MAKERERE UNIVERSITY

SCHOOL OF PUBLIC HEALTH

FACTORS INFLUENCING IMPLEMENTATION OF INFECTION CONTROL MEASURES IN HEALTH UNITS IN ARUA DISTRICT, UGANDA

BY

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"The very first requirement in a hospital is that it should do the sick no harm."

Florence Nightingale, 1820-1907.
DECLARATION

I Wasswa Peter Kityaba do hereby declare that the content of this report is my original work and nothing has been intentionally duplicated or plagiarised from any source that I am aware of to the best of my knowledge.

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DEDICATION

I dedicate this report to my Parents Dr and Justice Kitumba who encouraged me to pursue a postgraduate degree when I was unsure of what path to take and who made priceless sacrifices to cater for the considerable cost and time of undertaking this course.
ACKNOWLEDGEMENTS

I would like to appreciate the tireless efforts of all those persons who were instrumental in the conception, design, conduct, analysis and write up of this report.

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<td>DHO</td>
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<td>Hospital-acquired infections</td>
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<td>Health Management Information System</td>
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<td>Knowledge, attitude and practice</td>
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<td>PNFP</td>
<td>Private not-for-profit</td>
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<td>SPs</td>
<td>Standard Precautions</td>
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OPERATIONAL DEFINITIONS

Hand hygiene: A general term that applies to hand washing or surgical hand antisepsis that may include use of soap, disinfectants or alcohol-based hand solutions.

Healthcare worker (healthcare worker): Any medically trained persons such as nurses, nursing assistants, medical doctors, midwives, clinical officers and laboratory technicians whose activities involve contact with patients and/or their blood or other body fluids in a healthcare setting. This definition excludes cleaners and other support staff.

Health unit/health facility: Any health centre, hospital or clinic that is duly registered and recognized by the District Health Office from where patients can obtain medical services.

Hospital-acquired infections: Infections that are neither present nor incubating when a patient enters a health facility but are acquired during his/her stay in the facility. The term is synonymously used to mean healthcare-associated infections or nosocomial infections.

Housekeeping: General cleaning of baths, sinks, wash-basins, beds, tables, floors, walls and other surfaces in the health unit.

Infection control: Measures to ensure that recommended practices for the prevention of hospital-acquired infections such as standard precautions are implemented and
followed by healthcare providers in order to make the healthcare setting safe from cross-infections.

**Sharps:** Any pointed instrument that may cause physical injury. This includes scalpels, needles, syringes, infusion sets, broken glass and lancets.

**Standard precautions:** Those measures taken to prevent transmission of infections in the provision of health-care services, including methods of handling waste products that apply to all patients, regardless of diagnosis or presumed infection status. Standard precautions are a combination and expansion of universal precautions and body substance isolation.

**Yellow Star:** A program that assesses the quality of healthcare services provided in health units and awards a “yellow star” symbol to recognise those facilities that meet the minimum requirements over two successive supervisory visits.
ABSTRACT

Background: According to the 'Yellow Star' program, less than 60% of the health units in Arua district, Uganda, were adequately observing infection control measures in spite of the presence of guidelines on how to do so.

Objective: The aim of this study was to assess the factors influencing implementation of infection control measures in health units in Arua District.

Methods: This was a cross-sectional study. One hundred eighty six healthcare workers and sixteen key informants were interviewed while observations were done on 32 selected health units. Quantitative data underwent descriptive analysis and multiple logistic regressions at 95% confidence intervals. Qualitative data was summarised using a master sheet.

Results: About 51% of the respondents were aware of at least six of the eight infection control measures assessed. Hand washing was done in 60% of the units observed. Essential supplies such as soap, autoclaves and facemasks were observed in only 68.8%, 50% and 34.4% of the health units respectively. Significant findings at multivariate analysis included respondents being more likely to wash their hands if they had training on infection control (OR=2.71, 95% CI: 1.03-7.16), were educated beyond O'level (OR=3.30, 95% CI: 1.44-7.54) and had ever acquired a hospital infection (OR=2.84, 95% CI: 1.03-7.84).

Conclusions and recommendations: The major limiting factors to implementing infection control measures were inadequate resources and lack of training. Therefore, providing adequate infection control resources and regularly re-training healthcare workers may improve infection control compliance.
1.0 INTRODUCTION AND BACKGROUND

1.1 Introduction

Hospital-acquired infections are a major global problem which is on the rise (Alvarado, 2000). The rates of such infections range from as low as 1% in some countries in Europe and the North America to more than 40% in many regions of the developing world (Lynch et al., 1997). Most of these infections can be prevented with readily available and inexpensive strategies like adhering to recommended infection prevention practices especially hand hygiene and wearing of gloves (Ducel et al., 2002).

Hospital-acquired infections play a significant role globally to loss of resources in the health sector in addition to their contribution to the increase in morbidity and mortality (Orette et al., 1998). In developing countries, babies born in hospital are at a greater risk of neonatal infections arising from poor intrapartum and postnatal infection-control practices. Zaidi et al., (2005) reported that rates of neonatal infections in developing countries were up to twenty times higher than rates reported for hospital-born babies in developed countries following a comparison of figures from both sets of countries.

It is estimated that up to 50% of all hospital-acquired infections are associated with only five patient care practices which are: compliance with hand hygiene and standard precautions of infection control, use and care of urinary catheters, use and care of vascular access lines, therapy and support of pulmonary functions and experience with surgical procedures (Pittet et al., 2004). Standard precautions require that healthcare workers assume that the blood and body substances of all patients are
potential sources of infection, regardless of the diagnosis or presumed infectious status (John and Brachman, 1998).

Infection control is under the Department of Quality Assurance in the Ministry of Health. The department is responsible for policy formulation, training, and supervision of all health cadres as well as the procurement of supplies necessary for infection control among other things. There should be infection control committees at all health facility levels right from the hospitals to health center IIs. Their roles include investigating outbreaks, provision of advice on isolation of infectious patients and the approval of all chemicals used for disinfection (MOH, 2005c).

1.2 Background

After the identification of human immunodeficiency virus (HIV) and the revelation of the means of its transmission via contaminated blood, coupled with the evidence of the transmission of hepatitis B virus (HBV) to patients from surgeons and dentists, there was increased concern about cross-infection with blood-borne pathogens. As a result, there was an urgency to develop infection control recommendations designed to reduce the risk of transmission of blood-borne diseases in healthcare facilities. These procedures were termed as universal standard precautions, which considered all blood and blood-contaminated fluids as potentially infectious (Bell et al., 1995).

Globally, standard precautions are considered as an effective means of protecting healthcare workers, patients and the public (Roberts, 2000) and reducing hospital-acquired infections (Wang et al., 2003). In Arua District which was the site of conduct of this study, no particular emphasis had been placed on infection control measures.
Rather, it was assumed that healthcare workers implemented the measures during the routine conduct of their work (Onama, 2006).

Basing on the WHO guidelines on infection control for the Africa region, the most important components of infection prevention are: availability of supplies and equipment to the healthcare facility staff, presence of policies and guidelines for procedures used within the facility, a monitoring process for the health staff to identify and prevent staff-to-patient and patient-to-staff spread of infection, monitoring the use of disinfectants and the frequency of cleaning as well as collaboration with appropriate committees in monitoring the use of antibiotics and last but not least, continuous in-service programmes for all healthcare facility staff in the use of such policies and guidelines (WHO, 2001). In Uganda, the Ministry of Health identified five basic standard precaution measures that can enhance infection control within the health units which are: hand hygiene, adequate protective wear, proper sterilization, proper sharps disposal and safe waste management (MOH, 2005a).

Arua District is located about 530 kilometers northwest of Kampala City. It had an estimated projected mid-2007 population of about 499,600 people, 23% of which were under 5 years (UBOS, 2007). Malaria had been the leading cause of morbidity, accounting for between 41-48% of the cases reported in the out-patient department (OPD) for the last five years (2002-2006). During the same period, acute respiratory infections (22%), worm infestations (16%), diarrhoeal diseases (6%) and trauma (6%) were the most reported conditions (Source: Arua HMIS, 2007).
The district had 41 government and private not-for-profit (PNFP)/ NGO health units as of June 2007. These comprised of 2 hospitals, 2 health center (HC) IVs, 12 HC IIIs and 25 HC IIs. Arua also had 17 registered private health clinics. The doctor to patient ratio was about 1: 48,000 compared to the national estimate of 1: 24,700 (Arua HMIS, 2007). Household access to safe water was 63% and safe toilet coverage stood at 57% (UBOS 2007). Arua also had a large refugee population estimated at over 66,000. The majority of the population was composed of the Lugbara, Kakwa and Madi ethnicity whose major economic activity was subsistence agriculture (UBOS, 2002).
2.0 LITERATURE REVIEW

2.1 Introduction

The World Health Organization estimates that over 1.4 million people suffer from hospital-acquired infections at any one time, with the proportion of these infections being up to twenty times higher in developing nations (WHO, 2005a). These infections are among the leading cause of death and morbidity among hospitalized patients and present a considerable public health burden (Ducel et al., 2002). Most of these infections occur in intensive care units as well as in acute surgical and orthopaedic wards with the most susceptible patients being the elderly and those with underlying diseases or those on chemotherapy (Mayon-White et al., 1988).

2.2 Impact of hospital-acquired infections

Hospital-acquired infections (HAIs) tend to be overlooked due to the false assumption that the healthcare sector is hygienic and without risks and yet many of the exposures faced can be carrier or life-threatening (Wilburn and Eijkmans, 2004). For instance, hepatitis C and HIV are just two of at least twenty blood-borne infections that healthcare workers are exposed to. The Centres for Disease Control and Prevention recognized diseases like syphilis, malaria and herpes, as transmissible through needle stick injuries (CDC, 1998).

At a global level, unsafe injections alone are responsible for an estimated 20 million hepatitis B infections, 2 million hepatitis C infections and 260,000 HIV infections. In the largest outbreak of nosocomial HIV transmission ever reported, 400 children in Libya were infected with the disease arising from unsafe blood transfusion and invasive procedures (Visco-Comandini et al., 2002).
Simonsen *et al.*, (1999) estimated that between 2000 and 2003, chronic infections acquired at the start of the millennium would be responsible for about 9 million disability adjusted life years.

Kirkland *et al.* (1999) assessed the economic implications of HAIs by following a matched cohort of over 250 pairs of patients in North Carolina, USA. The authors noted that those who developed surgical site infections during their hospital stay had significantly longer (5-8 days more, 95% CI) and costlier hospitalisations ($2100 - $4100 more, 95% CI) compared to those who did not acquire such infections.

### 2.3 Risk factors for hospital-acquired infections

Several authors have reported a number of factors which increase the risk of hospital-acquired infections. For example, a review article by Kapil (2005) cited the excessive and inappropriate use of antibiotics that often lead to the emergence of antimicrobial resistant micro organisms. Another review article by Raad *et al.* (1997) stated that HAIs are more recognized and reported among patients in immunocompromised states such as HIV/AIDS. Conditions that create potential routes of infection such as surgical operations and invasive techniques like catheterization, over-crowded health units and non-compliance with infection control practices all increase incidences of HAIs (Ducel *et al.*, 2002). A meta-analytic study by Aiello and Larson (2002) indicated that appropriate hand hygiene practices significantly reduced the risk of hospital-acquired infections while a case-control study conducted in Brazil by Pessoa-Silva *et al.* (2002) singled-out hand hygiene in addition to overcrowding and understaffing as risk factors for hospital-acquired infections. These latter two risk factors were in fact responsible for the largest nosocomial salmonella outbreak ever reported that occurred in Brazil.
2.4 Knowledge on standard precautions

A number of studies have concluded that the knowledge, understanding and interpretation of standard precautions of infection control among healthcare workers are not adequate. This as a result has adversely affected the implementation of the precautions (Helfgott et al., 1998, Roberts, 2000, Henderson, 2001). It is also possible that healthcare workers understand the purpose of standard precautions but simply do not put them into practice. Whereas knowledge of standard precautions may improve adherence practices, there are other influencing factors. Nelsing et al. (1997) mentioned factors such as improved design and access to equipment after conducting a nation-wide survey of over 9000 Danish physicians. This was emphasized by McCoy et al. (2001) who reported that education alone was not enough in improving infection control as a number of other factors also needed to be considered. This followed a study to identify organisational factors linked with competence of healthcare worker training to monitor co-workers' compliance to standard precautions.

2.5 Compliance with standard precautions

When adhered to, standard precautions have been noted to reduce the chance of cross-infection. Giramonti et al. (2000) and Wang et al. (2003) attributed the reduction of hospital-acquired infections to the procedures. In spite of this knowledge, several studies have shown that adherence to standard precautions is not adequate with the use of gloves being the most common practice while wearing of eye protection being the least implemented practice (DiGiacomo et al. (1997), Evanoff et al., 1999).

A prevalence study conducted in Abeokuta, Nigeria by Sadoh et al. (2006) showed that compliance with the policy that forbids recapping of needles was best among trained nurses and oddly worst among the doctors. In this study, less than two-thirds
of the respondents always used personal protective equipment and over half of them had ever used eye protection gear during deliveries and surgeries. Bwire (2002) conducted a cross-sectional study in Kumi district, Uganda which showed that only 27% of healthcare workers washed their hands according to the recommended guidelines.

Even though overall compliance rates for standard precautions are low, there is significant variation among the individual components with several factors influencing this situation. Kermode et al. (2005) observed that a healthcare worker was likely to be more compliant if he/she had more experience on the job, was more knowledgeable about transmission of blood-borne pathogens and was strongly committed to a positive occupational safety climate. This followed a cross-sectional study of the predictors to compliance among 266 HCWs in rural India. A descriptive exploratory study conducted in Botswana identified resource constraints such as the lack of the necessary facilities, inadequate equipment and materials, inadequate staffing and the lack of sustainable in-service education as factors that could prevent healthcare workers from complying with standard precautions (Chenery and Endacott, 2006).

2.6 Attitude towards compliance with standard precautions

Even when availed with the necessary supplies, adequate compliance with standard precautions may not be realized. Dejoy et al. (2000) found that professional attitudes and beliefs were important in the adoption of standard precautions. For instance, a cross-sectional study of risk factors for non-compliance with hand hygiene and glove utilisation conducted in a rural part of China found that two out of every three healthcare workers found gloves unnecessary and inconvenient with an even higher
proportion of the healthcare workers giving similar reasons for not washing their hands. This study noted that the amount of institutional support and the knowledge of the healthcare workers as the most important factors influencing compliance (Ji, Yin and Chen, 2005).

Askarian et al. (2005) conducted a cross-sectional study among two hundred seventy healthcare workers at an Iranian medical university and found that only 52% of the nurses held a favourable attitude towards the guidelines on isolation. In another prevalence study conducted in Thailand by Patarakul et al. (2005), both the patients and the healthcare workers revealed that forgetfulness and skin irritation of hand hygiene agents were the reasons as to why they did not comply with the precautions. According to them, the patient’s welfare was more important than being concerned with observation of standard precautions of infection control.

2.8 Hand hygiene

Hand hygiene is considered as the most important practice for avoiding the spread of infections in healthcare facilities (Boyce and Pittet, 2002). The choice of hand washing procedure is determined by the nature of medical procedure and the availability of supplies (WHO, 2001). The effectiveness of hand washing in preventing cross-infections in health settings was documented as early as 1847 by the Hungarian scientist Ignaz Semmelweis. The scientist who is considered a pioneer of antiseptic procedures found that the mortality rates of mothers delivering at an obstetric clinic were significantly lower when the health staff washed their hands with an antiseptic agent than if they washed them with plain soap and water (Larson, 1988).
2.9 Personal protective equipment

The prevention of contamination of surgical sites as well as the reduction in the risk of transmission of blood-borne infections can be partly attributed to wearing of gloves (Beltrami et al., 2000). Simulated experiments have shown that wearing a single pair of gloves can reduce the risk of transmission of HIV by half and wearing of two gloves by a further 30% (Mast et al., 1993). Well-fitting latex gloves should always be worn when contamination of body fluids is anticipated, including venepuncture, the administration of injections, cleaning of wounds and the changing of dressing (MOH, 2005a). The rigorousness of the protective wear depends on the kind of hazards the health care workers are potentially exposed to. For example, laboratory coats, gowns and aprons are recommended for staff exposed to blood that has the potential to splash. Those providing direct service such as physicians and nurses should wear laboratory coats while cleaning staff should wear gowns or plastic aprons (CDC, 2006).

2.10 Sharps use and disposal

Cross-sectional studies conducted in Nigeria by Ernest (2002) and Musa (2005) found that awareness and practice of safe injection procedures was low. Another prevalence study conducted by Nsubuga and Jaakkola (2005) revealed that recapping of needles was a common practice which exposed nurses and midwives working in Mulago National Referral Hospital in Kampala, Uganda to needle stick injuries. According to the recommended procedures, needles must not be re-sheathed and they must be placed in puncture-proof containers which are suitable for incineration (MOH, 2005a).
2.11 Disinfection and sterilization

Disinfection makes most surfaces and instruments free of most pathogens so that they can be used safely. If disinfection is correctly followed, multiplication of microorganisms will be kept at bay, ensuring that the health unit is hygienic and safe to all who access its services (MOH, 2005). The importance of disinfection in the reduction of surgical site infections was demonstrated historically by the scientist Joseph Lister (1827-1912) who successfully introduced the chemical phenol in sterilizing instruments and cleaning wounds. By then, surgical gloves were non-existent and therefore appropriate disinfection of the surgical site and hand antisepsis by the surgeon were necessary (Mackenzie, 1988).

Following decontamination of instruments and other items, they need to be cleaned and finally sterilized or disinfected to a high level (Lynch, 1997). When properly done, sterilization is considered the safest and most effective means of end processing of medical and surgical instruments. When this is not possible however, high level disinfection is the only acceptable alternative for end processing (Rutala et al., 2002).

2.12 Housekeeping

Housekeeping involves the routine cleaning of all surfaces so as to maintain a high level of hygiene in the health facility. It is done in collaboration with the infection control committee that is also responsible for classifying the different hospital areas so that appropriate cleaning techniques and polices are developed (Ducel et al., 2002). Ideally, high level disinfectants and sterilization are not recommended in routine housekeeping activities. Visible dirt and dust should be removed with water and detergent and/or by vacuuming (WHO, 2001).
2.13 Healthcare waste management

In 2002, the World Health Organization conducted a study on healthcare waste management in 22 developing countries. The assessment showed that the proportion of healthcare facilities that did not use proper waste disposal methods ranged from 18% to 64% (WHO, 2005b). According to the national guidelines, all healthcare waste must be separated right from the generation point up to the final disposal point in a specified manner by complying with the colour-coded system for bins used for specific types of waste; yellow for sharps, red for infectious non-sharp wastes such as swabs and blue for other non-infectious wastes such as paper and food residue. Such waste must then be properly disposed of by burning, burying or incineration (MOH, 2005b).

2.14 Benefits of proper infection control

Several studies have shown that there is a lot to be gained through implementation of recommended infection control polices and practices. For instance, a single and yet thorough infection control program for premature infants was established in Bangladesh. Among its components, the program emphasized staff and caregiver education on the procedures to reduce the risk of contamination, especially hand washing, proper disposal of infectious waste, strict asepsis during procedures coupled with judicious use of antibiotics. The program registered reduction in the incidence of suspected sepsis by 47%, culture proven sepsis by 61%, clinically diagnosed sepsis by 79% and deaths due to clinical and culture-proven sepsis by 82% and 50% respectively (Darmstadt et al., 2005).

It is therefore imperative that this study be conducted so that it can address the information gaps on health worker knowledge, attitude and practice in the context of
the study area. Furthermore, it will be useful to know to what extent the measures are being implemented and whether the resources needed for these activities are adequate.
3.0 STATEMENT OF THE PROBLEM, JUSTIFICATION AND CONCEPTUAL FRAMEWORK

3.1 Statement of the Problem

The World Health Organisation estimates that at least 1.4 million people are affected globally by hospital-acquired infections at any one time. In some developing countries, the proportions of patients affected by hospital-acquired infections can exceed 25% (WHO, 2005a). Findings from supervisory visits to health units in Arua District in 2006 revealed that less than 60% of the assessed facilities implemented the required infection control measures yet the Ministry of Health guidelines are that these measures must be comprehensive in all health units.

Patients and healthcare workers are at a direct risk of acquiring hospital infections. The general community may also be exposed to the infections through poorly-dumped medical waste. Among the diseases likely to be transmitted through inadequate infection control include hepatitis B and C, HIV/AIDS, tuberculosis and post-operative wound infections. Hospital-acquired infections also increase the cost of healthcare through prolonged hospitalisations and the use of more expensive antibiotics.

The factors likely to be responsible for inadequate infection control include lack of supplies needed to implement the recommended measures, inadequate support supervision and lack of in-service training. Inexperience and inadequate qualification of the healthcare workers, limited knowledge and a poor attitude towards observing adequate infection control measures are also possible individual predictors. Previous
attempts at addressing the problem have involved occasional support supervision of health units by the ‘Yellow Star’ Programme and the district health team. Notwithstanding such attempts, infection control standards were still low. The factors that may have been influencing adherence of HCWs to infection control guidelines were not fully understood. This study therefore generated information for the district health team in order to help enhance interventions to improve infection control measures within health units in Arua District.

3.2 Justification

Infection control measures were not being adequately implemented in Arua District in spite of the presence of standard guidelines from the Ministry of Health which specified cheap and practical strategies for the implementation of these measures. The low levels of adherence could have been exposing both healthcare workers and patients to hospital-acquired infections such as hepatitis B and TB. It was hence important to carry out this study so as to identify barriers to achieving the expected standards so as to minimise the risk of transmission of these infections.
3.3 Conceptual Framework

Inputs
- Policies and guidelines
- Pre-service Curriculum
- Staff recruitment
- Supplies and resources

Processes (Individual)
- Knowledge
- Attitude
- Experience
- Qualification
- Age
- Sex
- Marital status

Processes (health unit)
- Monitoring and supervision
- Training
- Surveillance for hospital-acquired infections
- Patient load
- Health facility level
- Feedback to health workers
- Disease surveillance
- Capacity building
- Infection Control committee

Implementation of infection control measures

Outcome
Increased hospital-acquired infections
3.1 Conceptual Framework Narrative

In order for infection control measures to be adequately implemented, a number of factors need to be considered. These include inputs both at national and district level and associated processes at the individual and health unit level. Availability and adequate balance of these will ultimately influence the infection control status in the health units.

Inputs such as policies and guidelines, resources, supplies and staff recruitment need to be mobilised and allocated to the districts through the Ministry of Health. These inputs need to be availed to the healthcare workers through the respective health units. Some of the inputs like policies influence processes at the health unit level such as training of staff, support supervision as well as healthcare worker knowledge and attitude. These processes will in turn have an influence on the level of implementation of infection control measures in the health units that may result in a probable increase in hospital-acquired infections as the ultimate outcome if not adequately done.

3.4 Research questions

1. To what extent are health units implementing measures of infection control?

2. What are the barriers that could be deterring health units from adequately implementing measures of infection control?
4.0 OBJECTIVES

4.1 General objective

To identify the factors influencing implementation of infection control measures in health units in Arua District so as to assist the district health team in promoting interventions that can reduce the risk of transmission of hospital-acquired infections

4.2 Specific objectives

1. To determine the level of knowledge on infection control by healthcare workers in Arua District

2. To determine the attitude towards implementation of infection control measures portrayed by healthcare workers

3. To determine the extent to which healthcare workers observe infection control measures

4. To determine the extent to which health units observe infection control measures

5. To determine the availability of supplies needed for implementing infection control measures in health units in Arua District
5.0 METHODOLOGY

5.1 Study site

The study was conducted in Arua District which was the principal investigator’s field study site. The district is located about 530km northwest of Kampala City bordering the state of Democratic Republic of Congo (DRC) to the west, the districts of Nebbi to the south, Amuru and Adjumani to the east and Maracha-Terego to the north. Arua had a projected mid-2007 population of about 499,600 people, 23% of which were less than 5 years old (UBOS, 2007). There were a total of 36 government health units, 5 PNFP/NGO units and 17 private health clinics in the four health sub districts of Arua Municipality, Ayivu, Lower Madi and Vurra/Upper Madi as of June 2007.

5.2 Study population

This comprised of all government, NGO/PNFP units and private health clinics in Arua district as well as healthcare workers who were sampled from each of these categories.

5.3 Study design

This was a cross-sectional study.

5.4 Sample size determination

The formula for survey sampling by Leslie Kish (1965) was used to determine the number of healthcare workers selected for the study.

\[ n = \frac{Z_{\alpha/2}^2 \cdot p \cdot q}{d^2} \]

where \( n = \) sample size
\( Z_{0.02} \): value corresponding to 95% confidence interval for a standard normal distribution curve = 1.96

\( p \): Average global proportion of healthcare workers that observe recommended hand hygiene practices = 0.48 (Pittet et al., 2004)

\( q \): 1-\( p \)

\( d \): maximum acceptable sampling error = 0.05

Substituting the values,

\[
n = 1.96^2 \times 0.48 \times 0.52 \times \frac{0.05 \times 0.05}{0.05} = 384 \text{ respondents}
\]

However, because Arua District had an estimated total of 360 healthcare workers only, Cochran’s (1977) correction formula was employed to get the final sample size.

\[
n_1 = \frac{n_0}{1 + n_0/p}
\]

Where:

\( n_1 \) = adjusted sample size

\( n_0 \) = sample size obtained by Leslie Kish (1965) formula

\( P \) = total number of healthcare workers in Arua District

Substituting the values into the modified formula for a finite population,

\[
n_1 = \frac{384}{1 + 384/360} = 186 \text{ respondents}
\]

5.5 Sampling procedure

Thirty-two out of the fifty eight health units from all four health sub-districts were selected. Both hospitals, all three HC IVs and ten of the twelve HC IIIIs were selected by purposive sampling in order to increase the likelihood of obtaining useful information. Nine out of the seventeen private clinics and eight of the twenty five HC
IIs were selected using a simple random procedure. The number of healthcare workers obtained from each health centre level was arrived at using probability proportionate-to-size sampling in an approximate ratio of 5: 1: 2: 1: 1 for hospitals, HCIVs, HCIIIs, HCIIs and private clinics respectively as shown in the table below.

**Table 1. Proportionate sampling of the healthcare workers from the various health unit levels**

<table>
<thead>
<tr>
<th>Health Unit Level</th>
<th>Proportion (p)</th>
<th>Proportionate Sample Size (p x 186)</th>
<th>Actual sample used</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hospital</td>
<td>0.5</td>
<td>93</td>
<td>87</td>
</tr>
<tr>
<td>HCIV</td>
<td>0.1</td>
<td>19</td>
<td>23</td>
</tr>
<tr>
<td>HCIII</td>
<td>0.2</td>
<td>37</td>
<td>37</td>
</tr>
<tr>
<td>HCIII</td>
<td>0.1</td>
<td>19</td>
<td>19</td>
</tr>
<tr>
<td>Clinic</td>
<td>0.1</td>
<td>19</td>
<td>20</td>
</tr>
</tbody>
</table>

The respondents that were interviewed from each health facility were obtained by simple random sampling of the healthcare workers from the various sections while one key informant was purposively sampled from each of half the total number of the health units assessed.

The health units and the corresponding number of healthcare workers interviewed from each unit are shown in table 2 below.
<table>
<thead>
<tr>
<th>Health Facility</th>
<th>No. of Respondents</th>
<th>Health Sub district</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Private Clinics</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Adumi Health Clinic</td>
<td>3</td>
<td>Arua Municipality</td>
</tr>
<tr>
<td>2. Allied Clinic</td>
<td>1</td>
<td>Arua Municipality</td>
</tr>
<tr>
<td>3. Bazaar Medical Centre Clinic</td>
<td>2</td>
<td>Arua Municipality</td>
</tr>
<tr>
<td>4. Family Care Clinic</td>
<td>2</td>
<td>Arua Municipality</td>
</tr>
<tr>
<td>5. Guardian Clinic</td>
<td>1</td>
<td>Arua Municipality</td>
</tr>
<tr>
<td>6. Marie Stopes Clinic</td>
<td>2</td>
<td>Arua Municipality</td>
</tr>
<tr>
<td>7. Memorial Clinic</td>
<td>2</td>
<td>Arua Municipality</td>
</tr>
<tr>
<td>8. Nelton Clinic</td>
<td>2</td>
<td>Arua Municipality</td>
</tr>
<tr>
<td>9. Premier Medical Care Clinic</td>
<td>5</td>
<td>Arua Municipality</td>
</tr>
<tr>
<td><strong>Health Centre IIIs</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Ayivuni HC II*</td>
<td>0</td>
<td>Ayivu</td>
</tr>
<tr>
<td>2. Military HC II</td>
<td>6</td>
<td>Arua Municipality</td>
</tr>
<tr>
<td>3. Ombiodriondrea HC II</td>
<td>1</td>
<td>Ayivu</td>
</tr>
<tr>
<td>4. Orivu HC II*</td>
<td>0</td>
<td>Ayivu</td>
</tr>
<tr>
<td>5. Pajulu HC II</td>
<td>2</td>
<td>Ayivu</td>
</tr>
<tr>
<td>6. Police HC II</td>
<td>2</td>
<td>Arua Municipality</td>
</tr>
<tr>
<td>7. Prisons HC II</td>
<td>5</td>
<td>Arua Municipality</td>
</tr>
<tr>
<td>8. Uleppi HC II*</td>
<td>3</td>
<td>Vurra/Upper Madi</td>
</tr>
<tr>
<td><strong>Health Centre IIIs</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Ajia HC III</td>
<td>2</td>
<td>Vurra/Upper Madi</td>
</tr>
<tr>
<td>2. Aroi HC III</td>
<td>4</td>
<td>Ayivu</td>
</tr>
<tr>
<td>3. Bondo HC III</td>
<td>6</td>
<td>Vurra/Upper Madi</td>
</tr>
<tr>
<td>4. Ediofe HC III*</td>
<td>7</td>
<td>Ayivu</td>
</tr>
<tr>
<td>5. Inde HC III</td>
<td>2</td>
<td>Lower Madi</td>
</tr>
<tr>
<td>6. Masjid Noor HC III*</td>
<td>3</td>
<td>Arua Municipality</td>
</tr>
<tr>
<td>7. Offaka HC III</td>
<td>3</td>
<td>Vurra/Upper Madi</td>
</tr>
<tr>
<td>8. Oje HC III*</td>
<td>3</td>
<td>Ayivu</td>
</tr>
<tr>
<td>9. Okollo HC III</td>
<td>3</td>
<td>Vurra/Upper Madi</td>
</tr>
<tr>
<td>10. Riki HC III</td>
<td>4</td>
<td>Ayivu</td>
</tr>
<tr>
<td><strong>Health Centre IVs</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Adumi HC IV</td>
<td>8</td>
<td>Ayivu</td>
</tr>
<tr>
<td>2. Oli HC IV</td>
<td>10</td>
<td>Arua Municipality</td>
</tr>
<tr>
<td>3. Rhino Camp HC IV</td>
<td>5</td>
<td>Lower Madi</td>
</tr>
<tr>
<td><strong>Hospitals</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Arua Hospital</td>
<td>44</td>
<td>Arua Municipality</td>
</tr>
<tr>
<td>2. Kuluva Hospital*</td>
<td>43</td>
<td>Vurra/Upper Madi</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>186</td>
<td></td>
</tr>
</tbody>
</table>

* Non-governmental organisation (NGO) health units
*No healthcare workers interviewed in these facilities due to their absence or busy schedule
5.6 Sampling unit

A health facility and health care worker

5.7 Study unit

A health facility

5.7.1 Inclusion criteria

- All healthcare workers employed in the sampled health units
- All heads of infection control committees or health facility officer in-charge
  where the committees do not exist

5.7.2 Exclusion criteria

- Healthcare workers who were not on station
- Health workers from units in which pre-testing of the questionnaires was done

5.8 Study variables

5.8.1 Dependent variables

Washing of hands before conduct of aseptic procedures was the primary dependent
variable of interest.

Other secondary dependent variables assessed were: wearing of gloves before conduct
of aseptic procedures, disposal of used sharps, sterilisation of medical equipment,
disinfection of used materials, disposal of waste, isolation of patients and cleaning of
the health units.

5.8.2 Independent variables

- Knowledge about: importance of infection control, common HAIs, the persons
  responsible for its implementation
- Attitude towards: necessity and practicality of observing standard precaution measures of infection control
- Socio-demographic characteristics: age, sex, education level and marital status, medical/nursing qualifications and duration in health service
- Administrative factors: presence of supplies needed for infection control, presence of an infection control committee, surveillance for hospital-acquired infections, frequency of in-service education and training and frequency of support supervision from higher levels

5.9 Data collection

5.9.1 Data collection methods

5.9.1.1 Quantitative data

- Healthcare workers and officer in-charges of the sampled health units were interviewed individually.

5.9.2.2 Qualitative data

- Observations of specific health unit sections (injection/dressing rooms, examination rooms, laboratory and maternity wards) and healthcare workers for compliance with infection control measures
- Key informant interviews were conducted to obtain information from health facility in-charges/infection control heads about the availability of infection control supplies, policies and measures
5.9.2 Data collection tools

5.9.2.1 Quantitative data

- Interviewer-administered semi-structured questionnaires were used to obtain healthcare workers' knowledge, attitude and practice towards infection control.

5.9.2.1 Qualitative data

- A key-informant guide and voice recorder were utilised to obtain information from health facility in-charges/ infection control heads about the availability of infection control supplies and implementation of related activities.
- An observation checklist in addition to a digital camera where possible were utilised to document compliance of units with infection control measures.

5.9.3 Quality control

5.9.3.1 Training of data collectors

A team of three persons familiar with the study area and with a minimum education level of higher school certificate were recruited as data collectors. They were also briefed on the objectives of the study and the minimum quality expectations of their work. They were then trained on how to conduct the interviews using a sample of the actual questionnaires.

5.9.3.2 Pre-testing

The questionnaires were first pre-tested in two non-participating private health clinics so as to maximize data capture and to cater for any omissions and oversights before the actual data collection in the field commenced.
5.9.3.3 Field editing and management of missing data

All questionnaires were checked for completeness and consistency before the data collectors left the health units. Incomplete questionnaires were filled by retracing the respondents before leaving the field. Where the latter was not possible, missing values were coded as such and these questionnaires were only used to answer specific objectives. The questionnaires were numbered to aid the data entry and tracking process.

5.10 Data management and analysis

The data was first cleaned, edited and coded before it was entered into *Epi info* (2002) data base and then exported to *STATA*, version 10 software for analysis. Frequency tables were used to present the socio-demographic characteristics of the respondents. The findings arising from the knowledge-based variables where presented as frequency tables or graphs while those obtained from attitudinal variables where summarised in a frequency table. The practice variables reported by the respondents were also presented as either tables or graphs. Additionally, these KAP responses were conclusively regarded as poor, fair, good, very good and excellent if they fell within the ranges of 0-49%, 50-64%, 65-79%, 80-89% and 90-100% respectively. The dependent and independent variables were then cross-tabulated to test for strengths of associations and their significance at 95% confidence interval. Factors that were significant at bi-variate analysis were then subjected to logistic regression in order to develop a multivariate model that best explained predictors of observing infection control. Observation of infection control practices and availability of supplies was presented using tables and appropriate photographs. Qualitative data obtained from the key informants were coded and summarised using a master sheet and the findings were presented both textually and as verbatim.
5.11 Ethical considerations

Ethical approval was sought from the Uganda National Council of Science and Technology through Makerere University School of Public Health Higher Degrees Research and Ethics Committee. The District Health Officer (DHO) as well as the officer in-charge of the selected health units were contacted for their approval before data was collected. Written informed consent was obtained from all the respondents prior to the conduct of the interviews. This included the purpose of the study, any potential risks and benefits as well as the liberty to decline participation in the study. The names of the respondents were kept anonymous and confidentiality was observed at all stages of the study process.

5.12 Limitations of the study

There was limited time for observing participants within each facility which may not have given a comprehensive representation of the routine adherence practices especially hand hygiene and wearing of gloves. Hence, some of the observations were done indirectly like looking for used gloves and recapped needles in the waste bins.

Some staff in the health centre IIIs were inaccessible and consequently, only observations were made in these circumstances. Furthermore, this being a cross-sectional study design, inherent flaws like difficulty in establishing a cause-effect relationship was unavoidable.

5.13 Dissemination of the findings

A copy will be availed to MUSPH at the end of the study as part of the requirements for obtaining a degree of Master of Public Health. Pertinent findings will be disseminated to relevant district leaders at an appropriate time when resources permit.
6.0 RESULTS

6.1 Socio-Demographic Characteristics of the Respondents

The study involved 186 respondents whose mean age was 36.3 years (SD 8.9 years) with a range of 22-59 years and a median age of 35 years. The average time spent working in the health service was 11.9 years (SD 8.8 years). Most of the respondents were married (76.3%) and had attained at least ordinary level education (98.9%).

The results are summarised in table 3 below.
Table 3. Socio-demographic Characteristics of the Respondents

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Frequency N=186</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Age group (Years)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20-29</td>
<td>45</td>
<td>24.2%</td>
</tr>
<tr>
<td>30-39</td>
<td>83</td>
<td>44.6%</td>
</tr>
<tr>
<td>40-49</td>
<td>39</td>
<td>21.0%</td>
</tr>
<tr>
<td>50-59</td>
<td>19</td>
<td>10.2%</td>
</tr>
<tr>
<td><strong>Sex</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>85</td>
<td>45.7%</td>
</tr>
<tr>
<td>Female</td>
<td>101</td>
<td>54.3%</td>
</tr>
<tr>
<td><strong>Marital status</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Married</td>
<td>142</td>
<td>76.3%</td>
</tr>
<tr>
<td>Single</td>
<td>32</td>
<td>17.2%</td>
</tr>
<tr>
<td>Widowed</td>
<td>9</td>
<td>4.8%</td>
</tr>
<tr>
<td>Divorced</td>
<td>3</td>
<td>1.6%</td>
</tr>
<tr>
<td><strong>Highest education level</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Primary</td>
<td>2</td>
<td>1.1%</td>
</tr>
<tr>
<td>Ordinary</td>
<td>98</td>
<td>52.7%</td>
</tr>
<tr>
<td>Advanced</td>
<td>28</td>
<td>15.1%</td>
</tr>
<tr>
<td>Tertiary</td>
<td>58</td>
<td>31.2%</td>
</tr>
<tr>
<td><strong>Qualification</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nursing Assistant</td>
<td>40</td>
<td>21.5%</td>
</tr>
<tr>
<td>Enrolled Nurse</td>
<td>38</td>
<td>20.4%</td>
</tr>
<tr>
<td>Registered Nurse</td>
<td>33</td>
<td>17.7%</td>
</tr>
<tr>
<td>Enrolled Midwife</td>
<td>18</td>
<td>9.7%</td>
</tr>
<tr>
<td>Clinical Officer</td>
<td>15</td>
<td>8.1%</td>
</tr>
<tr>
<td>Laboratory Assistant</td>
<td>14</td>
<td>7.5%</td>
</tr>
<tr>
<td>Registered Midwife</td>
<td>13</td>
<td>7.0%</td>
</tr>
<tr>
<td>Others*</td>
<td>15</td>
<td>8.1%</td>
</tr>
<tr>
<td><strong>Years in service</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0-9</td>
<td>88</td>
<td>47.3%</td>
</tr>
<tr>
<td>10-19</td>
<td>62</td>
<td>33.3%</td>
</tr>
<tr>
<td>20-29</td>
<td>24</td>
<td>12.9%</td>
</tr>
<tr>
<td>&gt;30</td>
<td>12</td>
<td>6.5%</td>
</tr>
<tr>
<td><strong>Source of respondents</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hospital</td>
<td>87</td>
<td>46.8%</td>
</tr>
<tr>
<td>HC IV</td>
<td>23</td>
<td>12.4%</td>
</tr>
<tr>
<td>HC III</td>
<td>37</td>
<td>19.9%</td>
</tr>
<tr>
<td>Clinic</td>
<td>20</td>
<td>10.8%</td>
</tr>
<tr>
<td>HC II</td>
<td>19</td>
<td>10.2%</td>
</tr>
</tbody>
</table>

*1 medical doctor, 2 students, 4 health assistants, 2 orthopaedic officers, 3 dental assistants, 1 physiotherapist, 1 psychiatric nurse and 1 dispenser
6.2 KNOWLEDGE OF HEALTHCARE WORKERS ON INFECTION CONTROL

All except one of the respondents had ever heard of infection control while 78.5% of the respondents had ever heard of the infection control guidelines. The majority of the respondents (88.6%) also knew the importance of the measures.

Table 4. Knowledge on Infection Control

<table>
<thead>
<tr>
<th>QUESTION</th>
<th>Frequency (Yes)</th>
<th>%</th>
<th>Total n</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heard of infection control?</td>
<td>185</td>
<td>99.5</td>
<td>186</td>
</tr>
<tr>
<td>Can explain the meaning of infection control?</td>
<td>108</td>
<td>58.4</td>
<td>185</td>
</tr>
<tr>
<td>Heard of infection control guidelines?</td>
<td>146</td>
<td>78.5</td>
<td>186</td>
</tr>
<tr>
<td>Knows importance of infection control?</td>
<td>163</td>
<td>88.6</td>
<td>184</td>
</tr>
<tr>
<td>Ever heard of “injection safety?”</td>
<td>176</td>
<td>94.6</td>
<td>186</td>
</tr>
<tr>
<td>If yes, can explain the meaning of “injection safety”</td>
<td>84</td>
<td>48.0</td>
<td>175</td>
</tr>
<tr>
<td>Know method of ensuring adequate hand hygiene besides soap and water?</td>
<td>154</td>
<td>82.8</td>
<td>186</td>
</tr>
</tbody>
</table>

The majority of the respondents (51%) could mention at least 6 of the 8 major infection control measures while only 47.8% and a paltry 17.2% of them cited housekeeping and isolation respectively as indicated in figure 1 below.
Fig. 1: Infection Control Measures Known by the Respondents

Note: Hence, knowledge on hand washing and disinfection rated/regarded as good (65-79%), on PPW, sterilisation, waste disposal, injection safety regarded as fair (50-64%) and on housekeeping and isolation regarded as poor (<50%).

Most respondents thought that it was their sole responsibility to implement infection control measures in the health units and that other persons had no role to play as shown in figure 2 below.

Fig. 2: Person responsible for implementing infection control measures
When asked which procedures required wearing of gloves, wound dressing was the most commonly mentioned procedure (80.6%) while clinical examination (19.4%) and the conduct of delivery (15.6%) were among the least mentioned as shown below.

**Fig. 3: Procedures that require wearing of gloves**

Nearly all the respondents (96.7%) said HIV was one of the infections transmissible through sharps while 62.9% mentioned hepatitis B as depicted in figure 4 below.

**Fig. 4. Infections transmissible through sharps**
Incineration was cited as the best method of terminal disposal of medical waste by 89% of the respondents as illustrated in figure 5 below.

Fig 5. Final Disposal of Medical Waste

Most respondents (75.8%) cited tuberculosis as the disease that necessitated isolation of patients with cholera a distant second (52.7%) as illustrated in figure 6.

Fig. 6. Diseases that require isolation
6.3 ATTITUDE OF HEALTHCARE WORKERS TOWARDS OBSERVING INFECTION CONTROL MEASURES

As a means of assessing the attitude towards complying with infection control measures, questions leaning towards individual perceptions and opinions were put forward to the respondents.

Virtually all respondents (98.9%) thought that adhering to infection control at all times was necessary and the majority thought it was practical to do so. Those who differed mostly cited the limited resources available to implement the activities. Hand washing (42.5%) was considered as the most important practice among all the infection control measures. The findings are summarised in table 6 below.
Table 5. Attitude of HCWs towards Observing Infection Control Measures

<table>
<thead>
<tr>
<th>QUESTION</th>
<th>Frequency (Yes)</th>
<th>Total n</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Is it necessary to adhere to infection control at all times?</td>
<td>184</td>
<td>186</td>
<td>98.9a</td>
</tr>
<tr>
<td>Is it practical to adhere to the infection control guidelines?</td>
<td>163</td>
<td>186</td>
<td>87.6b</td>
</tr>
<tr>
<td>If not practical, why?</td>
<td></td>
<td>23</td>
<td></td>
</tr>
<tr>
<td>• Limited resources</td>
<td>16</td>
<td></td>
<td>69.6</td>
</tr>
<tr>
<td>• Too much work</td>
<td>3</td>
<td></td>
<td>13.0</td>
</tr>
<tr>
<td>• Others</td>
<td>4</td>
<td></td>
<td>17.4</td>
</tr>
<tr>
<td>What is the most important infection control measure?</td>
<td></td>
<td>186</td>
<td></td>
</tr>
<tr>
<td>• Hand washing</td>
<td>79</td>
<td></td>
<td>42.5</td>
</tr>
<tr>
<td>• PPW</td>
<td>33</td>
<td></td>
<td>17.7</td>
</tr>
<tr>
<td>• Others*</td>
<td>58</td>
<td></td>
<td>31.2</td>
</tr>
<tr>
<td>• Don’t know</td>
<td>16</td>
<td></td>
<td>8.6</td>
</tr>
<tr>
<td>Are there measures you find difficult to observe?</td>
<td>65</td>
<td>186</td>
<td>34.9</td>
</tr>
<tr>
<td>If yes, which are these?</td>
<td></td>
<td>65</td>
<td></td>
</tr>
<tr>
<td>• PPW</td>
<td>27</td>
<td></td>
<td>41.5</td>
</tr>
<tr>
<td>• Sterilisation</td>
<td>14</td>
<td></td>
<td>21.5</td>
</tr>
<tr>
<td>• Isolation</td>
<td>10</td>
<td></td>
<td>15.4</td>
</tr>
<tr>
<td>• Others</td>
<td>14</td>
<td></td>
<td>21.5</td>
</tr>
<tr>
<td>Why is this so?</td>
<td></td>
<td>59</td>
<td></td>
</tr>
<tr>
<td>• Limited resources</td>
<td>42</td>
<td></td>
<td>71.2</td>
</tr>
<tr>
<td>• Don’t know the measure</td>
<td>4</td>
<td></td>
<td>6.8</td>
</tr>
<tr>
<td>• Emergencies</td>
<td>4</td>
<td></td>
<td>6.8</td>
</tr>
<tr>
<td>• Too much workload</td>
<td>4</td>
<td></td>
<td>6.8</td>
</tr>
<tr>
<td>• Others</td>
<td>5</td>
<td></td>
<td>8.5</td>
</tr>
</tbody>
</table>

*Others: disinfection (13%), housekeeping (12%), injection safety (9%), sterilisation (9%), waste disposal (8%) and isolation (7%). Multiple responses were allowed.

*a regarded as excellent (≥ 90%)

*b regarded as very good (80-89%)
6.4 PRACTICE OF HEALTHCARE WORKERS

In order to capture information that would not easily be obtained through observation of individual healthcare workers as well as supplement the overall picture obtained from the health units, a set of questions concerning routine practices were posed to the healthcare workers.

Hand washing (74.7%) and wearing of gloves (66.7%) were the practices the respondents said did most frequently while isolation (4.3%) was the least done.

Fig. 7. Infection control measures practiced by the respondents

Only about half of the respondents (51.4%) said they had ever read the guidelines on infection control with an even lesser number (43.8%) who said they always follow them. The majority of the respondents (72.6%) said they had never had any in-service training on infection control since joining their respective health units. The findings are summarised in table 5 below.
Table 6. Continuous Education and Training on infection control

<table>
<thead>
<tr>
<th>Activity</th>
<th>Frequency</th>
<th>%</th>
<th>Total n</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ever read guidelines?</td>
<td>95</td>
<td>51.4</td>
<td>185</td>
</tr>
<tr>
<td>Follow the guidelines?</td>
<td></td>
<td></td>
<td>185</td>
</tr>
<tr>
<td>• Always</td>
<td>81</td>
<td>43.8</td>
<td></td>
</tr>
<tr>
<td>• Never</td>
<td>46</td>
<td>24.9</td>
<td></td>
</tr>
<tr>
<td>• Occasionally</td>
<td>32</td>
<td>17.3</td>
<td></td>
</tr>
<tr>
<td>• Most times</td>
<td>26</td>
<td>14.1</td>
<td></td>
</tr>
<tr>
<td>Ever had any in-service training on infection control?</td>
<td>51</td>
<td>27.4</td>
<td>186</td>
</tr>
</tbody>
</table>

When was the last training?*

<table>
<thead>
<tr>
<th>Year</th>
<th>Frequency</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>2006-2007</td>
<td>17</td>
<td>33.3</td>
</tr>
<tr>
<td>2004-2005</td>
<td>17</td>
<td>33.3</td>
</tr>
<tr>
<td>2002-2003</td>
<td>10</td>
<td>19.6</td>
</tr>
<tr>
<td>Before 2002</td>
<td>7</td>
<td>13.7</td>
</tr>
</tbody>
</table>

* The average time spent since the last training was 2.5 years and median of 3 years.

These findings agree with what most key informants reported. In most situations, patients were reportedly provided with information related to infection control as a wider component of environmental sanitation and hygiene on a regular basis. In other units, such education was limited to specific sections. However, most key informants reported that no education or training specific to infection control was provided to staff.

'We do regularly remind our staff about maintaining hygiene but this is general and not specific to the infection control'.

In some units, one or two individual staff had ever had such trainings. In most cases though, all that was available was the occasional reminders from the medical doctors or senior nurses.

The lack of a copy of the guidelines was by far the most cited reason as to why the healthcare workers did not consistently follow them.
Frequency of support supervision/inspection of infection control activities

Most key informants in units in or around the municipality reported that their units had been inspected for infection control activities within the last quarter prior to the conduct of this study, that is, between May and August 2007. This was done under the Yellow Star programme that assessed a wider aspect of quality of healthcare provided by government units. For some remote units however, they had reportedly not been inspected for over 1 year. Inde HC III had for instance reportedly last been supervised 15 months ago. Additionally, feedback on the findings of such inspections were for most part given verbally immediately after the inspection but written reports were at times sent to the units at the next inspection round or collected by the health unit management itself.

The lack of a copy of the guidelines was by far the most cited reason as to why the healthcare workers did not consistently follow them.

Fig. 8. Why respondents do not follow the guidelines
Bi-Variate Analysis of the Factors that May Influence Hand Washing

Chi-square tests for the strength of associations at 95% CI between hand washing which is the most important infection control measure (WHO, 2003) and the possible influencing factors were done and the results summarised in the table below.

**Table 7: Associations between hand washing and possible predictors**

<table>
<thead>
<tr>
<th>Factor</th>
<th>Yes (%)</th>
<th>No (%)</th>
<th>OR (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Received in-service training? (n=186)</td>
<td>Yes</td>
<td>44 (86)</td>
<td>7 (14)</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>95 (70)</td>
<td>40 (30)</td>
</tr>
<tr>
<td>Read guidelines? (n=185)</td>
<td>Yes</td>
<td>72 (76)</td>
<td>23 (24)</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>66 (73)</td>
<td>24 (27)</td>
</tr>
<tr>
<td>Can explain infection control? (n=184)</td>
<td>Yes</td>
<td>126 (77)</td>
<td>37 (23)</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>12 (57)</td>
<td>9 (43)</td>
</tr>
<tr>
<td>Educated beyond O’level? (n=186)</td>
<td>Yes</td>
<td>74 (86)</td>
<td>12 (14)</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>65 (65)</td>
<td>35 (35)</td>
</tr>
<tr>
<td>&lt; 35 years (n=186)</td>
<td>Yes</td>
<td>67 (76)</td>
<td>21 (24)</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>72 (73)</td>
<td>26 (27)</td>
</tr>
<tr>
<td>&lt;10 years in health service (n=186)</td>
<td>Yes</td>
<td>67 (76)</td>
<td>21 (24)</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>72 (73)</td>
<td>26 (27)</td>
</tr>
<tr>
<td>Sex (n=186)</td>
<td>Female</td>
<td>78 (77)</td>
<td>23 (23)</td>
</tr>
<tr>
<td></td>
<td>Male</td>
<td>24 (28)</td>
<td>61 (72)</td>
</tr>
<tr>
<td>Cites hand washing as one of infection</td>
<td>Yes</td>
<td>107 (86)</td>
<td>17 (14)</td>
</tr>
<tr>
<td>control measures known (n=186)</td>
<td>No</td>
<td>32 (52)</td>
<td>30 (48)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5.90 (2.73-12.87)*</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Has ever acquired a HAI? (n=186)</td>
<td>Yes</td>
<td>32 (82)</td>
<td>7 (18)</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>107 (73)</td>
<td>40 (27)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1.71 (0.67-4.95)</td>
<td></td>
</tr>
<tr>
<td>Qualified beyond nursing assistant? (n=186)</td>
<td>Yes</td>
<td>101 (81)</td>
<td>23 (19)</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>38 (61)</td>
<td>24 (39)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2.77 (1.17-5.13)*</td>
<td></td>
</tr>
</tbody>
</table>

*Statistically significant at 95% confidence interval

Bi-variate analysis showed that respondents who had received in service training (OR=2.65, 95 CI: 1.06-7.53), were educated beyond O’level (OR=3.32, 95% CI: 1.52-7.59), were qualified beyond a nursing assistant (OR=2.77, 95 CI: 1.17-5.13) and
those who knew hand washing as one of the measures of infection control (OR=5.90, 95 CI: 2.73-12.87) were more likely to wash their hands.

**Multivariate analysis**

The exposure variables that were found to be significant at bi-variate level and those that were plausible were put into a logistic model as shown below:

\[
\text{Logit } P (Y) = \alpha + \beta_1 \text{ (Received in-service training)}
\]

\[
\beta_2 \text{ (Ever read guidelines)}
\]

\[
\beta_3 \text{ (Can explain infection control)}
\]

\[
\beta_4 \text{ (Education level)}
\]

\[
\beta_5 \text{ (Age)}
\]

\[
\beta_6 \text{ (Marital status)}
\]

\[
\beta_7 \text{ (Sex)}
\]

\[
\beta_8 \text{ (Years in health service)}
\]

\[
\beta_9 \text{ (Qualification)}
\]

\[
\beta_{10} \text{ (Ever acquired hospital infection)}
\]

\[
\beta_{11} \text{ (Cites hand washing as a measure)}
\]

\[
\beta_{12} \text{ (Can explain infection control)}
\]

Where: Logit \( P (Y) \) = the probability of washing hands

\( \alpha \) is the intercept

\( \beta \) is the coefficient estimate of the exposure or potential confounder variables

Using backward stepwise conditional logistic regression to control for confounding and test for effect modification, the best-fitted model that predicted hand washing was obtained as shown by the table below:
Table 8: Coefficient estimates and odds ratios obtained from the best-fit model that explains hand washing ($R^2=19\%$)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient estimate ($\beta$)</th>
<th>AOR (95% CI)</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Received in-service training? (1=Yes, 0=No)</td>
<td>1.00</td>
<td>$2.71^a (1.03-7.16)$</td>
<td>0.045</td>
</tr>
<tr>
<td>Educated beyond O’level? (1=Yes, 0=No)</td>
<td>1.19</td>
<td>$3.30^a (1.44-7.54)$</td>
<td>0.005</td>
</tr>
<tr>
<td>Knows hand washing? (1=Yes, 0=No)</td>
<td>1.74</td>
<td>$5.70^a (2.64-12.32)$</td>
<td>0.000</td>
</tr>
<tr>
<td>Has ever acquired a HAI? (1=Yes, 0=No)</td>
<td>1.05</td>
<td>$2.84^a (1.03-7.84)$</td>
<td>0.043</td>
</tr>
</tbody>
</table>

* Significant findings

Healthcare workers who had received in-service training on infection control, had been educated beyond O’level, knew that hand washing was one of the infection control measures and had ever acquired a hospital infection were more likely to wash their hands than their colleagues that lacked these attributes.

A comparison of the associations before and after adjusting for other factors that may influence hand washing was done and the results are shown in the table below.
Table 9: Comparison of the crude odds ratios and adjusted odds ratios

<table>
<thead>
<tr>
<th>Variable</th>
<th>COR (95% CI)</th>
<th>AOR (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Received in-service training? (1=Yes, 0=No)</td>
<td>2.65&lt;sup&gt;b&lt;/sup&gt; (1.06-7.53)</td>
<td>2.71&lt;sup&gt;a&lt;/sup&gt; (1.03-7.16)</td>
</tr>
<tr>
<td>Educated beyond O’level? (1=Yes, 0=No)</td>
<td>3.32&lt;sup&gt;b&lt;/sup&gt; (1.52-7.59)</td>
<td>3.30&lt;sup&gt;a&lt;/sup&gt; (1.44-7.54)</td>
</tr>
<tr>
<td>Cites hand washing? (1=Yes, 0=No)</td>
<td>5.90&lt;sup&gt;b&lt;/sup&gt; (2.73-12.87)</td>
<td>5.70&lt;sup&gt;a&lt;/sup&gt; (2.64-12.32)</td>
</tr>
<tr>
<td>Has ever acquired a HAI? (1=Yes, 0=No)</td>
<td>1.71 (0.67-4.95)</td>
<td>2.84&lt;sup&gt;b&lt;/sup&gt; (1.03-7.84)</td>
</tr>
<tr>
<td>Qualified beyond nursing assistant? (1=Yes, 0=No)</td>
<td>2.77&lt;sup&gt;b&lt;/sup&gt; (1.17-5.13)</td>
<td>1.71 (0.72-4.06)</td>
</tr>
</tbody>
</table>

<sup>b</sup> Significant findings before adjusting  
<sup>a</sup> Significant findings after adjusting

Table shows that factors significant at bi-variate analysis were still significant at multivariate analysis except the qualification of the healthcare worker.
6.5 OBSERVATION OF HEALTH UNITS FOR IMPLEMENTATION OF INFECTION CONTROL MEASURES

6.5.1 Observation of Infection Control Practices

Disposal of sharps (90.6%) and use of separate containers (93.8%) for this process were the most commonly done practices while wearing of suitable gear (28.1%), the use of disinfectants (33.3%) and non-recapping of needles (65.6%) were the least common practices. The results are summarised in table 11 that follows.

Table 10. Observation of infection control practices done in the health units

<table>
<thead>
<tr>
<th>Activity</th>
<th>Frequency (Yes)</th>
<th>%</th>
<th>Total N</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wash their hands before aseptic procedures?</td>
<td>3</td>
<td>60.0</td>
<td>5</td>
</tr>
<tr>
<td>Wear gloves during aseptic procedures?</td>
<td>5</td>
<td>62.5</td>
<td>8</td>
</tr>
<tr>
<td>Wearing suitable protective wear?</td>
<td>9</td>
<td>28.1</td>
<td>32</td>
</tr>
<tr>
<td>Recap needles after use?</td>
<td>11</td>
<td>34.4</td>
<td>32</td>
</tr>
<tr>
<td>Dispose needles in suitable containers?</td>
<td>29</td>
<td>96.6</td>
<td>32</td>
</tr>
<tr>
<td>Separate sharp and non-sharp waste?</td>
<td>30</td>
<td>93.8</td>
<td>32</td>
</tr>
<tr>
<td>Sections below (where available) clean?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Injection / dressing</td>
<td>24</td>
<td>75.0</td>
<td>32</td>
</tr>
<tr>
<td>• Examination / consultation</td>
<td>21</td>
<td>80.8</td>
<td>26</td>
</tr>
<tr>
<td>• Laboratory</td>
<td>18</td>
<td>90.0</td>
<td>32</td>
</tr>
<tr>
<td>• Maternity</td>
<td>12</td>
<td>75.0</td>
<td>16</td>
</tr>
<tr>
<td>Bucket of mixed disinfectant in any section?</td>
<td>8</td>
<td>25.0</td>
<td>32</td>
</tr>
</tbody>
</table>

* Suitable protective wear: As per the health hazards the healthcare workers are potentially exposed to.
Comparison of infection control practices between healthcare workers in private health units and government health units

A comparison of infection control measures practiced by healthcare workers in government health units and those in private health units was done. The findings showed no significant difference between the two arms for all the measures except waste disposal. Those in government units were significantly less likely to dispose of waste (OR=0.36, 95% CI 0.18-0.74) than their counterparts in the private health units as shown in table 10.

Table 11: Comparison of infection control practices between healthcare workers in government health units and those in private / NGO health units

<table>
<thead>
<tr>
<th>Factor</th>
<th>Yes (%)</th>
<th>No (%)</th>
<th>OR (95% CI)</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hand washing</td>
<td>Gov't</td>
<td>86 (78)</td>
<td>24 (22)</td>
<td>1.56 (0.75-3.19)</td>
</tr>
<tr>
<td></td>
<td>Private</td>
<td>53 (70)</td>
<td>23 (30)</td>
<td></td>
</tr>
<tr>
<td>Disinfection</td>
<td>Gov't</td>
<td>51 (46)</td>
<td>59 (54)</td>
<td>0.74 (0.39-1.38)</td>
</tr>
<tr>
<td></td>
<td>Private</td>
<td>41 (54)</td>
<td>35 (46)</td>
<td></td>
</tr>
<tr>
<td>Waste disposal</td>
<td>Gov't</td>
<td>21 (19)</td>
<td>89 (81)</td>
<td>0.36 (0.18-0.74)</td>
</tr>
<tr>
<td></td>
<td>Private</td>
<td>30 (39)</td>
<td>46 (61)</td>
<td></td>
</tr>
<tr>
<td>Combined †</td>
<td>Gov't</td>
<td>99 (90)</td>
<td>11 (10)</td>
<td>1.21 (0.42-3.40)</td>
</tr>
<tr>
<td>Outcomes</td>
<td>Private</td>
<td>67 (88)</td>
<td>9 (12)</td>
<td></td>
</tr>
</tbody>
</table>

* Significant findings
† hand washing, waste disposal and disinfection

6.6 AVAILABILITY OF SUPPLIES NEEDED FOR INFECTION CONTROL

All the health units were observed for the necessary supplies needed to implement the infection control measures. The most available item was water (90.4%), while the least available items were alcohol hand rubs (3.1%) and protective eye wear (6.3%) as summarised in table 12 that follows.
<table>
<thead>
<tr>
<th>Supply</th>
<th>Frequency (Yes)</th>
<th>%</th>
<th>Total N</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hand rubs</td>
<td>1</td>
<td>3.1</td>
<td>32</td>
</tr>
<tr>
<td>Protective eye wear</td>
<td>2</td>
<td>6.3</td>
<td>32</td>
</tr>
<tr>
<td>Safety signs for hazardous wastes</td>
<td>6</td>
<td>18.8</td>
<td>32</td>
</tr>
<tr>
<td>Face masks</td>
<td>11</td>
<td>34.4</td>
<td>32</td>
</tr>
<tr>
<td>Functional placenta pit</td>
<td>13</td>
<td>40.6</td>
<td>32</td>
</tr>
<tr>
<td>Containers with secure lids</td>
<td>14</td>
<td>43.8</td>
<td>32</td>
</tr>
<tr>
<td>Gowns/aprons</td>
<td>16</td>
<td>50.0</td>
<td>32</td>
</tr>
<tr>
<td>Functional autoclave</td>
<td>16</td>
<td>50.0</td>
<td>32</td>
</tr>
<tr>
<td>Waste pit</td>
<td>18</td>
<td>56.3</td>
<td>32</td>
</tr>
<tr>
<td>Soap</td>
<td>22</td>
<td>68.8</td>
<td>32</td>
</tr>
<tr>
<td>Auto-destruct syringes</td>
<td>23</td>
<td>71.9</td>
<td>32</td>
</tr>
<tr>
<td>Pit latrine</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Functional</td>
<td>25</td>
<td>78.1</td>
<td>32</td>
</tr>
<tr>
<td>• Clean</td>
<td>11</td>
<td>44.0</td>
<td>25</td>
</tr>
<tr>
<td>Ordinary single-use syringes</td>
<td>26</td>
<td>81.3</td>
<td>32</td>
</tr>
<tr>
<td>Disposable gloves</td>
<td>27</td>
<td>84.4</td>
<td>32</td>
</tr>
<tr>
<td>Sharps disposal containers</td>
<td>27</td>
<td>84.4</td>
<td>32</td>
</tr>
<tr>
<td>Water</td>
<td>29</td>
<td>90.6</td>
<td>32</td>
</tr>
<tr>
<td>Waste pit contain sharps</td>
<td>18</td>
<td>100</td>
<td>18</td>
</tr>
</tbody>
</table>

Furthermore, all except two of the key informants reported lack of any structures specifically laid down to promote infection control activities, contrary to what was in the MOH guidelines. For example, except for Arua Hospital and Rhino Camp HC IV, most units lacked infection control committees. In a few cases, a single person was
assigned the roles of the committee but in most cases, he/she was not up-to-date with the infection control status of the unit. In some instances, the person responsible for infection control was not available.

'We do not have committees or any structure to monitor for those infections that may be got from our health facility. However, we suspect that some infections may be got from poorly done surgeries at times.'

Most of the units reported to have a generalised method of monitoring antibiotic usage. This was through use of the stock cards and out-patient registers which are meant to record all types of drug dispensation.

We keep records based on patient registers and stock but we have no special records available.

Stock outs were a relatively common occurrence as confirmed by most key informants. All government run units were reported to routinely experience some form of shortage of supplies essential for infection control during the past year. The most commonly inadequate supplies were gloves, disinfectants and soap. Whereas most stock-outs lasted about 1-2 weeks, some lasted for up to 3 months. Interestingly, unlike government units, key informants from NGO units did not report any stock outs of infection control supplies.

The key informants from both hospitals claimed that the units were grossly understaffed, with Kuluva Hospital reportedly operating with only about half the expected number of healthcare staff. Likewise, remote units were also having a
significant shortage of staff. A few health units like Oli HClV and Ediofe HCIII that were within or closer to the municipality were reported to have more than the required staffing capacity.

The key informants were asked to suggest ways of improving infection control activities within their respective health units and among the most frequently mentioned solutions were the following:

The district health office should provide more supplies and equipment that are essential for implementing infection control, train healthcare workers on the various aspects of infection control, recruit more staff should to reduce on the work burden on the available healthcare workers, increase the level of support supervision and provide copies of the infection control guidelines.
7.0 DISCUSSION

This study came up with several interesting findings that were similar as well different from those of similar studies as described in the section below. It is important to note that socio-demographic characteristics had no significant influence on implementation as well as the attitude of the healthcare workers.

7.1 Knowledge on Infection Control

All except one of the respondents was aware of the term ‘infection control’. This was not surprising as all HCWs are expected to undergo pre-service training on the measures. A significant number of the respondents (41.6%) could however not clearly explain the meaning of infection control, which was not surprising partly because only about half of the respondents had ever read the guidelines. Interestingly though, most healthcare workers knew the importance of observing infection control measures. This finding concurs with those of studies done in similar settings by Danchaivijitr (1995) and Askarian et al (2005).

The study revealed that the healthcare workers were generally knowledgeable about the components of infection control as slightly over half of them could mention six of the eight major practices. However, there was notably little mention of isolation as one of these measures. One reason for this is that isolation is rarely practiced in lower units due to limitations of space. However, even with these apparently encouraging findings, healthcare workers need to be retrained or reminded regularly as they are likely to forget the measures over time (Calabro et al, 2000).
Although adherence with infection control activities is the responsibility of several persons including both patients and their attendants, most of the healthcare workers considered themselves to be the only ones responsible for its implementation. This could be attributed to the fact that the guidelines emphasize what healthcare workers should do and not so much the role of the other persons (MOH, 2005*).

Although hand washing is considered to be the most important of all infection control measures (WHO, 2003), most of the healthcare workers were not aware of this. It could be that many healthcare workers thought it too obvious or less effective a measure given the wide array of more potent measures such as sterilisation and disinfection.

Most respondents had ever heard about injection safety which is one of the major components of infection control. However, the majority could not describe what the practice meant, with many pointing to proper dosage and injection site rather than prevention of cross-infection between patient and healthcare workers and proper disposal of sharps. Studies by Ernest (2002) and Musa (2005) similarly came up with low knowledge on injection safety.

At least 40% of all the respondents correctly cited TB, cholera, measles and meningitis as examples of diseases that required mandatory isolation. One reason could be that there is a lot of awareness about TB due to its high prevalence countrywide and its close association with HIV/AIDS, another well known condition. Another factor is that Arua district had been frequently affected by outbreaks of cholera and meningitis as recently as 2007 when data for this study was collected.
7.2 Attitude of HCWs towards Observing Infection Control Measures

It is interesting to note that nearly all HCWs deemed it necessary to adhere to infection control practices at all times. A high percentage also felt it practical to adhere to the guidelines at all times. The minority who differed pointed out the lack of adequate resources as the primary reason for failure to implement the measures. This high level of positive attitudinal response differs significantly from what several other studies have found. Mungherera et al (1997) found that 29% of healthcare workers did not perceive any risk in recapping used needles while Askarian et al (2005) found that only 51.8% of the workers held positive attitudes towards isolation precautions.

The use of personal protective wear, sterilisation and isolation were considered as the most difficult of all the measures to comply with. The most likely explanation for this finding is that resources to implement these activities are scarce, a reason given by over 70% of the respondents. For example, the stock out of gloves and shortage of appropriate uniforms is a common occurrence among both private and government units. However, whereas some studies such as that done by Al-Omari and Al-Dwairy (2005) established healthcare workers’ perceptions about patient risk was a determinant factor in using personal protective wear, this study did not come up with such findings.

7.3 Practice of Infection Control Measures by the Healthcare Workers

The limited number of healthcare workers who said they always followed the guidelines at all times may be partly attributed to the low percentage of respondents that had ever read the guidelines. In fact, the respondents cited the absence of a copy of the guidelines as a major reason why the measures were not respected. Another
explanation may be because of the low percentage of healthcare workers that had ever received in-service training on infection control.

Indeed multivariate analysis showed that healthcare workers were more likely to wash their hands if they had ever had training on infection control, a finding that was also observed by Rigbe et al (2005) in the Keren Hospital Study. Knowledge was also strongly associated with practicing the infection control measures. Similarly, Askarian et al (2005) found that nurses with adequate knowledge were 14.2 times more likely (p<0.0001) to comply with the eight precaution measures that the authors assessed.

The study found that implementation of all infection control measures did not differ significantly between government and private health units except the disposal of waste. A conceivable reason for this may be that most of the private clinics are small units which have only a few rooms that make it easier for the healthcare workers to individually dispose their waste unlike larger units where this role may be contracted out or assigned to specific staff.

According to the respondents, gloves were the most worn protective gear. This is probably due to the fact that they are arguably the most important protective wear. Furthermore, all categories of healthcare workers need them at some point during conduct of their work. Other wear such as goggles and masks are more commonly used for non-routine activities such as isolation and major surgeries (CDC, 2006).
7.4 Observation of Infection Control Measures by Health units

Even though 74.7% of the healthcare workers said they washed their hands, this was so in only 60% of the units observed. These findings compare with those of a similar study done in Eritrea by Rigbe et al (2005) where 72% of healthcare workers were observed washing hands although only 30% did so in the recommended way. Isolation was rarely enforced probably because most units, especially the private clinics, HCIIs and HCIIs lacked adequate space.

The low levels of compliance with personal protective wear could be attributed to limited resources among other plausible explanations. Most HCWs who did not always put on the protective wear attributed this to lack of resources (see table 6). It could also be reasoned that many HCWs find personal protective wear inconveniencing (Ji, Yin and Chen, 2005).

The considerably high levels of needle recapping (34.4%) were comparable to those of a cross-sectional study by Sadoh et al (2006) where 31.9% of the healthcare workers always recapped needles. This scenario could be as a result of the lack of clear guidelines on needle recapping. It could also be feasible to assume that many HCWs do not perceive the inherent risks of doing such an apparently innocent practice.

Although the presence of already mixed disinfectant within any of the sections of the health units would have provided some evidence of its use, many sections did not have the mixture around. While many healthcare workers claimed that they had already used it all up for that given day, this could not be verified. It is possible that
they were stock outs of the chemicals as was pointed out by several of the key informants.

Most units had separate bins for sharps and other wastes which was not surprising as these materials were provided free of charge by the district health office.

Unlike both hospitals were general housekeeping was contracted to external service providers, in all other health units, the cleaning was done by either the healthcare workers themselves or by locally employed unskilled staff. This may explain why the cleaning was neither routinely nor properly done in several of the units observed.

7.5 Availability of Infection Control Supplies

Surprisingly, most of the health units had water in at least one of the sections observed. This differed significantly from the service provision survey conducted by MOH and Macro International Inc. (2008) which found that only 43% of the maternal and child health units had running water. The same study found that only 56% of the health units had sharps disposal containers compared to 84.4% of the units in this study. These differences may be as a result of the much larger sample size (n=491) for the nationwide survey but also due to regional variations among other reasons.

Some of the supplies like waste pits and placenta pits were not available in many units probably because they were not that necessary for the level of operations of such units or there was limited space to accommodate them. In some situations, it would be environmentally unsuitable to provide for facilities such as incinerators due to incompatibility with the surrounding environment.
The lack of infection control committees in nearly all units may also have had a negative impact on observing the activities since it is these structures that are pivotal in promoting adherence to these measures besides ensuring availability of the necessary supplies (MOH 2005a). Absence of committees also makes it harder for units to look out for hospital-acquired infections.
8.0 CONCLUSIONS

Healthcare workers were at least fairly knowledgeable about most infection control measures with the exception of isolation and housekeeping.

The attitude of the healthcare workers towards implementing infection control measures was very good to excellent and therefore could not be regarded as a factor that significantly influenced compliance with the measures.

Isolation, the use of personal protective wear, injection safety (recapping used needles), sterilisation and disinfection were the practices that were still not observed adequately.

A shortage of resources to implement infection control measures has a significant negative impact on compliance with the infection control guidelines.

Regularly training healthcare workers on infection control and employing mostly those with at least O’level education may improve on the infection control compliance.

Actively involving all healthcare workers in waste disposal may promote waste disposal, especially in government run units.
9.0 RECOMMENDATIONS

The health unit administrations should ensure that there is on-going education and training on infection control provided to all staff within these units because such knowledge is bound to wane over time.

The district health office should ensure that there are adequate supplies necessary to implement infection control activities in all health units. Of particular concern should be personal protective wear such as gloves and gowns as well as disinfection and sterilisation equipment appropriate for the local conditions.

The district health office should provide sufficient copies of the infection control guidelines from the Ministry of Health for all sections in all health units of the district.

The health unit administrations should revive infection control committees so that these structures can oversee the implementation of these measures.
10.0 REFERENCES


http://www.reproline.jhu.edu/English/4moreh/4ip/IP_manual/01_Introduction.pdf

accessed on 15/10/06


UBOS and Macro International Inc. 2007. Uganda Demographic and Health Survey 2006. Calverton, Maryland, USA: UBOS and Macro International Inc.


APPENDICES

Appendix 1

QUESTIONNAIRE

Date..........................

Name of data collector....................................................

Name and level of health facility......................................

Ward/section...........................................

Personal Details

1. Age...........

2. Sex
   Male  []
   Female []

3. Marital Status
   Married
   Single
   Widowed
   Divorced

4. Qualification (grade)
   Nursing assistant []
   Enrolled nurse []
   Registered nurse []
   Enrolled midwife []
   Registered midwife []
   Clinical officer []
   Medical officer []
   Laboratory assistant []
   Other (specify).................................

5. Highest level of education attained
   Primary  []
   Ordinary level []
   Advanced level []
   Tertiary []

6. How many years have you spent in the medical service?.................
Knowledge on Infection Control

7. Have you ever heard of the term infection control? Y/ N

8. What do you understand by the term infection control?

9. Have you ever heard of infection control guidelines? Y/ N

10. What infection control measures do you know or have heard about? (tick all that apply)
    - Hand washing
    - Personal Protective Wear
    - Safe Injection and Sharps Use
    - Safe Medical Waste Disposal
    - Isolation
    - Disinfection
    - Sterilisation
    - Housekeeping
    - Others (Specify)........................

11. Of what importance is infection control in the delivery of health services?

12. Who should be responsible for ensuring that proper infection control practices are observed? (tick all that apply)
    - Patients
    - Patient visitors
    - Medical workers
    - Administration
    - Other.................................

13. Have you or any staff acquired infections you think were transmitted by patients attending this facility? Y / N / /Don’t Know

14. Have you ever heard of injection/sharps safety? Y/ N

15. If yes, what does it mean?.................................................................

16. How should used needles be best disposed of? (Tick all that apply)
    - Burn
    - Bury
    - Incinerate
17. What common infections do you think can be transmitted through unsafe needle/sharps handling *(Tick all that apply)*

HIV  
Hep B  
Hep C  
others  

18. When is it appropriate for a healthcare worker to wash their hands? *(tick all that apply)*

Before attending to each patient  
After attending to each patient  
Before and after attending to each patient  
Before any surgical/medical procedure  
After contact with dirty surfaces  
others  

19. Do you know of any other methods of ensuring adequate hand hygiene besides using soap and water? Y/ N  

20. If yes, which are these?

Hand rubs (alcohol, antiseptic)  
Other  

21. During what procedures must a healthcare worker wear gloves? *(Tick all that apply)*

Wound dressing  
Blood transfusion  
Surgical operations  
Giving injections  
Obtaining specimen  
others  

22. Mention at least 3 diseases you think require mandatory isolation.

a.  
b.  
c.  
Practice on Infection Control

23. Does this unit/section have a copy of infection control guidelines? Y/ N
(If yes, verify)

24. If no, why? ...............................................................

25. Have you ever read it? Y/ N

26. How often do you follow the guidelines?
   - Occasionally [ ]
   - Often [ ]
   - Always [ ]
   - Never [ ]

27. If not always, what prevents you from following them?
   ...............................................................
   ...............................................................
   ...............................................................

28. What infection control measures do you routinely practice? (tick all that apply)
   - Hand washing [ ]
   - Gloves [ ]
   - Gown wearing [ ]
   - Disinfection [ ]
   - Sterilisation [ ]
   - Housekeeping [ ]
   - Waste Disposal [ ]
   - Injection Safety [ ]
   - Isolation [ ]
   - Other ...........................................

29. Have you ever had any training on infection control ever since you started working in this facility? Y / N
30. If yes, when was the most recent one?
   2007  []
   2006  []
   2005  []
   2004  []
   2003  []
   Before 2003  []

31. How often do you wash your hands when dealing with patients?
   Always    []
   Often     []
   Occasionally []
   Never     []

32. How often do you use soap when washing your hands?
   Always    []
   Often     []
   Occasionally []
   Never     []

33. How often do you wear protective gear?
   Always    []
   Often     []
   Occasionally []
   Never     []

34. Which protective gear do you usually put on?
   Gloves    []
   Masks     []
   Gowns     []
   Aprons    []
   Goggles   []
   Boots     []
   Others....................
35. How often is this section/ward cleaned?
   Everyday []
   Every 2 Days []
   Once a Week []
   Twice a week []
   Other (write actual number of days) ............

36. What disinfectants do you commonly use to disinfect equipment? *(Tick all that apply)*
   Chlorhexidine []
   Cetrimide []
   Povidone iodine []
   Sodium-calcium hypochlorite []
   Ethyl alcohol []
   Others.............................

37. What do you use for sterilising surgical equipment?
   Autoclave []
   Boiler []

38. Do you have separate bins for sharps and infectious medical waste? Y/ N *(If yes, verify)*

39. Do you recap needles after use? Y/ N

40. Do you have an isolation unit in this facility? Y/ N *(If yes, verify)*

**Attitude**

41. Do you think it is necessary to observe infection control practices in all circumstances when handling patients? Y/ N

42. In your opinion, do you think it is practical to observe all the recommended infection control practices as stated in the guidelines? Y/ N

43. If no, why?---------------------------------------------------------------

44. In your opinion, what is the most important infection control practice that needs to be observed? *(tick only one)*
   Hand washing []
   Personal Protective Wear []
Safe Injection and Sharps Use  []
Safe Medical Waste Disposal  []
Isolation  []
Disinfection  []
Sterilisation  []
Housekeeping  []
Others (Specify)  

45. Are there any infection control measures you find particularly difficult to observe? Y/ N

46. If yes, what practices are these? (tick all that apply)
   Hand washing  []
   PPE  []
   Disinfection  []
   Sterilisation  []
   Housekeeping  []
   Isolation  []
   Other  

47. Why is this so? (tick all the apply)

48. What disease/s are you particularly concerned of being at a high risk of acquiring from the patients you are attending to?
   HIV  []
   Hep B  []
   Hep C  []
   TB  []
   Pneumonia  []
   Skin infections[]
   others  

49. What advice would you give to all those responsible on how to improve infection control in this health facility?  

Appendix 2

KEY INFORMANT GUIDE

Date..........................
Name and level of health facility..........................

Personal details
Name of key informant..........................................................

Age...................  Sex  M []
                   F []

Position of responsibility..............................................
Level of training (qualification)........................................

1. How would you describe the infection control situation in this health unit and do you think it is adequate?

2. What mechanisms do you have in place to ensure that infection control measures are implemented in this health unit?

3. How is this facility able to monitor hospital-acquired infections? (ask about post-operative surgical infections and injection abscesses)

4. Could you explain the mechanisms you have in place to monitor the use of antibiotics?

5. How often do you get personnel from the HSD or District Health Office to monitor or supervise infection control activities? (Ask when the last supervision was held, the method and promptness of feedback)

6. Does this facility have any system to educate patients, their visitors or staff about infection control?

7. Do you experience any stock-outs of supplies and equipment needed for infection control? (probe which supplies are most commonly out of stock, how often this occurs and how long these stock-outs last)

8. How do the current staffing levels of this health facility compare with the Ministry of Health requirements?

9. What advice would you give to the higher authorities on how to improve infection control in this health facility?
Appendix 3

INFECTION PREVENTION AND CONTROL SUPPLIES CHECKLIST

<table>
<thead>
<tr>
<th>A. Hand Hygiene</th>
<th>Available</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(tick and add comment where indicated in specified section)</td>
</tr>
<tr>
<td>Soap at washing points</td>
<td>Not available</td>
</tr>
<tr>
<td></td>
<td>(tick and add comment where indicated in specified section)</td>
</tr>
<tr>
<td>Tap/ vessel for pouring water</td>
<td></td>
</tr>
<tr>
<td>(tank, borehole or protected</td>
<td></td>
</tr>
<tr>
<td>spring)</td>
<td></td>
</tr>
<tr>
<td>NB. Confirm if water is</td>
<td></td>
</tr>
<tr>
<td>flowing from source</td>
<td></td>
</tr>
<tr>
<td>Alcohol-based hand solutions</td>
<td></td>
</tr>
<tr>
<td>Antiseptics e.g. dettol</td>
<td></td>
</tr>
</tbody>
</table>

| B. Personal Protective          |          |
| Equipment                       |          |
| Disposable gloves               |          |
| Protective eye wear             |          |
| Face masks                      |          |
| Lab coats/gowns/aprons          |          |

| C. Injection Safety/            |          |
| Sharps Management              |          |
| Single-use injections           |          |
| Sharps disposal containers      |          |
| (Puncture proof and water      |          |
| resistant)                      |          |
| Sharps injury log               |          |

<p>| D. Disinfection/Sterilization   |          |
| Functional Autoclave (NB        |          |
| not boiler, regularly serviced  |          |
| and with spares, temp. and      |          |
| pressure gauge working)         |          |
| Test-strips for autoclaves      |          |
| Suitable disinfectant           |          |</p>
<table>
<thead>
<tr>
<th>E. Waste disposal</th>
<th>Available</th>
<th>Not available</th>
</tr>
</thead>
<tbody>
<tr>
<td>color-coded plastics bags/containers or other sharps disposal vessels</td>
<td></td>
<td></td>
</tr>
<tr>
<td>containers with secure lids</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Safety signs for hazardous wastes on containers</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Strong gloves for waste disposal</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Functional incinerator</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Waste pit for non-infectious waste (not overfilled)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Functional placenta pit within premises</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Deep pit for burying sharps/blades/injections</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>F. Housekeeping items</th>
<th>Available</th>
<th>Not available</th>
</tr>
</thead>
<tbody>
<tr>
<td>(either in the store or on site)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cleaning items (ignore if service is tendered)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Brooms</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Rags</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Brushes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Buckets</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Gloves</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Disinfectants (indicate type)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Clean and well kept compound</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pit latrine within premises of h/ facility (tick all that apply)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Functional</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Clean</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Soap available</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Water available</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Appendix 4

**Observation Checklist to Assess Compliance with Infection Control Guidelines**

<table>
<thead>
<tr>
<th>Hand Hygiene</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>（Add comment where indicated in the specified section）</td>
<td></td>
<td>（Add comment where indicated in the specified section）</td>
</tr>
<tr>
<td>Does healthcare worker wash hands with soap and water before wound dressing, suturing, catheterization, injections, norplant insertion or removal, intravenous infusion or dental examination?</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Personal Protective Equipment</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>（Add comment where indicated in the specified section）</td>
<td></td>
<td>（Add comment where indicated in the specified section）</td>
</tr>
<tr>
<td>Does healthcare worker wear gloves before wound dressing, suturing, insertion or removal of norplant, IV infusion or dental examination?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Are physicians and nurses or other direct service providers wearing laboratory coats?</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Sharps management</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>（Add comment where indicated in the specified section）</td>
<td></td>
<td>（Add comment where indicated in the specified section）</td>
</tr>
<tr>
<td>Do healthcare workers recap used needles?</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>House Keeping</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>（Add comment where indicated in the specified section）</td>
<td></td>
<td>（Add comment where indicated in the specified section）</td>
</tr>
<tr>
<td>Are the sections below clean?（dust and litter free, well-mopped）</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- OPD</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- maternity,</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- injection and dressing rooms</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Appendix 5

INFORMED CONSENT FORM

Good morning/good afternoon Sir/ Madam,

I am ........................................................., part of a team from the office of the District Health Officer. Together with my colleagues, we are conducting a study on practices that may prevent or promote transmission of infections in health units in this district. You have been randomly selected among the healthcare providers as one of the suitable participants for this study. The information obtained from this study will be used by the district health team in promoting appropriate interventions that could be useful in reducing the risk of spread of infections associated with inadequate infection control practices.

You are kindly requested to volunteer some information for this study. All the information you provide will be treated with utmost confidence and your identity will also be kept anonymous. Feel free to ask any questions during the course of this interview and whenever you need any clarification. Your participation is also entirely voluntary and you are therefore at liberty withdraw from this study whenever you feel like at no financial or legal implications whatsoever.

Thank you very much.

Please kindly sign the document if you have consented to what has been stated above.

Signature of the respondent ...........................................
Signature of the interviewer ...........................................
Date ...................................................
Appendix 6:
Photographs of Selected Infection Control Practices/ Supplies from the Study Site

Plate 1. Waste disposal pit at one of the HClVs

Plate 2. Incinerator at one of the Hospitals

Plate 3. Typical non-electric autoclave used in the lower health units
Plate 4. Injection and dressing room at one of the health units

Plate 5. Typical safety box used in most health units