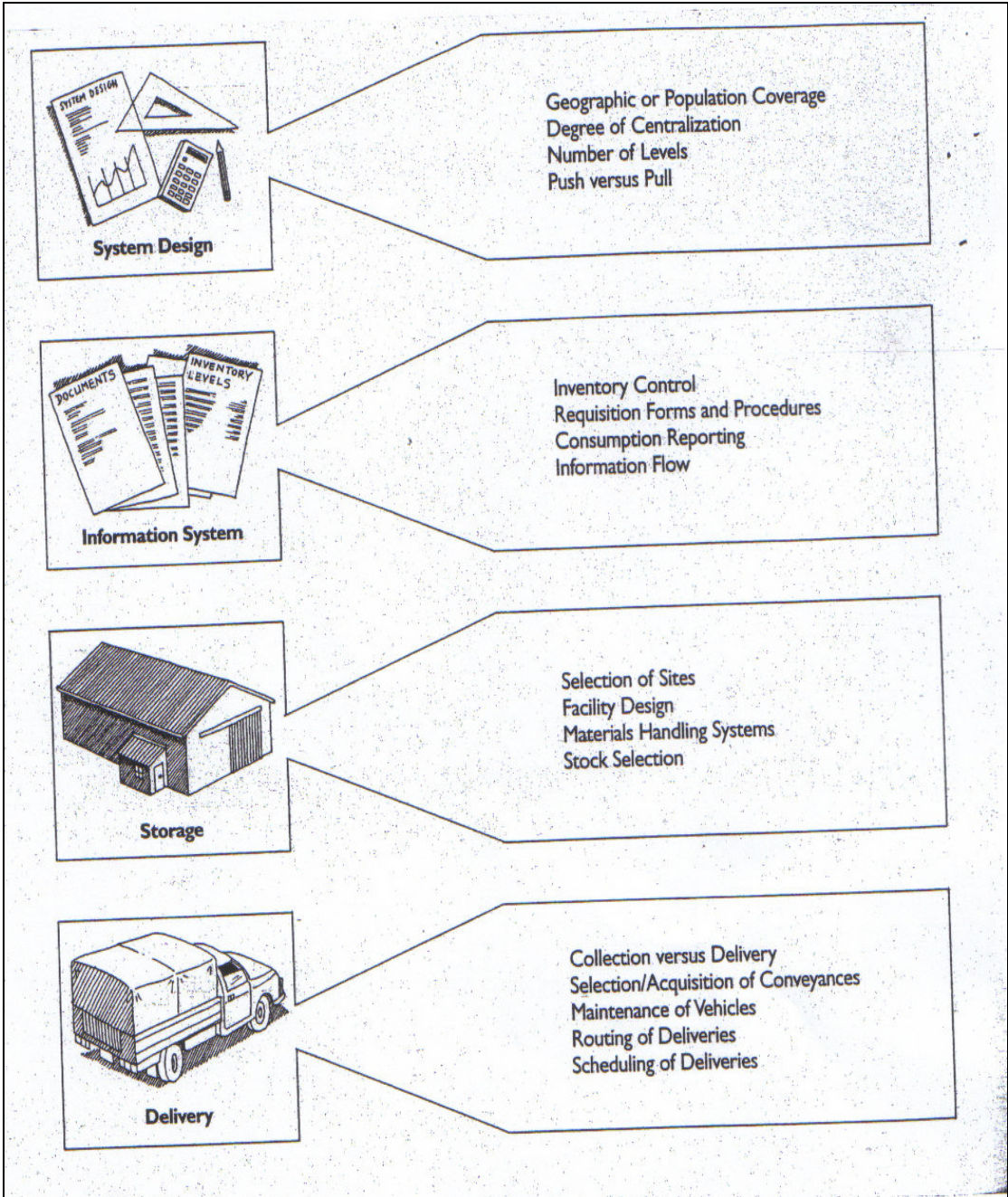


Figure 2.3 Design characteristics of a distribution system

(Quick et al 1997:320)

2.4.3.1 Degree of centralisation

In a typical central supply model, commodity procurement and distribution are coordinated at the national level. Commodities received at the central medical stores are distributed to lower-level warehouses and onward to the health facilities. In a decentralised system, the districts or regions are responsible for receiving, storing, and distributing commodities. In some cases, they may also be responsible for procurement (Quick et al 1997:319).

2.4.3.2 Distribution network

Commodities are distributed from the primary to intermediate stores, which may be independent but often on the site of a regional or district hospital. Intermediate stores distribute commodities to individual health facility stores. Determining the optimum number of storage levels should be done according to programme needs and resource constraints, weighing benefits against cost considerations (Quick et al 1997:321).

2.4.3.3 Type of distribution system

An essential decision must be made as to which levels of the system should order commodities and which, if any, will passively receive commodities distributed from higher levels. There are two basic alternatives, namely the

- *pull system*, in which each level determines what types and quantities of commodities it requires and then places orders with the central supply source
- *push system*, in which supply sources at some level in the system determine what types and quantities of commodities are required and deliver these to lower levels

When using a pull system, managers of operational units are expected to work out their own demand estimates and buffer stocks and submit requisitions to central stores indicating their requirements. In a push system, operational units are expected to supply certain stock and consumption information to the supply source, so that issuing officers can plan allocations (Quick et al 1997:323).

2.4.3.4 Re-supply intervals

Once the choice between a push and a pull system has been made, the next step is to select an appropriate re-supply interval (Quick et al 1997:323). This will determine whether deliveries are made to user units quarterly, monthly, weekly, or at any other time. The optimum re-supply interval needs to be worked out depending on the following factors:

- storage capacity at each level of the system
- availability, order size, carrying capacity, and cost of transport
- seasonal factors that affect transport reliability
- staffing levels and competence of staff at each level of the system
- other factors such as expiry dates, security against pilferage and locally relevant concerns

2.4.3.5 Storage

The geographic distribution of the population and health facilities determines where commodities are needed. Store locations should be chosen to make the most cost-effective use of existing public and private transport networks. Stores at health facilities may consist of a simple storeroom with shelving. Storage facilities should always be protected against theft and damage by water, pest or fire. Well-sited stores are vital to the success of a distribution system (Quick et al 1997:324).

2.4.3.6 Movement of commodities to user facilities

Supplies may be moved between the warehouse and the receiving facility using two options: collection or delivery. In the case of the collection system, the receiving facility takes on the responsibility of collecting supplies from the warehouse. In a delivery system, the warehouse is responsible for delivering supplies with either in-house transport or a private-sector contract. The general advantages and disadvantages associated with collection and delivery are summarised in table 3.1.

Table 2.1 Comparison of delivery and collection systems

System	Advantages	Disadvantages
Delivery	<ul style="list-style-type: none"> • If proper delivery routes, order intervals, and delivery schedules are in place, the total cost of transport will be less. • Deliveries of supplies can be combined with other important scheduled and compulsory visits to the field. • Commodity selection, assembly and packing operations can be scheduled and accomplished efficiently. 	<ul style="list-style-type: none"> • Needs reliable transport facilities. Outright purchase or leasing of vehicles gives rise to high capital and operating costs. • If the delivery route is long, there is the possibility of breakage and loss of quality. • Security lapses may occur due to lack of a responsible officer accompanying goods in many instances. • Health facilities may be closed when the delivery truck arrives, or there may not be a responsible officer on hand to receive supplies. • The delivery truck may be in a hurry to get to the next destination, making it difficult to check for short shipments, damage, and other problems before the truck departs.
Collection	<ul style="list-style-type: none"> • Provides an opportunity for issuing personnel to meet people from the field and discuss common problems, and for field officers to meet and exchange ideas among themselves. • Frees central-level staff from providing transport facilities to the field. • Provides greater incentives to obtain supplies regularly, since the facility is responsible for collecting supplies. • Allows field personnel to attend to other business in town. • Offers the possibility of a greater choice of methods of transport. • Allows better checking, handling and security of goods received. 	<ul style="list-style-type: none"> • Takes a lot of health facility staff time. • Time may be wasted waiting for the assembly of supplies, or supplies might not be ready for collection at the first visit. • Total cost of transport may be high. • Health centre personnel may tend to increase the frequency of visits for various reasons.

2.4.3.7 Transport

Transport is frequently the least reliable link in the distribution system and is often a source of great frustration. Transport planning requires the selection of the appropriate means of transport and the procurement and maintenance of vehicles or other conveyances. The best use of available transport should be made through careful route planning and delivery scheduling (Quick et al 1997:325).

2.4.3.8 Delivery schedules

Good planning is needed to ensure that each facility receives supplies regularly and on time. A number of factors must be considered when determining the appropriate delivery intervals for each store and health facility. These factors include storage capacity of health care facility stores, cost per unit supplied, efficient vehicle usage and climatic factors (Quick et al 1997:325).

2.4.4 Resources for distribution management

In order to maintain an effective distribution system, an input of four key resources is required, namely a strong logistics team, suitably qualified staff, a reliable information system, and a good communication infrastructure (Quick et al 1997:326).

2.4.4.1 The logistics team

A logistics team should be established to be responsible for operational planning, implementation and monitoring of the logistics tasks. Team managers must stress the importance of improving commodity availability and reducing distribution costs.

2.4.4.2 Staffing

A distribution system cannot work unless there are enough suitably qualified staff members to run it. The logistics team must therefore determine the staffing levels required to administer and operate the commodity distribution system effectively. There must be sufficient funds available to recruit and train additional staff, if necessary.

2.4.4.3 Information systems

Reliable management information is vital for coordinating the distribution network. The information system consists of forms and procedures to record inventory levels, costs and sales processes, and receipts for issues of commodities. Forms, records, and reports are the core of the supply information system. All necessary forms should be available and all staff should be trained in their use. The record system may be manual or computerised. Reports should be prepared regularly by individual health units to

district offices, which report to regional offices, which report to the central office. Such reports are used to project commodity needs, revise budgets, and assess commodity use.

2.4.4.4 Communication

Effective communication is essential to a drug distribution system. Well-planned and operational telecommunications reduce the need for travel, save staff time, and reduce wear and tear on vehicles. The maximum use should be made of available telecommunication resources, and appropriate investments made in communication technology. The provision of a radio transmitter and a fax machine to a facility could help to contain travel costs.

2.4.5 Performance monitoring and cost analysis

Performance monitoring should be carried out regularly using appropriate indicators to ensure that system performance is maintained. Depending on the results of monitoring, frequent minor adjustments may be required to respond to changing needs. It is crucial to compile and analyse data on current operating costs in order to model the potential cost impact of various alternatives to the existing distribution system should there be a need to revise it. The first tasks in the evaluation of options are to calculate the in-house costs of the distribution system (storage space, stores operation, equipment, staff, stock holding expenses and transport, administrative overheads, upgrading and costs of contracting out) and then to estimate the costs of other alternatives for making comparisons (Quick et al 1997:327).

2.4.6 Injection device distribution system in Uganda

The Ugandan distribution system for medicines and equipment for government health units is designed around a central supply model, in which commodity procurement and distribution are coordinated at the national level. Commodities received at the national medical stores, an autonomous government agency, are distributed to lower-level health facilities through district warehouses.

Commodities are distributed from the national medical stores to intermediate stores located at the centre of each district. District stores then distribute the commodities to individual health facility stores. A pull system is in place in which health facility managers' work out their demand estimates for syringes, injectable medicines and diluents and forward orders to National Medical Stores indicating their requirements. Delivery of ordered commodities from national medical stores to the district stores is scheduled for every two months. Stores at health facilities consist of a simple storeroom or a cupboard. Commodities are collected from district warehouses by the heads of health sub-districts who distribute these to the lower levels within their directorates. Each health sub-district has a vehicle used for the distribution.

The main source of funding for health supplies is the government fund allocated to the districts for primary health care activities. Public health facilities can only source drugs and equipment from elsewhere when they are out of stock at the national medical stores.

The faith-based (missions, religious organisations) health NGOs source their drugs and health supplies from Joint Medical Stores (or private pharmacies) from where each health care unit collects its supplies.

2.5 THE SYNERGY MODEL

The synergy model provides a viable model for health managers to use as a basis for a professional practice. The core concept of the synergy model is that the needs of patients and families influence and drive the characteristics or competencies of a health worker. Synergy results when the needs and characteristics of a patient, clinical unit or system are matched with a health worker's competencies (AACN 2006:1).

Each patient brings a unique set of characteristics to the health care situation. Eight characteristics are associated with patients experiencing critical events: resiliency, vulnerability, stability, complexity, resource availability, participation in care, participation in decision-making, and predictability. These characteristics underlie the patient's needs. Depending on each patient's needs, certain competencies of health care workers are required for providing care to acute and critically ill patients and their families. The health care worker characteristics of the synergy model are clinical

judgement, advocacy and moral agency, caring practices, collaboration, systems thinking, response to diversity, clinical inquiry, and facilitation of learning. Synergy occurs and optimal outcomes may result when the health care provider's competence complements the patient's needs (Becker, Kaplow, Muenzen & Hartigan 2006:131).

2.5.1 The AACN synergy model for patient care

During the 1990s, the American Association of Critical Care Nurses (AACN) Certification Corporation convened a think tank that developed a conceptual framework for certified practice. The framework was based on the premise that certified practice is more than tasks and should be grounded in nurses' meeting the needs of patients and optimising patients' outcomes (Becker et al 2006:131).

Outcomes are considered patients' conditions measured along a continuum. Six major quality indicators were identified under the synergy model (Becker et al 2006:133):

- satisfaction of patients and their families
- rate of adverse incidents
- complication rate
- adherence to a discharge plan
- mortality rate
- each patient's length of stay

The synergy model is congruent with three levels of outcomes of health care: those derived from the patient, the health care worker and the health care system (see figure 2.5).

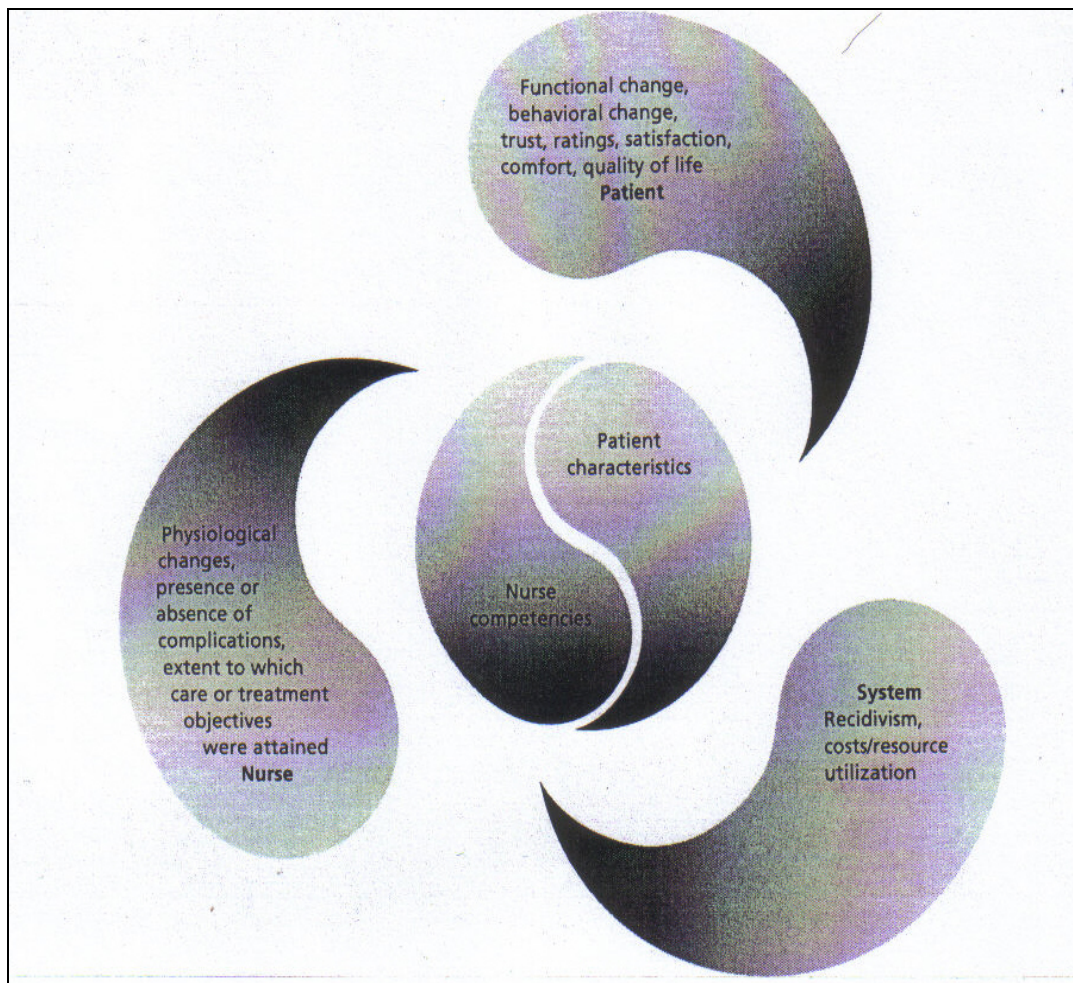


Figure 2.4 The AACN synergy model for patient care

(Becker et al 2006:134)

Outcomes derived from the patient include functional changes, behavioural changes, trust, satisfaction, comfort and quality of life. Outcomes derived from nursing competences include psychological changes, the presence or absence of complications, and the extent to which treatment goals were reached. Outcome data derived from the health care system include readmission rates, length of stay, and cost utilisation per case (Becker et al 2006:133). According to Kerfoot (2002:1), managers in health care must address all three these areas in order to create excellence in patient care. The manager's obligation is to create the environment in which good people can provide good care.

2.5.2 Assumptions of the synergy model

Becker et al (2006:133) state that there are nine basic assumptions of the synergy model, which provide the guide for identification of characteristics of patients and competencies of nurses in the model, namely

- Each patient is a biological, social and spiritual entity who is at a particular developmental stage. The whole patient (body mind and spirit) must be considered.
- Each patient, the patient's family and the community contribute to providing a context to the nurse-patient relationship.
- Patients can be described by a number of characteristics. All characteristics are connected and contribute to each other. Characteristics cannot be looked at in isolation.
- Nurses can be described in a number of dimensions. Interrelational dimensions paint a profile of the nurses.
- A goal of nursing is to restore each patient to an optimal level of wellness as defined by the patient.
- Nurses create the environment for the care of patients. The context or environment of care also affects what a nurse can do.
- Impact areas are interrelated, and the nature of the interrelatedness may change as a function of experience, situation or setting changes.
- Nurses may work to optimise outcomes for patients, patients' families, health care providers, and the health care system/organisation.
- Nurses bring their background to each situation, including various levels of education/knowledge and skills/experience.

2.5.3 The synergy model in practice

The synergy model is an organisational framework to organise the work of the health care worker and patient care. According to Kerfoot (2002:2), the model describes the characteristics of the patient, the health worker and the organisation within which the care is given. It provides a compelling picture of how the work of patient care can be organised to provide a "safe passage" for the patient through the health care system. It

also provides a framework for patient assessment, career advancement for the health care worker and the organisation of work between departments.

2.5.4 The synergy model applied to injection safety

In order to ensure injection safety, the patients' needs should be viewed as the desire to avoid infections acquired through the use of unsafe injections. Health care workers' competencies to fulfil patients' needs entail skills to administer safe injections by avoiding the re-use of syringes, proper disposal of used sharps such as contaminated syringes and needles, ensuring proper forecasting and ordering of required injection commodities, timely reporting to higher levels, and advocacy for timely and adequate supplies of commodities. Health managers then support the synergised care through the development of the required infrastructure, provision and maintenance of vehicles for delivery of supplies, provision of fuel for running the vehicles, developing the communication infrastructure, and recruiting and supervising staff.

2.6 CONCLUSION

This chapter discussed the literature review, which indicates that the subject of injection safety has been widely researched. Unsafe injections are common, especially in the developing world exposing many people to blood-borne infections like HIV/AIDS, Hepatitis B and Hepatitis C. Among the reasons for the administration of unsafe injections is the lack of adequate supplies, resulting in the re-use of injection equipment without sterilisation. Health care workers also lack adequate skills required for administering safe injections. The distribution system of health commodities must be carefully designed in order to ensure timely and adequate supplies of injection devices to health care facilities.

Chapter 3 describes the research methodology of this study.

CHAPTER 3

Research design and methodology

3.1 INTRODUCTION

Research methodology is the application of all steps, strategies and procedures for gathering and analysing data in a research investigation in a logical and systematic way (Burns & Grove 2001:26). The selection of the research methodology or strategy is the core of a research design and is probably the single most important decision the investigator has to make. The research methodology must include the research design, definition and selection of the population of interest, the definition of variables (characteristics of the individuals in the population), their status and relationships to one another, data-collection instrument and data-analysis procedure (WHO 2001a:11).

The selection of the research methodology for this study was guided by the desire to achieve the specific objectives. The specific objectives guiding this study were to

- Determine whether health care facilities in the Mpigi district of Uganda have sufficient quantities of injectable medicines, diluents, single use injection devices and safety boxes for therapeutic purposes.
- Investigate the factors that lead to stock depletion of injection devices at health care facilities in the Mpigi district of Uganda.

3.2 RESEARCH DESIGN

Mouton (2001:55) defines a research design as a plan or blueprint of how one intends to conduct the research. According to Burns and Grove (2001:223), the design guides the researcher in planning and implementing the study in a way that is most likely to achieve the intended goal.

The research design used for this study was quantitative, observational, descriptive and cross-sectional. These terms are described below.

3.2.1 Quantitative

A quantitative design was used to conduct this study. In quantitative studies, researchers use deductive reasoning to generate hunches that are tested in the real world. The researcher applies a scientific approach to the study of a question of interest by moving in a systematic fashion from the definition of a problem and the selection of concepts on which to focus, through the design of the study and collection of information, to the solution of the problem (Polit & Hungler 1995:12). The researcher also controls the study by imposing conditions on the research situation so that biases are minimised.

In quantitative research, evidence is gathered according to a specified plan, using formal instruments to collect the needed information (Somekh & Lewin 2005:215). The information gathered is quantitative, implying that it is numeric information that can be analysed by statistical procedures (Polit & Hungler 1995:13).

In this study, quantitative information was gathered on injection devices at health care units and the distribution system thereof in the Mpigi district using structured interviews and observations. The data were analysed using statistical procedures and inferences made as to the level of injection device security in the Mpigi district in Uganda and the challenges encountered by the distribution system.

3.2.2 Observational

Scientific observation involves the systematic selection, observation and recording of behaviours, events, and settings relevant to a problem under investigation (Polit & Hungler 1995:364; Somekh & Lewin 2005:138-139).

In this study, selected behaviour and events related to injection commodities and their distribution system were observed and recorded during the period of data collection in the Mpigi district in Uganda.

3.2.3 Descriptive

When a study is not structured formally as an analytical or experimental study, implying that it does not aim specifically to test a hypothesis, it is called a descriptive study, and belongs to the observational category of studies (WHO 2001a:16). In addition, Salks and Allsop (2007:6) describe a descriptive study as “providing current information or intelligence on a problem”.

The purpose of descriptive studies is to observe, describe and document aspects of situations as they naturally occur, sometimes as a starting point for hypothesis generation or theory development (Polit & Hungler 1995:195-196).

In this study, observations of injection devices and aspects of their distribution system were made, described and documented.

3.2.4 Cross-sectional

Cross-sectional studies entail the collection of data from a cross-section of the population, which may comprise the whole population or a proportion (sample) of it (WHO 2001a:17). Somekh and Lewin (2005:216) point out that cross-sectional studies involve the collection of quantitative data on at least two variables at one point in time and from a number of cases. The WHO (2001a:17) concurs, adding that cross-sectional studies provide a prevalent rate at a particular point in time (referred to as point prevalence) or over a period of time (referred to as period prevalence).

In this study, data was collected from a sample of health care facilities in Mpigi district and the point prevalence of injection device security at the facilities was determined at the specific time of data collection.

3.3 POPULATION AND SAMPLE

This section describes the study population and how the sample of health care units was selected from the population for inclusion in the study.

3.3.1 Population

According to Bryman (2001:85), a population is the totality of persons, events, organisation units, case records or other sampling units from which the sample is selected and with which the research problem is concerned. The population can also be regarded as the group to which results of a study are generalised (Trochim 2006:32). In addition, Somekh and Lewin (2005:217) refer to a population as a “complete set of units being studied when time, costs and accessibility often prohibit the collection of data from every member or about every item”.

The population for this study comprised all health care facilities administered by the Government of Uganda and NGO health care units in Mpigi district.

3.3.2 Sampling frame

Once the study population is identified, a listing of the accessible population from which the sample will be drawn is obtained. This is referred to as a sampling frame (Trochim 2006:32). The sampling frame for this study comprised a list of government health care facilities and NGO health care units at the various levels of the health care structure. The Mpigi district has 47 government health care units and 15 NGO health care units, making a total population of 62 health care units. Table 3.1 summarises the sampling frame.

Table 3.1 Sampling frame for health care units in the Mpigi district

Level of health unit	Ownership		Total number
	Government	NGO	
Health care centre II	28	6	34
Health care centre III	16	8	24
Health care centre IV	2	0	2
Hospital	1	1	2
Total	47	15	62

3.3.3 Sampling and sample

A sample is the segment of the population that is selected for investigation (Bryman 2001:85). According to Somekh and Lewin (2005:218), a sample is studied in order to understand the population from which it is drawn. A complete coverage of the population is seldom possible and even if it were possible, time and cost considerations usually make this a prohibitive undertaking. Sampling is the science and practice of selecting information from populations in a manner that allows defensive inferences to be drawn from those data (Saks & Allsop 2007:157). The use of samples may therefore result in more accurate information because with a sample, time, money and effort can be concentrated to produce better-quality research information (De Vos et al 2002:199).

The method of sample selection may be based on a probability or non-probability approach. A probability sample is one that has been selected using random selection so that each unit in the population has a known chance of being selected (Bryman 2001:85). The best-known kinds of probability sampling are stratified random sampling, simple random sampling, systematic sampling, cluster sampling, and panel sampling (De Vos et al 2002:203).

This study employed stratified random selection as the sampling strategy. In this strategy, the population is first divided into two or more strata or subgroups that are mutually exclusive, the members of which are homogeneous or across important groups in the population with regard to some characteristic such as level of service (Saks & Allsop 2007:159). The desired number of units is then selected proportionately within each of the different strata. This means selecting each sample according to the number of units in that stratum, implying larger samples from larger strata, and smaller samples from smaller strata. This enhances representativeness of all strata of the sample (De Vos et al 2002:205; Polit & Hungler 1995:286; Saks & Allsop 2007:159).

Health care units in the Mpigi district are stratified according to the level of service as hospital, health care centre IV, health care centre III and health care centre II. Since the membership of each stratum of health care units was unequal, a disproportionate sampling design was used in order to obtain sufficient numbers of sampling units from each stratum and therefore sharpen the precision and representativeness of the final sample (Polit & Hungler 1995:288; Saks & Allsop 2007:160).

Because of the small number of hospitals (n=2) and health care centre IVs (n=2) in the district, all the hospitals and health care centre IVs were included in the study. The remainder of the health care units were selected from a list of health care centre IIIs and health care centre IIs by proportionate stratified random sampling. Since the sampling frame had 34 health care centre IIs and 24 health care centre IIIs, health care units forming the sample from these two strata were selected in a ratio of 7:5. Storekeepers, persons in charge of health sub-districts, injection providers and patients found at the sampled units were selected for interviews. Information on stock levels and stock management was obtained by reviewing stock cards, requisition and issue vouchers and taking physical counts of items at the selected facilities. This information was recorded on checklists.

3.3.4 Sample size estimation

According to Somekh and Lewin (2005:218), the sample size is the crucial factor rather than the relative size or proportion of the population sampled. Saks and Allsop (2007:158) state that the larger the sample size, the smaller the error will be in estimating the characteristics of the whole population, but the more it will cost to administer a survey and analyse the data. The sample size is dependent on the accuracy required and the likely variation of the population characteristics being investigated.

In this study, an analytical (scientific) approach was used to determine the sample size for this study. According to Salks and Allsop (2007:219), this approach depends on the assessment of errors of interference and a desire to minimise sampling error. Sampling error measures the amount of variability between sample results; the less variable the sample results are, the closer the sample results are to the population results. The main determinant of the sample size is therefore, how accurate the results need to be and depends on whether the study is descriptive or analytical (WHO 2001a:74).

This study was descriptive in design with the objective of obtaining an estimate of the population parameter, which means the proportion of health units where injection device security had been achieved. According to the WHO (2001a:76), the calculation of the sample size for a descriptive study depends on two parameters: the width of the

confidence interval and the confidence coefficient. The sample size (n) can be calculated using this formula:

$$n = (z_{1-\alpha} / \delta)^2 p (1-p)$$

Where

1- α is confidence level

δ is confidence interval

p is prevalence of population parameter

The Mpigi district consists of 62 health care units that fell under the inclusion criteria of this study. Assuming simple random sampling, with injection device security achieved at 50% of the health units (prevalence), with a level of precision of $\pm 10\%$ and a confidence level of 95%, the sample size was calculated as 38 health units. Therefore, 38 health care units were selected for the study. Using disproportionate random sampling, two hospitals, two health care centre IVs, 20 health care centre IIs and 14 health care centre IIIs were selected. An additional 10% of the sample size units (two health care centre IIs and two health care centre IIIs) were added to the selected health care units to compensate for possible non-respondents due to failure to reach some health care units or closure of roads during the data-collection period. This procedure was consistent with the random sampling methodology (Israel 2003:4).

3.4 DATA-COLLECTION INSTRUMENTS

Structured interview schedules and structured observation checklists about the availability of injection commodities and challenges faced by the distribution system were used for this study. Research data, particularly in quantitative studies, are often collected according to a structured plan that indicates what information is to be gathered and how to gather it. Structured methods yield data that are relatively easy to quantify and analyse. Structured methods also enhance the objectivity of the data collected by eliminating bias due to the researcher's personal feelings or beliefs (Polit & Hungler 1995:310-311).

An interview schedule is a list of more or less structured questions that are read by an interviewer (with or without probing) in interrogating a respondent either face to face or

via telephone or post (Somekh & Lewin 2005:220). The interviewer then records the respondent's responses either verbatim (for open-ended questions) or according to pre-specified (or pre-coded) answers or categories thereof (WHO 2001a:171).

A checklist is a list of categories of behaviours or events that may or may not be manifested by the subjects. The observer's task is to watch for instances of the behaviours or events and to tick off the appropriate behaviours or events to designate their occurrence (Polit & Hungler 1995:310-372).

3.4.1 Instrument development

The interview schedules and checklists for structured observations were developed from those used in similar studies by the WHO (2003c:121), the Ministry of Health of Uganda (2003:87) and the MMIS (2005:4) project in assessment of injection safety. Quick et al's (1997:331) assessment guide for medicine distribution management was also consulted. The items included in the interview schedules and the checklists were carefully chosen to elicit responses that were specific to the research objectives. A combination of open-ended and closed questions was used for the interview schedule to offset the strengths and weaknesses of each type of question (Polit & Hungler 1995:336).

The language of communication was English and in case of patients' exit interviews, translation to the appropriate local language was done whenever necessary. The interview schedules and structured observation checklists included questions on the following:

- availability of injection devices
- distribution infrastructure
- delivery schedules
- forecasting and ordering of injection devices
- record keeping and reporting, communication
- the use of injection devices.

3.4.2 Reliability of the research instruments

The reliability of an instrument that yields quantitative data is a major criterion for assessing its quality and accuracy. In general, reliability refers to the extent to which the independent administration of the same instrument consistently yields the same (or similar) results under comparable conditions (De Vos et al 2002:168). Two aspects of reliability were used in this study, namely internal consistency and equivalence. An instrument is said to be internally consistent to the extent that all its subparts are measuring the same characteristic (Polit & Hungler 1995:415). Questions and observations that were relevant to the subject of investigation were used in order to enhance the reliability of the instrument.

Equivalence refers to the extent to which two different observers using the instrument yield equivalent measurements of the same traits in the same people or situations (Polit & Hungler 1995:416). Careful training, development of clearly defined and non-overlapping categories and the use of a small number of categories enhanced the accuracy of observer ratings and classifications.

3.4.3 Validity of the research instruments

Validity refers to the ability of an instrument to measure exactly what it is supposed to measure (De Vos et al 2002:167). Content validity is concerned with the sampling adequacy of the items for the construct that is being measured. This was assured by using questions from various instruments that had been used in other similar studies. The instruments were also subjected to evaluation and approval by the study supervisors. A combination of observations and interviews was used to check the accuracy of responses from interviewees and therefore minimise biases (Brink & Wood 1998:299).

3.4.4 Structure of the research instruments

Six research instruments were used for data collection as outlined below:

- Instrument 1: Structured interview schedule for the person in-charge of the health sub-district
- Instrument 2: An inventory of equipment and supplies at the facility (stores) by means of a checklist
- Instrument 3: Structured interview schedule for the store keeper
- Instrument 4: Checklist of observations of equipment and supplies at the facility
- Instrument 5: Structured interview schedule for the provider of medicines by way of injections
- Instrument 6: Structured interview schedule for the exit interview with patients.

3.4.5 Pre-testing of the research instrument

The research instruments were pre-tested on a small number of respondents who were comparable to the sample of correspondents but who were not part of it (WHO 2001a:178). This ensured that errors of whatever nature could be rectified immediately at little cost. After the necessary modifications had been made following the pre-test, the instruments were administered to the full sample (De Vos et al 2002:177).

The research instruments in this study were pre-tested at five health care facilities in the Mpigi district, which were excluded from the main study. Actual data were collected during the pre-testing and analysed carefully to ascertain whether or not they answered the research questions. The results of the pre-testing were used to refine the research instruments before using them in the actual study.

3.6 DATA COLLECTION

Permission to conduct this study was granted by the Research and Ethics Committee of Makerere University Medical School, Kampala, Uganda. Permission was also requested from and granted by the District Health Officer of the Mpigi district to visit the respective health care units (see Annexure A and C). A team of four research assistants was carefully selected and properly trained for the data collection. The research assistants were given instructions about confidentiality of information, patience and perseverance, being pleasant, the need to have a positive attitude, and the importance of following instructions. The researcher supervised the research assistants throughout the data collection period and process. The researcher checked the completed instruments at

the end of each day for omissions, incomplete answers, unclear statements or illegible writing. The research assistants were requested to revisit the health care units to collect missing or unclear information whenever this was deemed necessary. Data were collected for a period of five days, during January 2008.

3.7 ETHICAL CONSIDERATIONS

According to De Vos et al (2002:63), ethics refer to a set of moral principles that are suggested by an individual or group and are widely accepted, and offer rules and behavioural expectations about the most correct conduct towards experimental subjects and respondents, sponsors and other researchers. A number of key phrases describe the system of ethical protections that have been created to try to protect the rights of research participants. According to Trochim (2006:22), the principle of voluntary participation requires that people should not be coerced into participating in research. Closely related to the notion of voluntary participation is the requirement of informed consent. Essentially, this means that prospective research participants must be fully informed about the procedures and risks involved in the research and must give their consent to participate.

Ethical standards also require that researchers should not put participants in situations where they might be at risk of harm as a result of their participation. Harm can be defined as both physical and psychological (De Vos et al 2002:64). The privacy of research participants should be ensured during the research process. According to Trochim (2006:22), two standards are applied in order to help protect the privacy of research participants:

- First, a researcher should guarantee confidentiality by assuring participants that their identifying information will not be made available to anyone who is not directly involved in the study.
- The second standard is the principle of anonymity, which essentially means that the participant will remain anonymous throughout the study.

The principles of voluntary participation, informed consent, minimisation of harm, confidentiality and anonymity were strictly upheld in this study. The risk of harm was minimal because the study was non-invasive, involving observation of participants and

interviewing them. The scope and benefits of the study were explained to all the participants prior to being interviewed, using an introductory letter from the Mpigi district health officer and a consent form and thereafter written consent to participate in the interview was sought (Mouton 2001:239-247). The participants were also assured of anonymity and confidentiality. Anonymity was maintained by not recording the interviewees' names on the interview schedules, and the data collected was kept in the researcher's possession in a safe place to ensure confidentiality.

According to Trochim (2006:22), researchers should consider all relevant ethical issues in formulating research plans so that they are protected against potential legal implications of neglecting to address important ethical issues of participants. This is usually done through an Institutional Review Board (IRB), a panel of persons that reviews proposals with respect to ethical implications and decides whether additional actions need to be taken to assure the safety and rights of participants. The Institutional Review Boards of Makerere University Medical School, Uganda and the Department of Health Studies, University of South Africa reviewed and approved the research proposal for this study. Permission was also sought from the District Health Officer of the Mpigi district to visit the respective health units. Copies of permissions and the introductory letter to the participants and the consent form are attached in Annexures A, B, C and D.

3.8 LIMITATIONS OF THE STUDY

Although measures were taken to minimise errors through using structured instruments and training data collectors, the information obtained was vulnerable to interviewer, interviewee and observer distortions and biases.

Another limitation was that being a cross-sectional study the state of affairs found on the day of visit might have been influenced by recent special activities or events in the district. In addition, Mpigi district is peri-urban in nature and therefore the results obtained could not necessarily be generalised to rural districts.

3.9 DATA ANALYSIS

Data analysis entails the breakdown of data into constituent parts to obtain answers to research questions and to test research hypotheses (De Vos et al 2002:223). In most social research, data analysis involves three major steps, namely cleaning and organising the data for analysis, describing the data and testing hypotheses and models (Trochim 2006:101).

Data preparation involves checking or logging the data in; checking the data for accuracy; entering the data into the computer; transforming the data; and developing and documenting a data base structure that integrates the various measures (Trochim 2006:101). With the help of a statistician, the Epi-Info computer program was used for data entry and the Statistical Package for Social Sciences (SPSS), version 12 was used for analysis.

Descriptive statistics were used to describe the basic features of the data in the study, providing simple summaries about the sample's measures. Together with simple graphics analysis, descriptive statistics form the basis of quantitative analysis of data (Trochim 2006:101). Descriptive statistics were derived from the formed SPSS database to analyse and interpret the data. Descriptive statistics were used because this was a descriptive study, which aimed at describing the availability of commodities and challenges in their distribution at the respective health facilities. The proportion of health facilities where injection device security had been achieved was also determined.

3.10 CONCLUSION

This chapter covered the research design and methodology and described the population, sampling and sample, research instrument, data collection, ethical considerations, study limitations and data analysis in detail.

Chapter 4 presents and discusses the results of this study.

CHAPTER 4

Data analysis and interpretation

4.1 INTRODUCTION

This chapter discusses the data analysis and interpretation and the findings of this study. The data was analysed and the results were presented with the aid of percentages, tables and graphs, where possible.

The overall aim of this study was to identify the challenges encountered in maintaining an effective distribution of injection devices in the Mpigi District of Uganda. Variables such as the availability, the use and the distribution system of injection devices were used in order to accomplish the research objectives.

The specific objectives guiding this study were to:

- Determine whether health care facilities in the Mpigi district of Uganda have sufficient quantities of injectable medicines, diluents, single use injection devices and safety boxes for therapeutic purposes.
- Investigate the factors that lead to stock depletion of injection devices at health care facilities in the Mpigi district of Uganda.

The data collection and discussion of the results were done using a set of six instruments outlined below:

- Instrument 1: Structured interview schedule for the person in-charge of the health sub-district
- Instrument 2: An inventory of equipment and supplies at the facility (stores) by means of a checklist
- Instrument 3: Structured interview schedule for the store keeper
- Instrument 4: Checklist of observations of equipment and supplies at the facility

- Instrument 5: Structured interview schedule for the provider of medicines by way of injections
- Instrument 6: Structured interview schedule for the exit interview with patients

4.2 PRESENTATION OF FINDINGS

Data was collected from 38 health care units in the Mpigi district. The research assistants, who were guided and introduced to the selected health care unit staff by members of the District Health Team, filled in the research instruments. Figure 4.1 illustrates the distribution of health care facilities visited.

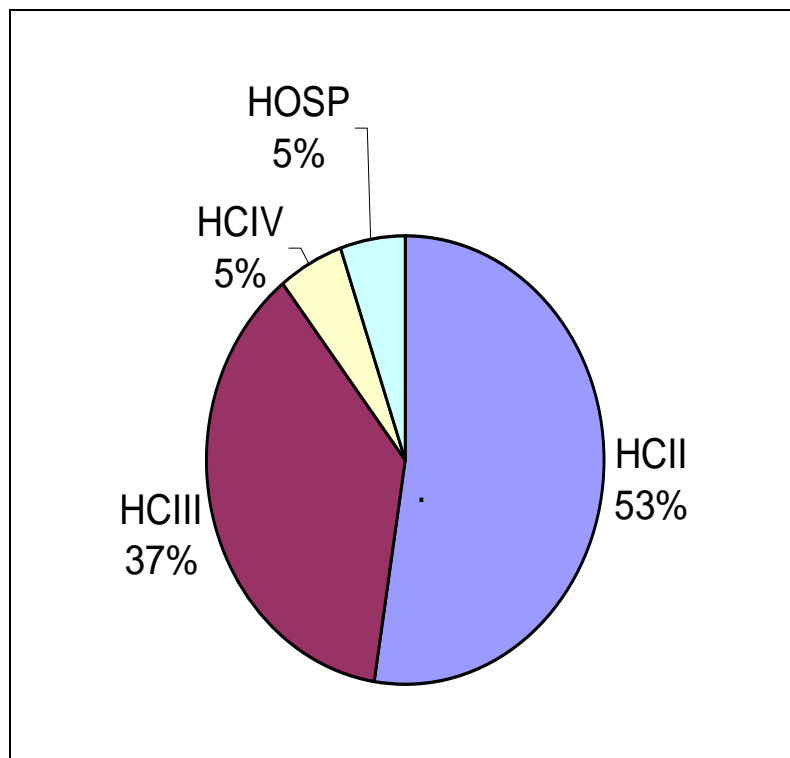


Figure 4.1
Distribution of health care units by level (N=38)

Of the assessed health care units, 53% (n=20) were at health centre II level (HCII); 37% (n=14) were at level III (HCIII); 5% (n=2) were at level IV (HCIV), and 5% (n=2) were at hospital level. All the HCIVs (2) and the hospitals (n=2) in the Mpigi district were selected for the study. Of the 38 health care units, 26.3% (n=10) were NGO health care units while

73.7% (n=28) were public health care units. Figure 2 illustrates the distribution of the selected health units by ownership.

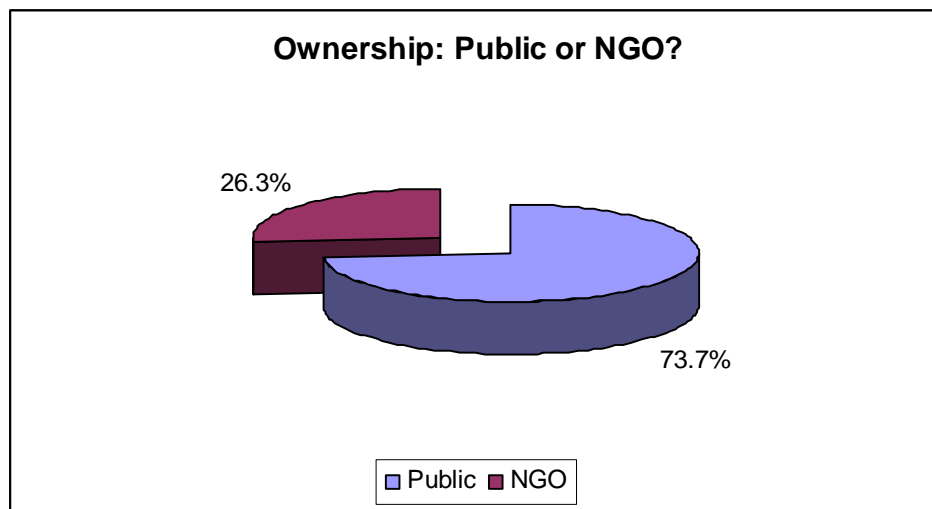


Figure 4.2
Distribution of health care units by ownership (N=38)

The data collected from all 38 health care units were subjected to computer-aided analysis, in line with the research questions of the study and with the assistance of a statistician.

4.2.1 Interview of the person in-charge of the health sub-district (instrument 1)

The four heads of health sub-districts in the Mpigi district were interviewed to find out the challenges affecting the distribution of injection devices to the lower level health care units under their jurisdiction as managers. According to Kerfoot (2002:2) and in line with the synergy model which guided this study, health managers should support the synergised care through the development of the required infrastructure, provision and maintenance of vehicles for delivery of supplies, provision of fuel for running the vehicles, developing the communication infrastructure, recruiting and supervising staff.

4.2.1.1 Type of distribution system

The persons-in-charge of the health sub-districts in Mpigi were asked whether the distribution to lower levels was done through a push or pull system. All four respondents reported that distribution of health care products to lower levels was done through a pull

system. According to Quick et al (1997:323), each level in a pull system determines the types and quantities of commodities they require and places orders with the supply source. This is consistent with the Ministry of Health of Uganda's (2005a:107) policy that managers of health care units should work out their own demand estimates and submit requisitions to the national medical stores.

4.2.1.2 *Timeliness in submission of requisitions*

A pull system requires that managers of lower level health care units submit requisitions to the supply source. The study showed that in two health care sub-districts, 80% to 100% of the lower health care units reportedly submitted requisitions on time while only between 50% and 59% of the lower health care units in the other two health sub-districts submitted requisitions on time. Timely requisition of requirements is necessary to ensure that re-supplies of health care commodities are delivered to health care units in time to avoid stock depletions.

4.2.1.3 *Method of communication*

Three (75%) out of the four health sub-districts managers reported that communication to lower level health care facilities was done by telephone while three (75%) health sub-district managers also reported that they made physical visits to the lower level health care units. None of the four health sub-districts reported having a radio link or fax for communication to the lower level health care units. According to Quick et al (1997:327), efficient telecommunication is essential for an effective health care commodity distribution system because it reduces the need to travel, saves staff time, and reduces the wear and tear of the distribution vehicles. In addition, reports and requisitions are received on time for decision making and timely processing of orders, respectively, in order to avoid stock depletions.

4.2.1.4 *Method of delivery*

Supplies may be moved between the warehouse and the receiving facility using a collection or delivery distribution system. Two (50%) of the four health sub-districts

reported that they delivered health care commodities to lower level health care units while the delivery system in the other two (50%) health sub- districts was reportedly by collection by the lower level health care units. According to Quick et al (1997:326), a delivery system offers the opportunity for higher levels to supervise fieldwork while having the disadvantage of requiring investment in reliable transport facilities. A collection system, on the other hand, provides an opportunity for issuing personnel to meet people from the field and discuss common problems while the cost of transport to the lower facility staff may be high.

4.2.1.5 Frequency of deliveries

The two health sub-districts that reported that they operated a delivery system were asked how often deliveries were made to the lower level health care facilities. One (50%) health sub-district manager reported that deliveries were made quarterly while the other health care sub-district reported making deliveries semi-annually. According to the Ministry of Health of Uganda (2003:30), health care units are supposed to receive supplies on a bi-monthly basis. Late delivery of supplies to health care units could cause stock depletions if the health care unit did not anticipate the delay.

4.2.1.6 Mode of transport

The persons-in-charge of the four health sub-districts were asked about the modes of transport used to deliver supplies to lower level health care units. All four health sub-districts reported that a district-managed vehicle was used while public transportation was reported by two health sub-districts. According to Quick et al (1997:325), transport is often the least reliable link in the distribution system, causing great frustration. Transport planning is therefore important if health care commodities are to reach the user health care facilities in a timely manner to avoid stock depletions.

4.2.1.7 Availability of distribution vehicles and fuel

Although all (100%) the health sub-district managers (n=4) reported that the vehicles used for distribution of supplies to the lower level health care facilities were available, there was not enough fuel to run them. According to the Ministry of Health of Uganda (2003:32),

shortages in funding for fuel often makes distribution difficult and this could lead to late delivery of health care commodities to user health care units, causing stock depletions.

4.2.1.8 *Monitoring and evaluation of distribution costs*

Two (50%) persons-in-charge of health sub-districts reported that they had in place a system for monitoring and evaluating distribution costs of supplies. The remaining 2 (50%) health sub-district managers reported that they did not have an effective system for monitoring distribution costs. Analysis of data on the current operating costs of the distribution system is necessary so that the current costs can be compared with costs of the alternative options (Quick et al 1997:327). This information helps the health care unit managers to operate an efficient and cost effective distribution system.

4.2.1.9 *Availability of private sector pharmacies*

All the persons-in-charge of the health sub-districts (n=4) reported that there were no private sector pharmacies within the catchment areas of their lower level health care units. In Burkina Faso, Logez et al (2005:1) showed that implementation of pharmaceutical depots next to public health care facilities increased geographical access to essential medicines and basic supplies, such as syringes and needles, contributing substantially to safer injection practices. The presence of private pharmacies within the catchment areas of health care facilities would be expected to fill the stock gap during stock depletions at health care facilities thereby supplementing the public sector distribution system.

4.2.1.10 *Availability of private sector storage and transport providers*

Three (75%) of the health sub-district managers reported that there were no private sector storage and transport providers that could be used for handling supplies and delivering services to areas where they are needed. According to Quick et al (1997:330), the private sector is able to distribute drugs more efficiently than the public sector and with a well-developed private sector it might be appropriate to contract out both storage and distribution to a private company.

4.2.1.11 Physical capacity of health care facility stores

Three (75%) persons-in-charge of the health sub-districts reported that the physical capacity of each health care facility store had sufficient space to handle the volume of supplies distributed to them. Only one (25%) person-in-charge of a health sub-district reported that the physical capacity of the health care facility stores in his health sub-district was not adequate. According to Quick et al (1997:324), available storage space should always be greater than the calculated maximum stock holding to allow for emergencies and for program expansion.

4.2.1.12 Problems affecting regular supply

The survey team interviewed the four persons-in-charge of the health sub-districts of the Mpigi district to find out the problems affecting the regular supply of products to health care units. Each person's response was recorded and the responses are summarized in table 4.1.

Table 4.1: Problems affecting regular supply of products to health care units

Problem	Frequency	
	(N=4)	Percent
Lack of transport	1	25
Lack of allowances for drivers	1	25
Lack of support staff for loading and offloading supplies	1	25
Fuel not enough	2	50
Stock depletion	1	25
Delay in submitting requisitions	2	50
Late delivery from NMS	2	50
Poor service levels	1	25
Inadequate funding	1	25

Table 4.1 shows that 50% (n=2) of the health sub-districts mentioned the delay in submission of orders by lower level facilities, the lack of fuel for running distribution vehicles, and the delay in delivering goods to the district by the national medical stores as problems affecting the regular supply of products to health care facilities. One (25%) of the persons in-charge of the health sub-districts mentioned lack of transport, lack of allowances to pay drivers, lack of support staff for loading and offloading supplies, stock depletion, delivery of less items than ordered and inadequate funding as the other problems affecting the regular supply of commodities to the health care facilities.

According to the WHO (2000:2), eradication of the re-use of syringes and needles without sterilisation requires an efficient distribution system to ensure the continuous, sufficient availability of injection equipment and infection control supplies in all health care facilities.

4.2.1.13 Support required to streamline the distribution of commodities

The heads of the health sub-districts were asked what kind of support they required in order to streamline the distribution of commodities to the health care units. Table 4.2 summarises their responses.

Table 4.2: Support required in streamlining the distribution system (N=4)

Support required	Frequency	Percentage
Provision of fuel for the distribution vehicles	2	50
Delivery of commodities directly to the health sub districts	2	50
Timely delivery	2	50
Improve transport infrastructure	1	25
Provide allowances for drivers	1	25

The results show that 50% (2) of the heads of the health sub-districts needed support in the form of the provision of fuel to run the distribution vehicles. Two (50%) respondents

mentioned the need to deliver supplies directly to the health sub-district stores by the national medical stores. Currently, the national medical stores deliver commodities to the district store from where the health sub-districts collect. Two (50%) respondents mentioned that there should be timely delivery of commodities to the district by the national medical stores in order to improve the distribution system of health care commodities and thereby avoid stock depletions at the health care facilities. One (25%) of the respondents stated improvement in the transport facilities and the provision of allowances for the drivers.

4.2.2 An inventory of equipment and supplies at the facility store (instrument 2)

This instrument was used to determine the availability of injection devices at the facility on the day of the survey and three months prior to the survey. The inventory records required for proper stock management were also scrutinized in order to identify the problems that could lead to stock depletions of injection devices at the health care facilities.

4.2.2.1 Availability of stock card or register

The commodity stores at each of the selected health care facilities were visited in order to observe the availability of stock cards or registers used to manage each of the items selected for the study which included: safety boxes for the disposal of contaminated sharps such as used syringes and needles; auto-disable syringes (of sizes 2ml, 5ml and 10ml); injectable drugs (quinine, fortified procaine penicillin, benzyl penicillin and benzathine penicillin) and diluents for the injectable medicines (dextrose solution 5% and water for injection). Among the injectable drugs, 34 (94.4%) facilities were found to be using stock cards for quinine; 33 (91.7%) facilities were using stock cards for fortified procaine penicillin; 35 (97.2%) facilities were using stock cards for benzyl penicillin and 32 (88.9%) facilities were using stock cards for benzathine penicillin. Among all facilities (n=36), 32 (88.9%) were using stock cards for 2ml auto-disable syringes and needles; 34 (94.4%) were using stock cards for 5ml auto-disable syringes and needles while 31(86.1%) were using stock cards for 10ml auto-disable syringes and needles; 33 (89.2%) were using stock cards for safety boxes used for disposal of contaminated sharps such as used syringes and needles; 13 (85.7%) facilities that manage dextrose injection 5% (HCIII, HCIV and hospitals), had stock cards for the item while 25 (71.4%) facilities had stock cards for water

for injection. Figure 4.3 shows the difference in availability of stock cards between government and non-government facilities by commodity category. The figure illustrates that public health care facilities maintain stock cards for safety boxes (92.6%, n=27) and auto-disable syringes and needles (93.6%, n=26) at a higher rate than non-government facilities (80%, n= 10 for safety boxes; 80%, n= 10 for auto-disable syringes and needles), and the results show that the stock card availability for diluents is less common at government health care facilities (59.8%) than at non-government facilities (85%). Public health care facilities are far more likely to maintain stock cards for safety boxes, syringes and needles and injectable drugs than for the diluents.

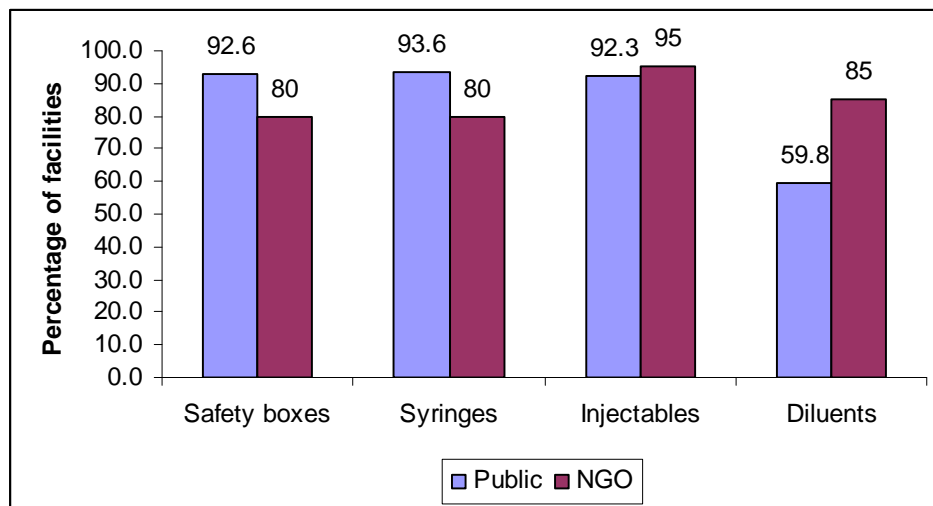


Figure 4.3
Availability of stock cards by commodity category

The instructions for the health management information system for commodity management require that any commodity which is kept for more than one week should be tracked, using a stock card (Ministry of Health of Uganda 2005a:99). The stock card includes information on where the commodities were issued to or from, the quantity issued, and the balance on hand. According to the Ministry of Health of Uganda (2003: 25), the stock card provides valid and timely information, which can be used by the stock manager to forecast and request for sufficient quantities in order to avoid stock depletions and thereby meet the needs of the clients at service delivery points. This study found an improvement in availability of stock cards at health care facilities compared to the study conducted in Uganda by the MMIS project (2005:7) to evaluate the first phase

implementation of the project in its four pilot districts of Mbarara, Nebbi, Pallisa and Mpigi, which showed that only 30% of health care units had stock cards for management of health care commodities in the therapeutic services.

4.2.2.2 Updating of the stock card or register

According to the Ministry of Health of Uganda (2005a:108), stock cards should be updated as soon as possible after receiving or issuing commodities in the store. Stock movements that are not immediately recorded on the stock card may be forgotten and the information on the stock card may become unreliable in the forecasting of re-supply quantities of the affected commodity (Ministry of Health of Uganda 2004b:8). Such unreliable information and inaccurate forecasting may result in stock depletions at the health care facility. The stock cards used to manage the selected injection devices at the selected health care units were scrutinized to find out whether they had been updated in the past 30 days prior to the survey. The results indicated that on average, the stock cards of injectable medicines were updated at 81.9% of the health care units; 66.4% of the facilities had stock cards of the diluents updated, while slightly above half of the health care units (54.5% and 57.6%) had the stock cards for safety boxes and syringes updated, respectively. Figure 4.4 illustrates the proportion of facilities that had stock cards updated in the 30 days prior to the survey by category of commodity.

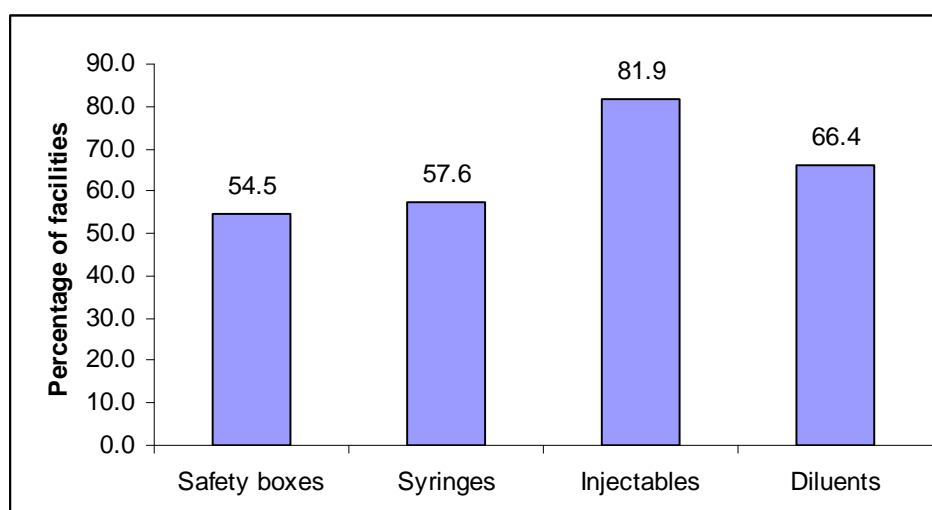


Figure 4.4
Facilities with updated stock cards by commodity category

The results for the safety boxes, syringes and needles and the diluents were consistent with the MMIS (2005:8) survey, which showed that about 60% of health units had had their stock cards updated in the past 30 days. Personnel in charge of the health care facility store should regularly update the commodity stock cards so that the information required for effective commodity management is available at all health care facilities.

4.2.2.3 Balance on stock card or register

According to the Ministry of Health of Uganda (2003:26), accurate data on the current stock status is vital for effective decision making at every level of the distribution system. This information is useful for determining how long the available stock would last, if a commodity were over- or under-stocked and how much to order. Inaccurate data, when used to make such decisions, could lead to inaccurate forecasting of requirements causing stock depletions of injection devices at the health care facilities. Information was collected regarding the accuracy of the quantity recorded on the stock card as the balance available for each of the selected injection devices at the health care facilities on the day of the survey. For each commodity studied, the quantity of stock on hand recorded on the stock card was compared with a physical stock count. The overall median percent discrepancy between the stock card record and the physical count for those facilities that had stock card records revealed that there was a median discrepancy of 31% (n=20) for safety boxes, 79% (n=17) for 2 ml auto-disable syringes, 51% (n=13) for 5ml auto-disable syringes, 68% (n=15) for 10 ml auto-disable syringes, 50% (n=5) for dextrose solution 5%, and 50% (n=17) for water for injection. The median discrepancy for quinine was 17% (n=14), 60% (n=13) for fortified procaine penicillin, 25% (n=15) and 100% (n=10) for benzathine penicillin. Figure 4.5 illustrates the median percentage discrepancy for safety boxes, auto-disable syringes and the diluents (dextrose solution 5% and water for injection). Overall, the results revealed that the median percentage discrepancy between the stock card record and the physical count for all the commodities studied ranged from 50% to 79% except for safety boxes, quinine and benzathine penicillin. These results were consistent with the MMIS study (2005:10), which showed an overall percentage discrepancy between physical count and stock card balances of 62% (n=93) in the four districts of Uganda that were surveyed.

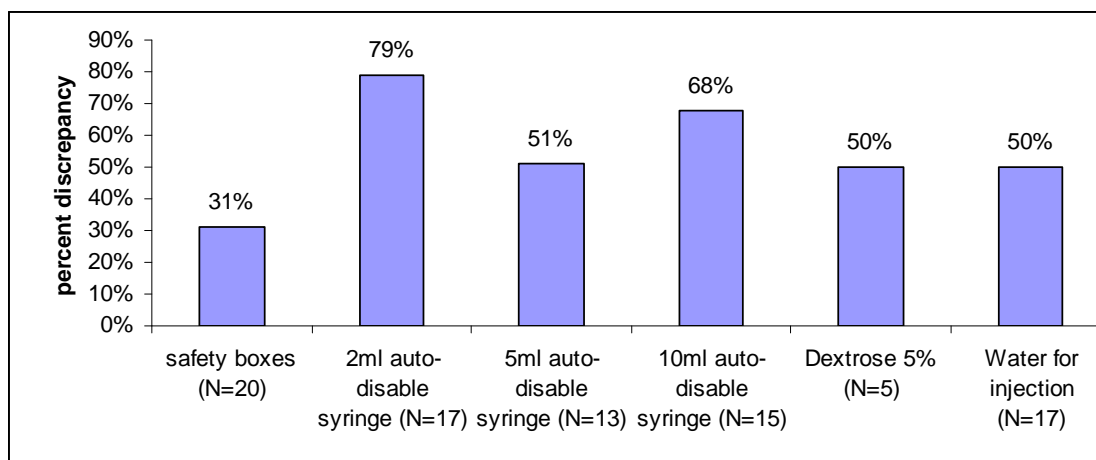


Figure 4.5

Median percentage discrepancy between stock card record and physical count

These results showed that the general quality of the data recorded on the stock cards in the facilities surveyed was poor. This was explained by the fact that commodity management at health care units was done by health care workers rather than dedicated storekeepers who may fail to allocate time to balancing the stock card records.

4.2.2.4 Stock depletions

Quick et al (1997:317) state that the primary management goal of an effective and efficient distribution system is to maintain a steady flow of supplies to facilities where they are needed. According to Logez et al (2005:2), the common failure of health care systems to ensure adequate and sufficient supplies of injection devices may have a negative impact on injection safety. According to the WHO (2000:2), eradication of the re-use of syringes and needles without sterilisation requires the continuous, sufficient availability of injection equipment and infection control supplies in all health care facilities. When facilities experience stock depletions, they are unable to practise according to the set standards. Stock availability is the ultimate indicator of a logistics system's performance and provides an indication of the overall effectiveness and efficiency of the entire system, from forecasting and procurement to distribution, storage, and inventory management (Ministry of Health of Uganda 2003:20).

At each health care facility visited for this study, stock cards were reviewed to collect information on the availability of the selected commodities on the day of the visit and during the three-month period prior to the survey from November 1, 2007 to January 31, 2008. A three-month period was reviewed in order to capture an accurate picture of stock availability at each health care facility and to allow for monthly variation in consumption and availability. Figure 4.6 shows the percentage of facilities that experienced stock depletion of safety boxes, auto-disable syringes and needles, dextrose solution 5% and water for injection during the three-month period for all facilities combined (all levels), shown separately for public and private facilities. Facilities without stock card records were excluded from the analysis.

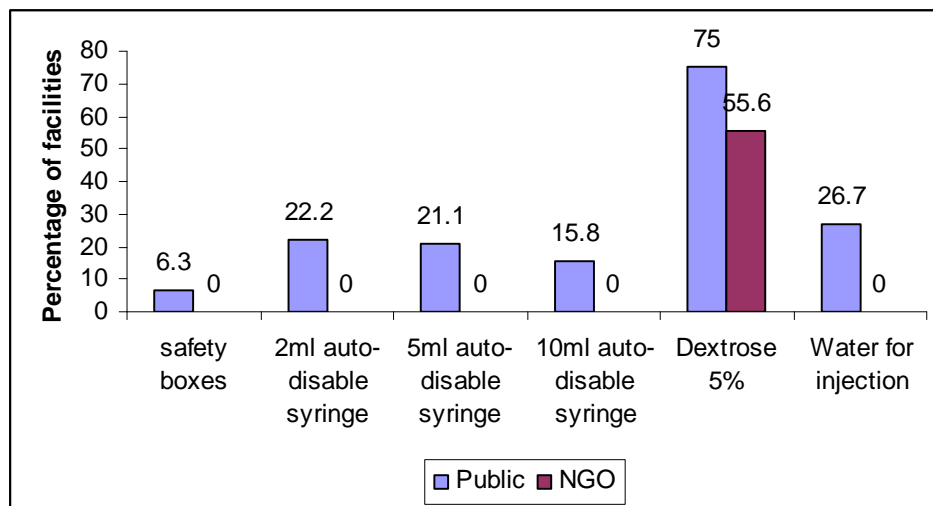


Figure 4.6
Stock depletions (November 1, 2007 – January 31, 2008)

The study showed that in the three months prior to the survey, among the public health care facilities, there were stock depletions of safety boxes at 6.3% (n=16) of the facilities, 2ml auto-disable syringes at 22.2% (n=18) of the facilities, 5ml auto-disable syringes at 21.1% (n=19) of the facilities and 10ml auto-disable syringes at 15.8% (n=19) of the facilities. There were no recorded stock depletions of safety boxes (n=4), 2ml auto-disable syringes (n=5), 5ml auto-disable syringes (n=6) and 10ml auto-disable syringes (n=4) at any of the NGO health care facilities with stock card records.

Analysis of stock depletions in the three months prior to the survey for diluents showed that 75% (n=8) and 55.6% (n=9) of the public and NGO health care facilities, respectively, experienced stock depletion of dextrose solution 5%. In addition, 26.7% of the public health care facilities recorded stock depletions of water for injection in the same period. The NGO facilities (n=4) did not record any stock depletion of water for injection during this period. Stock depletion of recommended diluents may force health care workers to use substitute diluents there by affecting the safety of medicines administered to patients through injections.

The study also showed that stock depletions of injectable medicines were common at both the public and NGO health care facilities (see Table 4.3). Above 50% of the public health care facilities registered stock depletions for all the injectable drugs studied while about one third of the NGO health care facilities registered stock depletions for all injectable drugs except benzyl penicillin during the three-month period.

Table 4.3: Percentage of facilities with stock depletions of injectable medicines over the three-month period November 1, 2007 – January 31, 2008

Ownership	Quinine	Number of facilities with records	Fortified procaine penicillin	Number of facilities with records	Benzyl penicillin	Number of facilities with records	Benzathin penicillin	Number of facilities with records
Public	68.2	22	81.2	22	90.9	22	95	20
NGO	28.6	7	33.3	6	16.7	6	50	8

The results of stock depletions were consistent with the Ministry of Health of Uganda (2003:20) survey, which showed that public health care facilities were much more likely to experience stock depletions of essential drugs than NGO facilities. The second health sector strategic plan (2005/06 – 2009/2010) of the Ministry of Health of Uganda (2005b:60) sets a target of less than 20% stock depletion for all the items required for delivery of the Uganda national minimum health care package. The results of this study showed that much more effort is required in order to reduce the occurrence of stock depletions.

4.2.2.5 Frequency of stock depletions

Frequent stock depletions of commodities may imply that stock management is inefficient at the health care facility. A national cross-sectional survey of injection safety practices in health care facilities conducted by the Ministry of Health of Uganda (2004a:2) indicated that 65% of the surveyed facilities reported having experienced stock depletions of disposable injection supplies in the 12 months prior to the survey and that this stock depletion was attributed to a less-than-optimal logistics system, including ineffective forecasting.

The frequency of stock depletions at the health care facilities, which had experienced stock depletions for any of the surveyed commodities and where records were available, was recorded. The results showed that most of the affected health care units had experienced stock depletions only once during the three-month period reviewed. One health care unit had experienced stock depletions of quinine five times and another health care unit had experienced stock depletions of dextrose solution 5% four times during the three-month period.

4.2.2.6 Duration of stock depletions

According to the Ministry of Health of Uganda (2003:22), an assessment of the duration of stock depletions gives a measure of the severity of the problem of stock depletion at the health care facilities. In addition, the Ministry of Health of Uganda (2003:22) states that an assessment of the average duration of stock depletion is a measure of the probability that a client who sought health care during the stock depletion period did not receive the commodity or the service needed. Stock depletion of injection devices at a health care facility could lead to unsafe administration of medicines to patients by means of injections.

The stock cards used to manage the commodities selected for the study were scrutinized in order to assess the duration of stock depletion where it had occurred. Facilities without stock card records were excluded from the analysis since the data for the duration of stock depletion was not available. The study found that the median duration of stock depletion for syringes, diluents and injectable medicines during the three-month period ranged from one

month to three months. There was no stock depletion recorded on the stock cards for safety boxes during this period. Figure 4.7 shows the median stock depletion for syringes.

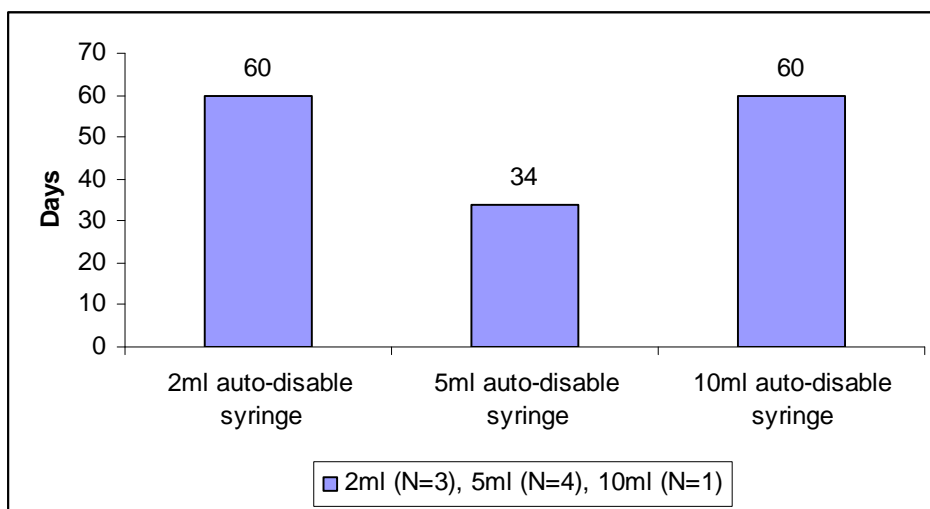


Figure 4.7
Duration of stock depletion of syringes

Figure 4.7 illustrates that median duration of stock depletion was 60 days for 2ml auto-disable syringes (n=3), 34 days for 5ml auto-disable syringes (n=4) and 60 days for 10ml auto-disable syringes (n=1). The few facilities that experienced stock depletions for syringes and needles agreed with the results of the MMIS study (2005:31-32), which showed that most health care facilities surveyed in the four districts of Uganda where the project was implementing injection safety programmes had never had any stock depletions. However, the duration of stock depletion in the MMIS study (2005:31) was much shorter (less than 10% of the reviewed period) when it occurred.

This study also showed that at some health care units, the stocks of injectable medicines were depleted for longer than two months out of the three-month period reviewed. Figure 4.8 illustrates the median duration of stock depletions of the injectable medicines and the diluents.

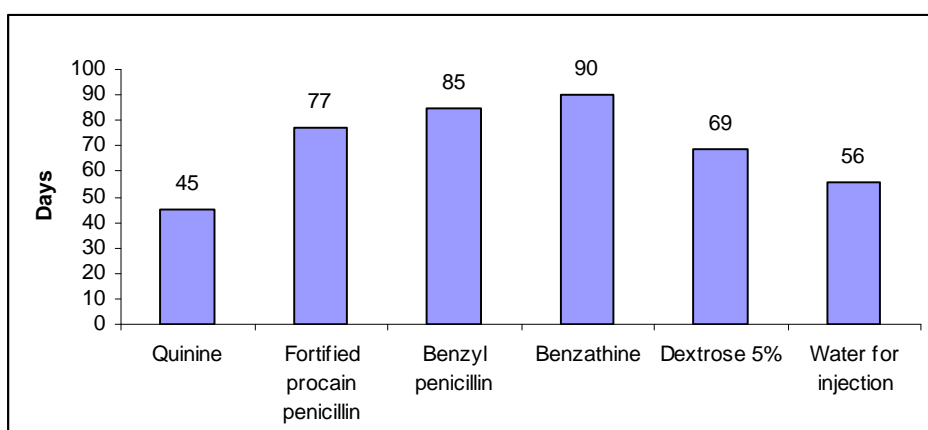


Figure 4.8

Median duration of stock depletion of injectable drugs and diluents

The median duration of stock depletion was 77 days (19) for fortified procaine penicillin, 85 days (21) for benzyl penicillin, 90 days (22) for benzathine penicillin. Among the injectable medicines, only quinine had a median duration of stock depletion of less than two months (45 days; 16). Analysis of the duration of stock depletion for the diluents studied showed that the median duration of stock depletions of dextrose solution 5% and water for mixing injectables was 69 days (13) and 56 days (4), respectively.

These results show that up to half (52.6%) of the surveyed health care facilities experienced stock depletions of injectable medicines with median durations of over two months. The results agreed with the national survey of the Ministry of Health of Uganda (2003:22), which showed that health care facilities were experiencing stock depletions for long periods of time. The long duration of stock depletion of injectable medicines observed in this study can be attributed to the delay by the national medical stores to fulfil the two scheduled deliveries of essential commodities to the Mpigi district from 1 September 2007 to 31 December 2007.

4.2.2.7 Total number of products issued

According to Nersesian et al (2004:6), consumption data informs forecasts and gives useful information for the full supply of injection devices. The Ministry of Health of Uganda's (2005:115) guidelines require the commodity manager at every health care unit to

determine the average monthly consumption of each health care commodity at their health care unit so that they are able to accurately determine the quantities to requisition for in order to avoid stock depletions. The consumption data is derived from the quantities issued out of the store as tracked by the respective commodity stock cards.

The stock cards for the commodities selected for the study were scrutinized in order to determine how many health care facilities had records of consumption over the three-month period prior to the survey. Figure 4.9 depicts the results of the analysis for safety boxes, syringes and diluents.

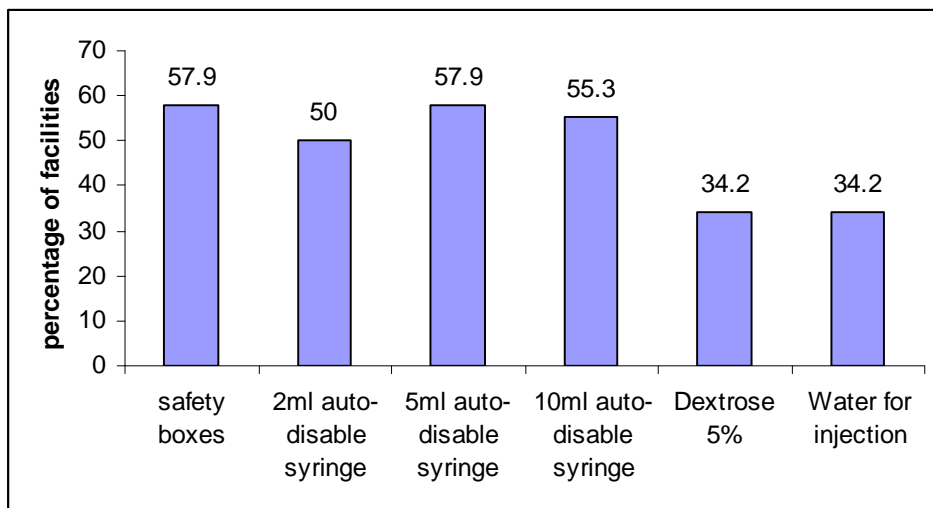


Figure 4.9

Percentage of facilities with consumption data for safety boxes, syringes and needles and diluents (N=38)

The results show that on average just above half (55.3%, n=38) of the facilities had the consumption data for safety boxes and syringes and needles for the three-month period prior to the survey. Consumption data was very poor for the diluents (dextrose solution 5% and water for injection) with just above one third (34.4%, n=38) of the health care facilities having consumption data.

Figure 4.10 illustrates the results of the analysis for the injectable medicines. The results showed that the average number of facilities with consumption data for fortified procaine

penicillin, benzyl penicillin and benzathine penicillin was 55.3%, (N=38). The consumption data for quinine was available at 71.1% (N=38) of the facilities.

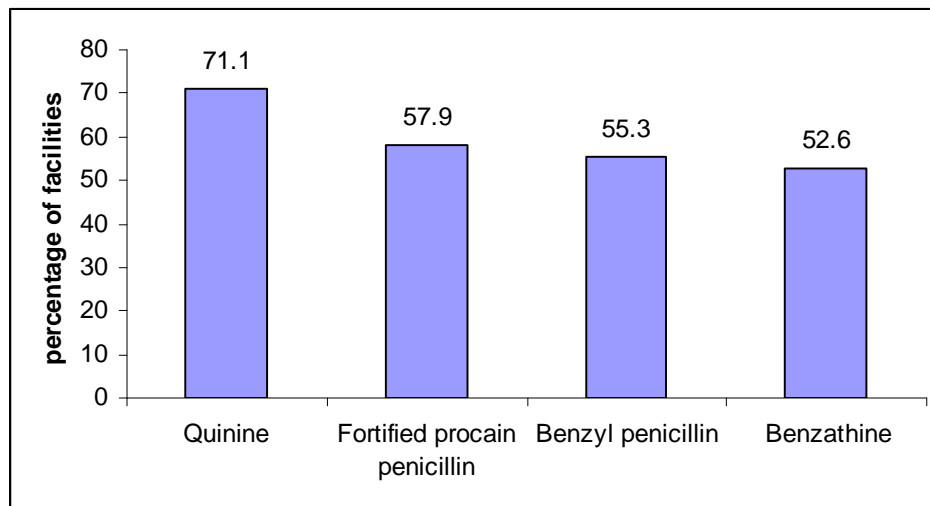


Figure 4.10

***Health care facilities with consumption data for injectable medicines
(N=38)***

The results show that the distribution system for injection devices is not well managed at most of the health care facilities in the Mpigi district since according to Quick et al (1997:317) an efficient distribution system should provide information for forecasting needs.

4.2.2.8 Physical count of injection devices

The physical count of the available stock of commodities can be used to estimate of how long the commodities in stock will last to serve clients at the health care facility. Health care facility staff can ration commodities in order to avoid stock depletions. Rationing or selectively offering commodities according to certain health conditions implies that all clients' needs will not be met and the logistics distribution system has not met its goal (Ministry of Health of Uganda 2003:23).

A physical count of the commodities studied was carried out and the stock ledger or stock cards were reviewed to gather historical data on the quantities consumed by clients or

issued out of the store during the three-month period prior to the survey. The historical data on the consumption was then used to estimate the average monthly consumption or monthly issue rates which were compared to the physical inventory to establish the number of months of stock of injection devices available to be used on the day of the survey. Figure 4.11 illustrates the results of the analysis. Facilities without consumption data were excluded from the analysis.

According to the Ministry of Health of Uganda's (2005:101) guidelines for drug management, the minimum amount of stock that managers should keep is two months' consumption. In addition, the guidelines state that the maximum amount of stock that a health care facility should not exceed is five months' consumption.

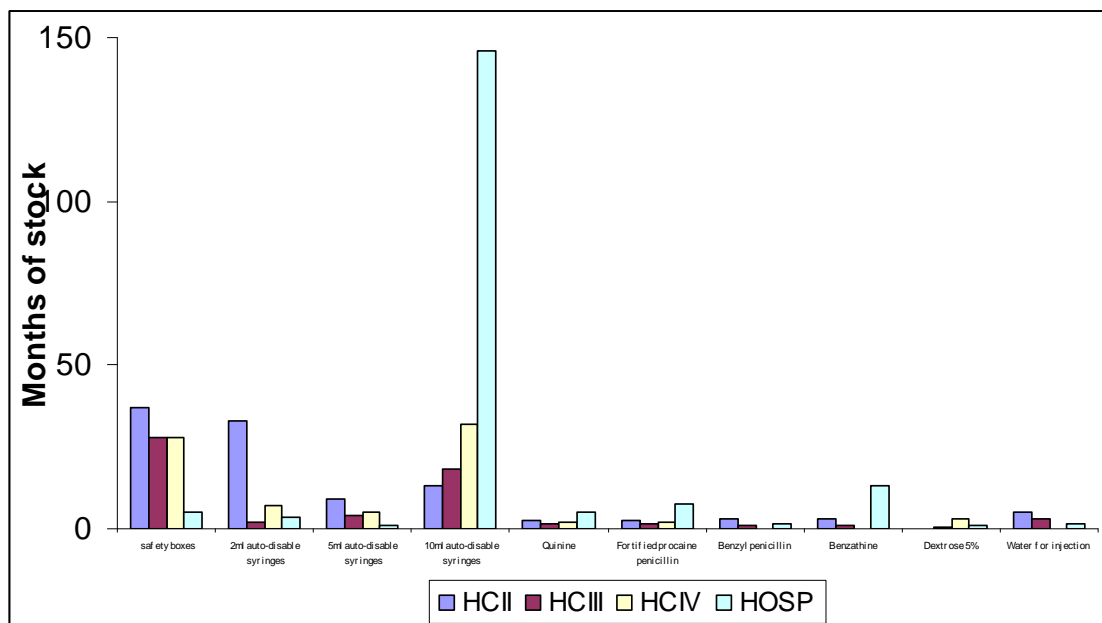


Figure 4.11

Average number of months of stock of injection devices available at each level of health care facility

This study found that the safety boxes were overstocked at all levels of the health care units except at hospital level where the average number of months of stock was the recommended maximum of five months. A review of the stock status of auto-disable syringes revealed that the 10ml size were overstocked at all levels of health care units with the average number of months of stock exceeding five months. The 2ml auto-disable

syringes were overstocked at HCII and HCIV levels while the 5ml auto-disable syringes were overstocked at HCII level. The overstocking of safety boxes and syringes could be explained by the fact that these two categories of injection devices are supplied to the health care facilities through a parallel supply channel to that of the injectable medicines. In addition the common stock depletion of injectable medicines in the three-month period prior to the survey could have contributed to the observed overstocking of the safety boxes and syringes at the health care units. The average stock level of 2ml and 5ml auto-disable syringes, however, was below the recommended minimum of two months supply at HCIIIs and hospitals, respectively.

The analysis of the stock status of the injectable medicines revealed that fortified procaine penicillin and benzathine penicillin were overstocked at the hospital level. All the injectable medicines were under stocked at the HCIII level with an average number of months of stock for each commodity studied of less than two months. Benzyl penicillin was also under stocked at the hospital level with the average number of months of stock of 1.5 months.

Among the diluents, dextrose solution 5% was under stocked at HCIII and hospital levels while water for injection was under stocked at HC IV and hospital levels.

The results of the analysis of the stock status are consistent with the Ministry of Health of Uganda's survey (2003:24), which showed that stock levels for most commodities were low at higher levels of the health care system and higher at the lower levels of the system.

4.2.2.9 Conditions of storage

According to the Ministry of Health of Uganda (2003:33), all health care commodities require specific procedures and conditions for safe storage to protect their integrity and effectiveness, maximize their shelf life, and make them readily available for distribution. When all the levels of the system follow the same standards of storage, clients can be assured that they will receive high-quality products. Quick et al (1997:317) point out that proper organisation and maintenance of storage facilities helps to maintain device quality, minimise theft, and maintain regular supply to health facilities.

At each facility, the survey team visually inspected the storage area for each of the categories of the commodities studied (safety boxes, syringes and needles, injectable medicines and diluents). The survey instrument included a checklist of seven standard storage conditions necessary to ensure the effective and efficient storage of all commodities (Ministry of Health of Uganda: 2004b:27-28). These included:

- Physical arrangement of the items in the store according to expiry dates also known as FEFO (First Expiry, First Out) in which items with the nearest expiry dates are issued first
- Capacity to handle the volume of commodities in the store
- Ventilation of the store
- Cleanliness of the store
- Presence of pallets to hold the commodities off the floor so that they are not spoilt by moisture
- Presence of shelves to increase the storage surface area and to create organized compartments of storage for easy access and
- Restricted access to the store to prevent loss of the items due to theft

Figure 4.12 illustrates the level of compliance with the seven selected conditions for proper storage of health care commodities in the surveyed health care facilities. On average, 72.6% (n=38) of the facilities fulfilled all seven conditions of storage for the injectable medicines while 71.1% (n=38) fulfilled all seven conditions of storage for diluents. In comparison to injectable medicines and diluents, storage conditions for syringes and needles and safety boxes were fulfilled by fewer health care facilities, with an average of 60.2% (n=38) of the facilities fulfilling all seven conditions of storage for safety boxes and 58.3% (n=38) fulfilling all seven conditions of storage for auto-disable syringes and needles.

The individual storage conditions were also analysed to identify the problem areas in need of improvement or reinforcement. Figure 4.13 shows the average percentage of health care facilities that met each of the seven selected conditions for the storage areas of each of the categories of injection devices studied.

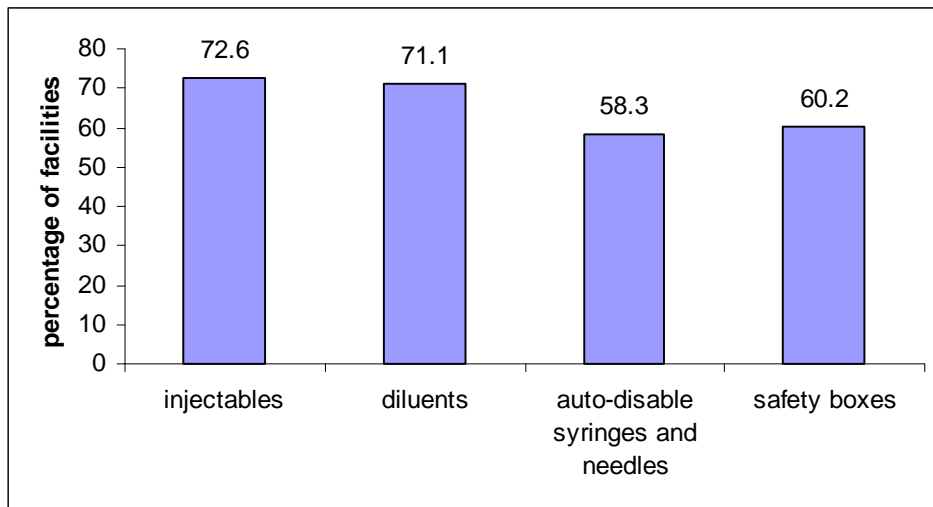


Figure 4.12

Health care facilities complying with the seven minimum storage conditions for each category of injection devices (N=38)

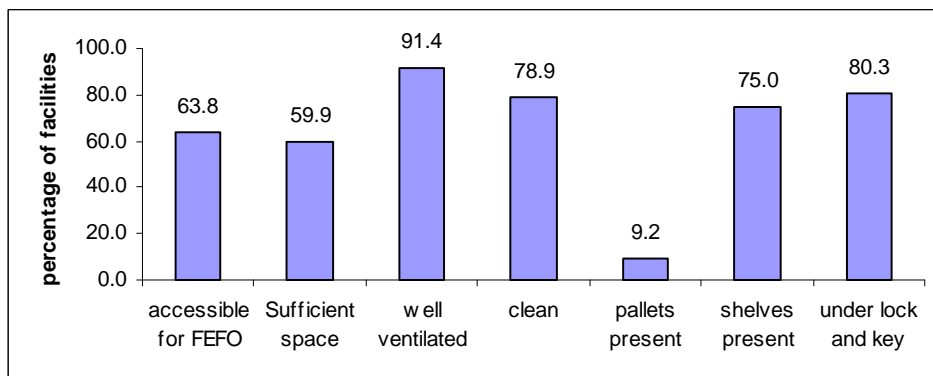


Figure 4.13

Health care units complying with individual storage conditions (N=38)

At least half of the health care facilities visited met all of the selected storage criteria except the presence of pallets. Approximately 40% (38) of health care facilities did not have sufficient space for the existing commodities or space for reasonable expansion (such as for the receipt of expected commodity shipments in the near future). The results show that 9.2% (38) of the health care facilities had pallets in their stores. This is an area that needs urgent attention in order to ensure that the quality of the health care products at the facilities' stores is not compromised.

These results were comparable to the Ministry of Health of Uganda's survey (2003:33-34), which indicated that the minimum storage criteria were met by at least half of the facilities visited and that half of the facilities did not have sufficient storage space.

4.2.3 Interview of the storekeeper (instrument 3)

In order to establish the performance level of the distribution system in the Mpigi district, the member of staff identified at each health care facility as the person responsible for commodity management was interviewed. An injection provider was interviewed if the health care facility did not have a storekeeper or if the storekeeper was not available on the day of the survey. The collected data was based on the storekeeper's answers only and not the observations of the data collectors.

4.2.3.1 Presence of a storekeeper

The staff responsible for stock management or, if not available, an injection provider were interviewed. Overall, 26 (78.8%) health care facilities had a store-keeper responsible for commodity management at the facility although the store-keepers were found at only 20 (60.6%) health care facilities on the day of the survey (see figure 4.14).

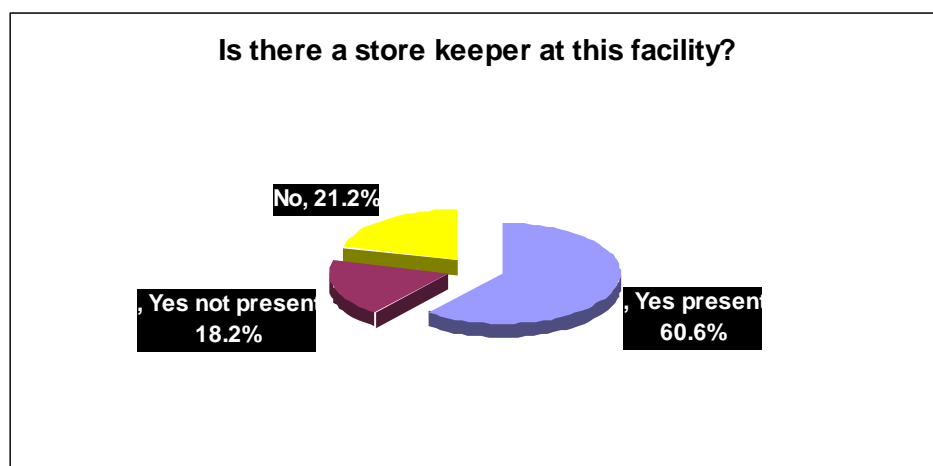


Figure 4.14
Percentage of health care facilities with a storekeeper (N=33)

According to Quick et al (1997:326), a distribution system cannot work unless there are enough suitably qualified staff members to administer and operate the commodity distribution system effectively. Of the facilities, 21.2% (33) did not have a person specifically responsible for stock management and an injection provider was interviewed.

The respondents were asked how they learned to complete the logistics forms used at the facility. Of all the stock managers interviewed, 57.9% (38) reported that they learned to complete the forms used at the facility during logistics training while 34.2% reported learning during on-the-job training; 5.3% reported self-learning, and 2.6% reported that they learned elsewhere.

Figure 4.15 shows the proportions of stock managers at each level of the surveyed health care facilities who reported each method of learning.

A greater proportion of staff at the hospitals and HCIII levels were more likely to have learned completing the forms through formal training in logistics while HCII staff were more likely to have learned through on-the-job training. This is consistent with the results of the Ministry of Health of Uganda's survey (2003:28), which showed that staff at the higher levels of the health care system was more likely to receive formal logistics training than staff at lower levels. People in charge of commodity management at all levels of the health care system should be suitably trained to efficiently operate the distribution system so as to avoid stock depletions.

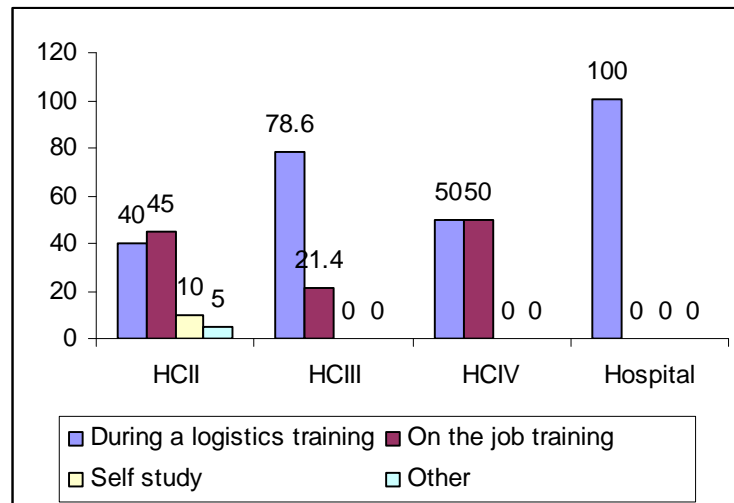


Figure 4.15
Training in completing logistics forms (N=38)

4.2.3.2 Availability of logistics forms

According to Quick et al (1997:326), reliable management information is vital for coordinating the distribution network. The information system consists of forms and procedures to record inventory levels, costs and sales processes, receipts for issues of commodities. Forms, records, and reports are the core of the supply information system. All necessary forms should be available and all staff should be trained in the use of these forms (Quick et al 1997:327).

According to the Ministry of Health of Uganda's (2005:99-108) procedures for the health management information, there are three forms that must be used at each of the health care facilities for the management of health care commodities. These forms are described below:

- The stock card, which is used to track the movements and balance of all commodities stored at any place in the health care unit for more than a week

- The requisition and issue vouchers, used to make internal and external orders for issuing of commodities from or to the health sub-district store or the national medical stores, and
- The record of issuing, used for recording the disbursement of commodities to clients and making consumption reports

The storekeepers were interviewed to find out whether the stock cards, the requisition and issue vouchers and the consumption reports were available to manage health care products at their facilities (see figure 4.16).

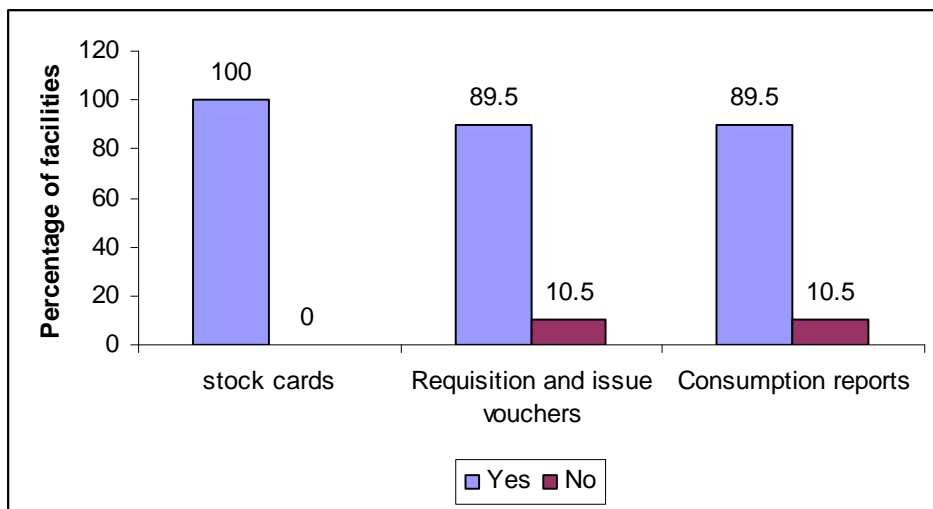


Figure 4.16
Health care units having logistics forms (N=38)

The results show that all the health care facilities reported having stock cards to manage health care products. However 10% (38) of the facilities did not have requisition and issue vouchers or the consumption reports. These results show a marked improvement since the MMIS survey (2005:7) to evaluate the first phase of implementation of its activities in the four districts of Uganda, which indicated that only 49% of health care facilities reported having stock cards to manage health care commodities in the therapeutic services.

4.2.3.3 Use of stock cards

Timely information can greatly improve stock managers' ability to identify, forecast, and procure sufficient quantities to meet the needs of the facilities in the supply chain and ultimately the needs of the clients at service delivery points (Ministry of Health of Uganda 2003:25). This information is derived from stock card records of each of the commodities managed by the facilities. The storekeepers were asked if they were using stock cards to manage syringes, safety boxes and injectable medicines. All the health care facilities (38) reported using stock cards to manage syringes and injectable medicines, and only 2 (5.3%) reported not using stock cards to manage safety boxes.

4.2.3.4 Use of the information on stock cards

The information on stock cards should be used to prepare reports to project commodity needs, revise budgets, and assess commodity use (Quick et al 1997:327). The storekeepers were interviewed to find out how the information on the stock cards was used. The respondents could give more than one use of the cards (see figure 4.17).

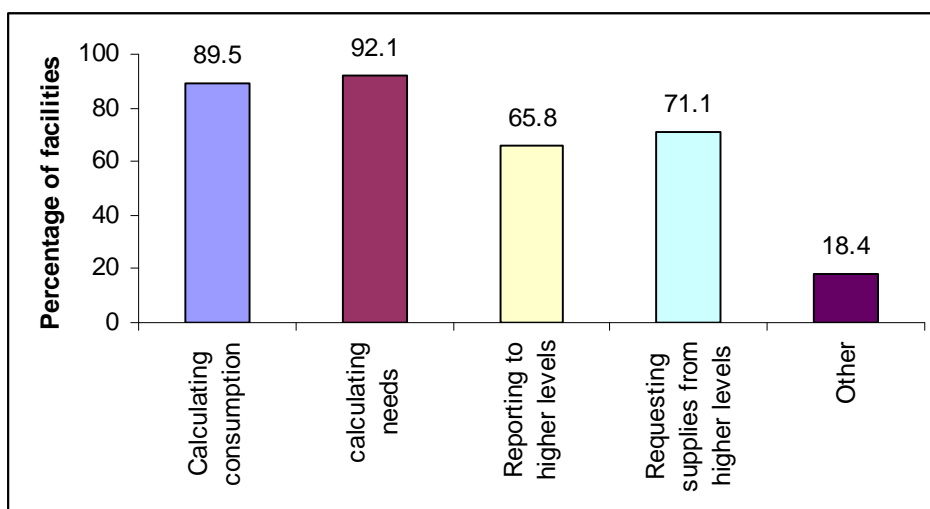


Figure 4.17

**Percentage of health care facilities using stock cards for each purpose
(N=38)**

The majority of health care units (above 89%, n=38) reported that they used the information from stock cards for calculating consumption and needs; 71.1% reported using the information for requesting supplies from higher levels. Only 65.8% reported that they used the information on stock cards for reporting to higher levels. The health management information system, however, requires that all health care units should use stock cards to prepare monthly reports on stock depletions and the duration of stock depletions at their health care facilities (Ministry of Health of Uganda 2005a:113). The other uses of the information on the stock card reported included accountability for the supplies at the health care units and tracking of expiry dates of health care products in the stores.

4.2.3.5 Logistics reports and their frequency

According to Quick et al (1997:327), logistics reports should be prepared regularly by the individual health care units to the health sub-district offices, which report to the central office. Such reports are used to project commodity needs, revise budgets, and assess commodity use in order to ensure constant availability of supplies at the health care units.

The storekeepers were interviewed in order to find out if they were sending any logistics reports to the higher level. All the staff interviewed (38) reported that they sent logistics reports to the higher level; 89.5% of the health care units reported that they were supposed send the reports to the higher level monthly and were actually sending the reports on a monthly basis. Four (10.5%) health care units reported that they were actually sending the logistics reports to the higher level on a quarterly basis (see figure 4.18).

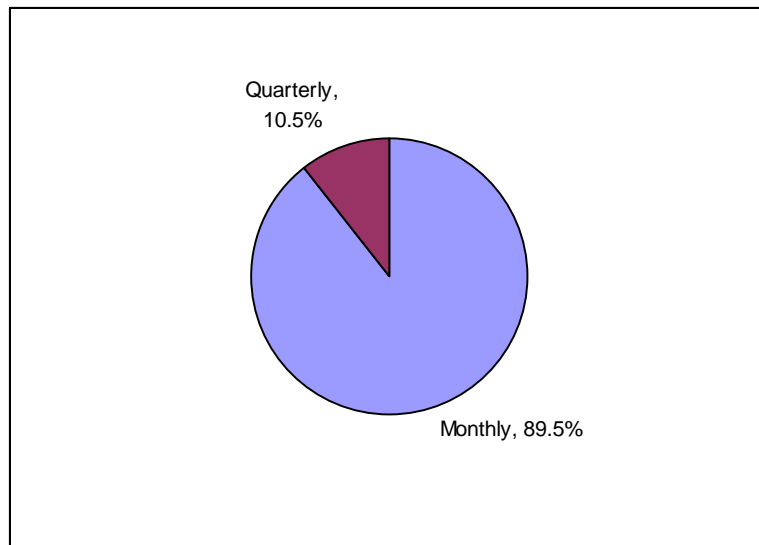


Figure 4.18
Frequency of logistics reports (N=38)

4.2.3.6 Method of communication

According to Quick et al (1997:327), an efficient communication system is essential for an effective health care commodity distribution system because reports and requisitions are received on time for decision making and timely processing of orders respectively in order to avoid stock depletions. The storekeepers at the selected health care facilities were interviewed to ascertain the methods of communication available and actually used to report to the higher level. The respondents could give more than one of the options on the interview schedule, such as postal service, telephone, fax radio link, physical visit, and any other means (see table 4.4).

Table 4.4: Methods of communication used for reporting

Method	Frequency	Percentage of facilities
Postal service	0	0
Telephone	20	52.6
Fax	1	2.6
Radio link	0	0
Physical visit	17	44.7
Other	0	0
Total	38	100

More than half (52.6%, n=38) of the health care facilities reported that they used the telephone to send reports to the higher level; 44.7% (n=38) reported physically taking the reports to the higher level. According to Quick et al (1997:327), an efficient telecommunication system such as the radio link and the faxing system should be invested in so as to save staff time and to reduce vehicle wear and fuel expenses due to physical visits.

4.2.3.7 Ordering intervals

According to the Ministry of Health of Uganda (2003:31), all health care facilities should forward their orders to the next highest level of the logistics system every two months. Timely requisition of requirements ensures that re-supplies of health care commodities are delivered to health care units in time to avoid stock depletions.

The storekeepers were asked how many times they were supposed to make orders and how many times they had done so in the year prior to the day of data collection (see figure 4.19).

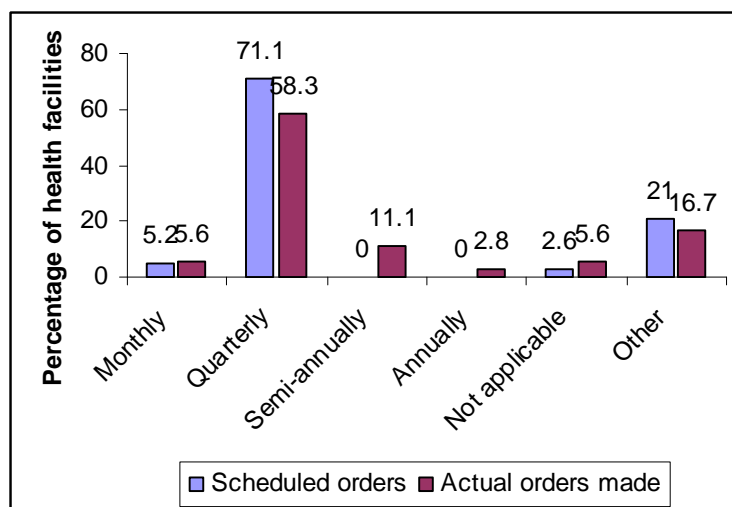


Figure 4.19
Number of orders made in the past year
(N=38)

The majority of the storekeepers (71.1%; 38) reported that they were supposed to order quarterly. No storekeeper reported that they were supposed to order semi-annually. Nevertheless, from the results, 11.1% of the health care facility storekeepers reported that they had actually made their orders only twice in the past year. Some of the interviewed staff did not know how many times their facilities had placed orders in the past year because the actual store persons in charge of commodity management were not available at the time of the survey.

4.2.3.8 Determination of re-supply quantities

According to the Ministry of Health of Uganda (2005b:58), managers of operational units are expected to work out their own demand estimates and buffer stocks and submit requisitions to central stores indicating their requirements. This order-based system is called a push system.

The researcher interviewed the storekeepers to find out which persons were responsible for determining their re-supply quantities and how the re-supply quantities were

determined. Of the storekeepers, 35 (92.1%) reported that they used a pull system in which they were expected to work out their demand estimates. The high number of facilities operating on a pull system shows that most facilities were following the government guidelines.

In addition, 26(68.4%) store keepers reported that they were using a formula to calculate their re-supply quantities. 6 (15.8%) store keepers reported that a higher level determined their re-supply quantities (push system) while 6(15.8%) reported that they were using experience to estimate their requirements. These results agreed with the Ministry of Health of Uganda's guidelines (2005a:100), which state that all health care units should use a formula to determine their re-supply quantities. Facilities using the experience of the store persons to estimate the re-supply quantities could easily experience stock depletions due to a lack of a basis for the estimation.

4.2.3.9 *Transportation of commodities*

Transport planning is important if health care commodities are to reach the user health care facilities in a timely manner to avoid stock depletions (Quick et al 1997:325). Of the storekeepers, 29 (78.4%) reported that it was the responsibility of their facilities to collect commodities while 8 (21.6%) reported that a higher level facility delivered commodities to their facility. Functional vehicles and sufficient fuel to run them are essential for a distribution system whether the commodities are collected from a higher-level facility or when they are delivered to the health care facility by a higher level facility.

Slightly over half (51.4%, 37) of the storekeepers reported that the most commonly used mode of transport for commodities to the health care units was a district-managed vehicle; 13 (35.1%) reported using public transportation, while 3 (8.1%) reported that they used privately hired vehicles. Each health sub-district at either hospital or HCIV level is allocated a vehicle for transportation of health care commodities to the lower level health care units. However, due to poor vehicle maintenance and lack of fuel, these vehicles are often grounded, necessitating the lower level health care units to devise means of collecting the supplies from the health sub-district stores. This causes further delay, which may result into

stock depletions at the health care units. Figure 4.20 illustrates that there is a problem with transportation of commodities to almost half of the health care facilities in the Mpigi district.

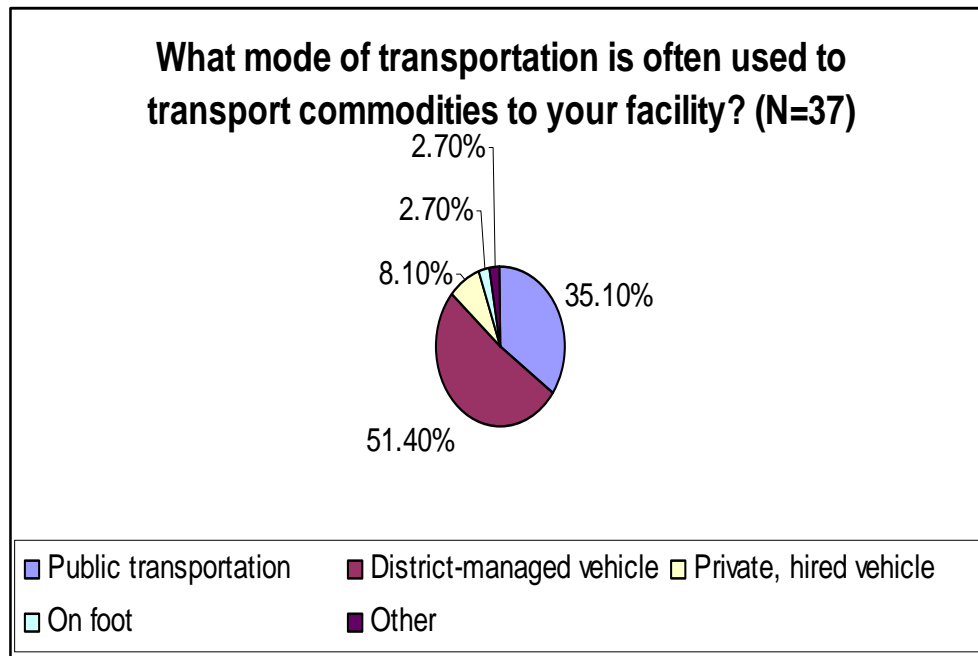


Figure 4.20
Mode of transportation of supplies (N=37)

4.2.3.10 Re-supply intervals

According to Quick et al (1997:323), an appropriate re-supply interval should be selected depending on factors such as the storage capacity of health care facilities, the availability of transport and the seasonal factors that affect transport. The Ministry of Health of Uganda (2003:30) states that health care units should receive supplies on a bi-monthly basis. The late delivery of supplies to health care units may cause stock depletions if the delay was not anticipated.

The storekeepers were interviewed to ascertain the frequency at which they were supposed to receive supplies and the frequency at which they were actually receiving supplies (see figure 4.21).

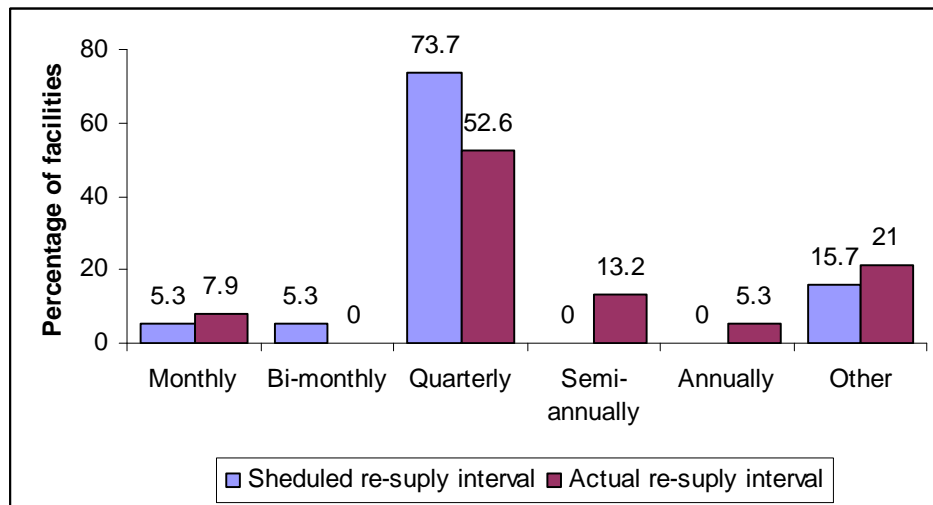


Figure 4.21
Comparison of the scheduled and actual re-supply intervals (N=38)

The results show that 73.6% (n=38) of the health care facilities reported that they were scheduled to receive re-supplies quarterly, but only 52.6% actually received re-supplies on a quarterly basis, and 13.2% reported receiving supplies semi-annually. Yet there was no health care facility scheduled to receive re-supplies on a semi annual basis.

Of the health care units, 21% reported that receipt of supplies to their facilities did not follow a regular schedule. These results showed a deviation from the actual re-supply interval from the scheduled bi-monthly re-supply interval planned by the Ministry of Health of Uganda and was an indication of the delay in delivering supplies from the national medical stores.

Storekeepers were also asked how long it took to receive supplies from the time they made their orders for re-supply (see figure 4.22).

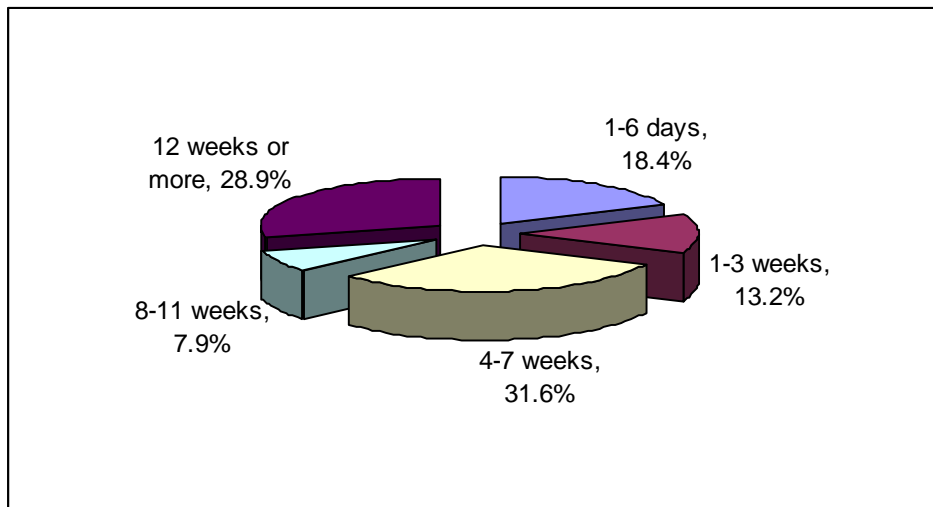


Figure 4.22
Interval between ordering and receiving re-supplies (N=38)

The results showed that 31.6% (n=38) of the health care units took between one month to seven weeks to receive re-supplies, while 28.9% took three months and longer to receive supplies from the time they placed their orders for re-supply. The Ministry of Health of Uganda's plan is for health care facilities to receive re-supplies every two months after ordering. The results also indicated that there was a delay in re-supplying about one third of the facilities. Nevertheless, it was not known from this result whether the delay was within the district or from the national medical stores. Such unanticipated delays could result in stock depletions at health care facilities, thereby negatively affecting the injection device security at those health care facilities.

4.2.3.11 Expired injectable medicines or syringes

Effective inventory management reduces the chance of experiencing stock depletions by helping to prevent losses through expiration. Expired products can no longer be offered to clients and therefore they contribute to the threat of stock depletion if they are not separated from usable stock in a timely manner and replaced with usable stock.

Five respondents (13.2%) reported that they had expired injectable medicines at their facility. The results, however, indicated that expiry of medicines was not a big problem in the Mpigi district. It should be noted that some amount of commodity loss due to expiration

is expected in any logistics system, but large quantities should be investigated. Managers should transfer excess supplies that are likely to expire to other facilities that may be able to use them faster.

4.2.3.11 *Losses of supplies due to damage or theft*

Seven respondents (18.4%) reported that they had incurred losses of supplies due to either damage or theft in the three months prior to the survey. According to Quick et al (1997:324), storage facilities are vital to the success of a distribution system and should always be protected against theft and damage by water, pest or fire.

Furthermore, most health care systems in developing countries operate with limited funding, and health commodities are precious and rarely in full supply. Losses of otherwise usable commodities due to damage or theft should therefore be avoided at all cost.

4.2.3.12 *Physical capacity of the stores*

The available storage space at the health care facilities should be sufficient to allow for emergencies and for programme expansion. Of the respondents, 23 (60.5%) reported that the physical capacity of their stores was not enough to hold all the facilities' supplies at any given time. Figure 4.23 indicates that the physical capacity of the storage facilities in the Mpigi district should be given priority so that health care commodities are secured from damage or theft, which could increase the chances of stock depletions at the health care facilities.

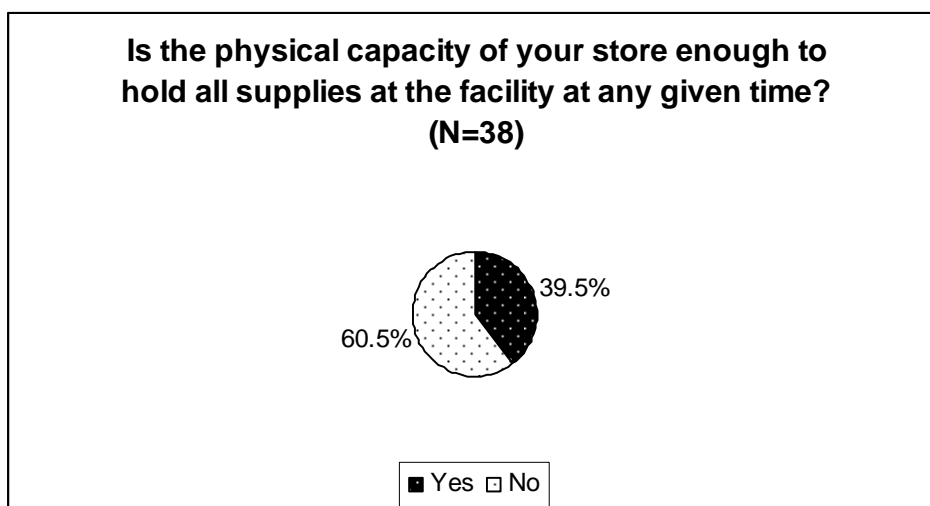


Figure 4.23
Physical capacity of stores (N=38)

4.2.3.13 Stock depletion of syringes

The primary management goal of an effective and efficient distribution system is to maintain a steady flow of supplies to facilities where they are needed. The storekeepers were asked whether they had registered any stock depletion of any size of syringes in the past three months and for how long. Of the respondents, 73% (n=37) reported that they had not registered any stock depletion of any size of syringe in the reviewed period; 5 (13.5%) reported having registered a stock depletion of at least one size of syringe for a period of one to three weeks; 2 (5.4%) registered a depletion for a period of 4-12 weeks, and 2 (5.4%) for a period of over three months. Only 1 (2.7%) respondent reported a stock depletion of 6 days or less. The results revealed that almost one quarter of the surveyed health care units had experienced a stock depletion of at least one size of the syringes in the three months prior to the survey (see table 4.5).

Table 4.5: Duration of stock depletion of syringes

Duration of stock depletion	Frequency (N=37)	Percentage
Not in 3 months	27	73.0
6 days or less	1	2.7
1-3 weeks	5	13.5
4-12 weeks	2	5.4
Over 3 months	2	5.4
Total	37	100.0

Stock managers should be vigilant in order to avoid stock depletions of injection devices because any stock depletion negatively affects the injection practices at the health care facilities.

4.2.3.14 Availability of safety boxes

Safety boxes are puncture resistant and moisture resistant containers used for the disposal of contaminated sharps including used syringes and safety boxes. According to Reeler (2000:135), unsafe disposal of used syringes and needles increases the risk of transmitting diseases. Health care centres often dispose of used syringes and needles in nearby open pits, a practice which makes it possible for people to obtain and reuse the injection equipment. Safety boxes should therefore be available at all health care facilities to facilitate the safe disposal of contaminated sharps including used syringes and needles.

All the storekeepers interviewed (n=38) reported that they always had safety boxes at their facility. This result indicated that health care facilities were generally practising appropriate sharps waste disposal.

4.2.3.15 Stock depletion of safety boxes

The respondents (n=38) were asked if they had ever registered a stock depletion of safety boxes in the three months prior to the survey. Of the respondents, 97.4% reported that they had never registered a stock depletion of safety boxes at their facility. Only one (2.6%) respondent reported having registered a stock depletion of safety boxes for a period of 4 to 12 weeks. Health care unit managers should collaborate with nearby units so that available commodities can be efficiently utilized.

4.2.3.16 Stock depletion of water for injections

According to the WHO (2003a:1), the concept of injection device security entails appropriate supply management so that injection devices including appropriate single dose diluents are available in adequate quantities. Water for injection is a sterile preparation used for the reconstitution or dilution of some injectable medicines. The lack of suitable diluents affects the quality of the reconstituted injectable medicines and therefore compromises the safety of the injected medicine.

The storekeepers were asked if they had been out of stock of water for injection in the last three months and for how long (see table 4.6).

Table 4.6: Duration of stock depletion of water for injection

Duration of stock depletion	Frequency (N=37)	Percentage
Not in 3 months	34	91.9
6 days or less	0	0.0
1-3 weeks	1	2.7
4-12 weeks	1	2.7
Over 3 months	1	2.7
Total	37	100.0

Of the respondents, 34 (91.9%) reported that they had never registered any stock depletion of water for injection in the past three months prior to the survey. One (2.7%) respondent reported a stock depletion of 1 to 3 weeks, another (2.7%) reported a stock depletion of one month to three months and another (2.7%) reported a stock depletion of over 3 months. The commodity was generally available in sufficient quantities at all health care facilities.

4.2.3.17 Stock depletion of dextrose solution 5%

Dextrose solution 5% is used for the intravenous administration of some injectable medicines like quinine used in the treatment of complicated malaria. In Uganda, dextrose solution 5% is stocked by HCIIIs, HCIVs and hospitals. Stock depletions of dextrose solution 5% at health care facilities presents a challenge to the health care workers who would need to use it for the administration of drugs such as quinine.

Storekeepers were asked if they had registered any stock depletion of dextrose solution 5% in the last three months and for how long (see figure 4.24).

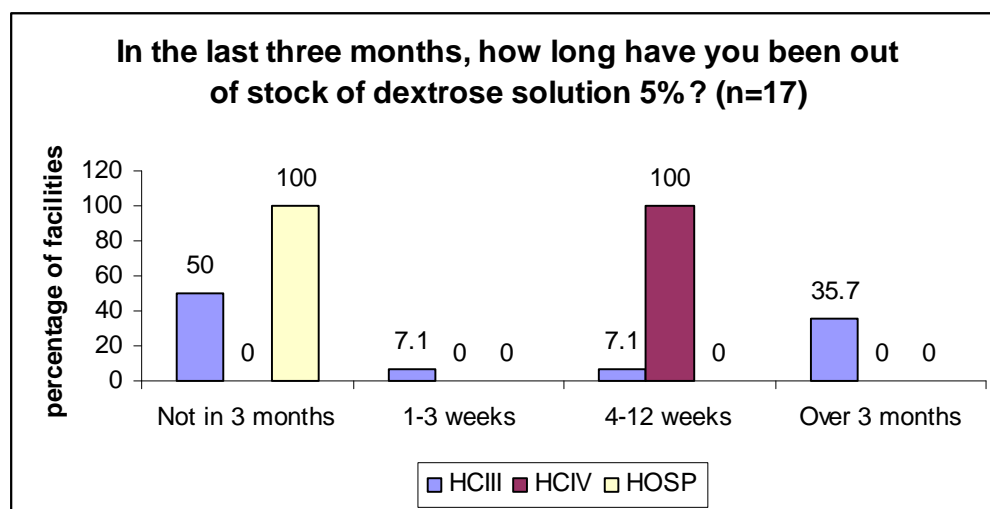


Figure 4.24

Duration of stock depletion of dextrose solution 5% (N=17)

The results revealed that there were no stock depletions of dextrose solution 5% reported by respondents at the hospitals (n=2) and at half (50%, n=14) of the HCIII health care

units. All the respondents at HCIV health care units (n=2) and at one HCIII (7.1%) reported having registered a stock depletion of 4 to 12 weeks prior to the survey; 5 (35.7%) respondents at HCIII health care units reported stock depletions of over three months while only one (7.1%) respondent at a HCIII health care unit reported a stock depletion which lasted 1 to 3 weeks. The stock depletion of dextrose solution, reported at the HCIV health care units and the HCIII health care units, should be avoided because these are referral facilities for very ill patients who cannot obtain appropriate health care from the lower level HCII health care units.

4.2.3.18 Delivery of injectable drugs with adequate quantities of syringes

The current global safe injection strategy calls for the use of single-use injection devices for every injection administered. According to Nersesian et al (2004:7), supporting this strategy requires coordinated distribution of quantities of single-use injection devices to match the number of doses of injectable preparations supplied.

Storekeepers were asked if the stocks of injectable drugs used for the curative services were delivered or available with adequate or matching quantities of syringes and needles. Of the respondents, 36(94.7%) reported that the injectable drugs were available with adequate quantities of syringes and needles while only 2 (5.3%) reported that the injectable drugs did not match the syringes and needles.

4.2.3.19 Delivery of stocks of syringes and needles with adequate quantities of safety boxes

A critically important issue to consider about supply management (including distribution) for safe injection devices is how to provide the supplies in complementary quantities, also called bundling. Syringes should be distributed with the appropriate number of safety boxes used for disposal of contaminated sharps including used syringes and needles, to ensure that the used syringe after every injection is disposed of safely.

Of the respondents, 97.4% reported that syringes and safety boxes used for curative services were delivered with adequate quantities of safety boxes (see figure 4.25).

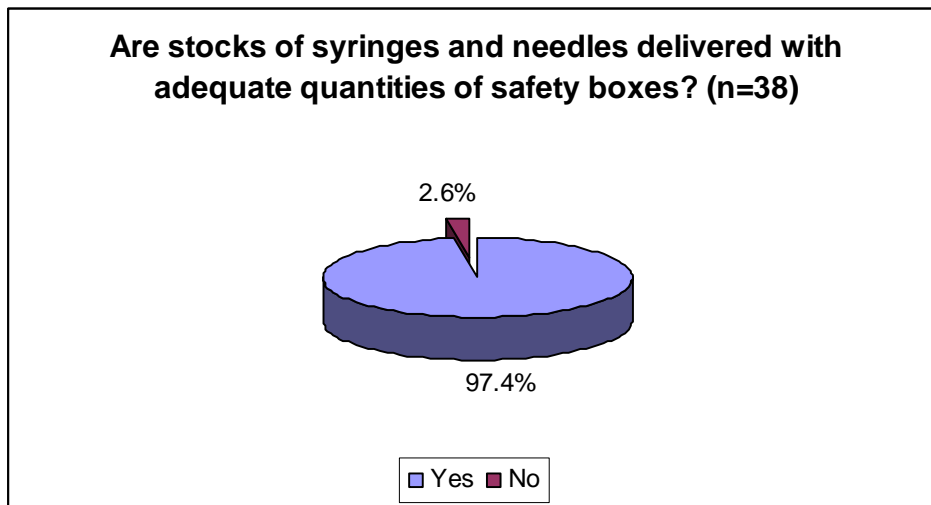


Figure 4.25

Delivery of syringes and needles with safety boxes (N=38)

4.2.3.20 Supply of syringes and needles

The storekeepers (n=38) were asked if they had been supplied with adequate quantities of syringes and needles for the services provided to the patients (see figure 4.26). Of the respondents, 35 (92.1%) reported that they had been supplied with adequate quantities of syringes and needles. Only 3 (7.9%) reported that they had not been supplied with enough syringes and needles.

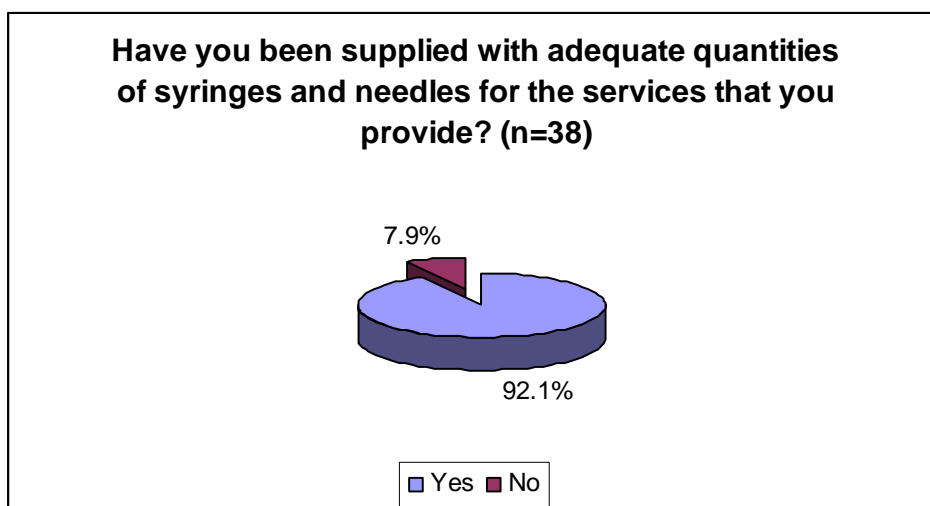


Figure 4.26

Supply of adequate quantities of syringes and needles (N=38)

4.2.3.21 Supply of safety boxes

Of the respondents, 37 (97.4%) reported that they had been supplied with adequate quantities of safety boxes for the services they provided to their patients. Only one (2.6%) respondent reported that he had not been supplied with adequate quantities of safety boxes (see figure 4.27).

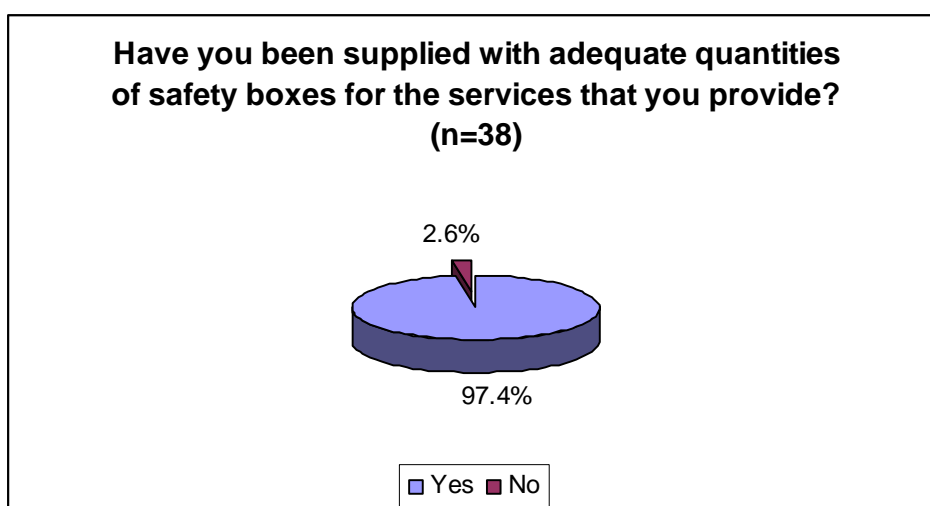


Figure 4.27

Supply of adequate quantities of safety boxes (N=38)

4.2.3.22 Support supervision

Supervision of individual staff members helps to promote adherence to standards and to identify the problems that contribute to poor quality services. The storekeepers were asked when last someone from outside the facility had personally supervised them and how long ago the supervision was conducted (see figure 4.28).



Figure 4.28
Time since last supervisory visit

The results showed that about one third (32.4%) of the respondents had been supervised within one month prior to the survey. The same number (32.4%) reported that they had been supervised within five weeks to three months while 35% had been supervised over three months previously. Regular supervision of all health care workers should be carried out to ensure that they are competent to meet their patients' need of safe health care services.

4.2.3.23 Activities done during supervision

Support supervision should add value to the quality of services rendered by the staff at health care facilities. The problems encountered by staff while trying to fulfil their roles should be identified during supervisory visits and rectified, if possible.

The respondents were asked which activities the supervisors had carried out during their last supervisory visit. The majority of the respondents (89.2%, n=37) reported that the supervisors checked supplies. Only 2 (5.4%) respondents reported that on-job training was performed (see figure 4.29).

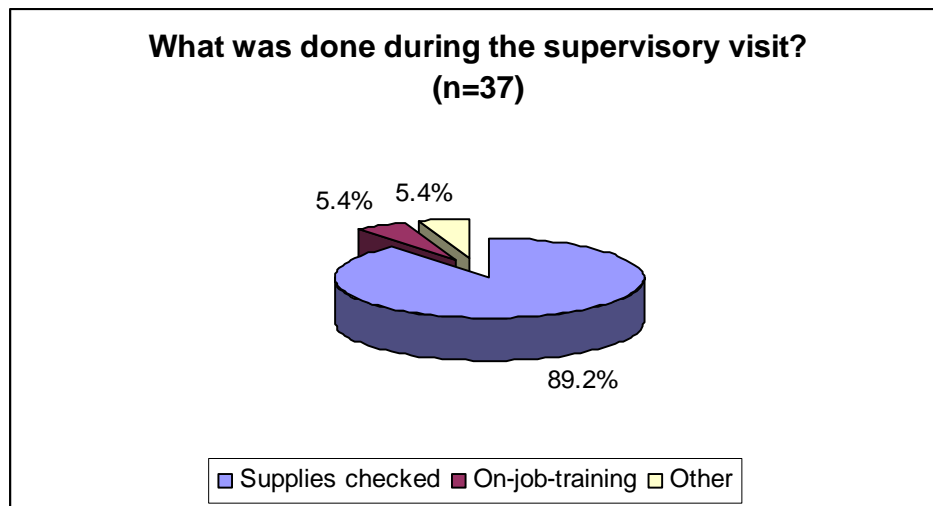


Figure 4.29
Activities performed by supervisors (N=37)

4.2.3.24 Ensuring regular supplies

The respondents were asked what could be done to ensure regular supply of injectable medicines, diluents, syringes and needles and safety boxes (see table 4.7).

Table 4.7: Activities to ensure regular supply (N=38)

What could be done?	Frequency	Percentage
Timely delivery	24	63.1
Provision of vehicles for transport of commodities	7	18.4
Supply of adequate quantities	7	18.4
Timely ordering	6	15.8
Supply all items on order	6	15.8
Regular supervision	5	13.1
Prompt order processing	4	10.5
Others	7	18.4

From the results in Table 4.7 it was evident that the biggest problem affecting regular supplies of injection devices to the health care units was the late delivery of supplies. The other significant factors included lack of transport, supply of inadequate quantities, late ordering by health care facilities, supply of less items than ordered and irregular supervision. These areas should be addressed if the health care workers' competencies are to be synergised with the needs of their patients in accordance with the synergy model.

4.2.3.24 Support required to do job better

In order to determine the problems faced by the storekeepers in ensuring efficient commodity management, respondents were asked what kind of support they required to do their jobs more effectively (see table 4.8).

Table 4.8: Support required by storekeepers (N=38)

Support required	Frequency	Percentage
Training	24	63.1
Support supervision	11	28.9
Provide more space	5	13.1
Supply adequate quantities	4	10.5
Provide stock cards	3	7.9
Increase funding for drugs	2	5.3
Provide vehicles for transport of commodities	2	5.3
Others	7	18.4

From the results it was evident that most (63.1%) of the respondents felt they should receive training in managing the stores more efficiently. About one third (28.9%) of the respondents said that they would benefit from regular support supervision while 13.1% wanted more storage space. The other forms of support mentioned included supply of adequate quantities of commodities (10.5%), provision of stock card forms (7.9%), increase in the funding for drugs (5.3%), and provision of vehicles for transporting commodities.

4.2.4 Observations of equipment and supplies at the facility (instrument 4)

The WHO (2000:1) recommends the provision of sufficient quantities of injection equipment and infection control supplies including appropriate management of all sharps used for invasive procedures such as syringes and needles. In line with this recommendation, health care facilities should stock sufficient quantities of safety boxes used for the disposal of contaminated sharps such as the used syringes and needles. This instrument helped to determine whether health care units had appropriate sharps containers for the disposal of sharps waste.

4.2.4.1 Presence of sharps containers

Observations of equipment and supplies in the out-patients injection room, in the in-patients' wards and in the laboratory revealed that all out-patients' injection rooms had a

sharps container for the disposal of contaminated sharps such as used syringes and needles (see figure 4.30). Among the health care facilities with laboratories (n=19), 16(84.2%) had a sharps container in the laboratory while only eight (53.3%, n=15), which admit patients on the wards, had a sharps container on the injection trolley. In order to avoid accidental needle stick injuries, safety boxes should be provided to all areas where medicines are administered by means of an injection. The absence of safety boxes in these areas could be an indication that supplies were not sufficient at the health care facility. The small number of facilities with safety boxes on the injection trolleys might be partly explained by the lack of injection trolleys at most of the visited health care facilities.

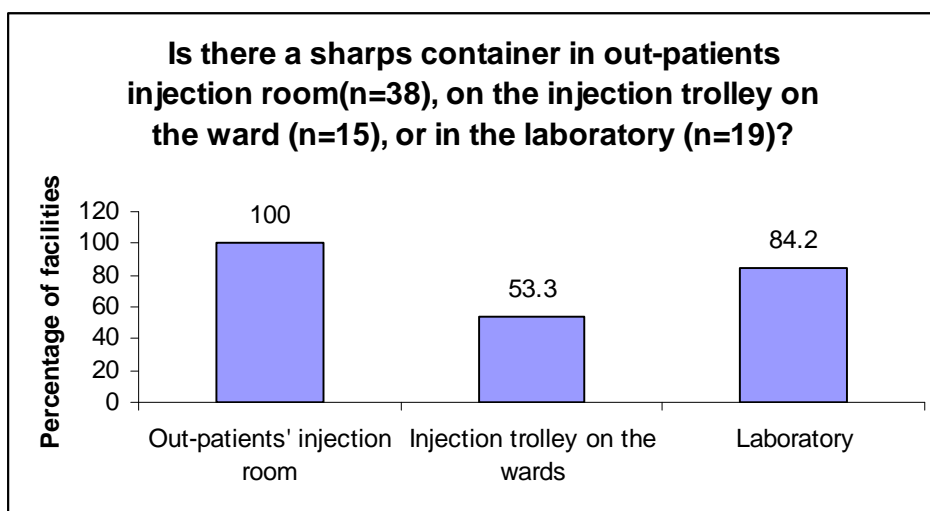


Figure 30
Presence of sharps containers

4.2.4.2 Presence of safety boxes

In order to provide the intended protection against needle stick injuries, all sharps containers provided to the health care facilities should be puncture resistant and moisture resistant. In addition, they should bear appropriate hazard markings for infectious sharps and they should be printed with clear conspicuous instructions regarding assembly and use. Sharps containers with all these characteristics are known as safety boxes.

The results revealed that the sharps containers observed at 37 (97.4%) health care units were puncture resistant and moisture resistant, bore appropriate hazard markings for

infectious waste, and were printed with conspicuous instructions regarding assembly and use, implying that the majority of the visited health care units were using safety boxes to manage sharps waste except at one health care unit.

4.2.4.3 Presence of over flowing sharps containers

Overflowing or pierced safety boxes were observed at 8 (21.1%) health care facilities. This result contrasted the findings of the MMIS study (2005:11) in Uganda, which put the percentage of the surveyed health care facilities with overflowing or pierced safety boxes at less than 5%. Safety boxes should be filled up to the three-quarter mark and then discarded. This ensures that needles do not stick out and cause needle stick injuries to the health care workers or the health care waste handlers. The presence of overflowing safety boxes could be an indication that inadequate quantities of safety boxes have been provided to the health care units. Sufficient quantities of safety boxes should be provided to all areas where medicines are administered by use of injections and staff should be educated on the dangers of overfilling the safety boxes.

4.2.4.4 Evidence of re-use of injection equipment

This question helped determine whether health care workers were re-using injection equipment due to insufficiency of supplies. There was no evidence that syringes or needles were being re-used at each of the health care facilities visited.

4.2.4.5 Evidence of used sharps around the health care centre or the disposal site

Used sharps were observed around the health care centre and/or the disposal site at 5 (13.5%) of the health care facilities. Most of these used sharps were observed at the disposal site. The presence of used sharps at the disposal site indicated that proper sharps disposal was not practised and could imply that sufficient sharps boxes for the disposal of used sharps were not provided. The presence of used sharps at the disposal sites exposed the community and the waste handlers to needle stick injuries.

4.2.5 Structured interview of the provider of medicines by injections (instrument 5)

The purpose of interviewing the providers of medicines by injections was to establish their competency in providing safe injections to the patients, within the conceptual framework of the synergy model. Becker et al (2006:131) state that certain competencies of health care workers are required to provide care to patients and synergy occurs when the competence of the health care provider complements the needs of the patient. Dicko et al (2000:167) recommend a holistic approach to injection safety in which injection safety is approached together with nursing practices.

4.2.5.1 Patients bringing their own needles and syringes

This question was asked to determine whether the health care workers had planned for or advocated for the supply of sufficient quantities of injection devices to cater for the needs of their patients. Whenever supplies are insufficient, health care workers request their patients to bring their own needles and syringes to the health care facilities. All the respondents (n=38) reported that patients never carried their own injection equipment to the health care facilities. This contrasted with the MMIS study (2005:23), which indicated that 30% of health care units reported that patients brought their own syringes and needles to the health care units. This study found that health care facilities in the Mpigi district had been provided with sufficient quantities of syringes and needles.

4.2.5.2 Possibility of buying new, disposable needles and syringes

The presence of private pharmacies within the catchment areas of health care facilities would be expected to fill the stock gap during stock depletions at health care facilities thereby supplementing the public sector distribution system. The respondents were asked if it were possible to buy new, disposable needles and syringes in a sealed packet in the community.

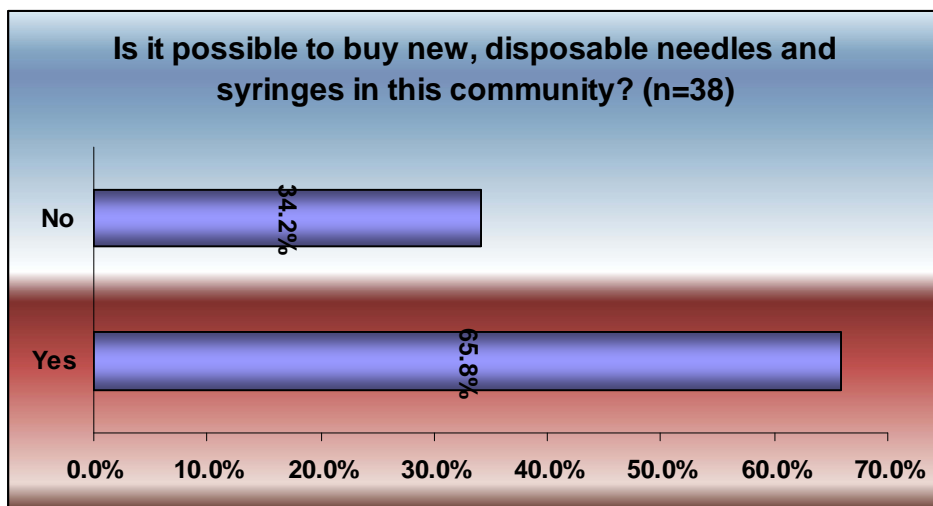


Figure 4.31

Possibility of buying new needles and syringes in the community (N=38)

According to Figure 4.31, it was possible to buy new disposable syringes and needles in the catchment areas of 65.8% of the facilities while a significant percentage of facilities (34.2%) reported that it was not possible to obtain new disposable syringes within their catchment areas.

Logez et al (2005:1) state that geographical hindrances of access to supplies may affect injection practices and points out the case of Burkina Faso, where the implementation of pharmaceutical depots next to public health care facilities increased geographical accessing of essential medicines and basic supplies, among which were syringes and needles, contributing substantially to safer injection practices. The health care facilities where there are no private pharmacies for the patients to access injection equipment should be adequately stocked to ensure that the safe injection practices are upheld at those facilities.

4.2.5.3 Sources of syringes and needles

The purpose of this question was to determine whether the sources of injection equipment in the community were legal. This was an indicator of the quality of the injection devices obtained from those sources. Procurement of health products from unlicensed drug outlets

carries the risk of obtaining expired or contaminated commodities, which in the end, affects the safety of the injections administered using such devices. Figure 4.32 indicate that the majority of the respondents (71.4%) reported that syringes and needles could be bought from drug shops while 14.3% reported that syringes and needles could be bought from private clinics. Only 3 (10.7%) reported that syringes could be obtained from a private pharmacy while 1 (3.6%) reported other means. Private pharmacies should be accessible to many people since they were the only authorised retail outlets for injection devices in Uganda.

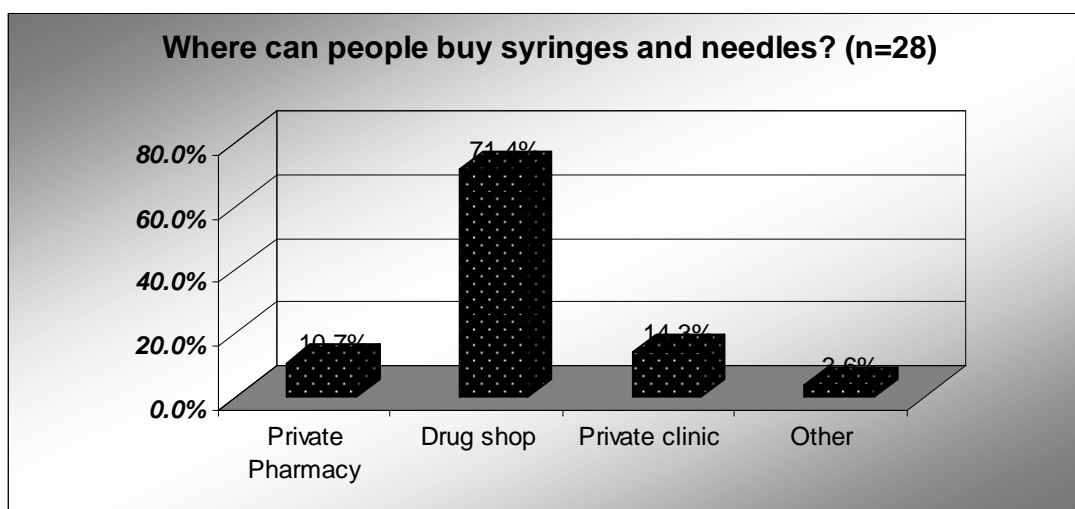


Figure 4.32
Sources of syringes and needles (N=28)

4.2.5.4 Availability of safety boxes

The respondents were asked if they had ever had safety boxes at their health care facility. According to Miller and Pisani (1999:810), investments need to be made in the safe, convenient and effective disposal of injection equipment to avoid the spread of infection among health care workers and the public. The WHO (2000:2) adds that the efficient, safe and environmentally-friendly management of contaminated waste is the only means of ensuring that disposable syringes and needles are not reused and that they do not lead to accidental needle stick injuries. All the respondents (n=38) reported that they had safety boxes for the disposal of contaminated sharps such as syringes and needles at their health care facilities.

4.2.5.5 Stock depletions of safety boxes

According to Logez et al (2005:2), the common failure of health care systems to ensure adequate and sufficient supplies of injection devices may have a negative impact on injection safety. Stock depletions of safety boxes at a health care facility implies that used sharps including contaminated syringes and needles are not properly disposed of, putting health care workers and the community at the risk of needle stick injuries.

Of the respondents, 36 (94.7%) reported that they had not had a stock depletion of safety boxes in the past three months prior to this study; 2 (5.3%) respondents reported having had a stock depletion in the past three months, one of them reporting a stock depletion duration of up to one month while the second respondent reported a stock depletion of between four weeks and three months. The two reported incidences of stock depletions of safety boxes occurred at a HCII level health care facility.

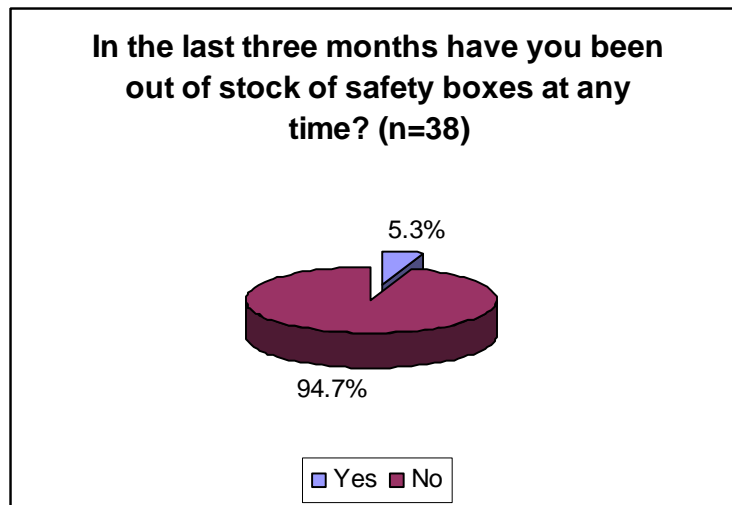


Figure 4.33
Stock depletion of safety boxes (N=38)

Figure 4.33 illustrates the results, which were comparable to those of the MMIS survey (2005:31), which showed that less than 10% of the surveyed health care units had experienced stock depletions of safety boxes in six months.

4.2.5.6 Stock depletions of syringes

A stock depletion of injection devices has a negative impact on injection safety. The respondents were asked if they had experienced a stock depletion of any of the sizes of syringes and needles in the three months prior to this survey. Figure 4.34 revealed that 25 (65.8%) respondents had not experienced a stock depletion of any size of the syringes in the reviewed period while 13 (34.2%) respondents reported having experienced stock depletion of at least one size of the syringes at least once in the past three months.

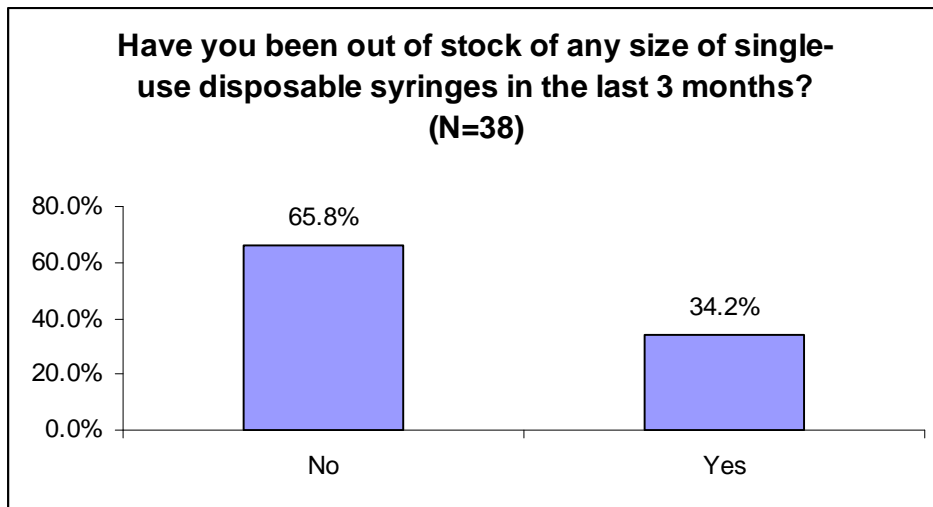


Figure 4.34

Stock depletion of single-use disposable syringes

No respondents reported stock depletions from either the hospitals (n=2) or the HC IVs (n=2). However, among the HC III respondents (n=14), 6 (42.9%) reported stock depletions, while 7(35%) of the HCIIIs (n=20) reported stock depletions of at least one size of the syringes and needles during the reviewed period. Managers of health care facilities should ensure that the appropriate sizes of syringes and needles required to render the services offered by their health care units are available at all times.

The respondents who reported stock depletions (n=13) were asked how long the stock depletions had lasted. According to figure 4.35, the majority of the respondents (58.3%) had experienced stock depletions at their health care facilities for a period of one week to one month. 2 (16.7%) respondents reported a duration of stock depletion of more than one month to three months while 2(16.7%) reported a duration of stock depletion of over three months. 2(16.7%) reported that the stock depletions at their facilities had lasted for a period of less than one week.

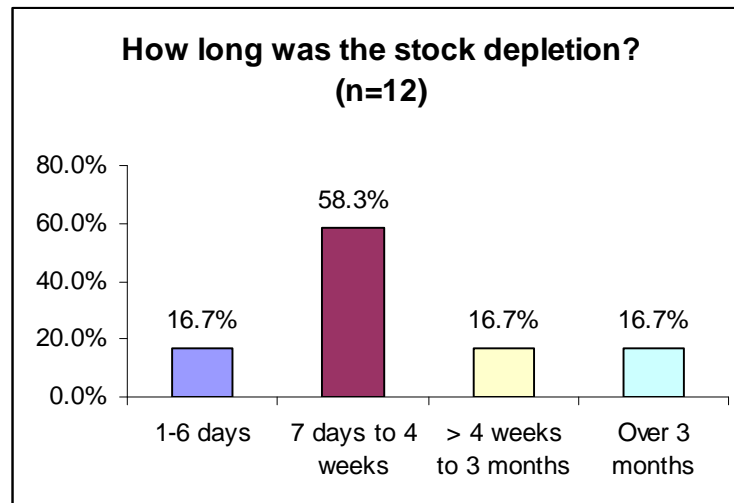


Figure 4.35

Duration of stock depletion of syringes and needles (N=12)

4.2.5.7 What was done during stock depletion

This question was asked in order to establish whether health care workers were re-using contaminated syringes and needles during stock depletions. The re-use of contaminated syringes and needles exposes the patients to the risk of acquiring blood borne infections such as HIV/AIDS and hepatitis B.

The results are shown in Table 4.9 in which 46.2% of the respondents (n=13) reported that they used a syringe with another gauge when the appropriate size was depleted. 23.1% said they borrowed syringes from another health care facility while one respondent (7.7%) reported that he stopped giving injections. None of the respondents reported that they had re-used contaminated syringes and needles during a stock depletion. The results show that the health workers were aware of the dangers of re-using contaminated injection equipment. In accordance with the synergy model, the knowledge of the safe injection practices by the health care workers is seen here as an important factor in taking care of the patients' needs such as the need to avoid acquisition of blood-borne infections during the process of seeking health care services.

Table 4.9: What the health workers did during a stock depletion

What did you do when the stock of injection devices was depleted?	Frequency (n=13)	Percentage
Stopped giving injections	1	7.7%
Borrowed from other facility/unit	3	23.1%
Used other gauge in stock	6	46.2%
Told patients to buy	3	23.1%
sterilized used devices	0	0.0%
Stock depletion lasted a short time	0	0.0%
Other	0	0.0%
Total	13	100

The results also show that some health care workers (23.1%, n=13) told the patients to go and buy the syringes and needles during a stock depletion. However, according to Kermode et al (2005:423), the resource-constrained circumstances of both patients and hospitals substantially influence the safety of injection practices.

4.2.5.8 Re-use of syringes and needles

This section of the interview schedule was used to establish whether health care workers were re-using contaminated syringes or needles either on the same patient or on another patient. 37(97.4%) respondents (n=38) reported that they would never re-use a syringe or a needle either on the same patient or on a different patient. One (2.6%) health care worker reported that he would re-use syringes and needles on a patient if they had been previously used for mixing drugs.

These results are in contrast to those of a study conducted by Simonsen et al (1999:795), which revealed that more than 50% of all injections in the developing world were administered with syringes and needles used on consecutive patients without sterilisation. Kermode et al (2005:426-7) also found that the practice of using one syringe repeatedly but changing the needle was evident in both hospital and community based immunisation clinics, and that some health care workers perceived this to be a safe practice.

The re-use of the syringes and needles, which have been used to reconstitute drugs, negatively affects the safety of injections and should be discouraged. Kermode et al (2005:427) states that the practice of re-using syringes by attaching new needles while drawing drugs from multi-dose vials should be discouraged as the drug could easily get contaminated with blood cells from the used syringe.

4.2.5.9 Training in injection safety

Depending on the needs of each patient, certain competencies of the healthcare workers are required for providing care to the patient. According to Becker et (2006:131), the health care worker characteristics of the Synergy Model (which guided this research) are clinical judgement, advocacy and moral agency, caring practices, collaboration, systems thinking, response to diversity, clinical inquiry, and facilitation of learning. Synergy and optimal outcomes occur when the competence of the health provider complements the needs of the patient.

The respondents were asked if they had received training on injection safety. The purpose of this question was to establish whether the health care workers were competent enough to administer safe injections and to advocate for the provision of the required injection devices. The non-availability of injection devices may affect the health worker's ability to perform safe injection practices even if they had the knowledge. However, knowledge of the safe injection practices drives the health care workers to advocate for the provision of adequate quantities of injection devices so as to avoid stock depletions.

Figure 4.36 shows that 29 (76%) respondents had been trained in injection safety whereas 9 (23.7%) had not received training in injection safety.

A study conducted in Egypt by Talaat et al (2003:239) indicated that untrained health care workers were contributing to a high frequency of the use of injections for therapeutic purposes among the general population. According to Kermode et al (2005:430), when there are limited opportunities for the health care workers to engage in professional development, recommended practices are slow to be implemented.

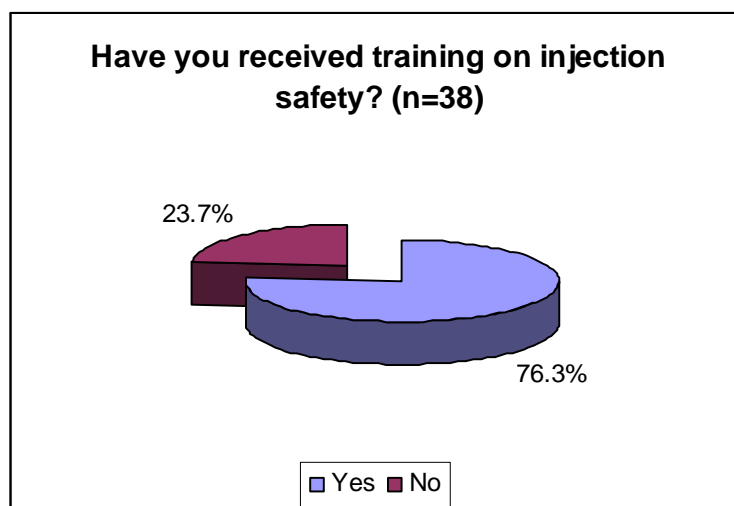


Figure 4.36
Training in injection safety (N=38)

All health care workers therefore need to appreciate the principles of injection safety such that the needs of their patients are synergised with their own competences.

The respondents also were asked how long ago they had received the training in injection safety. Of the respondents, 23 (60.5%) reported that they had received the training over six months in the past while 6 (15.8%) had received the training less than six months before the day of the survey (see figure 4.37).

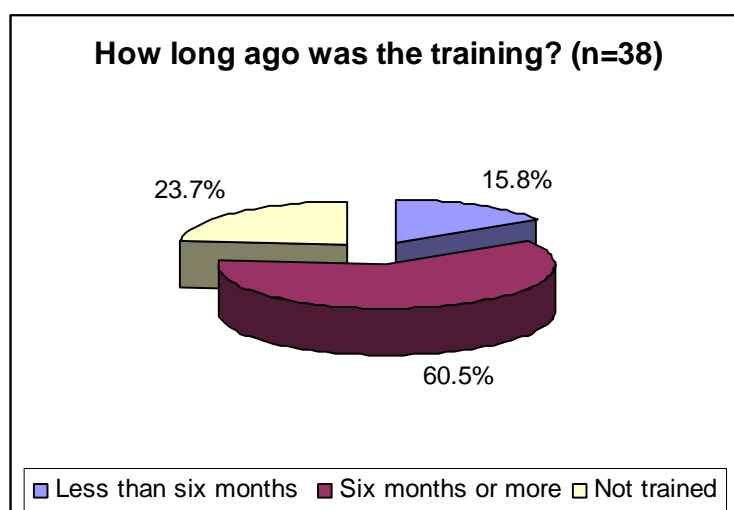


Figure 4.37
Time since the training in injection safety (N=38)

Knowledge in health care keeps changing with new technology and the challenges presented by emerging diseases and epidemics. Health care workers should keep abreast with the current knowledge in their area of practice so that their patients' needs are appropriately catered for.

4.2.6 Exit interview with patients (instrument 6)

Exit interviews with patients were conducted to assess whether the patients' needs were being met by the health care facilities in line with the synergy model, which guided this study. According to Becker et al (2006:133), the goal of health care is to restore each patient to an optimal level of wellness as defined by the patient. The patients' needs, in the context of injection safety, was the desire to avoid being infected with diseases such HIV/AIDS through the use of unsafe injections.

4.2.6.1 *Patients who received an injection*

Patients who had just been seen by health care workers at each facility were asked if they (or their children) had received an injection from the health care facility on the day of the survey. This question helped in the identification of patients who had had an experience with being treated at the health care facility using injection devices. At least one patient who had received an injection at the time of the survey was found at 12 (31.6%) of the health care facilities. Figure 4.38 indicates that of the patients (n=12) who had received an injection 8 (66.7%) were children and 4 (33.3%) were adults. The results revealed a higher frequency of injection use among children compared to adults.

4.2.6.2 *Source of syringe or needle*

The respondents were asked if they had brought their own needles or syringes for the injections they received at the health care facilities.

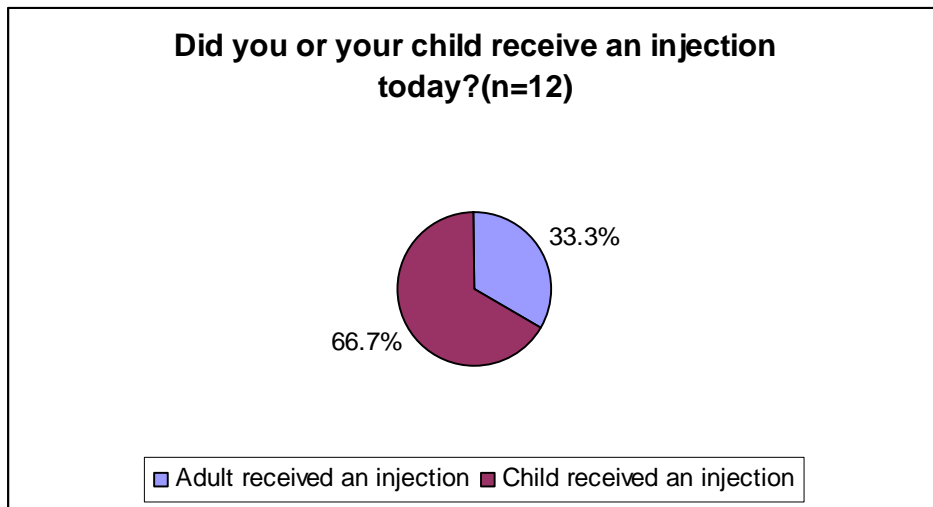


Figure 4.38
Patients who received an injection (N=12)

This question helped to determine whether there was enough injection equipment at the health care facilities such that patients did not have to carry their own injection equipment. None of the patients (n=12) interviewed had carried their own needle and syringe for the injection they had received.

4.2.6.3 Disposal of the used syringe and needle

To establish whether health care facilities had safety boxes for immediate disposal of used sharps such as used syringes and needles, respondents were asked what the injection provider had done to the used syringe and needle after the injection. According to Table 4.10, 11(91.7%) respondents reported that the used syringes and needles were disposed into a closed container.

Table 4.10: Disposal of used syringe and needle (N=12)

What did the health worker do with the used syringe and needle?	Frequency	Percent
Immediately disposed them into a closed container	8	66.7
Cut off needle with a needle cutter and disposed the syringe into a closed container	3	25
Disposed them into an open container or area	0	0
Gave them back to me	0	0
Other	1	8.3
Total	12	100

This result is supported by the MMIS (2005:48) study, which showed that 80% of the health care workers disposed used needles and syringes into a closed container.

4.2.6.4 Number of injections received in the last three months

To prevent injection-associated transmission of blood-borne pathogens, injection frequency should be reduced and safe injection practices should be carried out on a regular basis (Miller & Pisani 1999:809). The reduction in injection frequency reduces the demand for injection devices thereby reducing the frequency of stock depletions of injection devices at health care facilities.

In order to determine the frequency of administration of medicines by way of injections at the health care units in the three months prior to this survey, respondents were asked how many times they had received injections at the health care facilities in the previous three months. Out of the 12 respondents, 7 (58.3%) had not received any other injections from the health care facilities in the previous three months and 5 (41.7%) had received only one injection from the health care facility during the three months prior to the survey. The result translated into an injection frequency of about 1.6 injections per person per year. Although the result was not representative because of the small sample, it indicated that there was reduced injection frequency in the Mpigi district in comparison to the Ministry of Health of

Uganda's study (2004a:3), which showed that over 70% of the respondents in their survey had received more than three injections per year.

4.2.6.5 *Number of times patients brought own syringe and needle*

This question was asked to determine the availability of injection equipment at the health care facilities in the three months prior to the survey. All the respondents (n=5) reported that they had not carried their own syringe or needle for the injections they had received at the health care facilities in the last three months prior to the survey. The results of this study are in contrast to those of the MMIS (2005:49) study in Uganda, which showed that 21.6% of respondents reported that they sometimes brought their own injection equipment to the health care facility. The findings of this study revealed that there was an improvement in the availability of injection equipment at the health care facilities in the Mpigi district.

4.3 SUMMARY OF THE RESULTS

The researcher used the synergy model to explore whether the characteristics of the health care worker, the Mpigi district health care system and the needs of the patients who had been prescribed treatment by injection administration of medicines were synergised to provide a "safe passage" for the patients through the health care system.

4.3.1 Health care worker characteristics

The health care workers demonstrated knowledge of safe injection practices. The results showed that contaminated syringes and needles were not re-used and used syringes and needles were properly disposed of in safety boxes. Supplies of syringes and needles and safety boxes were adequately provided, however, the diluents and injectable drugs were not fully supplied. The most common challenges in ensuring the full supply of injection devices included the delay in making orders for re-supplies and the lack of information for stock management decisions.

4.3.2 Health care system

Suitably qualified staff were available at the health care units. Injection devices such as syringes and safety boxes were delivered to health care units in adequate quantities. However there was need to support the synergised care through advocacy for the timely delivery of supplies from the national medical stores, the provision and maintenance of vehicles for delivery of supplies, the provision of fuel for running the vehicles, the increase in the physical capacity of health care facility commodity stores and the performance of regular support supervision of health care workers.

4.3.2 Patient needs

The patients were aware of the risks of re-using contaminated injection equipment and they reported that the used syringes and needles were properly disposed of in closed containers at the health care facilities.

4.4 CONCLUSION

This chapter discussed the data analysis and interpretation of the findings with reference to the literature review wherever possible. The data were presented in tables and figures.

Chapter 5 concludes the study by discussing the limitations and makes recommendations for practice and further research.

CHAPTER 5

Conclusions, limitations and recommendations

5.1 INTRODUCTION

As a way of improving injection safety, this study explored the challenges encountered in maintaining an effective distribution system using a cross-sectional, descriptive study of thirty eight health care facilities in the Mpigi district of Uganda. This chapter discusses the conclusions with reference to the objectives and findings, and the limitations of the study and makes recommendations for practice and further research.

5.2 CONCLUSIONS

Upon completion of the data analysis the researcher made conclusions based on the objectives, which were to:

- Determine whether the health care facilities in the Mpigi district of Uganda have sufficient quantities of injectable medicines, diluents, single use injection devices and safety boxes for therapeutic purposes.
- Investigate the factors that lead to stock depletion of injection devices at health care facilities in the Mpigi district of Uganda.

5.2.1 Objective 1

Determine whether the health care facilities in the Mpigi district have sufficient quantities of injectable medicines, diluents, single use injection devices and safety boxes for therapeutic purposes.

Instruments 2, 3, 4, 5 and 6 contributed to the data collected on this objective.

5.2.1.1 Availability of injectable medicines

The study revealed that stock depletions of injectable medicines were common at both the public and the NGO health care facilities. Stocks of injectable medicines were depleted for periods of up to three months at some health care facilities. Injectable drugs were available in sufficient quantities on the day of the survey at the hospitals, the HCIV health care units, and the HCII health care units. However, not all the HCIII health care units had adequate quantities of injectable medicines. Injectable medicines are required in the treatment of the seriously ill, such as during emergency situations, and therefore should be available at health care units in sufficient quantities to serve the intended clients.

5.2.1.2 Availability of diluents

The study revealed that water for injection was available at most of the health care units although it was under stocked at the hospitals and the HCIV health care facilities. Stock depletion of dextrose solution 5% was common, especially at HCIV health care units and HCIII health care units, with stock depletions lasting over two months at some health care units. Stock depletion of the diluents encourages substitution with other non-recommended liquid preparations in the reconstitution of injectable medicines (when required). Substitute diluents could affect the quality and safety of the injectable medicines with which they have been mixed.

5.2.1.3 Availability of single-use injection devices

Single-use syringes and needles were available in adequate quantities at most of the health care facilities. Most of the respondents reported that they had not registered any stock depletion of syringes and needles in the three months prior to the survey. Most of the health care workers had received training in safe injection practices, although some remained untrained. The observed reduced injection frequency at the health care units visited could have contributed to the reduced consumption and therefore the observed availability of syringes and needles at the health care facilities. The health care workers were not re-using single-use syringes and needles at all the health care facilities visited and the interviewed patients reported that they never carried their own syringes and needles to the health care facilities, further confirming that the facilities were adequately

stocked. The depletion of injectable medicines could further explain the apparent overstocking of syringes, especially the 10ml size, at many of the health care facilities. The training of health care workers on safe injection practices reduces the frequency of injections and the consumption rates of injection devices.

5.2.1.4 Availability of safety boxes

Most of the health care units were overstocked with safety boxes. There were no used sharps at or around the health care facilities and overfilled safety boxes were not observed at most of them, further indicating that safety boxes for the disposal of used sharps including syringes and needles were adequately available at the health care facilities. Moreover, the interviewed patients indicated that they had observed health care workers disposing the used syringes and needles in closed containers. Safety boxes were not found on most of the wards and the health care units lacked trolleys for carrying the safety boxes during injection administration on the wards.

5.2.2 Objective 2

Investigate the factors that lead to stock depletion of injection devices at the health care facilities in the Mpigi district of Uganda.

Instruments 1, 2 and 3 contributed to the data collected on this objective. Data on the basic features of a drug distribution system were gathered in order to identify the weaknesses that could lead to stock depletions of injection devices in the Mpigi district of Uganda.

5.2.2.1 Late requisitions

Health care facilities submitted their re-supply orders late thereby increasing the re-supply intervals. The increase in the re-supply intervals caused late deliveries of supplies, leading to stock depletions.

5.2.2.2 *Late deliveries*

There were delays in delivering supplies from the national medical stores to the districts and from the district stores to the health sub-district stores and finally to the lower level health care units. Some of the health care units reported that they had received health care commodities only twice in the past year prior to the survey instead of the scheduled six deliveries in a year. The late delivery of health care commodities to health care centres resulted in stock depletions of injectable medications and diluents.

5.2.2.3 *Lack of transport*

The health sub-districts had vehicles for the collection of supplies from the districts to the health sub-district stores and onwards to the lower level health care units, but there was inadequate funding for the fuel required to run the vehicles. Most of the health care units used public means of transport to collect supplies from the health sub-districts. Generally, there was no effective system for monitoring the distribution costs.

5.2.2.4 *Poor communication systems*

The majority of the health care workers used personal telephones to communicate to the higher levels. Reports were collected and requisitions delivered by physical visits. Reports and requisitions might not be sent in time for appropriate action if staff did not have credit on their personal telephones and/or if they were too busy to travel.

5.2.2.5 *Absence of private sector pharmacies*

There were no private sector pharmacies in the catchment areas of the public and NGO health care facilities to supplement the public sector distribution system. The absence of private sector pharmacies meant that the health care units risked having stock depletions on the occasions that the national medical stores delayed supplying the district.

5.2.2.6 *Insufficient storage space*

Most of the health care facilities did not have sufficient space to hold all the supplies delivered to them. In addition, health care commodities, such as safety boxes, syringes and needles, were stored on the floor and in corridors at most of the health care facilities. The health care facilities that did not have sufficient space to store all the health care commodities supplied to them often left their supplies at the health sub-district stores from which they drew small quantities at a time. Such facilities risked having stock depletions on the occasions that there was no transport for their collection.

5.2.2.7 *Poor logistics management information system*

Injection device security is threatened by inadequate information systems. Stock cards for the management of diluents were not available at many of the health care facilities. Stock cards were more likely to be used at the public health care facilities than at the NGO facilities. In general, the stock cards were not updated for syringes and safety boxes and the quality of the data captured on the stock cards was poor at many of the health care facilities. Several facilities did not have consumption data records. The lack of records and the poor quality of the data recorded on the stock cards indicated that the stock managers were not effectively monitoring their stock levels and therefore could not make informed decisions.

5.2.2.8 *Irregular supervision*

Support supervision was not regularly conducted. Some storekeepers reported that they had not been supervised in over three months. Support supervision can be used as a tool for monitoring the distribution system performance in order to resolve problems quickly and improve the performance of staff.

5.3 LIMITATIONS

The researcher found the following limitations in this study, which could restrict the generalisability of the research results:

- The study was conducted in one district of Uganda and therefore the results of the study may not be generalised to all the districts in the country. In addition, unlike other non-project districts, the Mpigi district has implemented activities of the MMIS project since 2004 and has benefited from improved injection device management.
- The stock cards were poorly maintained at most of the health care units and a lot of data was missing. The analysis of data on inventory management was therefore based on very few cases, thereby affecting the generalisability of the results.
- The reduced injection frequency at all the health care facilities visited meant that fewer than planned exit interviews with patients were conducted.
- The Mpigi district has only two HCIV health care centres and two hospitals. The findings with regard to the injection device security for these levels of the health care system were based on too few cases to be generalised.
- The literature review revealed very few sources on the subject of injection device security.

5.4 RECOMMENDATIONS

Based on the study findings, the researcher makes the following recommendations for the improvement of the injection device distribution system and further research.

5.4.1 Improvement of the injection device distribution system

5.4.1.1 *Delivery of supplies*

The national medical stores should regularize deliveries of essential medicines and other health care supplies to the districts as per the scheduled bi-monthly deliveries to avoid stock depletions. There should be a mechanism of monitoring the stock status at the health care facilities such that stocks from overstocked facilities can be transferred to the health care facilities with stock depletion.

The managers of the health sub-districts should allocate adequate funds to cover the cost of the fuel required to run the distribution vehicles. Motorcycles should be provided to the lower level health care units for the collection of supplies from the health sub-

district stores. The managers should also put in place a mechanism of monitoring the distribution costs so that the most efficient distribution mechanisms are used.

5.4.1.2 Requisition of injection devices

All the health care unit managers should submit their requisitions every two months as per the Ministry of Health of Uganda's guidelines. Injectable medicines requiring reconstitution should be ordered with matching quantities of the appropriate diluents.

5.4.1.3 Availability of safety boxes

Safety boxes should be provided to all areas where medicines are administered by use of injections and staff should be educated on the dangers of overfilling the safety boxes. The health care facilities should also be provided with trolleys for carrying injection devices, including safety boxes, during injection administration on the wards.

5.4.1.4 Communication

To save staff time and reduce the wear and tear on vehicles, the district management, with the assistance of the Ministry of Health of Uganda, should make appropriate investments in communication technology to reduce the need for staff to travel long distances. Where feasible, radio transmitters and Internet services should be provided to the health care facilities to avoid unnecessary travel costs and delays.

5.4.1.5 Private pharmaceutical sector incentives

The Government of Uganda should provide incentives to the private sector investors to open pharmacies within the district in order to supplement the public sector health commodity distribution system.

5.4.1.6 Storage

The physical capacity of the health care facility storerooms should be increased by the installation of shelves and the quality of the health care commodities maintained by the provision of pallets.

5.4.1.7 Support supervision

The members of the district health management team and the staff from the Ministry of Health of Uganda should carry out support supervision of the staff involved in commodity management on a regular basis. The supervision should entail on-the-job training in proper commodity management practices. The appropriate maintenance of stock card records should be emphasized. Training in commodity management should also be conducted, especially targeting the lower level storekeepers.

5.4.1.8 Future research

The researcher recommends that further research be conducted on the following topics:

- A comparative study of injection device security between an MMIS project implementing and a non-MMIS project implementing district in Uganda.
- Exploring the relationship between the availability of injection devices and their use by the health care workers.
- Determining the challenges and the motivating factors for proper record-keeping by stock management personnel at health care facilities.
- Determining the challenges faced by the national medical stores in delivering health care commodities to the districts according to schedule.

5.5 CONCLUSION

Ensuring injection device security enhances safe injection practices at health care facilities and saves lives. An inefficient distribution system of health care commodities is a hindrance to the achievement of injection safety. Managers of health care programmes should therefore implement an efficient system of supply management and financing so that injection devices are supplied in a timely manner and in adequate quantities at all health care facilities.

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ANNEXURE A

**Permission from the Research and
Ethics Committee of the Makerere
University Medical School, Kampala,
Uganda**

ANNEXURE B

**Permission from the University of South
Africa, Health Studies Research and
Ethics Committee**

ANNEXURE C

**Permission requested and granted by
the District Health Officer of the Mpigi
district**

ANNEXURE D

Data collection instruments