INFECTION CONTROL AND PREVENTION PRACTICES IN PUBLIC MATERNITY UNITS IN KENYA[h]

BY
WAITHAKA PETER MUCHINA
B.Sc.N (U.O.N)

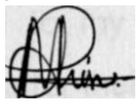
A THESIS SUBMITTED IN PART FULFILMENT OF THE AWARD OF THE DEGREE OF MASTERS OF PUBLIC HEALTH OF THE UNIVERSITY OF NAIROBI

u: r?,?c *i* '»» V
L i

March 2005

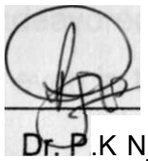
DECLARATION

I hereby declare that this dissertation is my own original work and has not been presented for a degree in any other University.

Date a o / V ^ [5] signed 

Waithaka Peter Muchina, BscN.

This dissertation has been submitted for examination with our approval as University supervisors.

Date t D [^ / o < signed. 

Dr. P.K Njoroge, MBChB, MPH
Lecturer, Dept of Community Health
University of Nairobi.

Date l i p d o S L s signed. 

Mr. L. Nyabola,Bsc,Msc,ScM.Dip Epid.
Senior Lecturer, Dept of Community Health
University of Nairobi.

Date 26/4/n \ signed U_____

Dr. G Revathi MBBS, MD clinical microbiology.
Consultant Microbiologist, Chief Medical Specialist
Kenyatta National Hospital and associated
College of Health Sciences, University of Nairobi.

Date \\ \ b l p . C signed ftM/vyooJtx'

Professor M.A Mwanthi PhD, MSEH, Bsc.
Associate Professor, Environmental and Occupational Health
Chairman, Department of Community Health
University of Nairobi

DEDICATION

This work is dedicated to my wife Emily Njeri Muchina and our daughter Marlyn Wairimu for their patience and encouragement in my very busy time while working on the project.

Also to my parents, Mr Bedan Waithaka Muchina and Mrs Tabitha Wairimu Waithaka, who endeavored to educate me in my formative years, and for not giving up even in the most trying moments.

May the Almighty God bless you all.

ACKNOWLEDGEMENT

I would like to express my sincere appreciation to all those who assisted me in one way or another during my study period. Special thanks to;

- The University of Nairobi for funding the study.
- Dr Revathi, my external supervisor, for her inspiration and for sparing time to discuss and to correct where necessary also thank her for facilitating my use of the laboratory at Kenyatta National Hospital.
- My internal supervisors Dr. P.K Njoroge and Mr. Lambert Nyabola for their guidance throughout the study. They both challenged me to work hard.
- Professor Elisha K. Muchunga for his timely interventions in times of need.
- The research assistants who spared no effort to ensure that the data collection process went on as planned, and for their enthusiasm. Some sought accommodation near the hospitals to make sure they arrived in time for the early morning shift changeover.
- All the laboratory staff of Medical microbiology, Kenyatta National Hospital specifically Loise Wandia Kariuki, Festus Ngei Kyule, Mr. Betty Nasipwondi Chwalla and Miss. Grace Mungai for the support they offered towards success of this study. Mr Kyule worked with me so closely that I felt a part of the Laboratory staff.
- The Medical superintendent of Pumwani Maternity Hospital, Dr. Kiragu, who was also my supervisor there. His timely advice helped me a lot.
- The Director, Kenyatta National Hospital, Medical Officers of Health in Thika District Hospital, Kiambu District Hospital and the Doctor in-charge of Tigoni sub district hospital, together with members of staff in the labor and maternity wards in these institutions.
- Any other person or institution that contributed for the successful completion of this work.

TABLE OF CONTENTS **Page**

List of Figures **Page**

List of Tables **Page**

List of charts **Page**

List of photographs. **Page**

List of maps **Page**

List of abbreviations

AIDS	Acquired Immune Deficiency Syndrome
AMREF	African Medical Research Education Foundation
CDC	Center of Disease Control
CE	Continuing Education
DTC	Decentralized Training Centers
EOC	Emergency Obstetrics Care
GoK	Government of Kenya
HBV	Hepatitis B Virus
HCW	Health Care Worker
HIV	Human Immune Deficiency Virus
HLD	High Level Disinfectant
ICP	Infection Control and Prevention
KDH	Kiambu District Hospital
KNH	Kenyatta National Hospital
MoH	Ministry of Health
MRSA	Methicillin Resistant Staphylococcus Aureaus
NGO	Non Governmental Organizations
NI	Nosocomial Infection
NRHS	National Reproductive Health Strategy
PMH	Pumwani Maternity Hospital
RHU	Rural Health Unit
SDP	Service delivery points
SMI	Safe motherhood Initiative
TDH	Thika District Hospital
TSDH	Tigoni Sub-District Hospital
UN	United Nations
UNICEF	United Nations Children's Fund
UON	University of Nairobi
USAID	United States Agency for International Development
VRE	Vancomycin Resistant Enterococcus
WHO	World health organization

DEFINITION OF TERMS

Cleaning: A process that removes foreign material (e.g. soil, organic material, and microorganisms) from an object.

Decontamination: The first step in the infection prevention process. It makes instruments, gloves and other items safe for handling by health care workers. It involves soaking instruments in Jik for 10 minutes immediately after use.

Disinfecting: A process that reduces the number of pathogenic microorganisms, but not necessarily bacterial spores, from inanimate objects or skin to a level, which is not harmful to health.

Hazardous waste: Includes blood, pus, urine, stool and other body fluids. Items, which have come in to contact with body fluids, such as used dressings, are also considered as hazardous, as well as waste from operating theatres and laboratories.

High-level Disinfecting (HLD): A process that kills *Mycobacterium tuberculosis* and enteroviruses in addition to other vegetative bacteria, fungi and more sensitive viruses.

Infection control committee: A special committee that handles issues on infection control practices within health care facilities and must be seen to function efficiently. The committee should act as a liaison between departments responsible for patient care and supportive departments (e.g. pharmacy, maintenance). Its aim should be to improve hospital Infection Control and Prevention (ICP) practice and recommend appropriate policies, which should be subject to frequent review.

Infection prevention: Collective efforts made by health care providers and clients to prevent or minimize the risks of transmitting infections such as hepatitis B and HIV/AIDS and bacteria to clients or health care providers.

Instrument: Instruments, equipment and items that are repeatedly used for patient care hence are processed before reuse.

Maternal death: Death of a woman while pregnant or within 42 days of termination of pregnancy, irrespective of the duration and site of the pregnancy, from any cause related to or aggravated by the pregnancy or its management, but not from accidental causes.

Maternal morbidity: Any symptoms or condition resulting from, or made worse by pregnancy. In both developing and developed countries, there are 12 to 16 serious maternal complications to each maternal death.

Maternal mortality rate: The number of maternal deaths per 100,000 women of reproductive age

$$= \frac{\text{Total number of maternal deaths X 100,000}}{\text{Total number of women of chiidbearing age (15-49years)}}$$

Maternal mortality ratio: The number of maternal deaths per 100,000 live births.

Non-hazardous waste: Waste that does not carry infection risks to persons handling them e.g. paper, ordinary rubbish, and boxes.

Puerperal Infection: A more general term than puerperal sepsis and includes all extra-genital infections. Infections specifically related to the birth process but not of the genito urinary system e.g. breast abscess, incidental infections include malaria and respiratory tract infections among others.

(NB: Complications of puerperal sepsis include septicemia, peritonitis, pelvic abscess, and septic shock).

Puerperal sepsis: An infection of genital tract occurring at any time between the onset of rupture of membranes or labor and six weeks postpartum, in which two or more of the following are present: pelvic pain, fever, abnormal vaginal discharge or abnormal smell, foul odorous discharge and delay in the rate of reduction of the size of the uterus.

Sharps: Items capable of inflicting injury and may contain the organisms that cause blood borne diseases such as Hepatitis B and HIV.

Sterilization: A process that destroys all microorganisms including bacterial spores.

ABSTRACT

Study objective was to establish the status of infection control and prevention practices in maternity units within public hospitals in Nairobi, Kiambu and Thika districts of Kenya.

Study design was descriptive cross-sectional survey that focused on infection control and prevention practices of health care workers, within the maternity units of public hospitals.

The setting was in Maternity units of Kenyatta National Referral Hospital, Pumwani Maternity Hospital, Kiambu District Hospital, Thika District Hospital and Tigoni Sub District Hospital.

Subjects, materials and methods. Health care workers including doctors, nurses, clinical officers and support staff were observed and questionnaires administered to them. Samples from disinfectants in use were collected and analyzed in the laboratory, for growth of microorganisms. Medical records were reviewed for mortalities, 24 months retrospectively. Caesarean section cases were followed for postoperative morbidity 12 weeks prospectively. Photographs were taken on various infection control and prevention facilities within the institutions.

Main outcome measures. The observed practices were compared with the recommended ICP practices based on the *Standard Infection Control Practices* as laid down in the "AVSC Infection Prevention Participants Handbook (1999)". Disinfectant in use test was done. Maternal morbidity and mortality were evaluated and compared with the Kenya Demographic and Health Survey findings.

Results. A majority (60.1%) of health care workers (HCW) have at least 3.5 years of training. However, only 19.4% had attended update courses. The ICP

committees are present but not effective. Health care workers are aware that they should practice infection control and prevention effectively. However, their practice was found to be significantly below the recommended standards. In addition, when disinfectants in use were tested for growth of microorganisms 40% of them failed when they grew mainly *Staphylococcus, Enteric bacilli, Proteus and Pseudomonas* species. The prevalence rate of infections post caesarian section was 132 per 1000 patients for the twelve weeks of study. Infections were a major cause of maternal mortality, second to hemorrhage at 22.1% and 23.7% respectively. There was no significant correlation between the infection rates and ICP practices by health care workers. This may have been due to the practice of prophylactics and early use of antibiotics in the institutions studied.

Conclusion. : Health care workers are lacking in updates courses on ICP practices. This may be a contributing factor to the poor practices observed. The situation is made worse by the lack of active infection control committees. Most of the institutions studied use disinfectants wrongly. The poor practices may have contributed to the occurrence of infections that are a major cause of both maternal morbidity and mortality.

Recommendations

- Health care workers need to attend updates more frequently and regularly.
- The ICP committees need to be more active and effective
- Use of disinfectants need to be as per manufacturers recommendations.
- There is need for further studies in the area of ICP so as to improve on the practices.

CHAPTER ONE

1.0 INTRODUCTION

The practice of Infection Control and Prevention (ICP) is quite significant in the maintenance of quality of care in health care facilities. In these, facilities some areas are more sensitive to compromised practice of ICP owing to the nature of procedures performed and clients involved. One such area is the maternity unit, where childbirth takes place, a procedure that is performed under conditions that are highly contaminated with body fluids such as blood, amniotic fluids, vaginal fluids, urine and some times feces. Those at risk of contamination include:

- Health care workers (HCW); from pricks and contact with the clients' body fluids.
- The client (mother and infant)
    - Mother as a result of contamination of perennial tears, lacerations and episiotomies
    - Infant as a result of contamination on its bruised skin and the umbilical cord. It should also be noted that at this stage the infant's body is immunologically challenged
- Members of the community:
    - Visitors to the health care facility who may come in to contact with contaminated surface, and objects within the maternity/labor ward.
    - Who may come into contact with improperly disposed products of conception like placenta as well as infectious sharps that are dumped in open fields.

Hospital-acquired sepsis is unacceptable given that patients entrust their lives to the confidence and skills of health care workers. It would be sad to note that those who should be taking care of the patients are the same ones in the forefront of endangering their lives. McAllen (1990), quoting Wendell (1893) stated that;

> [u] The disease known as puerperal fever is so far contagious as to be frequently carried from patient to patient by physicians and nurses. It has closed the eyes just opened on a new world of love and happiness, bowed the strength of manhood in the dust, cast the helpless of infancy into the stranger's arm, or bequeathed it, with less cruelty, the death of its dying parent...God forbid that any member of the profession to which a woman trusts her life, doubly precious at this eventful period should hazard it negligently!'

Infectious diseases are constantly in transition: new diseases develop, known disease become widespread or re-emerge and some are eradicated. Diseases like HIV and hepatitis have been newly identified and are a significant cause of illnesses and deaths in many parts of the world (AVSC Int. 1999).

In a hospital setup, infectious agents such as bacteria, viruses, fungi or parasites may be transmitted by contact with patients or contaminated body secretions and fluids. Some of the serious infectious agents commonly found in a hospital environment include Human Immunodeficiency Virus (HIV), Vancomycin resistant *Enterococcus* (VRE), Methicilin resistant *Staphylococcus aureas* (MRSA), Hepatitis B and Hepatitis C virus, and tuberculosis among others (CDC, 2001).

Simple but very effective measures to prevent infections have been recommended and should be practiced at all times by all concerned, without laxity or compromise. The recommended practices include:

- Hand hygiene
- Use of protective devices
- Appropriate and adequate instrument processing such as
    - Decontamination
    - Cleaning
    - High-level disinfection (HLD)
    - Sterilization

- Cleaning of the working environment
- Correct and appropriate use of chemical disinfectants and antiseptics.
- Proper waste management.
- Effective infection control committee, continuous surveillance and facilitative supervision. The infection control committee also conducts continuing education to members of staff including doctors, nurses and cleaners/house keepers (Emerson 1998).

The field of obstetrics/ gynecology pioneered in the area of infection control and prevention in health institutions especially in the maternity wards. Even though much has been achieved in developed countries. The developing countries are very far behind in this because sepsis is still one of the major causes of maternal mortality and morbidity.

Currently, infections cause an overwhelming 87000 maternal deaths worldwide annually. Studies indicate that sepsis is the second major cause of maternal deaths in Kenya (Wendy, 1997) as well as worldwide (Babara, 1997).

Health care personnel are trained in ICP practices during their course of training. However, there seems to be a shortfall as far as the ICP practice is concerned at the health care facility level. Lack of priority for infection control by health care managers and administrators; lack of commitment by care providers coupled with ignorance and lack of extensive studies in this area may be some of the reasons for the problems that are associated with ICP.

Efforts should be made to clear the existing disparity in infection control practices between developed and developing countries, as well as regions and sectors within countries. This will enhance globalization of ICP practice for the people of the world.

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 Historical perspective of ICP practices

Dr. James Willocks, a consultant obstetrician gynecologist at the Queens Mother's hospital in Glasgow in 1980, stated, "Infections have always been a problem in obstetrics/gynaecology. Puerperal sepsis, or childbed fever as it was called, was a major cause of maternal mortality until comparatively recently" (McAllen, 1990). Ignaz Philipp Semmelweis, a Hungarian obstetrician working in Vienna between 1847 and 1849 demonstrated how infection occurred in his obstetric patients and how the death rate could be greatly reduced by cleanliness. In his work at Lying-in hospital he managed to reduce maternal deaths from 16% to 1% by implementing three measures, namely; isolation of all cases, boiling of instruments; and hand washing with lime treated water (Richard, 1993). The decline in mortality continued with the introduction of antiseptic methods by Dr. Lister and has been practically eliminated by the use of antibiotics, so that in the report on maternal and prenatal deaths in Scotland for the period 1981-1985 only one woman died as a direct result of infection during this quiquenium - a truly remarkable change (McAllen, 1990).

Unfortunately, these good results are not repeated worldwide. Currently overwhelming infections cause an estimated 87,000 maternal deaths worldwide each year. Sterile procedures during all deliveries (including abortions) and use of antibiotics prevent many of these deaths (Barbara, 1997).

2.2 Epidemiology of maternal deaths

Years after Semmelweis discovered simple measures on ICP practices that greatly lowered maternal deaths, maternal morbidity and mortality is an age-old problem that continues to challenge midwives and their colleagues around the world (Cara, 2002).

The saddest fact is that every minute of everyday at least one woman dies from complications of pregnancy and childbirth, more than 585,000 maternal deaths occur every year, 99% of these deaths being of women living in the developing countries (WHO UNICEF, 1996). In Africa alone 150,000 maternal deaths occur every year (Barbara, 1997). The most recent estimates of maternal mortality for major world regions confirm sub-Saharan Africa as having the highest level. Maternal death ratio is as high as1100 per 100,000 live births in developing countries, while in developed countries it is as low as one maternal death per 100,000 live births (Cara, 2002). If women in developing countries had the same risk of dying, as those in developed world, there would be 460,000 fewer maternal deaths and 1.5 million fewer children would be motherless each year (Richard, 1993). Although health care is heavily influenced by political and cultural norms, infection control efforts should be blind to race, gender and socioeconomic class (Richard, 1993).

2.3 Sepsis: A major cause of maternal deaths

Studies indicate that infections are the second largest cause of direct obstetric maternal deaths (15%) second to hemorrhage which accounts for (25%). Other causes are unsafe abortion (13%), hypertensive disorders (12%), obstructed labour (8%), and other direct causes (8%), while indirect causes account for 19% (Barbara, 1997). Hospital based studies in various developing countries support this fact.

A study done on changing trends in maternal mortality indicated a decrease in maternal mortality between 1971 and 1991,with sepsis leading followed by hemorrhage and hepatitis as the main causes of those deaths (Juneja, 1994). In a similar study in Dakar, Senegal, out of 152 maternal deaths, 51 were due to sepsis and other infections (Garenne, 1997). In Malawi's Thyolo district maternal mortalities were as a result of hemorrhage (25%), abortions (18%) and sepsis (13%) among others (Chiphangwi, 1992). In Jos Medical School Nigeria maternal mortality ratio rose from 450 to 1,060 per 100,000 total deliveries between 1990 and

1994; the main causes of these deaths were hemorrhage (28.1%), sepsis (21.3%) and eclampsia (15.7%).

Locally the Government of Kenya official figures for maternal mortality are 365 per 100,000 live births, which were derived from the 1994 national survey and refers to the period 1990 to 1994 (Wendy, 1997). Several studies conducted in Kenya indicate infections/sepsis among the top causes of maternal mortality. Studies done at Pumwani maternity Hospital for the years 1975 -1984 indicate that sepsis contributed to 19% of the deaths, second to eclampsia (21%) (Ngoka, 1987). Another study done in three rural district hospitals for the years 1989-1990 indicated that sepsis is a leading cause (23%) of maternal deaths followed by anemia (22%) and hemorrhage (16%) (Makokha, 1994). In a different study conducted in 18 district and provincial hospitals in 1993, puerperal complications (sepsis) contributed to 7% of deaths (Population Studies & Research Institute, 1996). An unpublished study conducted in Kiambu District hospital on maternal mortality indicated that in one month, out of 15 deaths, 3 were due to hemorrhage, 3 to sepsis and the rest were as a result of various other complications.

These statistics show that much needs to be done to improve on control and prevention of infections to avert most of these deaths. In the studies sited recommendations were suggested to improve on health care workers' knowledge, hospital equipment and instruments, health education to the community and poverty alleviation among others.

2.4 Government policy

A safe motherhood initiative that was launched in Nairobi Kenya in 1987 indicated that an estimated 88% of maternal deaths are preventable. It was stated that in order to reduce maternal morbidity and mortality, efforts should be focused on the four pillars of safe motherhood, which include; family planning, focused antenatal care, clean and safe deliveries and essential obstetric care (MoH. E.O.C Manual, **2002).**

The Government of Kenya's National Reproductive Health Strategy for 1997 - 2010 aims at reducing maternal mortality from the current 365 per 100, 000 to 230 per 100, 000 by the year 2005, then down to 170 per 100,000 by the year 2010. Among the activities to achieve the reduction was strengthening facilities at the health centers, district and tertiary levels for effective handling of all referrals, and management of obstetric and medical complications of pregnancy and delivery and care of the newborn (MoH NRHS, 1996). To ensure clean/safe delivery the quality of delivery care should be improved at all levels of healthcare (MoH NRHS, 1996). This is an indication that the government of Kenya is committed to high quality of care. One of the effective approaches would be to ensure high level of infection control and prevention in maternity units.

2.5 The ICP Practices

Healthcare workers face occupational risks as a result of poor ICP practices. Studies done in South-Eastern Nigeria indicate that doctors, nurses and laboratory workers' risk of acquiring HIV and HBV infections in the course of performing their duties is apparently high (Ansa, 2002). In another study in Mwanza Tanzania, incidences of pricks and splashes were reported with an average health worker being pricked five times and splashed nine times per year, the annual occupational risk of HIV transmission was estimated at 0.2%(Gumodoka, 1993).

In surgical and obstetrical settings, contact with blood varies with occupation, specialty, procedures performed, and precautions used. Many contacts appear to be preventable through changes in technique or instrument design and by use of protective barriers (Short, 1993). Use of personal protective equipment and adoption of standard hygienic practices among health workers must be encouraged. Supply of protective materials and equipment should be greatly improved (Ansa, **2002).**

Controlling infection in the hospitals of the world demands substantial creativity. Effective systems require a national infrastructure and substantial financial resources (Richard, 1993). Hospital infection control programs span the

evolutionary spectrum from primitive programs that have minimal impact to advanced ones capable of substantially improving patient outcome.Many times health care managers fail to evaluate the quality of care provided in their institutions, which would help them to know what the practice is and what it should actually be. Puerperal infection can result from unsterile procedures during delivery such as the use of unclean hands and dirty instruments. It can also result from prolonged labor, when fetal membranes have ruptured and the woman fails to deliver within 24 hours. Serious infections may ensue unless prevented by antibiotics and by action taken to speed up delivery (Babara, 1997). These deaths can be greatly reduced through cleanliness during delivery; simple delivery kits are designed to provide the minimum supplies needed to allow clean delivery without contamination (Rosenfields, 1990). Proper instruments processing and sterile procedures maintained throughout the delivery have a great role to play in reduction of maternal deaths.

A study carried out in a dental clinic in USA indicated that six patients acquired HIV infection as a result of improper ICP practices. The clinic had no written policy, or update courses on ICP principles or practice provided to its members of staff. It was also observed that, the dentist and his assistant recapped Local Anesthetic needles or left them uncapped. Staff did not always change gloves between patients. Occasionally, staff washed their gloves rather than change them between patients. There was no written protocol or consistent pattern for cleanup and instrument reprocessing. Equipment was cleaned and disinfected inconsistently. Some disposable items were reused without quality control (Haley, 2000. CDC Updates, 1995).

The Ministry of Health (Kenya) has developed an Essential Obstetric Care Manual for health service providers in Kenya (2002). The manual indicates clearly the purpose, principles and basic methods of infection control that should be followed. It indicates the purpose of infection control as two fold:

- To minimize infections due to microorganisms causing serious wound infections, abdominal abscess, pelvic inflammatory disease, gangrene and tetanus.

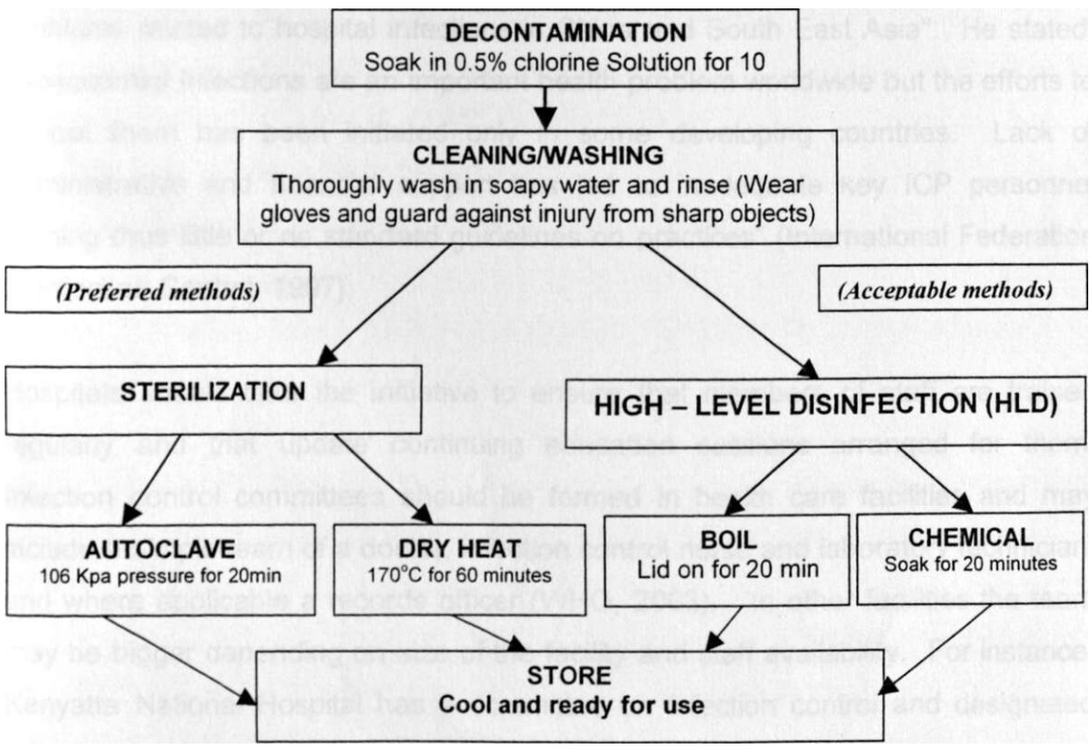
- To prevent the transmission of serious life threatening diseases such as hepatitis B and HIV.

The principles of infection prevention that are recommended include:

- Every person (patient or staff) must be considered potentially infectious.
- Hand washing is the most practical procedure for preventing cross-contamination.
- Wear gloves before touching anything that has been in contact with blood or other body fluids (secretions or excretions).
- Use barrier (protective goggles, facemask or aprons) if splashes and spills of any body fluids (secretions or excretions) are anticipated.
- Use safe work practices, such as not recapping or bending needles, proper instrument processing and proper disposal of medical waste.

(International federation of infection control, 1997; Ndambuki, 1999)

Fig 1. Steps for processing used instruments, equipment, gloves and other items



Adapted from Infection prevention for Family Planning Services Programs. JHPIEGO (Tietfan, 1992).

Note.

- Wrapped sterile packs can be stored for up to one week.
- Unwrapped items should be stored in a sterile or HLD container with a tight fitting lid or used immediately.

These principles and methods should be practiced in all healthcare facilities where deliveries care is conducted.

Apart from reluctance, lack of knowledge, lack of policies and protocols of infection control in facilities and lack of resources would also contribute to poor infection control practices. Professor Michael Erickson of Queens Medical Center, U.K. indicated that 8-10% of patients in hospitals acquire nosocomial infections, which extends their hospital stay by an average of four days. The additional length of stay is very costly and adds to the burden of hospital costs. He however notes, "the management of infection control particularly when resources are minimal is a difficult task for the special group (infection control committee) responsible (Michael, 1998). Dr. Somwang, also shared the same view in his study report on "correct problems related to hospital infections in China and South East Asia". He stated; "Nosocomial Infections are an important health problem worldwide but the efforts to control them has been initiated only in some developing countries. Lack of administrative and financial support has led to inadequate key ICP personnel training thus little or no standard guidelines on practices" (International Federation of Infection Control, 1997).

Hospitals should take the initiative to ensure that members of staff are trained regularly and that update continuing education sessions arranged for them. Infection control committees should be formed in health care facilities and may include a simple team of a doctor, infection control nurse and laboratory technician, and where applicable a records officer (WHO, 2003). In other facilities the team may be bigger depending on size of the facility and staff availability. For instance, Kenyatta National Hospital has a committee on infection control and designated infection control nurses in each of its departments. The hospital developed a guideline in 1999 titled "Handling infectious diseases". In the guideline they have

highlighted precautions on patient placement, patient teaching and instruction, visitors teaching and instruction, hand washing and protective devices, appropriate and adequate instrument processing, environmental cleaning, correct and appropriate use of chemical disinfectants and antiseptics; wound management, waste management, use of microbial agents; linen handling and food handling. This is a very wide spectrum of infection control-practice that the hospital considers important and a surveillance team uses the guideline to ensure they are adhered to (Ndambuki, 1999).

Infection control programs have played a major role in reducing mortality, morbidity and hospital costs. That role has been played out principally in developed countries. In the future, participation from developing countries must be increased until infection control becomes a truly global project (Richard, 1993).

2.6 Health care workers Training on ICP

Infection Control and Prevention (ICP) practices are taught to the healthcare providers namely doctors, nurses and laboratory workers among others. This is done as part of their curriculum through topics like Microbiology, Family planning methods and techniques, Operating theatre hygiene, Midwifery/Obstetrics, Aseptic techniques and ward administration among others. The training is at various levels ranging from masters, bachelors, diploma and certificate.

Various in-service training in infection control is undertaken by various organizations including the Ministry of Health through Division of Primary Healthcare, under the Decentralized Training Centers (DTC). In the D.T.C. healthcare workers undergo several weeks of training on various skills including infection control and prevention. Non-governmental organizations also undertake training and update courses for HCW on infection control practices. Example include AVSC international, Engender health, Amkeni, USAID, and UNFPA among others. They do it directly or indirectly by providing funds and materials support to training institutions. Some health care institutions have continuing education departments, which facilitate update courses

for their workers on ICP practices. Major hospitals like Nairobi, Aga Khan and Mater are very active in this.

House keeping/ subordinate staff are poorly oriented on ICP practices owing to the fact that they do not undergo any training prior to employment. This is a matter of concern given the fact that they are the ones responsible for cleaning, disinfecting and waste disposal in the healthcare facility. Some hospitals like Kenyatta National Hospital as well as Aga Khan hospital among others have taken an initiative in training this cadre of staff on the job.

Despite the training, studies indicate that healthcare workers are still lacking in knowledge and skills on ICP practice. A study among nurses working in medical, surgical and obstetrics units in Royal Free hospital London, showed that nurses did not consider themselves at higher risk of blood born infections like HIV and Hepatitis than any other healthcare workers. Others felt that they were not at risk of infections from pricks infected with patient's blood and other body fluids. The findings suggest that these HCWs would benefit from further education regarding infection from blood-borne viruses (Leliopoulou, 1999).

Information on the training of health care workers on ICP practices in labor wards is lacking despite the high risk of infections that exists in this area. Studies are needed to evaluate the status of infection control in labor wards especially in the health care facilities that serve the rural population that make up to 80% of Kenya's population.

In 1986 when the Safe Motherhood Initiative was started an estimated 500,000 women died each year from pregnancy related causes, at the rate of about one per minute. In 2001, updated estimates indicate a higher death toll of more than 600,000 women-more than one per minute (Cara 2001). The clinical solutions like infection ICP practices would aid in minimising these problems, but for some reasons, implementing them has not been adequately done. The barriers range from lack of political will, the poor regard for women in society, low quality of care

and team work in the labor and delivery ward between midwives and obstetricians (Cara, 2001).

Despite the training HCW undergo, and having known the effect of compromising standards in ICP practices, evidence has it that mortality and morbidity related to ICP is still on the increase as evidenced by among others the maternal mortalities. A question that is left unanswered is: why is there such a gap between knowledge and ICP practices among the HCW especially those who work in sensitive areas like maternity units.

CHAPTER THREE

3.0 PROBLEM STATEMENT, JUSTIFICATION AND OBJECTIVES

3.1 Problem statement

The problem of hospital-acquired infections has been a major concern in the field of obstetrics and maternity units since time immemorial (Richard, 1993); it is a problem worldwide though developing countries are most affected. Currently, about 587,000 women worldwide die every year as a result of childbirth and related complications (Wendy, 1997), 99% of these deaths occur in the developing countries. Sepsis accounts for 87,000 of the deaths and is ranked the second major cause of these deaths worldwide (Barbara, 1997). In Kenya several studies indicate that sepsis is among the top causes of maternal mortality and morbidity (Juma, 2000; Babara, 1997). Infants are at risk of acquiring nosocomial infections if admitted to any intensive care unit (Cologna, 1995). Infant mortality and morbidity are highest especially in the developing countries (including Kenya), and some of the highlighted causes include sepsis acquired during the process of labour or soon after (Ghiorghis, 1997).

Health care personnel are at a higher risk of contracting fatal disease like hepatitis, tuberculosis and HIV among others. On the other hand there are possibilities that they may transmit these diseases to their clients/patients (OSHA updates, 2002). In Kenya, health care workers are not left behind and cases of hospital-acquired infections have been mentioned though not well documented. Visitors to health care facilities and community at large may also be affected as a result of improper disposal of biohazard waste (AVSC Int., 1999).

Despite the training of healthcare workers on ICP practices and organizing various update courses on the same, hospital acquired infections continue to claim lives of many while others are left to deal with complications that arise from such infections. With diseases like HIV and Hepatitis, health care workers, clients/patients and the community at large are at an increased risk.

3.2 Study questions

- Are the ICP practices by HCW in maternity units associated with reported high levels of maternal morbidity and mortality?
- Are health care workers implementing ICP practices as they should?
- Are there support mechanisms (ICP committees activities) to ensure that ICP practices are up-to-date within the health care facilities?

3.3 Justification

Nosocomial infections are proving to be a major public health concern throughout the world and more so in the developing countries. Infections, being a major contributor to maternal mortality and morbidity, are unacceptable since simple measures can be put in place to prevent them. Infections in maternity wards also contribute greatly to infant mortality and morbidity, not to mention the healthcare workers' occupational risks; the risk to visitors in the hospital and the communities that may be exposed to improperly disposed infectious waste and sharps.

Women play a major role in economic development in their societies. Death of a woman has major repercussions; it leaves the husband widowed and the children orphaned. Those who survive the infections are weakened health wise and have to deal with recurrent illness, more hospitalization days with associated cost implications. Women being primary care givers, the child's health is greatly influenced by the health status of its mother and her well being.

Concerns on health care workers occupational safety and the hospital wastes health hazards to the community at large calls for immediate attention and adequate action planning to deal with the issue.

The study focused on identifying the current gaps that exist on ICP practices within maternity units in public institutions. The findings from the study and its recommendations would act as a basis on which health care managers and administrators at various levels will make decisions to improve the quality of healthcare provision, with emphasis on maternity units. The findings are also aimed

at creating awareness among the healthcare workers on the need to improve ICP practices in their daily endeavors to quality of patients care in their practice.

3.4 Objectives and hypothesis of the study

3.4.1 Hypothesis

The infection control and prevention practices in the public maternity units positively influence the outcome of deliveries.

3.4.2 Broad objective

The study aimed at establishing the status of infection control and prevention practices in maternity units within public Hospitals in Nairobi, Kiambu and Thika Districts namely, Kenyatta National Referral Hospital (KNH), Pumwani Maternity Hospital, Thika District Hospital, Kiambu District Hospital and Tigoni Sub-district Hospital.

3.4.3 Specific objectives

1) To establish the basic training background of the health care workers in maternity units.
2) To establish the update course attendance on ICP by the health care providers.
3) To establish whether there is an ICP committee and document its difficulties in maternity units.
4) To establish the hand hygiene practices within the maternity units.
5) To establish the quality of disinfection of instruments/equipment as practiced in the maternity units.
6) To identify the waste disposal practices in the maternity units.
7) To establish maternal mortality and morbidity trends in relation to infections within the maternity units.
8) To document the maternal mortality rates in the maternity units.
9) To generate information that will enable the healthcare managers ana care providers improve the quality of care in the institutions.

CHAPTER FOUR

4.0 STUDY METHODOLOGY

4.1 Study area

The study was conducted in Nairobi, the capital city of Kenya and in Kiambu and Thika districts in central province of Kenya.

Nairobi was established in 1899 as a small settlement during the construction of the Kenya-Uganda railway, taking over from Machakos as the capital. It covers a land area of 684 square kilometers, approximately 0.1% of Kenya's total land area. The City is situated at the edge of Athi plain and borders Kajiado district to the south and west, Kiambu and Thika districts to the north and Machakos to the east (refer to map 1).By 1999 it had a population of about 2.137 million. The city has health care facilities run by the government, city council, private institutions and individuals. The government, through a parastatal, runs the Kenyatta National Hospital, which is the largest teaching and referral hospital in the country. The city council runs the health centers and the Pumwani Maternity Hospital. There are hospitals and clinics run by private organizations, missions, private practitioners and NGOs.

Thika district is located in the southern part of central province. The district boarders Nairobi city to the south, Kiambu district to the west, Muranga district to the north and Machakos district to the east (refer to map 1). Thika district was curved out of Kiambu District and Muranga districts in 1994. It covers an area of 2,024 square kilometers.Administratively it has six divisions that include Thika Municipality, Gatanga, Kakuzi, Ruiru, Gatundu and Kamwangi. The proximity to Nairobi has had profound impact on industrial development of the district. By 1989, Thika district population was 489,306 and had been projected to be 692,946 in 2001 at a growth rate of 2.9%.Thika district has two government hospitals and one private hospital that are fully operational. The government hospitals, namely Thika District Hospital and Gatundu are over utilized, as they serve about 2,000 patients daily. The District has six Nursing Homes and hospitals in total, 16 Health Centers and 28

dispensaries. The district has a large number of private clinics. Most patients however, still attend public health institutions due to high fees charged by private medical practitioners.

Kiambu district borders Nairobi city and Kajiado district to the south, Nakuru district to the west, Nyandarua district to the northwest and Thika district to the east (refer to Map No.1). The district covers an area of 1458.3 square kilometers divided in to five administrative divisions and twenty-two locations. The district had an estimated population of 812,535 in 2001, half of them aged 0-24 years. The district has fairly well distributed health facilities. It has 6 hospitals, 19 health centers, 37 dispensaries and 55 clinics. Out of these the government sponsors two hospitals, 14 health centers, 15 dispensaries and two clinics.

A district forms the basic unit for primary health care. It has a referral system that starts with the clinics, dispensaries, health centers, sub-district hospitals and then the district hospital. Patients/clients are referred to the provincial hospitals and later to the national referral hospital for services that are not available within the districts. In the case of Kiambu and Thika districts patients/clients are referred to Kenyatta National referral hospital directly due to the geographical proximity of these districts to the hospital..

4.2 Study design

This is a descriptive study, whose aim is to generate data on infection control practices in maternity units in public owned hospitals in Nairobi, Thika and Kiambu districts.

4.3 Study population

Public owned hospitals representing national and district levels, urban and rural setups were studied. They included the Kenyatta National Referral Hospital, Pumwani Maternity Hospital, Thika District Hospital, Kiambu District Hospital and Tigoni Sub-district Hospital.

Public facilities at the primary level namely health centers, dispensaries and clinics lack the capacity to offer surgical intervention (caesarian section) services and to admit patients with complicated deliveries and infections. These cases are referred to hospitals for management hence exclusion of the primary level health care facilities from this study.

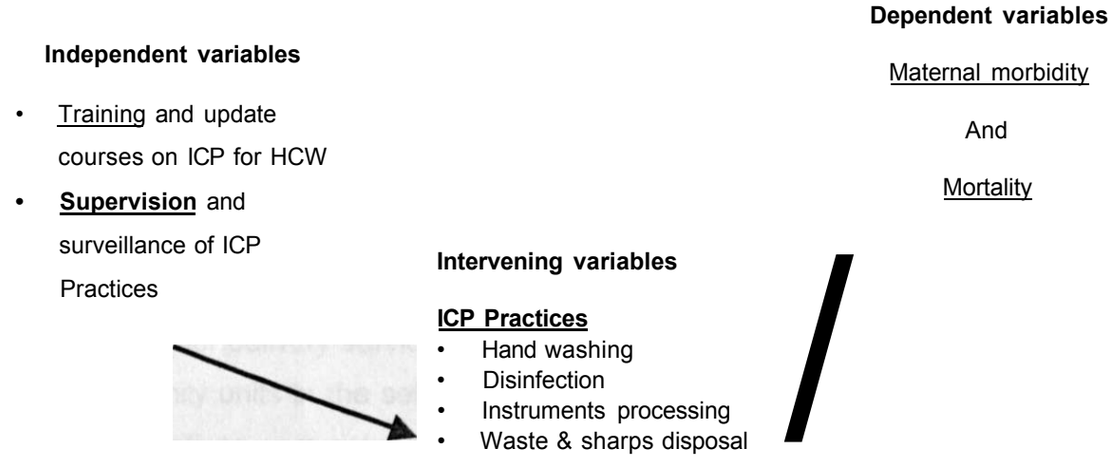
Members of staff working in the maternity unit of the institutions studied were interviewed. Interviews also targeted the administrators (mainly those in charge of the maternity unit) so as to gather information on administrative concerns of ICP practices such as supplies, supervision and policies on ICP within the respective institutions. Records departments' staff was also involved in the study for the purpose of availing information on records.

Disinfectants that are used in the hospitals were sampled for in use test, so as to demonstrate the effectiveness of the disinfection process in the hospitals.

4.4 Study Variables

The study focused on interacting variables that are basic and mandatory to ICP practices in maternity units. There are independent, intervening and dependent variables, which according to this study were viewed as illustrated in figure 2.

Fig 2 Interacting ICP variables in maternity units



Thus training and supervision of health care workers would influence the HCW practices and attitudes on ICP. These have an impact on ICP related morbidity and mortality.

The study focused on some specific variables, which are central to ICP practice in maternity units within facilities at all levels of health care provision. They include the following:

- The Level of training of healthcare workers
- Attendance of ICP update course by healthcare workers
- Activities of ICP committee on supervision and surveillance
- Hand hygiene practices in the facilities
- Quality of disinfection as practiced in the facilities (an in-use test was used to test the potency of disinfectants in use).
- Waste disposal practices in the facilities.
- Trends of maternal mortality and morbidity in relation to infection control practices.

Reference test: The in-use test for disinfectants

For the purpose of confirming the quality of the disinfection within the facilities, an "In-use test " for disinfectants was used. This is the most appropriate test for hospital, laboratories and wards. It can confirm that the chosen disinfectant has been effective under the conditions and period of use. The test was performed on the diluted disinfectants before and after they had been used. Refer to Appendix 3 for the procedure of in-use test for disinfectants.

4.5 Sampling

In this study purposive sampling was done. The unit of sampling was the public hospitals that offer delivery services, including caesarian section. The unit of study was the maternity units in the selected hospitals. Hospitals serving both the urban and rural populations were selected for study.

All the study units are referral and training centers for various cadres of healthcare workers particularly midwives and obstetricians. As a result they are expected to demonstrate high standards of patients/client care.

Kenyatta National Referral Hospital was selected from of the two national referral hospitals. Pumwani Maternity Hospital was included in the study because it is the only hospital in the country that specializes in maternity care services. The hospital serves an urban community, and refers complicated cases to Kenyatta National Hospital for management. Thika District Hospital was included in the study because it serves as a referral center for a rural community; and refers patients directly to Kenyatta National Hospital.

Kiambu District Hospital, like Thika, is a referral center for rural health facilities. Students are sent there for clinical experience and it also refers patients directly to Kenyatta National Hospital for management. Tigoni sub-district hospital was included in the study because it represents the lowest level of institutions that offer secondary health care. The facility serves a rural community and refers patients to Kiambu District Hospital and/or Kenyatta National Hospital for management. Students use the facility in their rural experience training placements.

Healthcare workers in these hospitals at the time of data collection were included in the study. Maternity unit in-charges were also targeted for interview.

Records officers on duty were contacted to offer information on clients' records both retrospectively (the past twenty four months) and prospectively (the twelve weeks of the study).

4.6 Sampling criteria

(a) Inclusion criteria

RESPONDENTS

- Health care workers included doctors, nurses and subordinate staff working in maternity units within the selected facilities. "
- Health care workers on duty at the time of data collection.
- Health care workers who volunteered to participate.
- Administration members of staff i.e. maternity unit in-charge.
- Records officers in charge of maternity unit records. xi

DISINFECTANT SAMPLES

- Those that were in use at the time of samples collection
- Samples from maternity units only

(b) Exclusion criteria

RESPONDENTS

- Those who failed to consent.
- Those not on duty during the time of data collection

DISINFECTANT SAMPLES

- Those that had not been diluted for use at the time of collection.
- Those from other units and wards.

4.7 Study tools

1. A structured questionnaire was administered to the respondents (Appendix 1.1)

2. A checklist was used for observation of ICP practices within the healthcare facility (Appendix 1.3). This checklist had items on staff training and update courses, hand hygiene, equipment/instrument processing practices, aseptic techniques, surface cleaning and disinfection, sharps and waste disposal, infection control committee activities.

3. A prospective follow up form (Appendix 1.5) was used for patients receiving care during the time of data collection indicating the date of admission, date of delivery, mode of delivery, delivery outcome, presence or absence of infection post delivery and date of discharge or death.

4. Retrospective records review form was used for gathering information on past deliveries and maternal mortality and morbidity in the last 24 months (Appendix1.4).

5. A disinfectant In-use test form was used to indicate the outcome of the test in terms of growth of microorganisms on the sampled disinfectants (Appendix 1.6).

6. A digital camera was used to take photographs of various facilities used for ICP practices within the Institutions under study.

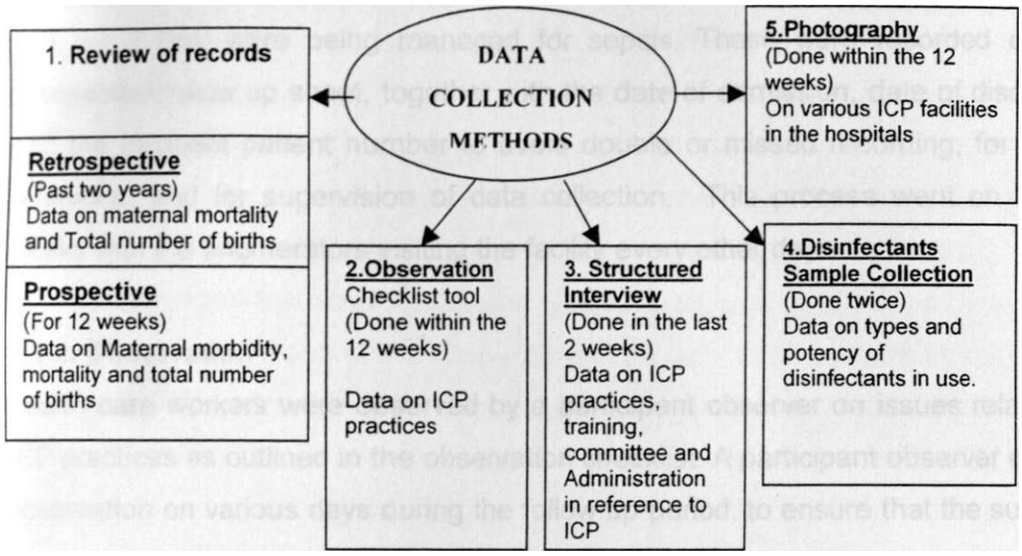
4.8 Study tools Pretest

The study tools were pre-tested for appropriateness in maternity units and among health care workers under circumstances similar to the ones of the actual study. After the pretest the necessary adjustments were effected on the tools, for effectiveness and efficiency in actual data collection.

4.9 Data collection

Bachelor of Science Nursing Interns were recruited and trained to assist in data collection. Five methods of data collection were applied in this study. Figure 3 summarizes the data collection methods.

Fig 3. Summary of Data collection methods used in the study



4.9.1. Review of records

Retrospectively records for the past 24 months relating to maternal deaths and live births within each facility were reviewed and recorded. This provided information about trends of maternal mortality within the facilities for that period.

Prospective recording of births, maternal mortality and morbidity was done over a period of three months. This provided a clear picture on maternal morbidity and mortality in relation to ICP practices as they occur within the facilities. This process minimized errors of recall bias, misreporting or under reporting for the purpose of the study. The focus was on caesarian section deliveries because patients stay in the hospital longer making it possible to monitor signs and symptoms of infections that may originate from the hospital.

Patients were observed for signs and symptoms of sepsis which were defined as fever of 38 °C or more on two or more consecutive occasions, raised blood pressure of more than 140/90mmHg on two readings of four hours apart, raised pulse rate of 90 or more per minute, pain on the wound site, pus and foul smell from the wound (Population council and MOH 1999, Myles Margaret 1971). A

combination of three or more of these signs occurring at the same time was indicative of sepsis. Investigations were also done on any patient on antibiotics to find out if they were being managed for sepsis. These were recorded on the prospective follow up sheet, together with the date of admission, date of discharge and the inpatient patient number to avoid double or missed recording, for future reference, and for supervision of data collection. This process went on for 12 weeks with the enumerators visiting the facility every other day.

4.9.2. Observation

Health care workers were observed by a participant observer on issues related to ICP practices as outlined in the observation checklist. A participant observer did the observation on various days during the follow up period, to ensure that the subjects were not aware.

4.9.3. Interviews

Health care workers were interviewed towards the end of the follow-up period. This was done to guard against respondents having prior knowledge of what was being investigated, as this would have influenced their behavior during the observation period. The interviews were done over a period of two weeks so as to cover as many health care workers on duty as possible. For effective data collection, enumerators were trained on interviewing and observation of ICP practices based on the *Standard Infection Control Practices* as laid down in the "AVSC Infection Prevention Participants Handbook (1999)".

4.9.4. Disinfectant, in-use test sample collection

Samples of disinfectants for in-use test were collected from the labor ward and postnatal wards. Healthcare workers were not informed before the samples were collected so as not modify their behavior. Samples of disinfectants before and during use were collected from the facilities in sterile containers containing peptone medium

9 mis. The disinfectant in use was drawn using a 2 ml sterile syringe and 1ml of it discharged into the laboratory container to make a dilution of 1:10 as per the test

recommendation. This was then labeled the facility code, type of disinfectant, its duration in use, date and time of collection. The sample was then transported for analysis in the laboratories at Kenyatta National Hospital the same day. In the laboratory the samples were mounted on nutrient agar on a petridish. Each petridish had ten spots marked on it and on each spot 0.02mls of sample from each bottle (containing samples from the hospitals) were placed. Two such petridishes were prepared from each of the sample bottles; one was stored in an incubator at 37 °C for three days while the other was stored at room temperature for seven days. They were observed for growth of microorganisms on a daily basis and the observations recorded on Disinfectant in-use report sheet. Growth of microorganisms that was observed on any marked spot was recorded. If the spots with growth totaled five or more from the same disinfectant sample (at room temperature and at 37°C incubation) that sample had failed the potency test. If the spots were less than five from one sample it was recorded as pass.

All the samples that failed the test were then subjected to further analysis to isolate the probable microorganism(s) that were present. This was also recorded.

4.9.5. Photography

Photographs were taken using a digital camera. Areas of interest included facilities used for hand washing, disinfection, sterilization, waste disposal and laboratory analysis. The photographs were then down loaded in the computer for use as supportive evidence in the report.

4.10 Data analysis

The data collected was cleaned and prepared for analysis, which was done using the computer Statistical Package for Social Sciences (SPSS) version 11.5 for Windows, as well as spread sheet (Excel package) for Windows 2000. Descriptive methods of data analysis and presentation were applied as well as tests of significance for reliability, validity and for purposes of data interpretation. A biostatistician was involved at various stages for authentication and credibility of the analysis process.

4.11 Data presentation

Data was presented in form of frequency counts, percentages, charts and tables for ease of interpretation. The findings will be prepared for presentation in various forums for discussion, recommendation and further actions. Such forums include Department of Community Health (U.O. N), seminars, scientific conferences, and publishing in various scientific journals.

4.12 Ethical considerations

The proposal was forwarded to Kenyatta National Hospital and Pumwani Maternity Hospital research and ethical committees for review and approval. The permission and authority to carry out the study was sought and granted from the Ministry of Education and Ministry of Health. Authorization letters were forwarded to district heads for the two Ministries in Nairobi, Kiambu and Thika Districts, respectively.

Heads of the selected institutions were also approached and they gave consent for the data to be collected. Individual health care workers were approached and verbal/written consent obtained from them before the questionnaire was administered. A commitment was made that findings of the study would be made available to the participating institutions.

4.13 Study limitations

Observation method of data collection could easily have introduced observer bias. This was overcome through the selection, recruitment and thorough training of the enumerators on observation using the checklist. The enumerators were selected from amongst Bachelor of Science nursing interns whose training curriculum covers issues on infection control and prevention practices.

Obtaining accurate records on causes of maternal mortality was not easy because in many cases the information was not accurately recorded. However, the enumerators had to go through each patient's file and counter check with the nurses' records in the ward. Incases where the two were not matching, the information was not analyzed.

Photography was not easy. It had to be done without prior knowledge of the staff in the ward, who were not aware of the disguised observation process that was going on at the time. However consent had been obtained from the relevant authority. In Kenyatta National Hospital the ward-in-charge insisted on receiving a letter from the "superiors", before the process could continue. Obtaining such a letter involved several hierarchies of personnel in the hospital administration. As a result only one photograph was obtained from the institution.

Some of the laboratories (Government chemist and KEMRI center for microbiology research) targeted for analysis of the disinfectants in-use test proved difficult to work with. They stated that the process was not regular and hence would involve extra staff, reagents and equipment that were not available. The cost of analysis proved to be exorbitant. However on discussion with the head of medical laboratories in Kenyatta National Hospital it was agreed that the hospital would provide the technical support and the researcher would provide some of the supplies that were specific to the study. This option was within the study budget and we therefore used the facility.

CHAPTER **FIVE**

5.0 **FINDINGS**

This was a descriptive study conducted in five hospitals ranging from a National referral hospital, a special maternity hospital, two district hospitals and a sub-district hospital. Health care workers (HCW) who included doctors, nurses and support staff working in labor ward and postnatal wards in these hospitals were observed on Infection Control and Prevention (ICP) practices. Trained participant observers administered the questionnaire to 103 HCW out of the expected162. Another questionnaire was given to the maternity ward in-charges in the five hospitals. Twenty samples of disinfectants in-use were taken to the laboratory for analysis. In total 88,846 deliveries that had occurred in the five institutions the 24 months before the study were reviewed. Three hundred and eighty five cases of caesarian sections were followed up for a period of three months. Lastly, photographs of various facilities related to ICP practices within the institutions were taken.

5.1 HEALTH CARE WORKERS

5.1.1 Profession and training

One hundred and three HCWs responded to the questionnaire out of whom 31% were males and 69% were females. Out of these, 12.6% were doctors, 59.2% nurses, 11.7% clinical officers and 16.5% support staff. Table 5.1 illustrates the distribution of HCW per institution. From the table, majority of HCW (83.5%) had undergone training in medical school and colleges while only 16.5% (the support staff) had not undergone any medical training.

The majority of health care workers in the institutions studied had a high level of training with 60.1% having had at least three and a half years of training in the medical colleges and university. This is a relatively high level of trained manpower in the institutions but a lot needs to be done in training of the support staff especially those working in close contact with the patients, because they are likely to jeopardize their own safety, that of other HCW, patients and the community.

Table 5.1 Distribution of HCW by profession and institution

Institution	Profession					
	Doctor	Nurse registered	Nurse Enrolled	Clinical officer	Support Staff	Total
KNH	5	14	4	5	3	31
PMH	4	11	12	5	7	39
KDH	0	4	1	1	1	7
TDH	3	4	7	0	3	17
TSDH	1	4	0	1	3	9
Total %	13 (12.6)	37 (35.9)	24 (23.3)	12 (11.7)	17 (16.5)	103 (100)

Key **to institutions:** KNH= Kenyatta National Referral Hospital
PMH= Pumwani Maternity Hospital, KDH=Kiambu District Hospital
TDH=Thika District Hospital, TSDH= Tigoni Sub District Hospital

5.1.2 HCW ICP Updates attendance

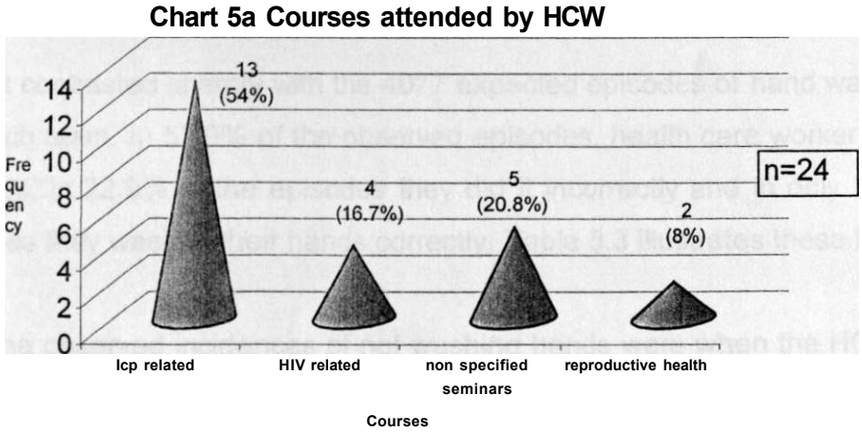
There were 19.4% of the respondents who indicated that they had attended update courses in the last three years, the duration of the courses ranging from four days to six weeks. Table 5.2 illustrates the distribution of ICP updates attendance by institution and cadre. It is evident that the attendance was low with 23% doctors, 21.6% registered nurses, 20.8% enrolled nurses and 23.5 %support staff having attended ICP updates. None of the clinical officers interviewed attended any updates for the last two years. Despite the high quality of training for most of the HCW, the study findings indicate low levels of attendance of update courses. This is not favorable in the current dynamic field of healthcare.

Table5.2 Distribution of iCP updates attendance by institution and staff cadre

Institution	Profession					
	Doctor	Nurse registered	Nurse Enrolled	Clinical officer	Support Staff	Total
KNH	1	1	1	0	2	5
PMH	2	2	1	0	2	7
KDH	0	1	0	0	0	1
TDH	0	4	3	0	0	7
TSDH	0	0	0	0	0	0
Total	3 n=13 (23)	8 n=37 (21.6)	5 n=24 (20.8)	0 n=12 (0)	4 n=17 (23.5)	20 n=103 (19.4)

Out of the respondents who had attended updates, all indicated a variety of courses as demonstrated by chart 5a There were 13 responses indicating ICP related courses, 4 on HIV related courses, 2 on reproductive related courses and 5 stated they attended unspecified seminars. However, one registered nurse from Thika indicated having attended three courses, one enrolled nurse from Thika had attended two and one doctor from Kenyatta had attended two courses, the rest attended one course each making a total of 24.

Chart 5a Courses attended by HCW



5.1.3 Supervision by the iCP committee

All the maternity unit in-charges from the five institutions admitted that there was an infection control committee within their facilities. Three in-charges from Pumwani Maternity, Kiambu and Thika District Hospitals respectively responded that there was supervision by the committee on a monthly basis. However, there was no recorded evidence to support this response. The unit in charge from Kenyatta National Hospital indicated that supervision is not done regularly while in Tigoni it was indicated that they do not have such activities due to shortage of staff.

Supportive supervision is necessary as failures and inadequacies of HCW on ICP practices can be detected early and corrective measures initiated.

5.2 ICP PRACTICES

5.2.1 Hand Hygiene practices

5.2.1.1 Handwashing

Health care workers who responded that they always washed their hands before and after every procedure were 86.6 % (n=103) while 19.4 % responded that they did not always do it. The reasons given for not washing hands always were that the hand washing taps are far away (Pumwani), there were many procedures and hence no time (all facilities) and that at times there was no water at all (Tigoni).

This report contrasted sharply with the 4077 expected episodes of hand washing by the research team. In 57.9% of the observed episodes, health care workers did not wash hands, in 22.9% of the episodes they did it incorrectly and in only 19.3% of the episodes they washed their hands correctly. Table 5.3 illustrates these findings.

Some of the observed incidences of not washing hands were when the HCW went in or out of the ward, between the procedures especially when there is no direct contact with body fluids and before or after use of gloves. The observed incorrect hand washing incidents are; when HCW used only water without soap, when the

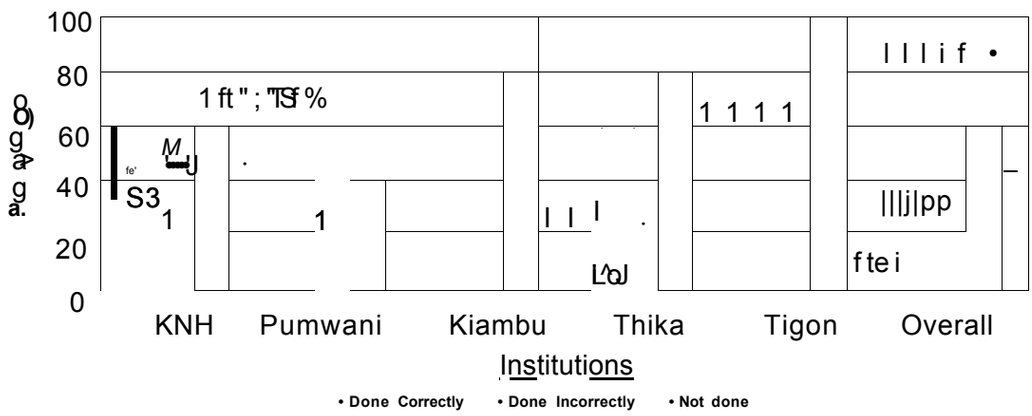
water for hand washing was in a container and was used severally without changing.

Table 5.3 Observed hand washing practice

Hand washing practice	Number of hand washing episodes					
	Kenyatta	Pumwani	Kiambu	Thika	Tigoni	Overall total & %
Expected	885	1762	300	728	402	**4077**
Done Correctly (%)	237 (26.7)	327 (18.6)	41 (13.7)	175 (24)	5 (1.3)	**785 (19.3)**
Done Incorrectly (%)	138 (15.6)	735 (41.7)	16 (5.3)	19 (2.6)	25 (6.2)	**933 (22.9)**
Not done (%)	510 (57.6)	700 (39.7)	243 (81)	534 (73.4)	372 (92.5)	**2359 (57.9)**
At 8 df; a.05 x2= 862.8353 >15.507 ' (p<0.0001) *There was a significant difference between the observed correct hands washing practice by HCW in the five institutions and the recommended practice.*						

The levels of correct hand washing were very low in all institutions but Kenyatta hospital had the highest percentage (26.7%). Pumwani had the highest percentage (41.7%) of incorrect hand washing and Tigoni had the highest percentage (92.5%) of not done episodes of hand washing (Chart 5b).

Chart 5b Observed hand washing practices



5.2.1.2 Gloving[4] practices

There were 3,089 expected episodes of gloving by HCW. Correct gloving was represented by 49.6% of the observed episodes, incorrect gloving by 39.1%. There was no gloving in 11.3% of the episodes. Table 5.4 illustrates these findings.

Some of the observed incidents of incorrect gloving were; when HCW used the same pair of gloves for several procedures, use of wrong types of gloves especially by support staff who used disposable gloves for heavy-duty procedures. Some of them used the same gloves throughout the shift. Non-use of gloves was noted especially in procedures that did not involve direct contact with body fluids, though the procedures were equally dangerous, for example fixing of intravenous lines, handling of newborn babies and cleaning of instruments.

Table 5.4 Observed episodes of gloving practices by HCW

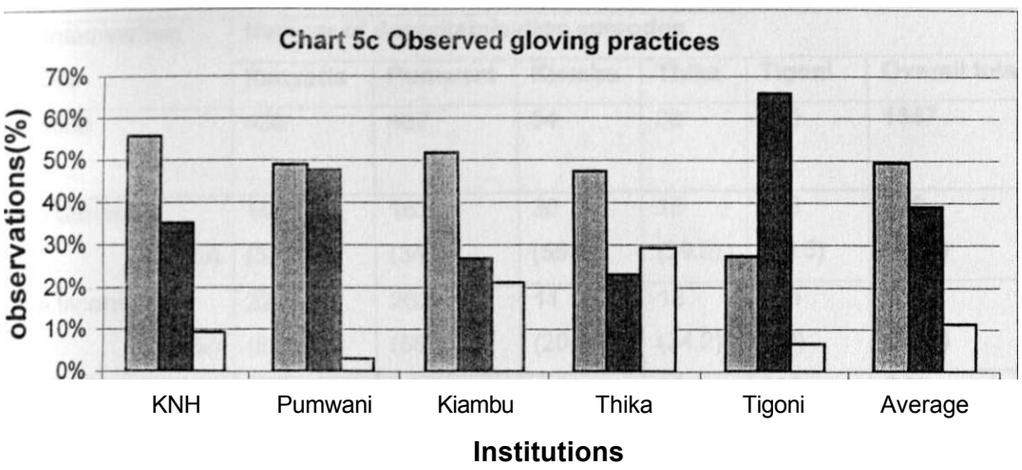
Gloving practices	Number of gloving episodes					
	Kenyatta	Pumwani	Kiambu	Thika	Tigoni	Overall total & %
Expected	665	1457	208	653	106	**3089**
Done Correct (%)	369 (55.8)	716 (49.1)	108 (51.9)	310 (47.5)	29 (27.4)	**1532 (49.6)**
Done Incorrect (%)	234 (35.2)	697 (47.8)	56 (26.9)	151 (23.1)	70 (66)	**1208 (39.1)**
Not done (%)	62 (9.3)	44 (3)	44 (21.2)	192 (29.4)	7 (6.6)	**349 (11.3)**

At 8 df; a.05 $_x$2= 417.6939 >15.507 (p<0.001)

There was a significant difference between the observed correct gloving practice by HCW in the five institutions and the recommended practice.

As was the case in hand washing, the level of gloving practiced by HCW was very low. Kenyatta National Hospital had the highest percentage (55.8) of correct gloving. Tigoni Hospital had the highest incorrect gloving percentage (66) and Thika District Hospital had the highest percentage (29.4) of non-gloving. Chart 5c

illustrates the findings. The study shows that despite the dangers involved in caring for the patients during and after delivery, HCW did not use gloves, as they should, hence posing a risk to their health, that of the clients and the community at large.



• Total Correct Gloving BTotal Incorrect Gloving DNot done

5.2.2 Instruments Processing Practices

5.2.2.1 Decontamination

There were 1547 observed episodes of instruments decontamination. Correct instruments decontamination was done in only 33.5% of the episodes. Instruments were incorrectly decontaminated in 50.9% of the episodes and not done at all in 15.6% of the episodes. There was a significant difference between the observed instruments decontamination by HCW in the five institutions ($p<0.05$) and the recommended practice. Table 5.5 illustrates these findings.

The observed incidents of incorrect decontamination were: the decontaminant being used over very long durations e.g. diluted jik used for more than the recommended six hours, instruments being left in the decontaminant over a longer duration than specified and in other cases the decontaminant was not enough hence some instruments were not fully immersed in it (see photograph P1). Observed cases of non-decontamination resulted from the HCW assuming decontamination had been

done while it had not been done. Other HCW did not decontaminate if the instruments did not have visible stains.

Table 5.5 observed decontamination practices by HCW

Decontamination practice	Number of decontamination episodes					
	Kenyatta	Pumwani	Kiambu	Thika	Tigoni	Overall total & %
Expected	438	467	54	38	550	1547
Done Correct	143	163	30	15	168	519
(%)	(32.6)	(34.9)	(55.6)	(39.5)	(30.5)	(33.5)
Done Incorrect	229	262	11	13	275	787
(%)	(52.1)	(56.1)	(20.3)	(34.2)	(50)	(50.9)
Not done	66	42	13	10	107	241
(%)	(15.1)	(9)	(24.1)	(26.3)	(19.5)	(15.6)
At 8 df; a.05 $_x$2= 48.43696 >15.507 p<0.005						
There is a significant difference between the observed instruments decontamination by HCW in the five institutions and the recommended practice.						

Photograph P1

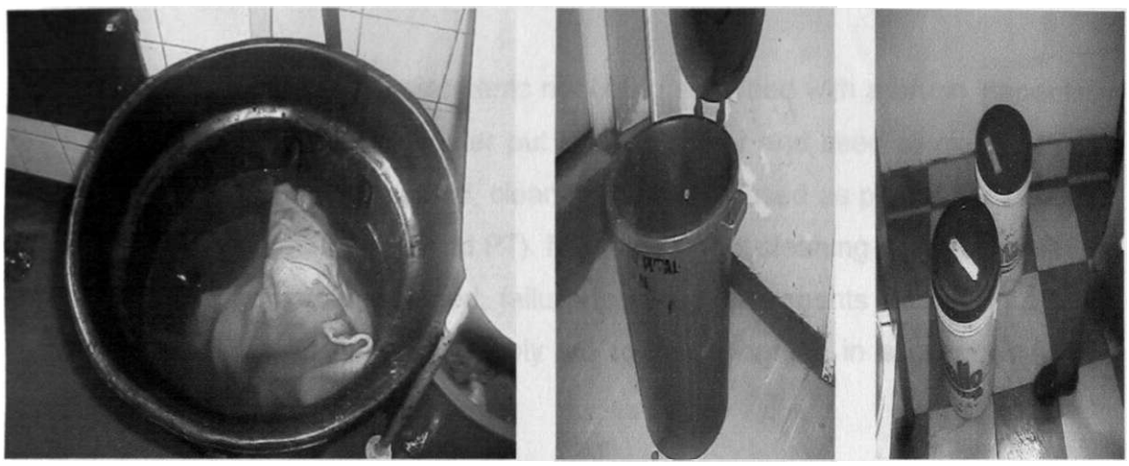
Photograph P2

Photograph P1 taken at Thika District Hospital illustrates incorrect decontamination practice. The kidney dishes have been put in Jik but not all are completely submerged rendering the process ineffective.

Photograph P2 taken at Pumwani Maternity Hospital illustrates decontamination containers and instruments that had just been decontaminated. The containers are not covered with a tight lid as required hence the active component of the

decontaminant (jik) evaporates to the atmosphere. This renders the decontaminant ineffective in a shorter duration than the recommended one.

Photograph P3 **Photograph P4** **Photograph P5**



Photograph P3 taken at Pumwani Maternity Hospital illustrates linen decontamination in progress. The container is not covered with a tight fitting lid. This is incorrect storage of decontaminant in use and renders the decontaminant (Jik) ineffective within a shorter duration than the recommended six hours.

Photograph P4 taken at Thika District Hospital illustrates a large decontamination container not covered though it has an inbuilt lid.

Photograph P5 taken at Kiambu District Hospital illustrates decontamination containers with lids. This type of practice is effective in storage of decontaminants in use. Note how well the containers are covered and clearly labeled. Decontaminants so covered remain active longer than when not covered.

5.2.2.2 Cleaning Practices

There were 1315 observed episodes of instruments cleaning. Correct cleaning was done in 35.7% of the episodes; incorrect cleaning episodes were 48.8%, while in 15.4% of the episodes cleaning was not done. These are very low levels of instruments cleaning.

Ineffective cleaning often leads to ineffective disinfection or sterilization since most of the microorganisms are supposed to be removed from the instruments during cleaning. Table 5.6 illustrates the findings.

Incorrect cleaning included; instruments not being scrubbed with a brush, especially the toothed, non use of soap, water put in a container and used to clean several instruments without being changed, cleaning taps also used as places for cleaning floor mops (see photograph P6 and P7). Incidents of not cleaning **were;** assumption that instruments had been cleaned, failure to clean instruments that did not have visible stains, shortage of water supply led to non cleaning in several observed cases.

Table 5.6 **Observed episodes of instruments cleaning practices by HCW**

Instruments cleaning practices	**Number of instruments cleaning episodes**					
	Kenyatta	**Pumwani**	**Kiambu**	**Thika**	**Tigoni**	**Overall total & %**
Expected	380	410	48	17	460	**1315**
Done Correct (%)	186 (48.9)	108 (26.3)	4 (8.3)	3 (17.6)	169 (36.7)	**470 (35.7)**
Done Incorrect (%)	116 (30.5)	288 (70.2)	40 (83.3)	12 (70.6)	186 (40.4)	**642 (48.8)**
Not done (%)	78 (20.5)	14 (3.4)	4 (8.3)	2 (11.8)	105 (22.8)	**203 (15.4)**

At 8 df; a .05 x2=187.7817 >15.507 (p<0.001)

There was a significant difference between the observed instruments cleaning practice by HCW in the five institutions and the recommended practice.

Chart 5d illustrates the percentage score by institution on instruments cleaning as practiced by HCW. Kenyatta National Hospital had the highest percentage (48.9%) of correctly done instruments cleaning, Kiambu Hospital had the highest incorrectly done percentage (83.3%) and Tigoni Hospital had the highest percentage (22.8%) of non-cleaning of instruments.

Chart 5d observations on cleaning of Instruments

Photograph P6

Photograph P7

Photographs taken at Thika District Hospital illustrate a sink used for cleaning instruments. Notice the floor-cleaning mops had been cleaned and left in the sink. A closer-up view in photograph P7 illustrates the status of the sink with stains on the sides and soil from the ward's floor at the bottom. This observation rendered all the instruments that were washed in the sink, incorrectly cleaned.

5.2.2.3 Disinfection

On the question whether HCW disinfect instruments always, 93.7%(n=103) responded that they did, while the rest (6.3%) responded that they did not always

do so. This is a clear indication that HCW appreciate the need for disinfection of instruments. However on observation the findings were different.

There were 450 observed episodes of instruments disinfection by HCW. It was observed that correct disinfection was done in 54.7% of these episodes, 18.2% episodes were done incorrectly while 27.1% of the episodes were not done at all. This demonstrates a wide gap between what the HCW believe they should be doing and what they actually do i.e. 93.7% and 54.7% respectively. This could be a reflection of the low update attendance and poor or lack of supervision as demonstrated in the previous sections of this report. There was a significant difference ($p<0.001$) between the correct observed instruments disinfection by HCW in the five institutions and the recommended practice. Table 5.7 illustrates the findings.

The observed incidents of incorrect disinfection included; use of wrong solution for disinfection e.g. savlon, use of disinfectant for longer duration than recommended, instruments not fully submerged (see photograph P8), disinfected instruments placed on dirty surfaces to dry (see photograph P9).

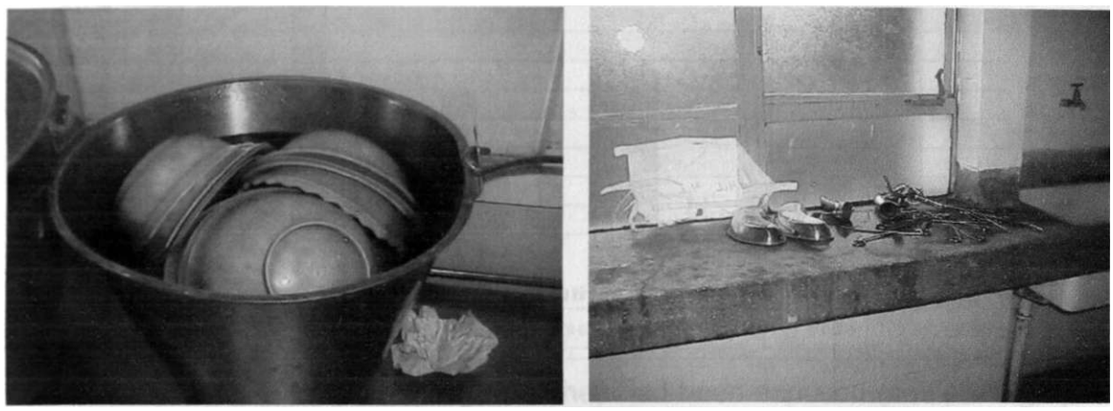
Table 5.7 **Observed** instruments' **disinfection practices by HCW**

Instruments disinfection practices	**Number of instruments disinfection episodes**					
	KNH	**Pumwani**	**Kiambu**	**Thika**	**Tigoni**	**Overall total & %**
Expected	216	59	51	56	68	**450**
Done Correct (%)	108 (50)	39 (66.1)	33 (64.7)	28 (50)	31 (45.6)	**246 (54.7)**
Done Incorrect (%)	39 (18.1)	8 (13.6)	9 (17.6)	25 (44.6)	15 (22.1)	**82 (18.2)**
Not done (%)	69 (31.9)	12 (20.3)	9 (17.6)	3 (5.3)	22 (32.4)	**122 (27.1)**

At 8 df; a .05 *2= 42.18677>15.507 **(p<0.001)**

There was a significant difference between the observed instruments disinfection by HCW in the five institutions and the recommended practice.

Photo graph P8 **Photograph P9**



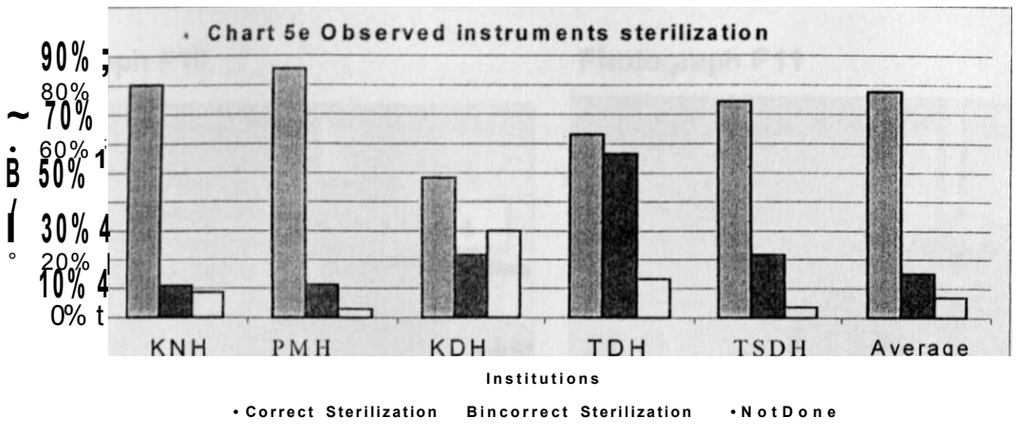
Photograph P8 taken at Kenyatta national hospital postnatal ward illustrates bowls used for infants' care being disinfected yet some are not fully submerged in the disinfection solution, thus rendering the process ineffective and hence incorrect.

Photograph P9 taken at Kiambu District Hospital shows instruments that were placed on the same surface before and after cleaning. The surface was not cleaned and dried before the cleaned instruments were placed on it. The instruments were later taken for disinfection. This was recorded as incorrect disinfection since the instruments were not processed as required prior to disinfection.

5.2.2.4 Sterilization

There were 1020 observed episodes of sterilization of instruments. The correct sterilization of the instruments was done in 77.8% of the episodes, 15.2 % of the episodes were incorrectly done and in 7% of the episodes, sterilization was not done. Instruments sterilization practices had a better rating compared to the other processes. However its effectiveness is dependent on the other processes such as decontamination and cleaning. Despite the high overall percentage of the sterilization practice, there was still a significant difference ($p<0.001$) between the observed instruments sterilization by HCW in the five institutions and the recommended practice. Table 5.8 illustrates the findings.

The observed incorrect sterilization manifested in a number of ways such as; many instruments being packed together and wet instruments observed in the sterilized packs. Episodes in which sterilization was not done were as a result of using



instruments from opened packs long after they had been exposed (see photograph P10). However all of the institutions had fairly good facilities for sterilization.

Table 5.8 Observed instruments sterilization practices by HCW

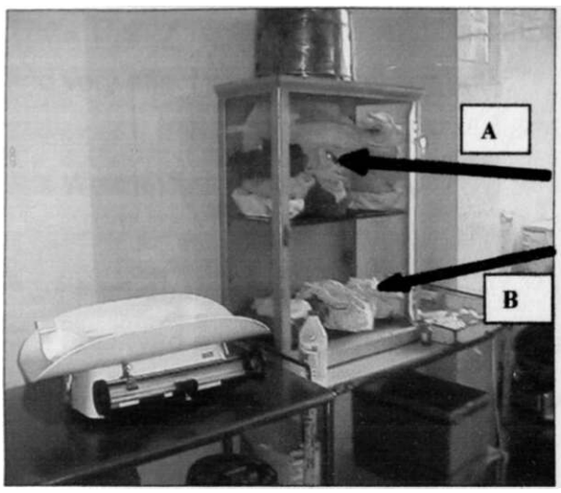
Sterilization Practices	Number of sterilization episodes					
	Kenyatta	Pumwani	Kiambu	Thika	Tigoni	Overall total & %
Expected	127	467	60	30	336	**1020**
Done Correct (%)	102 (80.3)	400 (85.7)	29 (48.3)	19 (63.3)	250 (74.4)	**800 (77.8)**
Done Incorrect (%)	14 (11)	53 (11.3)	13 (21.7)	7 (23.3)	74 (22)	**161 (15.2)**
Not done (%)	11 (8.7)	14 (3)	18 (30)	4 (13.4)	12 (3.6)	**59 (7)**

At 8 df; a .05 *2= 104.7015 >15.507 (p<0.001)

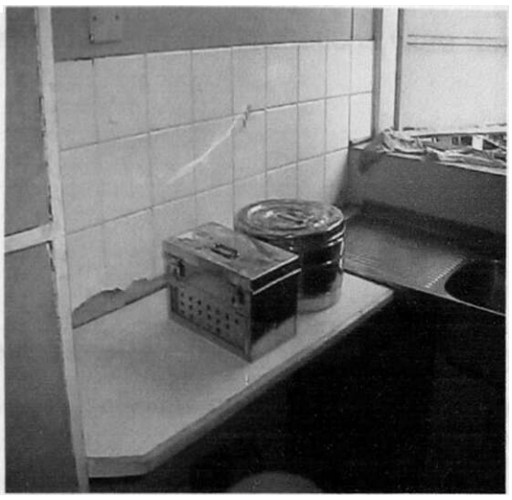
There was a significant difference between the observed instruments sterilization by HCW in the five institutions and the recommended practice.

Chart 5e shows the percentage score by the institution on instruments sterilization practices by HCW. Pumwani Maternity Hospital had the highest percentage (85.7%) of correct sterilization. Thika had the highest percentage (23.3%) of incorrect sterilization and Kiambu the highest percentage (30%) of failure to sterilize.

Photograph P10



Photograph P11

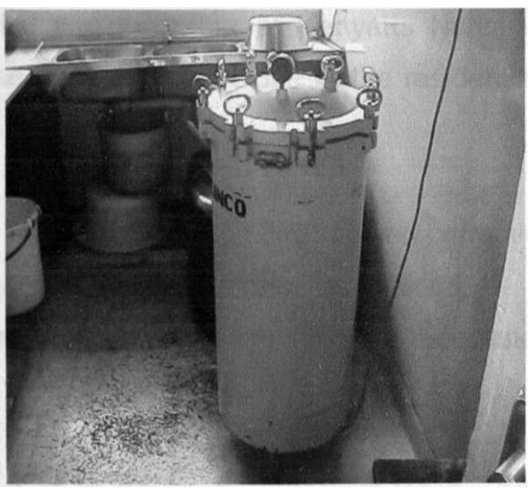


Photograph P10 taken at Kiambu district hospital illustrates packs that have already been sterilized but two of them are incorrectly stored. The upper arrow (A) shows an instrument that is exposed yet the pack was considered to be sterile. The lower arrow (B) illustrates a pack that had been opened and a few instruments removed, the rest were assumed to be sterile and were later used for sterile procedures. Both were reported as incorrect.

Photograph P11 taken at Thika District Hospital shows some of the drums used for packing instruments for sterilization.

Photograph P12

Photograph P13



Photographs P12 was taken at Pumwani Maternity Hospital and P13 was taken at Thika District Hospital. The sterilizers that are in use in the institutions were new and very effective when used correctly.

5.3. Waste Disposal Practices

5.3.1 Non-sharps wastes

The observed episodes of non-sharps waste disposal, for the purpose of this study was categorized into clinical incinerable waste, clinical non-incinerable waste, general waste and placenta disposal.

The overall correct clinical Incinerable waste disposal was observed in 36.5% (n=2441) of the cases while in 63.4% of the cases this was incorrectly done. Table 5.9 illustrates the findings.

It was observed that in many cases waste was not separated or containers color-coded into incinerable and non-incinerable waste. In other cases even when separated, the two categories of waste were later mixed, for the final disposal in the institutions' dumping site. All the institutions had incineration facilities. However, it was observed that during the time of data collection only two facilities were operational, one at Kiambu District Hospital and the other at Kenyatta National Hospital. Even those in operation were inadequate or very close to the residential areas as shown in the photographs P16 and P18.

For the clinical non-incinerable wastes, the overall percentage of observed correctly done episodes was 43%(n=1023) of the total. Table 5.9 illustrates the findings.
It was observed that incorrect incineration was through failure to separate the waste into various categories (see photographs P14, P15 and P17).

The general waste was correctly disposed of in 37.7% (n=2392) of the overall observed episodes. Table 5.9 illustrates the findings.

The incorrect general waste disposal incidents were; failure to separate wastes, the waste container over flowing (see photographs P15) and the mixed waste thrown in an open disposal site within the institution, where local council workers would come and collect them for disposal in their dumpsites. This was a common observation in all the facilities apart from Tigoni that had a pit and once full, the garbage would be burnt. The photographs P14 - 15 further illustrates the actual practices in terms of waste disposal.

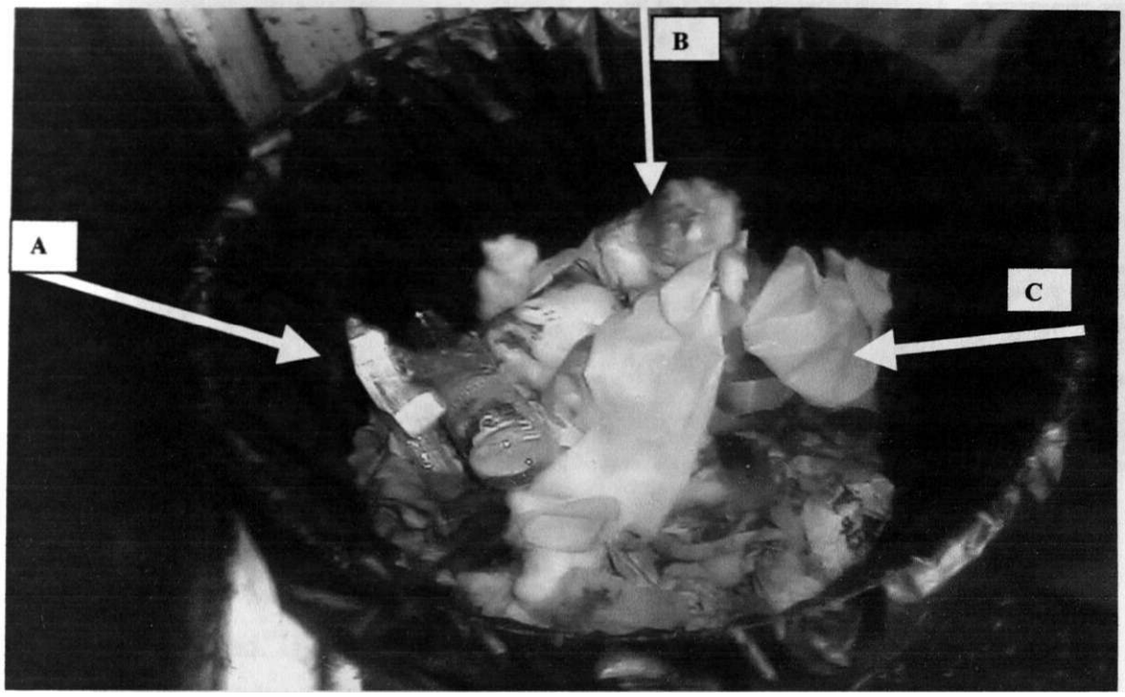
The overall correct placenta disposal was observed in 81.9%(n=199) of the episodes. Table 5.9 illustrates the findings. Three of the facilities had an operational placenta macerator; these are Pumwani Maternity Hospital, Kiambu and Thika District Hospitals (see photographs P19 and P20). However in some cases malfunctioning of the macerator led to incorrect disposal practices. For example, in Pumwani maternity hospital, it was observed in one occasion that the placentas were wrapped in a bag by the support staff and later thrown together with the rest of the waste. Two of the institutions had a placenta pit i.e. Kiambu and Thika District Hospitals in addition to the macerator, Tigoni sub-district Hospital had a well-covered placenta pit without a macerator.

Table 5.9 summarizes all the findings on waste disposal practices by the HCW, as observed in the five institutions.

Table 5.9 observed waste disposal practices by HCW

Practice		Number of the observed episodes					
		KNH	**Pumwani**	**Kiambu**	**Thika**	**Tigoni**	**Overall total & %**
Clinical Incinerable waste	**Total expected**	**780**	**338**	**108**	**363**	**852**	**2441**
	Done Correct (%)	345 (44.2)	118 (34.9)	73 (67.6)	79 (21.8)	278 (32.6)	**893 (36.6)**
	Done Incorrect (%)	435 (55.7)	220 (65.1)	35 (32.4)	284 (78.2)	574 (67.4)	**1548 (63.4)**
	At 4 df; a .05 $_x$2= 104.9412 >9.488 (p<0.001) *There is a significant difference between the institutions regarding the observed clinical Incinerable waste disposal by HCW.*						
Clinical Non-Incinerable wastes	**Total expected**	**392**	**127**	**36**	**124**	**344**	**1023**
	Done Correct (%)	173 (44.1)	50 (39.4)	19 (52.8)	47 (37.9)	158 (45.9)	**447 (43.7)**
	Done Incorrect (%)	219 (55.9)	77 (60.6)	17 (47.2)	77 (62.1)	186 (54.1)	**576 (56.3)**
	At 4 df; a .05 $_x$2= 4.592526 < 9.488 (p>0.1) *There is no significant difference between the institutions regarding the observed clinical non-Incinerable waste disposal by HCW.*						
General waste	**Total expected**	**851**	**259**	**50**	**334**	**898**	**2392**
	Done Correct (%)	450 (52.9)	82 (31-6)	22 (44)	78 (23.4)	270 (30.1)	**902 (37.7)**
	Done Incorrect (%)	401 (47.1)	177 (68.4)	28 (56)	256 (76.6)	628 (69.9)	**1490 (62.3)**
	At 4 df ; a .05 $_x$2= 140.247 > 9.488 (p< 0.001) *There is a significant difference between the institutions regarding the observed general waste disposal by HCW.*						
Placenta	**Total expected**	**57**	**24**	**20**	**32**	**78**	**199**
	Done Correct (%)	47 (82.5)	19 (79.2)	18 (90)	26 (81.3)	53 (67.9)	**163 (81.9)**
	Done Incorrect (%)	10 (17.5)	5 (20.8)	2 (10)	6 (18.7)	15 (32.1)	**36 (18.1)**
	At 4 df; a .05 $_x$2= 2.938296 < 9.488 (p>0.1) *There is no significant difference between the institutions regarding the observed placenta disposal by HCW.*						

Photograph P14



This photograph (P14) taken at Pumwani maternity hospital illustrates a waste disposal container that is well fitted with a black polythene bag. Note the different types of waste that are discarded in it as shown by the arrows. Arrow A points at a bottle fitted with a giving set and it has a needle and syringe (clinical incinerable waste) at its bottom side. Arrow B at the top points at a piece of cotton wool soaked with blood (clinical non incinerable waste). Arrow C shows used gloves (clinical non-incinerable waste). In addition, the container had other types of general wastes. This illustrates incorrect waste disposal.

* O

Photograph P15

Photograph P16

Photograph P15 taken at Pumwani maternity hospital, illustrates a waste container overflowing with waste upon closer examination, it was observed that, the waste was not separated. This would later be collected and disposed of at the institution's dumping site mainly by support staff.

Photograph P16 taken at Pumwani maternity hospital illustrates an open dumping waste disposal site for the institution. All types of waste are disposed of here, from where the City council lorry comes to collect it. Next to it is an ideal waste collection container that is not in use. Note how close the staff residential houses are to the open dumpsite.

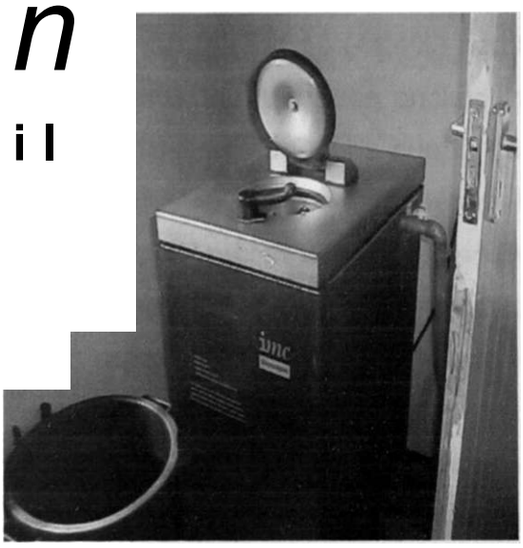
Photograph P17

Photograph P18

Photograph P17 taken at Kiambu District Hospital illustrates a waste disposal site with combined incinerable, non-incinerable clinical waste and general wastes. Once in a while the Municipal council lorry collects the waste. It was observed that the council workers are not well protected and equipped to handle this mixture of hazardous waste.

Photograph P18 taken at Kiambu District Hospital, shows an incinerator that is operational. The incinerator does not have the top high chimney. In the background are residential houses with their windows facing the incinerator.

Photograph P19



Photograph P20

Photograph P19 taken at Thika district hospital and photograph P20 taken at Pumwani Maternity Hospital shows macerators used in the two institutions respectively. Both incinerators are electricity operated and are connected to the sewerage system for drainage. The two institutions have a placenta pit in addition to the macerator, incase of water shortage or electricity failure or blockage of the sewerage system. The placenta macerators shown in the photographs can handle up to six placentas per cycle. One cycle runs for about five minutes.

5.3.2 **Sharps disposal**

5.3.2.1 **Needles**

When asked what they do with needles after use, 42.7% (44) of health care workers responded that they recap them, 33.9% (35) said they dispose without recapping, 11.7% (12) indicated that they decontaminate and then dispose. The rest 11.7% (12) did not respond to this question.

When asked if a needle had ever pricked them within the last two years, 36.9% (38) respondents said yes while 63.1% (65) said no. Out of the ones who admitted having been pricked 16 (44.4%) had been pricked once, 15 (41.7%) twice, while 2 (5.6%) said they had been pricked thrice. One person had been pricked 5 times, another 10 times and one support staff had been pricked 15 times. Two of the respondents said they could not remember how many times they had been pricked. Support staff recorded more episodes of needle pricks (54.3%) compared to the rest of the workers. One of the support staff commented that it happens mainly when collecting the waste for disposal or when cleaning and dusting the ward.

Table 5.10 indicates that on observation, 50.2% (n=1326) episodes of needle recapping took place and in the remaining 49.8% episodes recapping was not done. Decontamination of used needles was done in 10% of the episodes; in all other 90% episodes the HCW did not decontaminate the needles. It was observed that this procedure is not common and was mainly done by the nurses who come to give vaccinations to the newborn babies in postnatal wards. For the safety of the community members who may come into contact with the needles that have been used for such activities, it has been suggested that these needles be decontaminated then disposed of into puncture proof containers at the user level.

There were 83.7% (n =1319) recorded episodes of needles disposal into a puncture resistant container. This practice.is essential in reducing the incidents of pricks from used needles. Most of the health care workers were disposing of the needles

correctly. It was also observed that the disposal containers were easily accessible to the HCW.

The correct disposal of sharps containers was done in only 60.1% (n=80) of the observed episodes. Incidents of inappropriate disposal of sharps containers (40%) were: containers being left to fill beyond three quarters - which is the acceptable level, containers being left in the ward long after they were full and being combined with the rest of the wastes at the hospitals dump site instead of being incinerated. The photographs P21, P22 and P23 illustrate these findings.

The entire needle waste disposal practices showed significant ($p<0.05$) difference between the institutions as practiced by HCW (Table 5.10).

Table 5.10 Observed episodes of needle stick disposal practices by HCW

Practice		Number of episodes					
		Kenyatta	**Pumwani**	**Kiambu**	**Thika**	**Tigoni**	**Overall total & %**
Needle Recapping	**Total**	**434**	**182**	**47**	**309**	**354**	**1326**
	Done (%)	207 (47.7)	110 (60.4)	18 (38.3)	[illegible]	**184** (52)	**666 (50.2)**
	Not Done (%)	227 (52.3)	72 (39.6)	29 (61.7)	162 (52.4)	170 (48)	**660 (49.8)**
	At 4 df; a .05 *2= 12.68513 > 9.488 (0.01<P<0.05) *There is a significant difference between the institutions regarding the observed recapping of needles by HCW.*						
Needle and syringe Decontamination	**Total**	**115**	**178**	**52**	**129**	**222**	**690**
	Done (%)	0 (0) .	63 (35.4)	2 (3.8)	(3,1)	6 (2.7) .	**69 (10)**
	Not Done (%)	115 (100)	115 (64.6)	50 (96.2)	25 (97)	216 (97.3)	**621 (90)**
	At 4 df; a.05 x2= 162.4541 > 9.488 (P<0.001) *There is a significant difference between the institutions regarding the observed decontamination of needles.*						

Practice		Number of episodes					
		Kenyatta	Pumwani	Kiambu	Thika	Tigoni	Overall total & %
Disposal into puncture resistant container	**Total**	**418**	**196**	**60**	**273**	**372**	**1319**
	Done (%)	358 (85.6)	179 (91.3)	49 (81.7)	227 (83.2)	291 (78.2)	**1104 (83.7)**
	Not Done (%)	60 (14.4)	[illegible]	11 (18.3)	46 (16.8)	81 (21.8)	**215 (16.3)**
	At 4 df; Q.05 $_x$2= 17.92916 > 9.488 P<0.05 *There is a significant difference between the institutions regarding the observed disposal of needles into puncture resistant container by HCW.*						
Disposal of Puncture resistant container	**Total**	**58**	**6**	**11**	**21**	**37**	**133**
	Done (%)	40 (69)	2 (33.3)	9 (81.8)	13 62	16 43.2	**80 60.1**
	Not Done (%)	18 (31)	4 (66.7)	2 (18.2)	8 (38)	21 (56.8)	**53 (39.9)**
	At 4 df; a.05 $_x$2= 99.93482 >9.488 (P<0.001) *There is a significant difference between the institutions regarding the observed disposal of puncture resistant sharps container practice by HCW.*						

Photograph P21

The photograph P21 was taken at a wastes disposal site at Tigoni sub district hospital. The arrow shows a needle and syringe on a disposed intravenous fluid bottle. Notice other mixed wastes including used gloves, giving sets and general wastes.

Photograph P15 **Photograph P16**

Photograph P22 taken at Pumwani maternity hospital illustrates two puncture resistant sharps containers. One is in use while the other one is full but has not been disposed of.

Photograph P23 taken at Pumwani maternity hospital illustrates a sterile pack, placed on it, is a used needle and syringe and next to it is a sharps container. The needle might have contaminated the sterile pack, which was later used for a sterile procedure.

5.3.2.2 Other sharps disposal practices

For the purpose of the study other sharps included razor blades, surgical blades, suturing needles, broken glass, ampoules and vials.

Health care workers were asked if they dispose of other sharps in the right containers, and 85.1%(n=103) of the respondents said yes, with the rest responding "not always". Reasons given for non-compliance were that the HCW were not aware of the requirement to separate (25%), containers were not adequately labeled (66.5%), there were no separate containers available in the ward (25%), forgetting to do so (6.3%), and not seeing the need to do so (6.3%).

On observation, correct disposal was done in 37.5%(n=1356) of all the expected episodes of the sharps disposal. In 53 % episodes sharps disposal was incorrectly done and in 8.9% it was not done. Table 5.11 illustrates the findings.

In many cases the blades were discarded in the general waste containers together with vials and ampoules. There is a large difference between needles disposal and other sharps disposal practices by health care workers.

Table 5.11 Observed episodes of other sharps (e.g. vials, razors and surgical blades) disposal practices by HCW

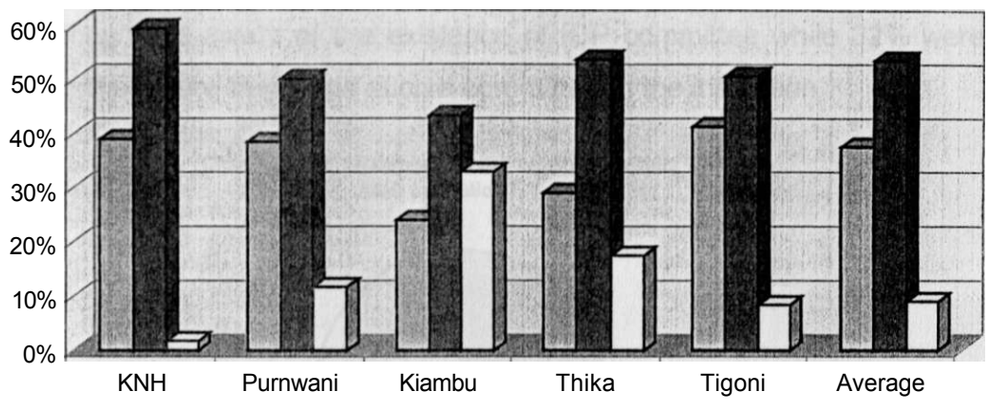
Other **sharps disposal practices**	**Number of other sharps disposal episodes**					
	Kenyatta	**Pumwani**	**Kiambu**	**Thika**	**Tigoni**	**Overall total & %**
Expected	458	138	67	190	505	**1358**
Done Correct (%)	178 (38.9)	53 (38.4)	16 (23.9)	55 (28.9)	208 (41.2)	**510 (37.5)**
Done incorrect <%)	272 (59.4)	69 (50)	29 (43.3)	102 (53.7)	255 (50.5)	**727 (53.5)**
Not done (%)	8 (1.7)	16 (11.6)	22 (32.8)	33 (17.4)	42 (8.3)	**121 (8.9)**

At 8 df; **a** .05 ***2= 100.5286 >15.507 (P<0.001)**

There is a significant difference between the observed correctly done sharps disposal practice by health care workers in the five institutions and the recommended practice.

Chart 5f illustrates the percentage score by the institutions on disposal of sharps (other than needles). There is a significant difference (p<0**.001)** between the institutions regarding the other sharps disposal practice by health care workers. Tigoni sub district hospital has the highest percentage (41.2%) of correct disposal. Kenyatta National Hospital has the highest percentage of incorrect disposal (59.4%) and Kiambu District Hospital has the highest percentage (32.8%) observed practice of non- disposal.

Chart 5f Observed disposal of sharps other than needles



5.4 INFECTION CONTROL COMMITEE ACTIVITIES

The maternity unit in-chaiges were asked if there were infection control committees in their institutions and they all responded that these committees existed. When asked if the five basic activities of ICP were going on in their institutions, they gave 36% (9) positive responses while negative responses were 64%(16). None of the institutions had research within ICP activities taking place. Table 5.12 illustrates the findings. On the question of how frequently these activities were conducted in the institution, positive responses ranged between one month, and three months but there was no documentation available to support this.

Table 5.12 **In-charges response on Infection Control Committee activities**

Activity practiced	**Yes**	**No**	**Total**
Supervision	3	2	5
Surveillance of diseases	2	3	5
Continuing education	2	3	5
Developing ICP policies	2	3	5
Research on ICP	0	5	5
Total	9 (36%)	**16 (64%)**	**25**

When HCW were asked about their awareness of the existence of ICP committees in their institutions, they responded as shown in chart 5.4. A majority of HCW (61%) indicated they were aware of the existence of ICP committee while 32% were not and 7% were not sure there was such a committee in the institution.

Chart 5g HCW awareness on ICP existence within their institution

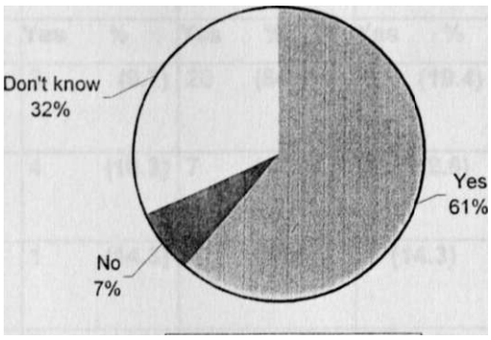


Table 5.13 illustrates the responses that were given by health care workers from each institution in relation to their awareness of each of the five ICP committee activities within their institutions. Out of a possible 103 possible responses from the HCW, only 22.3% indicated they were aware of supervision activity, 11.6% had knowledge of surveillance activities within their institutions and 40.8% indicated that they were aware of continuing education activities by the ICP committee. Only 9.7% of 103 HCW were aware of research activities by the ICP committee, and 20% were aware of the policy development function of the ICP committee in their institutions.

Overall institutional performance indicated that Thika District Hospital HCW had the highest percentage 30.9% (n=155) of ICP committee activities awareness, then Kenyatta National Hospital 30.3% (n=155), Kiambu 22.9% (n=35), Pumwani 11.3% (n=195) and Tigoni 11.1% (n=45).

Each respondent was asked the same question for each of the five ICP activities and a total of 515 possible responses were expected from all the five institutions. Only 20.9 % of the responses were received.

Table 5.13 HCW awareness of ICP committee activities within the institutions

	Supervision	Surveillance	Continuing Education	Research	Policy dev.	Total
	Yes %	Yes %	Yes %	Yes %	Yes %	Yes %
KNH (n=31)	10 (32.3)	3 (9.7)	20 (64.5)	6 (19.4)	8 (25.8)	47 (30.3) n=155
Pumwani (n=39)	5 (12.8)	4 (10.3)	7 (17.9)	1 (2.6)	5 (12.8)	22 (11.3) n=195
Kiambu (n=7)	2 (28.6)	1 (14.3)	2 (28.6)	1 (14.3)	2 (28.6)	8 (22.9) n=35
Thika (n=17)	5 (29.4)	2 (11.8)	13 (76.5)	2 11.8)	4 (23.5)	26 (30.6) n=85
Tigoni (n=9)	1 (11.1)	2 (22.2)	0 (0)	0 (0)	2 (22.2)	5 (11.1) n=45
Total n=103	23 (22.3)	12 (11.6)	42 (40.8)	10(9.7)	21 (20.4)	108 (20.9) (N=515)

5.5 DISINFECTANTS IN-USE TEST

The test used to determine the effectiveness of disinfectants that were in use within the institutions is called the "disinfectant in-use test". Each sample was divided in to two plates and one was stored at room temperature while the other was incubated at 37°C. A total count of five or more microorganism colonies from both or either of the two petridishes was interpreted as fail and less than five as pass for that sample.

A total of twenty samples were collected from the five institutions and taken to the laboratory for analysis. Only 60% of them passed the test while 40% of them failed by supporting growth of microorganisms. There were great institutional variations: all the samples from Pumwani Maternity Hospital passed the test while all the samples from Thika district hospital failed. The samples that were taken from

Kenyatta National Hospital and Kiambu District Hospital scored 50% pass while Tigoni had 66.7% pass. Table 5.14 summarizes the performance of disinfectant in use test in each of the institutions.

Table 5.14 Institutional performance on Disinfectant In-use test

Institution	Samples taken	Pass		Fail	
		Count	%	Count	%
KNH	6	3	50	3	50
PMH	6	6	100	0	0
KDH	2	1	50	1	50
TDH	3	0	0	3	100
TSDH	3	2	66.7	1	33.3
Total	**20**	**12**	**60**	**8**	**40**

Chart 5h indicates that from 0 to 6 hours, most of the disinfectants were effective after which they lost their potency. There were two samples that failed the test at 0 hours duration in use, while another was still active at 48 hrs. Those that lost their potency at 0 hours were as a result of lack of proper washing of the container, after pouring the old disinfectant. The one active at 48 hrs was Cidex, which remains active for 14 days.

Chart 5h Disinfectant's duration in use

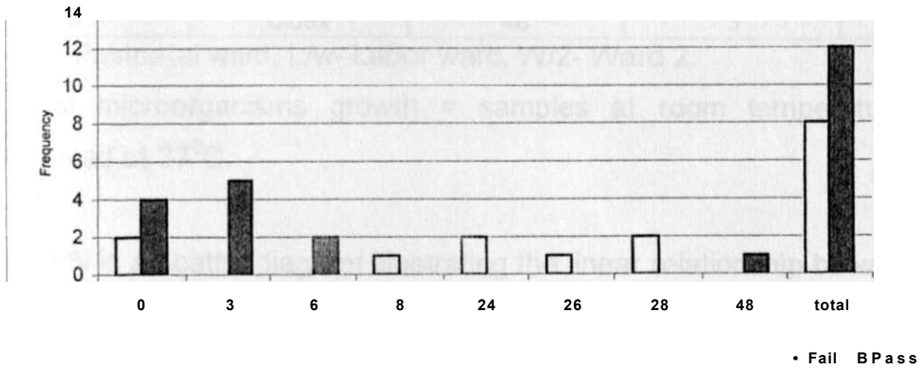


Table 5.5b.shows the type of disinfectant and institutions where they were obtained. The table also shows the duration of use and total microorganism growth per

sample, and the outcome is indicated as pass or fail. Those that had a count of five or more failed the test. It is clear that the more the hours in use the more the likelihood of failure of the disinfectants and also the more the amount of microorganisms' growth (refer to table 5.15). Fifteen of the tested disinfectants were Jik, 2 were Biotex, and one each of Cidex, Precepts and Lysol. Seven out of those that failed were Jik samples and one was a precepts sample.

Table 5.15 Duration of disinfectant in use and total Microorganism growth both at room temperature and at 37°c incubation.

Facility	Disinfectant	Duration In use	"Total Micro org. growth	Out come
KNH (Pnw)	Biotex	0	4	Pass
PMH W/2	Jik	0	4	Pass
PMH L/w	Jik	0	0	Pass
KDH	Jik	0	5	Fail
Tigoni	Jik	0	6	Fail
Tigoni	Lysol	0	2	Pass
KNH L/w	Biotex	3	3	Pass
PMH W/2	Jik	3	3	Pass
PMH L/w	Jik	3	1	Pass
KDH	Jik	3	3	Pass
Tigoni	Jik	3	4	Pass
PMH W/2	Jik	6	4	Pass
PMH L/w	Jik	6	3	Pass
KNH L/w	Precepts	8	7	Fail
KNH	Jik	24	20	Fail
TDH	Jik	24	6	Fail
TDH	Jik	26	7	Fail
KNH Pnw	Jik	28	20	Fail
TDH	Jik	28	7	Fail
KNH L/w	Cidex	48	3	Pass

*Pnw- Postnatal ward, L/w- Labor ward, W/2- Ward 2.

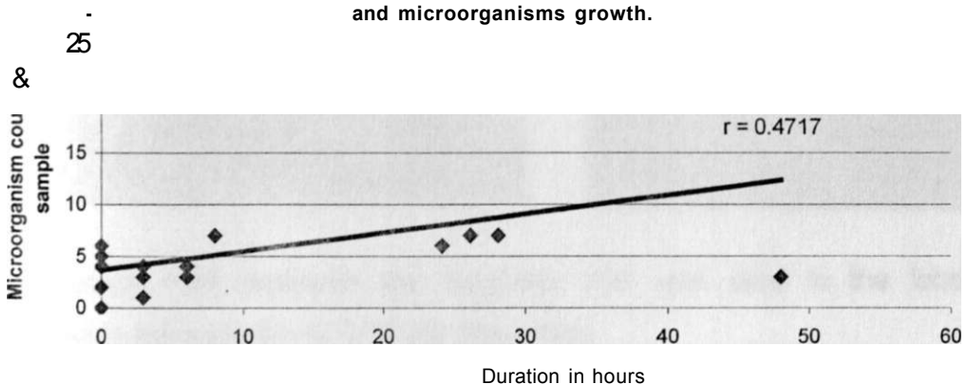
**Total microorganisms growth = samples at room temperatures + samples incubated at 37°C.

Chart 5i is a scatter diagram illustrating the linear relationship between the duration of disinfectant in use and the growth of microorganisms. The line in the diagram shows the positive nature of the relationship between the two variables.

At a.05 and 28 df $t_{.975}$ —2.**1009.** The correlation coefficient **r = 0.4717.** Using the t test **= r** (V **(n-2)/(1-r^2)= 2.849** thus **p<0.05.** There is significant positive linear

correlation between duration of disinfectant in use and the growth of microorganisms. The relationship is positive and significant in that the longer the duration a disinfectant is used the more the microorganisms are likely to grow. The HCW should be careful to follow the specifications of diluting, storage and duration of disinfectant in use.

Chart 5i A scatter diagram of correlation between duration of disinfectant in use and microorganisms growth.



5.5.1 Isolation of microorganisms

Following the growth of microorganisms in the disinfectants in-use test, additional tests were done to isolate the microorganisms in the samples that failed the disinfectant in-use test. The samples were tested and observed. The following were the microorganisms that were identified.

- Hemolytic *Staphylococcus, Staphylococcus, Enteric bacilli, Proteus* species and *Pseudornonas* species,
- There was also an overgrowth of normal airborne contaminants that included; micrococci, aerobic spore bearing bacteria and, filamentous fungi.

The photographs below illustrate the findings on disinfectants in use test

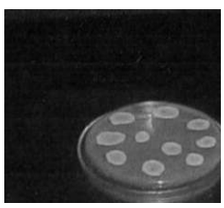
Photograph P24

Photograph P25

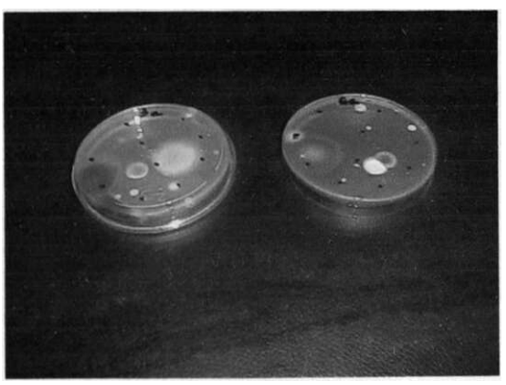
Photograph P24 illustrates the incubator that was used in the laboratory for incubating the samples at 37°C for three days.

Photograph P25 illustrates petridishes (or plates) soon after they were marked and samples mounted on them; one was stored in the incubator and the other at room temperature for 7 days. Note the 10 black spots per plate, on each spot was 0.02mls of sample disinfectant.

Photograph P26



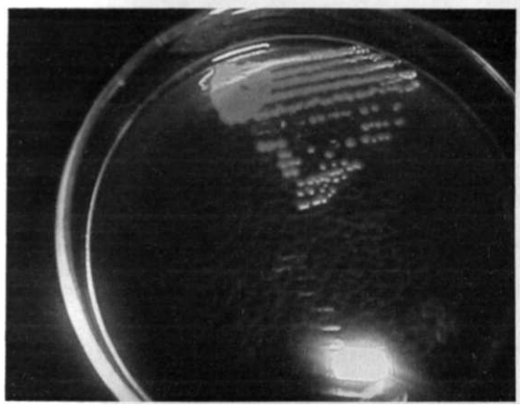
Photograph P27



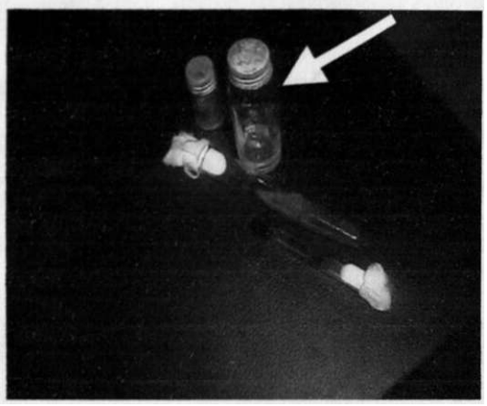
Photograph P26 Illustrates growths of microorganisms on each of the marked spot. This plate was among the plates that had the heaviest growths.

Photograph P27 Illustrates growth of microorganisms i.e. the white spots seen on the plates and an overgrowth of airborne microorganisms seen as large sports colored lemon yellow, rose red, cream and white.

Photograph P28



Photograph P29

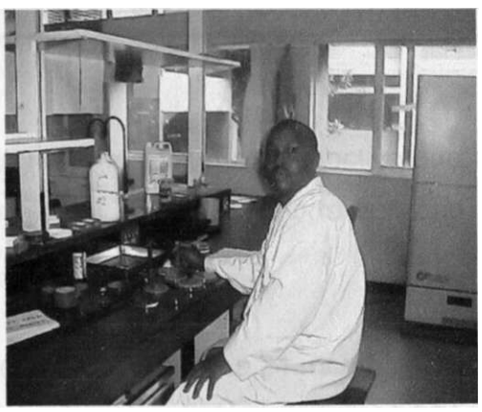


Photograph P28 illustrates isolated microorganism growing on blood agar plate. This was obtained from the sample in photograph P26.

Photograph P29 shows sample bottles used to collect the samples from the institutions (pointed by the arrow), and test tubes used for isolation of the specific microorganisms.

Photograph P30

Photograph P31



Photograph P30 Illustrates the laboratory bench that was used for preparation of the samples.

Photograph P31 shows one of the laboratory technologists who was assisting in the testing and analysis of the laboratory results.

5.6 ICP RELATED MORBIDITY FOLLOW-UP (PROSPECTIVELY)

Patients who underwent caesarian section during the 12 weeks of prospective data collection were followed up to establish whether they developed puerperal sepsis. This was recorded and findings are as summarized in table 5.16 In all the institutions, the prevalence rate of infections post caesarian section was 132 per 1000 patients for the twelve weeks of study. However institutional variations were evident with Pumwani having the highest (283 per 1000 patients) and Kenyatta having the least (48 per 1000 patients).

Table 5.16 Institutional infection prevalence post-caesarian sections

Institution	Well Patients	Infected Patients	Total	Prevalence per1 000 patients
KNH	98	5	103	**48.5**
PMH	53	21	74	**283.8**
KDH	46	3	49	**61.2**
TDH	127	21	148	**141.9**
TSDH	10	1	11	**90.9**
TOTAL	**334**	**51**	**385**	**132.5**

5.7 MORTALITY TRENDS

The institutional records were retrospectively reviewed for a retrospective duration of 24 months prior to the study. All the recorded deliveries, mortalities and the mortality causes were analyzed.

Table 5.17 describes the recorded statistics of deliveries for the 24 months duration. Kenyatta National Hospital and Pumwani Maternity Hospital, recorded 13,201 and 49,605 of deliveries respectively. In total, caesarian sections comprised 15% of all deliveries; Kenyatta had the highest caesarian section rate (375 per 1000 births) followed by Thika (156 per 1000 births) while Tigoni had the least (54 per 1000 births). Maternal mortality was calculated at maternal deaths per 100,000 live births. The average maternal mortality for the five institutions was 338 per 100,000 live births. Stillbirths rate was highest in Kiambu (2475 per 100,000 births) followed by

Tigoni (2019 per 100,000 births) while Pumwani had the least (36 per 100,000 births). The overall stillbirth rate for all institutions was 790 per 100,000 births.

Table 5.17 24 Months Retrospective Data on Deliveries and Mortalities

Institution	Duration	Total Deliveries	Live Births	Still Births	C/ Sections	*C/s rate	Maternal Deaths	"Maternal Mortality	Still birth Rate
KNH	2002Jan-2003Dec	13201	13018	185	4944	375	252	1935.8	1401.5
PMH	2002Jan-2003Dec	49605	49586	18	5572	112	12	24.2	36.3
KDH	2002Jan-2004Dec.	9737	9504	241	774	79	4	42.1	2475.1
TDH	2002Jan-2003Dec	12143	11967	174	1889	156	24	200.6	1432
Tigoni	2002Jan-2003Dec	4160	4076	84	226	54	6	147.2	2019.2
Total		88846	88151	702	13405	151	298	338	790

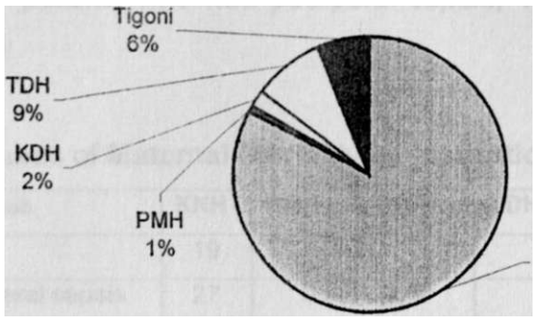
*c/s rate = caesarian sections/total births x 1000

** Maternal mortality= maternal deaths /live births x100, 000

*** Still birth rate = stillbirths / total deliveries x 100,000

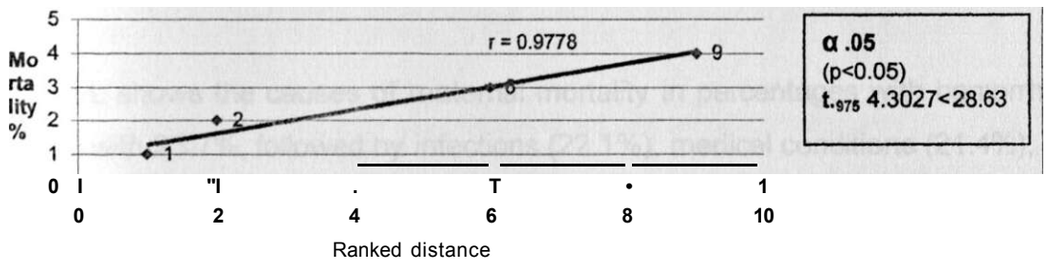
Chart 5j shows the maternal mortality percentage by institution. Kenyatta national hospital had the highest percentage (82%) among the five institutions while the rest shared the remaining 18% of the total maternal mortalities.

Chart 5j Maternal mortality per 100,000 live births for the duration 2001-2003 in percentages



There was a significant positive correlation between the distance of the other institutions from Kenyatta National Hospital and the maternal mortality (percentage). The correlation coefficient r = 0.9778. Using the t test = **r** (V ***(n-2)HA-t*)= 28.63**

chart 5k correlation between distance from KNH and mortality in the other



Institution	Pumwani	Kiambu	Tigoni	Thika
Ranked distance from KNH	1	2	3	4
Ranked Maternal Mortality %	1	2	6	9

Causes of maternal mortality

The main cause of maternal mortality was hemorrhage, followed by infections, medical conditions, pregnancy induced toxemia, anemia, caesarian section

complications and lastly cancer. Table 5.18 illustrates the maternal mortality by institution while chart 5.k shows the percentage causes of maternal mortality.
There were 27 patients who had puerperal sepsis, 16 of whom were HIV /AIDS positive as well.

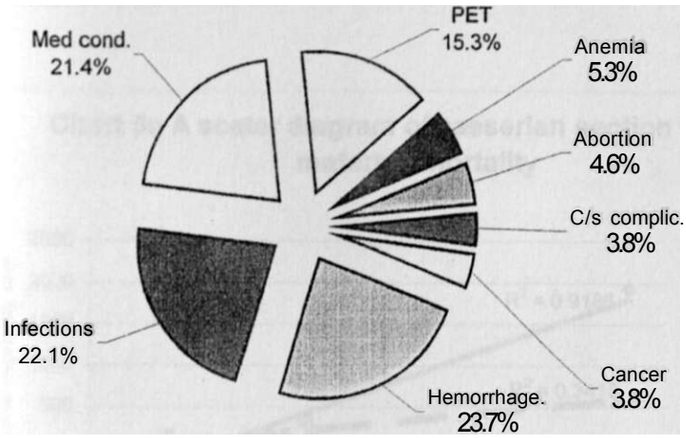
Table 5.**18** Causes of Maternal Mortality by **Institution**

Documented cause	KNH	PMH	*KDH	TDH	TSDH	TOTAL
Hemorrhage	19	7	0	1	4	31
Infections-Puerperal sepsis	27	0	0	2	0	29
Medical conditions	27	0	0	1	0	28
PET	17	3	0	0	0	20
Anemia	7	0	0	0	0	7
Abortion	6	0	0	0	0	6
C/s complication	2	2	0	1	0	5
Breast Cancer	5	0	0	0	0	5
Total deaths	110	12	0	5	4	131

'Kiambu district hospital records on causes of maternal deaths were not reliable hence could not be used.

Chart 5L shows the causes of maternal mortality in percentages with hemorrhage leading with 23.7%, followed by infections (22.1%), medical conditions (21.4%), Pre-eclamptic toxemia (PET)(15.3%), anemia (5.3%), abortions **(4.6%),** caesarean sections complications 3.8%, and breast cancer 3.8%.

Chart 5L Percentage causes of maternal mortality

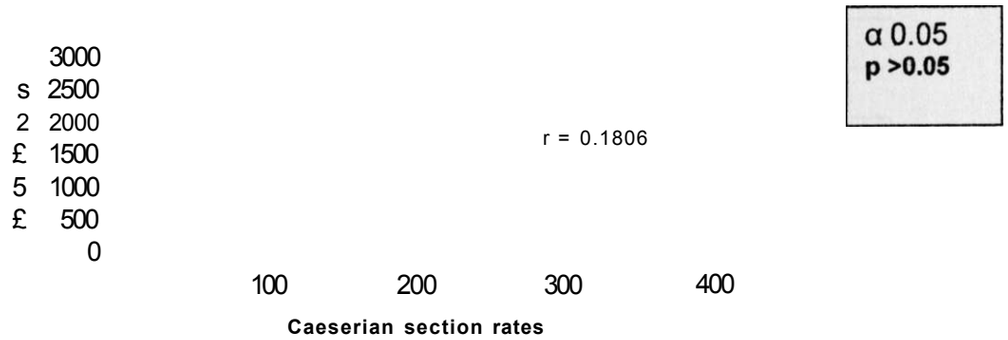


5.8 CORRELATIONS

5.8.1 Morbidity And Mortality Correlations

The correlation between caesarian section rate and stillbirth rate was inverse but showed no statistical significance. This implies that the institutions that are performing more caesarian sections may be saving more infants lives. See Chart 5m

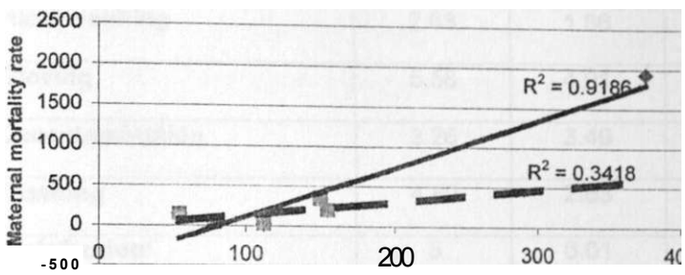
Chart 5m A scatter diagram of caeserian section rate and stilbirth rate



The correlation between caesarian section and maternal mortality was positive and was statistically significant (p>().G05). However Kenyatta National Hospital was an outlier with extremely high maternal mortality rates. When it was removed there was

no statistical significance (p< 0.05) between maternal mortality rate and caesarian section rates. See chart 5n.

Chart 5n A scater diagram of caeserian section rate and maternal mortality

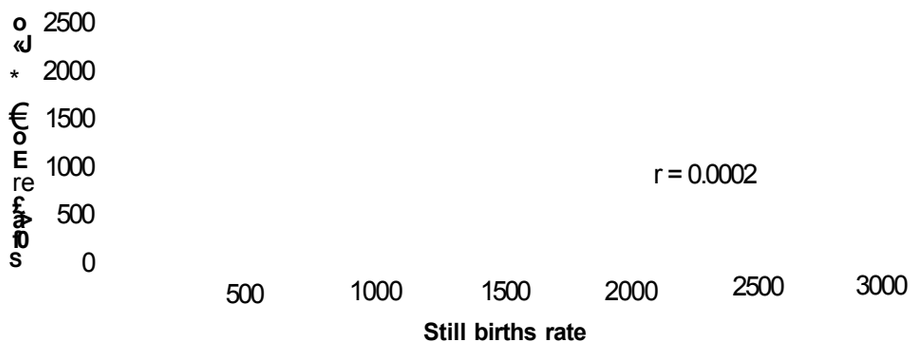


straight line
p> 0.005

dotted line
p<0.05

There was no correlation between,the maternal mortality rate and still birth rate. See chart 5p

Chart 5p A scatter diagram of maternal mortality and still births



5.8.2 Variables correlation

The ICP correct practices were given a score between 0 - 9 i.e. 0-9% =0, 10 -19% =10, 20 -29%=2, 30 -39% =3, 40-49% = 4, 50-59%=5, 60-69% = 6, 70-79% =7, 80-89%=8 and 90-100% =9.

Then the overall rank was determined cumulatively per institution and average of the same was determined (table 5.19). The institutions were then ranked in order of the average score.

Table 5.19 Ranked sores of ICP practices in the five institutions

	ICP Practices	KNH	PMH	KDH	TDH	TSDH
1	**Hand washing**	2.68	1.86	1.37	2.4	0.13
2	**Gloving**	5.58	4.91	5.19	4.75	2.74
3	**Decontamination**	3.26	3.49	5.56	3.95	3.05
4	**Cleaning**	4.89	2.63	0.83	1.76	3.67
5	**Disinfection**	5	6.61	6.47	5	4.56
6	**Sterilization**	1.1	1.13	2.17	2.33	2.2
7	**Clinical Incinerable**	4.42	3.49	6.76	2.18	3.26
8	**Clinical non Incinerable**	4.41	3.94	5.28	3.79	4.59
9	**General**	5.29	3.16	4.4	2.34	3.01
10	**Placenta**	8.25	7.92	9	8.13	6.79
11	**Needle recap**	4.77	6.04	3.83	4.76	5.2
12	**Syringe decontamination**	0	3.54	0.38	0.31	0.27
13	**Disposal into cont**	8.56	9.13	8.17	8.32	7.82
14	**Container disposal**	6.9	3.33	8.18	6.2	4.32
15	**Other sharps**	3.89	3.84	2.39	2.89	4.12
16	**Disinfectant in use**	5	10	5	0	3.33
17	**ICP committee activity**	3.03	1.13	2	3.06	1.11
	Cumulative score	**77.03**	**76.15**	**76.98**	**62.17**	**60.17**
	Average score	**4.53**	**4.48**	**4.53**	**3.66**	**3.54**
	Rank	**1**	**3**	**2**	**4**	**5**

The average scores for each institution were correlated with the out comes of matern. morbidity (infection) and mortality. The tables 5.20 and 5.21 illustrate.

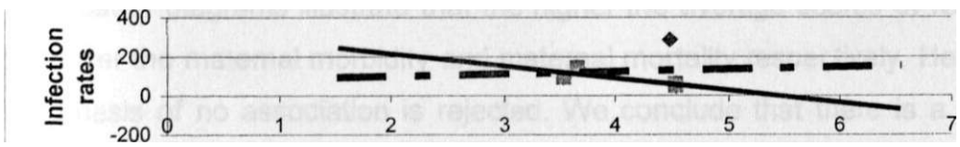
The outcome of maternal morbidity showed no significant correlation, with the ICP average scores. However Pumwani Maternity Hospital was an outlier, and when it was removed the correlation was significant ($p<0.050$). Table 5.21 and chart 5q illustrate the findings.

The outcome of maternal mortality showed no significant correlation with the ICP average scores. However KNH was an outlier and when it was removed the correlation was significant ($p < 0.05$) table 5.21 and chart 5r illustrates the findings.

Table 5.20 The correlation of ICP practices average scores and the out come of infection

	KNH	PMH	KDH	TDH	TSDH	Correlation coefficient (r)
[Average score	4.53	4.48	4.53	3.66	3.54	
Infections	48.5	283.8	61.2	141.9	90.9	0.060
Infections without PMH	48.5		61.2	141.9	90.9	0.925
						P < 0.05

chart 5q A scatter diagram of ICP practices average scores and maternal morbidity.

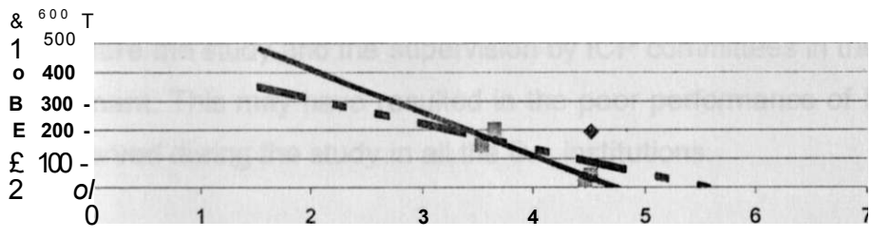


ICP practices

Table 5.21 the correlation of ICP practices average scores and the out come of mortality

	KNH	PMH	KDH	TDH	TSDH	Correlation coefficient (r)
Average score	4.53	4.48	4.53	3.66	3.54	
Mortality	193.58	24.2	42.1	200.6	147.2	-0.53
Mortality without KNH		24.2	42.1	200.6	147.2	-0.93
						P<0.05

Chart 5r A scatter diagram of ICP practices average score and maternal mortality



ICP average score

The scatter diagrams illustrate that the higher the average scores of ICP practices the lower the maternal morbidity and maternal mortality respectively. Hence the null hypothesis of no association is rejected. We conclude that there is a relationship between the ICP practices and the outcomes of maternal morbidity and mortality.

CHAPTER SIX

6.1 DISCUSSION

This study was conducted in five hospitals in two provinces of Kenya namely Nairobi and Central. The study aimed at establishing the status of infection control and prevention (ICP) practices among the health care workers (HCW) in these institutions. Generally, professional training, update courses and supervision were viewed to have had influence on the HCW practices of ICP and hence the outcomes of patient care in terms of morbidity and mortality.

It was established that a majority of HCW working in these institutions had gone through at least three years of medical training in a medical college or university. However, the majority of them had not attended any updates on ICP for the last two years before the study and the supervision by ICP committees in the five institutions was dormant. This may have resulted in the poor performance of ICP practices as was observed during the study in all the five institutions.

Hand hygiene is said to be the most effective and basic ICP practice. Health care workers indicated that they were aware of the importance of hand washing. Their practice on hand washing revealed that the HCW washed hands correctly 19.3% of the time. This compares to a study by Graravaglio et al (2004), where only 5.6% compliance of HCW to CDC guidelines for hand washing was recorded. The reasons given are similar in both studies and they all converge at logistical problems such as shortage of water and soap as well sinks being far from the patients' beds.

This study established that HCW gloving practices were generally incorrect and were done mainly to protect the HCW. There were several occasions when HCW were observed putting two or more gloves and conducted several procedures on various patients without changing the gloves. They also failed to wash their hands after removal of gloves. Tenario et al (2001) in their study on gloving carried out in

Chicago USA concluded that hands should be washed after gloving, as gloving does not prevent contamination.

Instruments processing is very important in maintaining standards of aseptic procedures within the hospitals. The study found out that this practice differed significantly from the expected recommended standards in all the hospitals. Instruments cleaning and decontamination when performed poorly would affect the effectiveness of sterilization or disinfection process. The study noted that in all the five institutions sterilization was correctly done with a score of 77.8%, while decontamination, cleaning and disinfection scored 38.6%, 35.7% and 54.7% respectively. The implications of failure to implement proper ICP procedures are potentially serious hence adequate education and training of staff is of critical importance, especially on instruments disinfection and sterilization (Mc Nally et al 2001).

Hospital waste disposal should be handled with caution in order to protect not only the HCW and patients but also the community members where such waste is disposed. There were significantly low standards of waste disposal practices in all the institutions. Incinerable, non-incinerable and general wastes were all mixed together. This is dangerous especially to the support staff and waste handlers who are charged with the responsibility of disposing of the waste. Support staff are members of the health care team that is in direct contact with the patients. They mainly handle the hygiene and sanitation issues for the patients and the entire ward in general. However they lack skills and knowledge especially on ICP. Shiao, (2001) in a study on sharps injuries among hospital support personnel, states that support staff receive little attention in scientific literature, they also receive no courses on preventive measures and are at risk of occupational hazards.

From the photographs it is evident that waste disposal sites within the institutions need to be reviewed as they are very close to the residential areas and dangerously accessible to the communities living nearby. This is the same case with the incinerator facilities in Kiambu district hospital and Kenyatta national hospital, which

are very close to the residential areas and in addition are in poor state that pollutes the surroundings with smoke and hazardous gases.

Placenta disposal in all the institutions was in conformity with recommended practice. This could be attributed to availability of macerators in all the institutions apart from Tigoni. This institution instead had a well-constructed placenta pit. However in a few occasions like in Pumwani Maternity hospital it was observed that when the macerator was malfunctioning, the placentas were mixed with the rest of the waste.

Despite efforts to discourage HCW from recapping needles, half of them still recap. This practice exposes HCW to risks of needle prick. A total of 36.9% indicated having been pricked, with the support staff having had more pricks than any other cadre of HCW. Similar studies by Gumodoka et al, (1997) in Tanzania indicated that 22% of nurses working in labor wards and 25% of those working in operating theatres had pricked themselves in the previous month. Gisore.Were and Obimbo (1999) in their study here in Kenya indicated that, 61% of HCW reported needle prick Injuries, where 35% had been injured during recapping and 21% during disposal.

A WHO draft Health Care waste management Policy paper (2002) highlighted the serous risks that arise out of poor disposal of needles. The paper estimated that persons who experience one needle prick injury from a needle used on infected source patient has a risk of infection of 30%, 1.8% and 0.3% for Hepatitis B virus, Hepatitis C virus and HIV respectively. Following such findings one can appreciate the fact that Taylor in his study on injection safety issues in Kenya (2004) set the measures of risk level indicators at 100%= excellent, 80%= satisfactory, 60%= intervention needed and less than 60%= Urgent Intervention. If these measures were to be applied in this study it would call for very urgent measures to be taken on ICP practices as most have scored a mean below 60%.

Infection control committees were said to be present in all the facilities, but both the in-charges and the HCW admitted not being aware of most of their activities within the institutions. There were no records of the few activities that they were conducting. This is an indication that they are dormant and need to be revived.
When active, they would ensure that; basic research, continuing education, supportive supervision, nosocomial diseases surveillance and development of policies related to ICP activities are being undertaken within the institutions.

Samples of disinfectants in use were taken for laboratory analysis to establish their effectiveness. A total of 40% of them failed the test and it was established that there was a positive correlation between the duration of use and growth of microorganisms. Pumwani Maternity Hospital samples did not grow any microorganisms while all the samples from Thika District Hospital were positive for growth of microorganisms. Pumwani Maternity Hospital have high patient turnover rate and it was observed that disinfectants are changed frequently i.e. even up to three times within a shift. This would explain why the samples did not grow microorganisms. On the contrary, some samples from Thika and Kenyatta hospital postnatal ward had been in use for up to 28 hours, while 6 hours is the manufacturer's recommended time. Some samples that had been taken immediately after dilution failed the laboratory test. This may be attributed to the fact that the containers were not cleaned before fresh disinfectant was put in them or to incorrect dilution of disinfectant.

Similar studies indicated that 5 of the 18 samples of working dilutions of disinfectants used in the University of Ilorin Teaching Hospital Nigeria, the University Clinic, and three other urban medical centers were contaminated with bacteria. The results confirmed that disinfectants in storage support the growth of infectious agents, underlining the need to use fresh preparations of disinfectants (Oleyani, 1994). In a study at a university teaching hospital in Nigeria, Ogunsola et al (2002) found that, contamination levels were high with 82 (63.1%) of the 130 in-use disinfectants contaminated.

The microorganisms isolated in this study were *Streptococcus, Staphylococcus, Enteric bacilli, Proteus* and *Pseudomonas.* There was an overgrowth of normal airborne contaminants that included; Micrococci, Aerobic spore bearing bacteria and, filamentous fungi. In Nigeria a study by Ogunsola et al (2002) examined disinfectants and 134 isolates were obtained of which 120 (91%) were gram-negative with *Pseudomonas* species being the commonest, constituting 67.2% of all the isolates. Gram-positive organisms made up the remaining 12 (9.0%) isolates. Yet another study done in Malaysia showed that of the 9265 disinfectants in-use, 1519 (16.4%) were contaminated. Among the organisms isolated was *Pseudomonas spp.* (44.3%), *Bacillus spp.* (13.0%), *Enterobacter spp.* (9.5%) and *Acinetobacter spp* (Keah et,al 1995). The results of this study conform to these findings.

It is evident that the ICP practices are significantly below the recommended levels. The outcome of this is reflected in the morbidity and mortality associated with infections as observed in the study. There were 13.2% cases of infections out of all the patients that were followed up post-caesarian section. The figure may have been different since some of the patients were put on antibiotics immediately after the operation, which was an added cost to the patient. Those who got infected had an added cost for treatment and wasted days as a result of prolonged hospital stay.

Kenyatta National Referral Hospital had the highest mortality rate. The overall maternal mortality for the five institutions was slightly lower than the national one.
It was noted that the farther the other institutions were from Kenyatta the higher the mortality. Pumwani maternity hospital, despite having the highest number of deliveries had the least maternal mortalities.

Main causes of maternal deaths were hemorrhage (23.7%) and infections/sepsis (22.1%). Ujah et al (1999) reported from Nigeria that maternal mortality causes were hemorrhage (28.1%), and sepsis (21.3%) was second. A study by Makokha, 1994 as cited by Wendy (1997) indicated that between 1974 and 1984, distributions of maternal deaths in Pumwani maternity hospital were; eclampsia (21%) while

sepsis (19%) was the second major cause. In the three rural districts hospitals in this study, sepsis was the second cause of maternal deaths at 23%.

6.2 CONCLUSIONS

The study brings out clearly the following facts that should be disturbing to all those concerned about ICP practices at institutional and national levels:

- The HCW have a good professional training background. They also know the importance of observing ICP in their working environment.

- Lack of update courses and adequate supervision may have contributed to inadequacies in ICP practices demonstrated by HCW.

- ICP practices of hand hygiene, instruments processing and waste disposal are way below the expected levels. Applying Taylor's categorization of measuring ICP related indicators; most of the observations scored below 60% and hence need urgent attention.

- Institutional ICP committees do exist but they are dormant or inactive in terms of dissemination of information and involvement of HCW on the ground. These committees are not playing their roles of supervision, surveillance, continuing education, policy development and research.

- Disinfectants in use are poorly diluted, inappropriately stored and used for longer durations than is recommended. As a result they are supporting growth of microorganisms, ,which they are meant to destroy.

- Post caesarian section, puerperal sepsis rates are high among all the study institutions and are a major contributor to maternal mortality.

- Mortalities are high though the levels are close to the national maternal mortality rate levels. The maternal mortality rate in the national referral hospital is extremely high while institutions closer to it have recorded very low levels. This could imply that the latter may be referring complicated cases to the national hospital.

- Health care workers are not practicing infection control and prevention as recommended.

- There was a significant linear correlation between the ICP practices by HCW and the outcomes of both maternal morbidity and mortality. Hence, the null hypothesis of no relationship between ICP practices and outcome of infections and mortality was rejected.

6.3 RECOMMENDATIONS

1. There is need to evaluate the kind of ICP teaching that is given in the medical colleges and universities.
2. Update courses should be enhanced especially for the HCW who are involved directly with the care of patients.
3. The ward-in-charges should ensure that the disinfectants in use are not taking longer than they should before being changed. They should also ensure correct dilution is done as per the manufacturers' recommendations.
4. Infection control committees are dormant in all the institutions. The hospital administration should ensure that they are more active and their activities are well documented.
5. The practice of waste disposal needs to be addressed in terms of waste generation, segregation and final disposal. More specifically disposal sites like in Pumwani maternity hospital and the incinerator in Kiambu district hospital should either be improved or moved from their current sites.
6. Similar studies should be carried out especially in non-governmental/ private institutions, as this would bring out their status in terms of ICP practices.

REFERENCES

Ansa V.O., Udoma E.J., Umoh M.S., Anah M.U.2002. Occupational risk of infection by human immunodeficiency and hepatitis B viruses among health care workers in south- eastern Nigeria. *East African medical journal.* May: 79(5): 254-6

AVSC International. 1999. *The infection prevention curriculum: A training Course for Health Care Providers and others staff of Hospital and Clinics: Participant's hand book.* New York USA.

Barbara S. 1997 *Family planning saves lives*, A WHO publication. 3:2-8.

CDC Update.2001. *Investigations of patients who have been treated by HIV infected health care workers.* MMWR. 41: 344-46.

Chipangwi J.D., Zamaere T.P.,.Graham W.J., Duncan B., Kenyon T., Chinyama R. 1997. Maternal mortality in the Thyolo District of southern Malawi. *East African Medical Journal* Dec: 69(12): 675-9

Garavaglia MT, Bassoli L. 2004.Hand hygiene in intensive care. (Article in Italian) *Minerva Anestesiol.* 2004 May: 70(5): 425-30.

Garenne M., Mbaye K., Bah M.D., P. Corrrea.1997. Risk factors for maternal mortality: a case-control study in Dakar hospitals (Senegal). *African Journal of Reproductive Health* Mar: 1(1): 14-24

Gisore.F. Were and 0bimbo.2004. *Needle Injuries in Kenyan Health Workers.* A WHO report on Kenya. A paper presented at injection safety stakeholders meeting: Hilton Hotel Nairobi. 10th June.

Gumodoka B, Favot I., Berege Z.A., Dolmans W.M.1996. Occupational exposure to the risk of **HIV** infection among health care workers in Mwanza Region,United Republic of Tanzania. *East African Medical Journal,*

Haley R.W.1999. The National Nosocomial Infection Rate, a new beginning for vital statistics. *American Journal of Epidemiology.* 121: 159-167.

Juma E.A.2000.Maternal mortality occuring at the Rift valley Provincial General Hospital,Nakuru. *East African Medical Journal:* 77 :7

Juneja Y, Goel U., Sood M.C.1994. Changing trends in maternal mortality over a decade. *International Journal of Gynecology and Obstetrics.* Sep :46(3):265-9

International federation of infection Control. 1997: Safe and unsafe methods of infection control. *Proceedings of the international federation of infection control Global Network conference.* 5-7 Sept. Queens college, Cambridge UK.

Keah K.C. 2002. Bacterial contamination of hospital disinfectants ^*Medical Journal of Malaysia.* Dec: 50(4): 291-7.

Liliopoulou C., Waterman H., Chakrabarty S. 1999.Nurses failure to appreciate the risks of infection due to needle stick accidents: A hospital based survey. *Journal of Hospital Infections:* May: 42(1): 53-9.

Makokha A.E., Kirumbi L.W., Mukohue J.L., Sekadde K. C.1994. *Causes and Prevention of maternal mortality in* Kenya.USAID/FHI: 1-85.

McNally O, Thompson I.M.2001. Sterilization and disinfection in general practice within university health services. *J Hosp Infect.* Nov; 49(3): 210-4.

McAllen A. B.1990 *Clinical Infection prevention in Obstetrics and Gynaecology,* Blackwell Scientific publications ltd.

Michael E., Margaret M. 1998. The importance of an infection control Committee. *Infection control bulletin,* May-Aug.

Ministry of Health.2002. *A Kenya 1999 service provision Assessment.* Nairobi, Kenya.

Ministry of Health.2002: *Essential Obstetric Care Manual: For Health Service Providers in Kenya A safe Motherhood Initiative,* MoH,

Ministry of Health.2002. *A demonstration project on Approaches to providing quality maternal Care in Kenya: Findings from a Baseline survey in four Districts in Western Kenya.* MoH.

Ministry of Health. 1996 *National Strategy for Reproductive Health care in Kenya,* Government of Kenya.

Myles M. (1971). *A textbook for midwives.* 7th edition Churchill Livingston Edinburgh London.

Ndambuki K. M. 1999. *Handling infectious Diseases: A guide for Kenyatta National Hospital.* Kenyatta National Hospital.

Ngoka WM., Bansal Y.P .1987. Maternal mortality: Pumwani Maternity Hospital; 1975-1989. *East Africa Medical Journal.* 64(4): 277-283.

Ogunsola F.T., Orji B.O., Oduyebo O.O. 2002.Contamination levels of in-use disinfectants in a teaching hospital in Lagos, Nigeria. *Afr J. Med. Sci.* Jun: 31(2): 111-4.

Olayemi A.B., Obayan.M. 1994. Contaminated disinfectants in health clinics in llorin, Nigeria. *Infect Control Hosp Epidemiol.Sep:* 15(9): 581-2.

Population council, Nairobi and Ministry of health, Kenya 1999. *A report of a workshop on postpartum care in Kenya*^June 28th to 30th Eldoret Kenya.

Population studies and research institute. 1996. *Kenya maternal mortality baseline Survey.* UNICEF: 1:1-86.

Richard P.W.1993. *Prevention and Control of Nosocomial Infection,*2nd edn.

Rosenfield A, 1990. *The F.I.G.O. Manual of Human Reproduction: Reproductive Health Issues.* Center for Population and Family Health Collumbia University.3rd edn.

Shiao J.S., McLaws M.L., Huang K.Y., Guo Y.L. 2001. Sharps injuries among hospital support personnel. *J Hosp Infect.* Dec: 49(4): 262-7.

Short L.J., BellD.M.1993. Risk of occupational infection with blood-borne pathogens in operating and delivery room setting. *American journal of infection control.*Dec: 21(6): 343-50.

Songa J. 2004. Injection safety and waste management. *Making Medical Injections Safer.*John Snowlnc.Kenya.

Taylor E. 2004. *Injection Safety Issues In Healthcare Management.* WHO East African office and Ministry of Health Kenya. A baseline study Presentation to Stake holders Meeting on Injection safety in Kenya: June.

Tenorio A.R., Badri S.M..2001. Effectiveness of gloves in the prevention of hand carriage of vancomycin-resistant enterococcus species by health care workers after patient care. *Clin Infect Pis.* Mar: 1:32 (5):

Tietfen L.1992. *Infection prevention for family planning programmes*A JHPIEGO and IPPF.

Tincker .A., Marge K..1993. Making Matherhood safe *World Bank discussion Paper No. 202:3.* Washington, DC. World Bank.

Ujah I.A., Uguru V.E Aisienm A.O., Sagay A.S.,Otubu J.A..1999. How safe is motherhood in Nigeria?: The trend of maternal mortality in a tertiary health institution. *East African Medical Journal* .Aug:76(8):436-9

Wendy J.G, .1997. *A Question of survival? Review of safe motherhood*, MoH, Kenya. Divisions of Primary Health care. June

WHO and UNICEF. 1996. *Revised Estimates of maternal mortality, A new Approach,* WHO and UNICEF, Geneva. April.

White R.R., Smith J.M.1995. Infection control in general practice: results of a questionnaire survey. *J Public Health Med.* June: 17(2): 146-9.

APPENDIX I: STUDY TOOLS

1.1 QUESTIONNAIRE FOR HEALTH CARE WORKERS

UNIVERSITY OF NAIROBI
COLLEGE OF HEALTH SCIENCES DEPARTMENT OF COMMUNITY HEALTH

A STUDY ON
INFECTION CONTROL AND PREVENTION PRACTICES IN PUBLIC MATERNITY UNITS IN KENYA

(Fill one questionnaire for each respondent)

Facility code _____ Enumerator

Date _____ Questionnaire Number

1. Respondents sex (gender) M/F

2. Title of respondent (circle one)
   i. Doctor
   ii. Nurse Registered
   iii. Nurse Enrolled
   iv. Clinical officer
   v. Other (specify)
3. Training background of respondent (Circle one)
   i. Masters
   ii. Bachelors
   iii. Diploma
   iv. Certificate
   v. Others (specify)

4. Indicate up date courses on ICP that the respondent has attended
   (Attach additional list if necessary)

Title of the Course/workshop/seminar/continuing education attended	Venue	When	Duration of the update in (Days /Hours)
		Total hours	

5. Do you always wash hands before and after every procedure?
   Yes_____NO
Others (specify)_

5a. Give reason for your response.

6a. Do you always disinfect equipment/instruments after use?
   Yes_____NO_____Others(specify)

6b. Give reason for your response.

7. What do you do to needles after use? (Circle the appropriate response(s).
   i. Recap then dispose
   ii. Dispose directly
   iii. Decontaminate in jik/disinfect then dispose
   iv. Other (specify)

8. Have you ever been pricked by a needle during or after a procedure?
   YES_____NO_____Others (specify)

9. If YES in Q8. How many times can you remember?

10. Do you dispose of waste in separate containers (i.e. clinical and general waste)?
   YES_____NO
Others (spfy)_

11. If NO in Q8. Why? (Circle all that apply)
   i. Not aware they should be separated
   ii. No separate containers
   iii. Containers not adequately labeled/ color-coded
   iv. Forgets
   v. See no need to
   vi. Others (specify)

12. Is there an Infection control committee in the facility?
YES_____NO_____Do not know

13. If YES in Q10. What are some of the activities the committee undertakes?
(Circle all that apply)
   i. Supervision
   ii. Disease surveillance
   iii. Continuing education
   iv. Research
   v. Policy development on infection control
   vi. Others (specify)_

12. What can you comment about infection control and prevention activities in the institution? (Circle one)
   i. Very good
   ii. Satisfactory
   iii. Need improvement
   iv. Very poor
   v. Others (specify)_

1.2 FACILITY QUESTIONNAIRE AND CHECKLIST

UNIVERSITY OF NAIROBI COLLEGE OF HEALTH SCIENCES DEPARTMENT OF COMMUNITY HEALTH

A STUDY ON
INFECTION CONTROL AND PREVENTION PRACTICES IN PUBLIC MATERNITY UNITS IN KENYA

Facility code _____ Enumerator _____
Date _____ Questionnaire Number _____

1. How many members of staff in the following cadres work within the maternity unit?

i. Doctors
ii. Nurses (registered)
iii. Nurses (enrolled)
iv. Clinical officers

2. a Is there an infection control committee in the facility/
YES_____NO_____Others (specify)

2b. If NO to Q2a. Give reasons why_

2c. If YES in Q2 above does the committee perform the following activities?

Activity	**Indicate YES or NO**	**How frequently (Within the past 6 months)**	**Records available Indicate Yes / No**
Supervision of ICP activities			
Surveillance of diseases in the health facility			
Continuing education for members of staff			
Development of ICP policies and standards in the facility			
Research on ICP			
Others (specify)			

1.3 OBSERVATION CHECKLIST

UNIVERSITY OF NAIROBI COLLEGE OF HEALTH SCIENCES DEPARTMENT OF COMMUNITY HEALTH

A STUDY ON
INFECTION CONTROL AND PREVENTION PRACTICES IN PUBLIC MATERNITY UNITS IN KENYA

Facility code _____ Enumerator
Date Questionnaire Number
(Tally the observations within the spaces provided in the tables, if space is inadequate continue on another sheet).

Note: The criteria for observations are based on the Infection Control Trainers manual recommendations. Enumerators should be familiar with the criteria.

I.Hand washing (Tally as appropriate)

Health Care Worker (that has been observed carrying out the activity).	**Expected hand washing episodes**	**Observed hand washing episodes**	
		Correctly done (Soap and flowing water)	**Incorrectly done**
Doctor			
Nurse			
Clinical officer			
Other support staff			
Totals			

2. Gloving (Tally as appropriate)

Health Care Worker (that has been observed carrying out the activity).	**Expected gloving episodes**	**Observed gloving episodes**	
		Correctly done	**Incorrectly done (Overuse of glove)**
Doctor			
Nurse			
Clinical officer			
Other support staff			
Total			

3. Disinfectant (Tally as Appropriate)

Indicate name of observed Disinfectant in use	**Changed as recommended**		**Stored as recommended**		**Instruments left for the recommended duration**	
	YES	**NO**	**YES**	**NO**	**YES**	**NO**
Total						

4. Instruments processing (Tally as appropriate)

Health care worker	**Decontamination**			**Cleaning**			**Decontamination**			**Sterilization**		
	Exp.	Corr.	In.cor	Exp.	Corr.	Incor	Exp.	Corr.	Incor	Exp.	Corr.	Incor
Doctor												
Nurse												
Clinical officer												
Other support staff												
Total												

5. Waste disposal (Tally as appropriate)

Health care worker	**Clinical Incinerable waste**		**Clinical non Incinerable waste**		**Placenta**		**General waste**	
	Correct	Incorrect	Correct	Incorrect	Correct	Incorrect	Correct	Incorrect
Doctor								
Nurse								
Clinical officer								
Others								
Total								

6. Sharps disposal i.e. needles and syringes (Tally as appropriate)

Health Care worker	**Recapping**		**Decontamination**		**Disposal**		Total
	YES	NO	YES	NO	Correct	Incorrect	
Doctor	.						
Nurse							
Clinical officer							
Other support staff							
Total							

7. Other Sharps disposal i.e. drugs vials, ampoules, surgical blades, razor blades, broken glass

Health care worker	**Disposal in to the container**			**Container d sposal**		
	Expected Episodes	Correct	Incorrect.	Expected Episodes	Correct	In correct
Doctor						
Nurse						
Clinical officer						
Support staff						
Total						

8. Health care waste disposal methods (Tick as appropriate)

METHOD	**Available**		**Operational**		**Adequate**	
	YES	NO	YES	NO	YES	NO
Incinerator						
Open dumping site						
Dumping pit						
Placenta pit						
Other (specify)						

1.4 Retrospective record review sheet for deliveries Sheet No.

Hospital

Enumerator

Starting date of recording

Data collection date(s)

Months	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	Total
Total deliveries																									
Live births																									
Caesarian sections																									
Maternal deaths																									
Maternal sepsis																									
Total																									

In case of maternal death (add sheet in case more than provided for)

Date of death	Cause of death

r

1.5 Prospective follow-up sheet for caesarian section cases

Hospital _____ Enumerator Sheet No..

Date	Inpatient Number	Date of admission.	Date of delivery	Mode of delivery.	Date of discharge	Maternal condition (well/infected/dead)

Incase of maternal infection

Mode of delivery	**Diagnosis**	**Infecting microorganism(s)**	**Outcome (recovery/transfer/dead)**	**Comments**

1.6 DISINFECTANT IN-USE TEST FORM

INFECTION CONTROL AND PREVENTION PRACTICES IN MATERNITY UNITS

Facility	Facility Code	Disinfectant	Date of Collection	Duration In-Use	Lab Code	Plates Condition	Days of Observation							Total growths At 37°C+ Room temp.	Comment
							D1	D2	D3	D4	D5	D6	D7		
KNH	00100	Jik	20.4.04	24 hrs	2	37	10	10	10						
						Rt	10	10	10	10	10	10	10	**20**	**Fail**
KNH(Pnw)	00100	Jik	20.4.04	28 hrs	3	37	10	10	10						
						Rt	10	10	10	10	10	10	10	**20**	**Fail**
KNH(Pnw)	00100	Bio tex	23.4.04	0 hrs	5a	37	0	0	0						
						Rt	0	**1**	1	2	3	3	4	4	Pass
KNHL/w	00100	Bio tex	23.4.04	3 hrs	2a	37	0	2	2						
						Rt	0	0	1	1	1	1	1	3	Pass
KNHL/w	00100	Cidex	23.4.04	48 hrs	6a	37	**1**	1	1						
						Rt	0	1	1	2	2	2	2	3	Pass
KNHL/w	00100	Presepts	28.4.04	8 hrs	2b	37	2	4	4						
						Rt	0	1	1	2	2	2	3	**7**	**Fail**
PMH W/2	00200	Jik	23.4.04	0 hrs	4a	37	1	3	3						
						Rt	0	0	0	1	1	1	1	4	Pass
PMH w/2	00200	Jik	23.4.04	3 hrs	3a	37	0	1	1						
						Rt	0	0	0	1	1	2	2	3	Pass
PMHw/2	00200	Jik	23.4.04	6 hrs	1a	37	1	1	2						
						Rt	0	0	0	2	2	2	2	4	Pass
PMH L/w	00200	Jik	28.4.04	0 hrs	6b	37	0	0	0						
						Rt	0	0	0	0	0	0	0	0	Pass

INFECTION CONTROL AND PREVENTION PRACTICES IN MATERNITY UNITS

DISINFECTANTS IN-USE TEST DATA COLLECTION SHEET

Facility	Facility Code	Disinfectant	Date of Collection	Duration In-Use	Lab Code	Plates Condition	Days of Observation							Total growths at 37°C+ Room temp.	Comment
							D1	D2	D3	D4	D5	D6	D7		
PMH L/w	00200	Jik	28.4.04	3 hrs	5b	37	0	0	0						
						Rt	0	0	0	0	0	1	1	1	Pass
PMH L/w	00200	Jik	28.4.04	6 hrs	7b	37	1	1	1						
						Rt	0	1	2	2	2	2	2	3	Pass
KDH	00300	Jik	20.4.04	0 hrs	6	37	0	1	1						
						Rt	0	1	2	2	3	4	4	**5**	**Fail**
KDH	00300	Jik	20.4.04	3 hrs	7	37	0	0	1						
.						Rt	0	0	1	1	1	2	2	3	Pass
TDH	00400	Jik	20.4.04	24 hrs	1	37	0	1	1						
						Rt	0	1	4	4	4	5	5	**6**	**Fail**
TDH	00400	Jik	20.4.04	26 hrs	5	37	0	1	1						
						Rt	0	0	2	2	4	5	6	**7**	**Fail**
TDH	00400	Jik	20.4.04	28 hrs	4	37	0	2	2						
						Rt	0	1	1	1	3	4	5	**7**	**Fail**
Tigoni	00500	Jik	28.4.04	0 hrs	4b	37	0	3	3						
						Rt	0	0	3	3	3	3	3	**6**	**Fail**
Tigoni	00500	Jik	28.4.04	3 hrs	3b	37	1	1	1						
						Rt	0	0	0	2	2	3	3	4	Pass
Tigoni	00500	Lysol	28.4.04	0 hrs	1b	37	0	0	0						
						Rt	0	0	1	1	1	2	2	2	Pass

Rt = room temperature, 37°C= Incubation at 37°C

U = labor ward, Pnw Postnatal ward , w2 postnatal ward 2.

Appendix 2: CONSENT

2.1 CONSENT FORM (for the institution)

INFECTION CONTROL AND PREVENTION PRACTICES IN PUBLIC MATERNITY UNITS IN KENYA

A THESIS STUDY IN PARTIAL FULFILMENT OF THE MASTERS OF PUBLIC HEALTH (MPH) DEGREE OF THE UNIVERSITY OF NAIROBI

INVESTIGATOR
WAITHAKA PETER MUCHINA
(STUDENT DEPARTMENT OF COMMUNITY HEALTH UNIVERSITY OF NAIROBI)

I am conducting this study for the purpose of establishing the current infection control and prevention practices in the maternity units. Interviews and observation tools will be used for data collection as well as review of records for establishment of trends on morbidity and mortality related to hospital acquired infections. Disinfectants in-use samples will be collected for the purpose of testing their quality and effectiveness.

The aim of the study is to generate information for health care workers, administrators and planners on the status of infection control and prevention practices within the institutions. Secondarily the study aims to offer recommendations on improvement of the ICP practices. This is intended to contribute towards improved quality of care, occupational safety for health care providers and a safe working environment for patients/client care.

Your participation in the study will highly be appreciated, and the information offered will be treated with high confidentiality.

A copy of the study report will be presented to the Department of Community Health University of Nairobi and all the participating institutions. Copies will also be provided to the University of Nairobi library services for future reference.

I_____the overall in-charge /medical superintendent of the_____Hospital does give an informed and voluntary consent for the study to be undertaken in this institution.

Sign
Date

2.2 CONSENT FORM (for individual respondent)

INFECTION CONTROL AND PREVENTION PRACTICES IN PUBLIC MATERNITY UNITS IN KENYA

A THESIS STUDY IN PARTIAL FULFILMENT OF THE MASTERS OF PUBLIC HEALTH (MPH) DEGREE OF THE UNIVERSITY OF NAIROBI

INVESTIGATOR
WAITHAKA PETER MUCHINA
(STUDENT DEPARTMENT OF COMMUNITY HEALTH UNIVERSITY OF NAIROBI)

I am conducting this study for the purpose of establishing the current infection control and prevention practices in the maternity units. Interviews and observations tools will be used for data collection as well as review of records for establishment of trends on morbidity and mortality related to hospital acquired infections. Disinfectants in-use samples will be collected for the purpose of testing their quality and effectiveness.

The aim of the study is to generate information for health care workers, administrators and planners on the status of infection control and prevention practices within the institutions. Secondarily, the study aims to offer recommendations on improvement of the ICP practices. This is intended to contribute towards improved quality of care, occupational safety for health care providers and a safe working environment for patients/client care.

Your participation in the study will highly be appreciated, and the information offered will be treated with high confidentiality. If you decline to participate in the study, you will not be intimidated or coerced to do so under any circumstance.

A copy of the study report will be presented to the Department of Community Health University of Nairobi and all the participating institutions. Copies will also be provided to the University of Nairobi library services for future reference.

I_____have read and/ or explained and understood the nature of the study and do give an informed and voluntary consent for participation in the study.

Sign
Date

Appendix 3: DISINFECTANTS IN-USE TEST

Disinfectants when properly used are a powerful tool against sepsis. When used inappropriately it can be a costly affair not only because disinfectants are expensive but also because of the high cost of managing sepsis.

A study done in Malaysia indicated that up to 16% of fresh disinfectants obtained from pharmacy and ward stock were found to be contaminated with bacteria. This is alarming since these disinfectants were freshly prepared prior to actual use. It is ironic that the agents meant for preventing infection are themselves the vehicles for the spread of infections. Not surprisingly, there was a corresponding high failure rate in the "in-use" tests (VKE Lim, 2002). A range of unused disinfectants including alcohol, chlorhexidine and phenolics were contaminated with bacteria including *Pseudomonas aeruginosa,Acinetobacter and Flavobacterium.* These are common nosocomial pathogens. Similarly, a wide range of disinfectants failed the "in use' test. These included solutions of gluteraldehide, amphyl and chlorhexidine. Chlorhexidine 1:5,000 for instance had a failure rate as high as 81% (VKE Lim, **2002).**

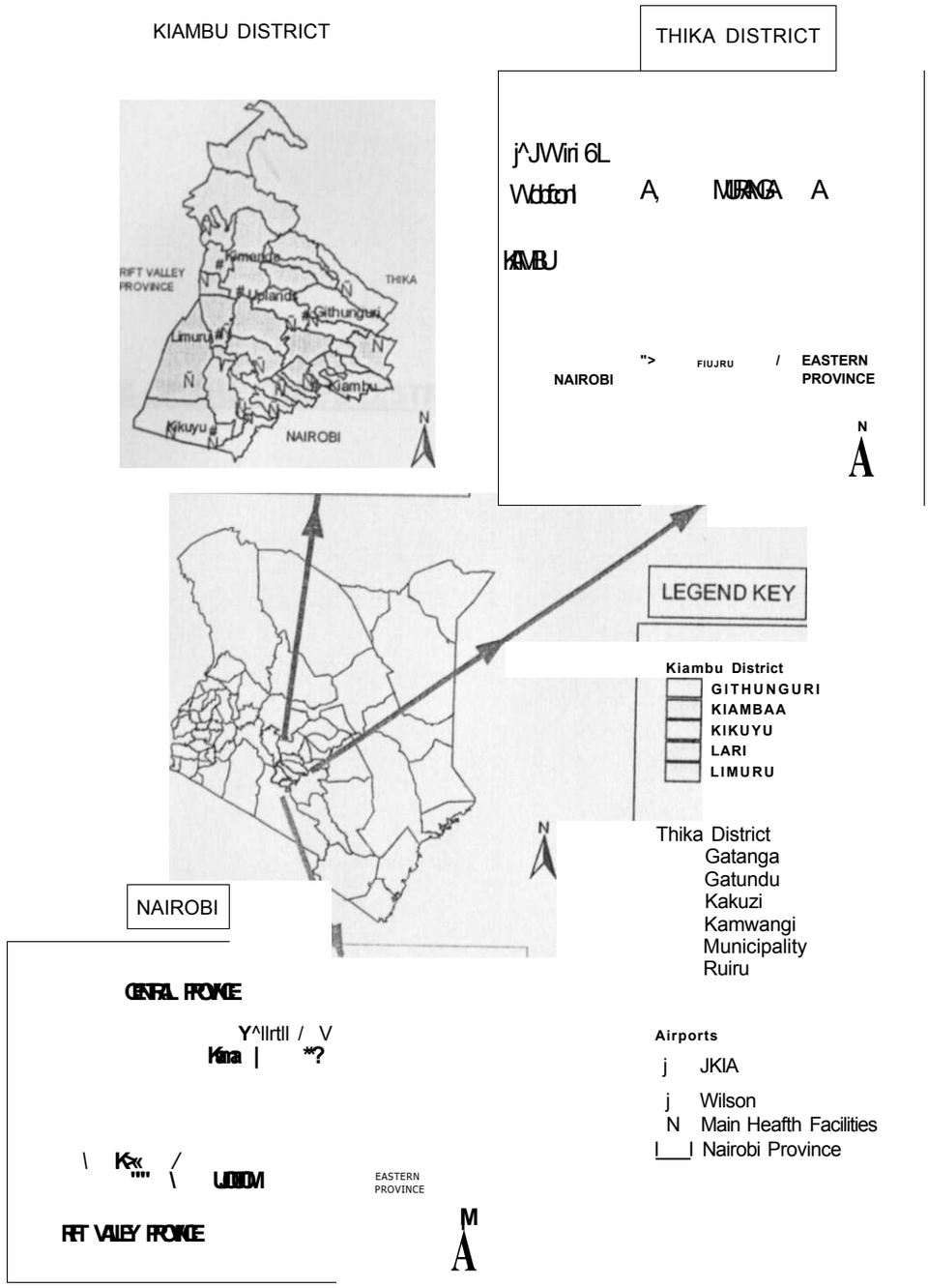
These results emphasis the importance of close monitoring of the preparation, storage and use of disinfectants. In many cases failure may result from improper preparations, concentration and dilution. Improper use could be another problem where the solution is subjected to a lot of soiled instruments without changing it, or where instruments are left not fully submerged in the solution for the required amount of time as per manufacturers recommendations. Storage of the chemicals can also cause some of the problems when the storage container is refilled without proper cleaning or is left open for a long time.

THE PROCEDURE

1. With a sterile pipette transfer 1 ml of the used disinfectants into 9ml nutrient broth in a sterile universal container 1:10.
2. Place 0.02ml drops of this mixture into ten different areas on well-dried nutrient agar plates.
3. Incubate one plate for 3 days at 37°C and other for 7 days at room temperature.
4. Failure of disinfection is indicated if there is growth in more than 5 drops on both or either plate (Mackie and Macartney 2000).

Appendix 4 Maps

4.1 MAP 1 STUDY AREA (KIAMBU AND THIKA DISTRICTS. NAIROBI)



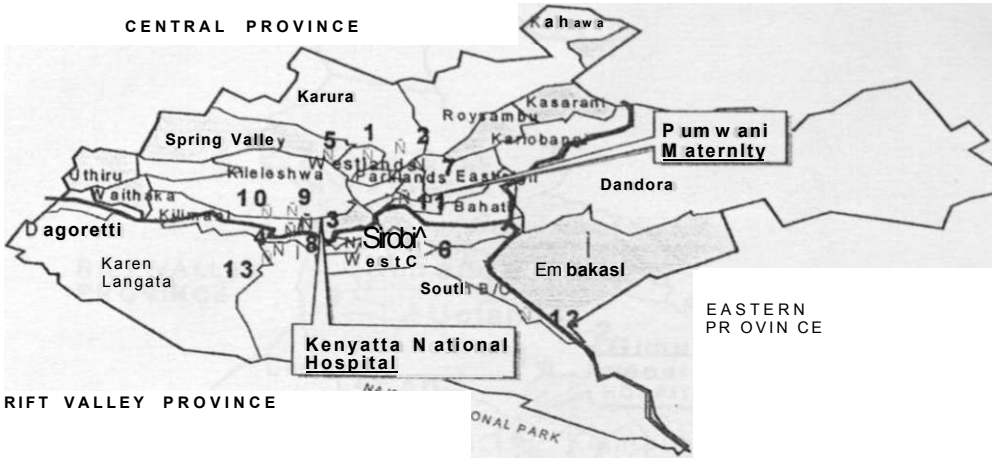
M

MAPS OF THE THREE DISTRICTS SHOWING VARIOUS HEALTH CARE FACILITIES

APPENDIX 4.1

MAP 2 STUDY HEALTH FACII ITIES. NAIRORI (KENYATTA and PUMWANI)

MAIN HEALTH FACILITIES, NAIR0BI



TEUT

Health facility type
- N Prlvate
- N Public

Main Health Facilities
- N 1 Aga Khan Hospital
- N 2 Gertrude Childrens Hospl
- N 3 Kenyatta National Hospit
- N 4 Langata Health Center
- N 5 M. P. Shah Hospital
- N 6 Mater Misericordiae
- N 7 Mathare Mental Hospital
- N 8 Mbagath1 District Hospit
- N 9 Nairobi Hospital
- N 10 Nairobi Women's Hospital
- N 11 Pumwani Maternlty
- N 12 St. James Hospital
- N 13 St. Mary's Hospital

Airports
- j JKIA
- | Wilson

Rail

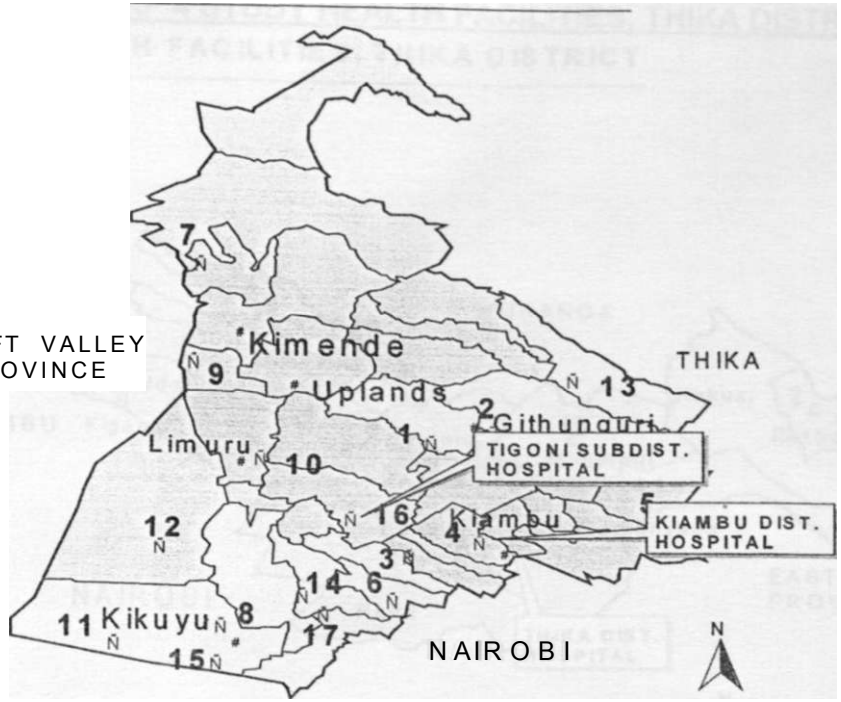
Province boundary

Map features and boundaries are approximate
Map design and layout by J. Karanja

APPENDIX 4.3

MAP 3 STUDY HEALTH FACILITIES KIAMBU **DISTP,nT (KIAMBU** and TIGONI))

MAIN HEALTH FACILITIES, KIAMBUDISTRTCT



Health facility type
- **Health Centra**
- **Hoapltal**
- **Nursing Home**

Maln health facilities
- **1 Glthlga H/C**
- **2 Glthungurl H/C**
- **3 Karurl H/C**
- **4 Klambu D/Hosp**
- **SKlgumo HIC**
- **6 Kiharа H/C**
- **7 Kljabe Mission**
- **8 Klkuyu Nursing Hornе**
- **9 LarlH/C**
- **10 Llmuru H/C**
- **11 Luslgettl H/C**
- **12 Ndelya H/C**
- **13 Ngewa H/C**
- **14 Nyathuna H/C**
- **15Thogoto Mlsslon**
- **16Tlgonl SubD 1st**
- **17 Wanglge H/C**

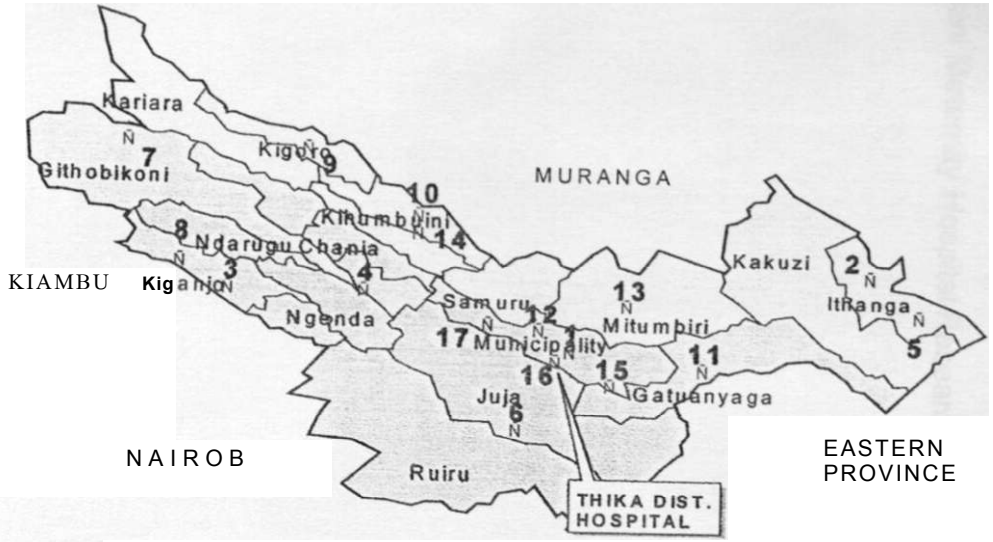
• **Towns**

Klambu dlvlslons
- **GITH UNG URI**
- **KIAM BAA**
- **KIKUYU**
- **LA RI**
- **LIM URU**

District boundary

Map features and boundaries are approximate
Map design and layout by J. Karanja

MAN HEALTH FACUHT^Wa DISTRIei



Health facility type

- N Dispensary
- N Health Centra
- N Hospital
- ft Nu rsing Horn*

Health facilities

- N 1 Chanla
- N 2 G lathan in i
- N 3 Gitare
- N 4 Ig eg an ia
- N 5 Ithanga
- N 6 Juja
- N 7 Kam wangi
- N 8 K iganjo
- N 9 Kigoro
- N 10 Kihumbuini
- N 11 K illm am bog o
- N 12 M em orlal
- N 13 Mitumblri
- N 14 PCEA Kihumbuini
- N 15 St. M ulu mba
- N 16 Thika D/Hospital
- Kl 17 Thika Nursing Ho

Thika District

- G a ta n g a
- Gatundu
- Kakuzl
- Kam wangi
- Mun icipality
- Rulru

District boundary

Appendix 5

Authorization documents

- Ministry of Education Science and Technology, research authorization.
- Ministry of Education Science and Technology, research permit.
- Ministry of Health, research authorization for Kiambu Thika and Tigoni Hospitals.
- Office of the President Provincial commissioner, Nairobi research authorization.
- Kenyatta National Hospital, Ethics and Research committee approval.
- Kenyatta National Hospital, H.o.D Obstetrics and gynaecology authorization.
- Pumwani Maternity Hospital Research and Ethical Review committee approval.

MINISTRY OF EDUCATION, SCIENCE AND TECHNOLOGY

Telegrams: "Education", Nairobi
Teleph**: Nairobi 334411
What replying please quote
Ref. No. MOEST 13/001/33C 354/2
tnil

JOCOO HOUSE "D"
HARAMBEE AVENUE
P.O. Box 30040
NAIROBI

8th December

Peter Muchina Waithaka
University of Nairobi
P.O. BOX 30197
NAIROBI

Dear Sir

RE: RESEARCH AUTHORISATION

Please refer to your application for authority to conduct research on 'infection Control and prevention practices in Public Maternity Units in Kenya, I am pleased to inform you that you have been authorised to conduct research in Nairobi, Kiambu and Thika Districts for a period ending 31st July, 2004.

You are advised to report to the Provincial Commissioner Nairobi, the Provincial Director of Education Nairobi, the District Commissioners and the District Education Officers of the respective Districts before embarking on your research project.

It is noted that the research is a requirement in part fulfilment for the award of Master of Public Health Degree by the University of Nairobi.

Upon completion of your research project, you are expected to deposit two copies of your research report to this Office.

Yours faithfully

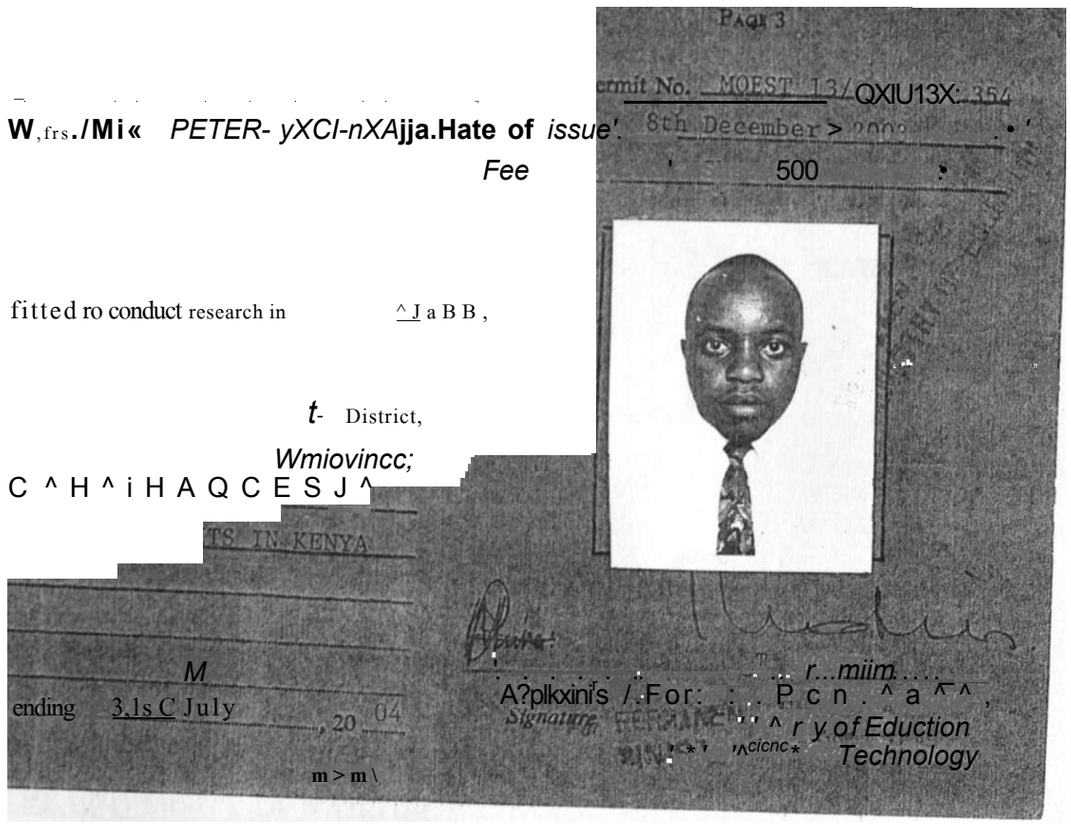
T. MOTURI

FOR: PERMANENT SECRETARY/EDUCATION

CC
The Provincial Commissioner
Nairobi
The Provincial Director of Education
Nairobi

The District Commissioenr
Thika
Kiambu Districts

The District Education Officer
Thika
Kiambu Districts



Page 3

ermit No. MOEST 13/ QXIU13X: 354

W,frs./Mi« PETER- yXCl-nXAjja.Hate of issue'. 8th December > 2000

Fee 500

fitted ro conduct research in ^ J a B B ,

t- District,

Wmiovincc;

C ^ H ^ i H A Q C E S J ^

TS IN KENYA

M

ending 3.1s C July , 20 04

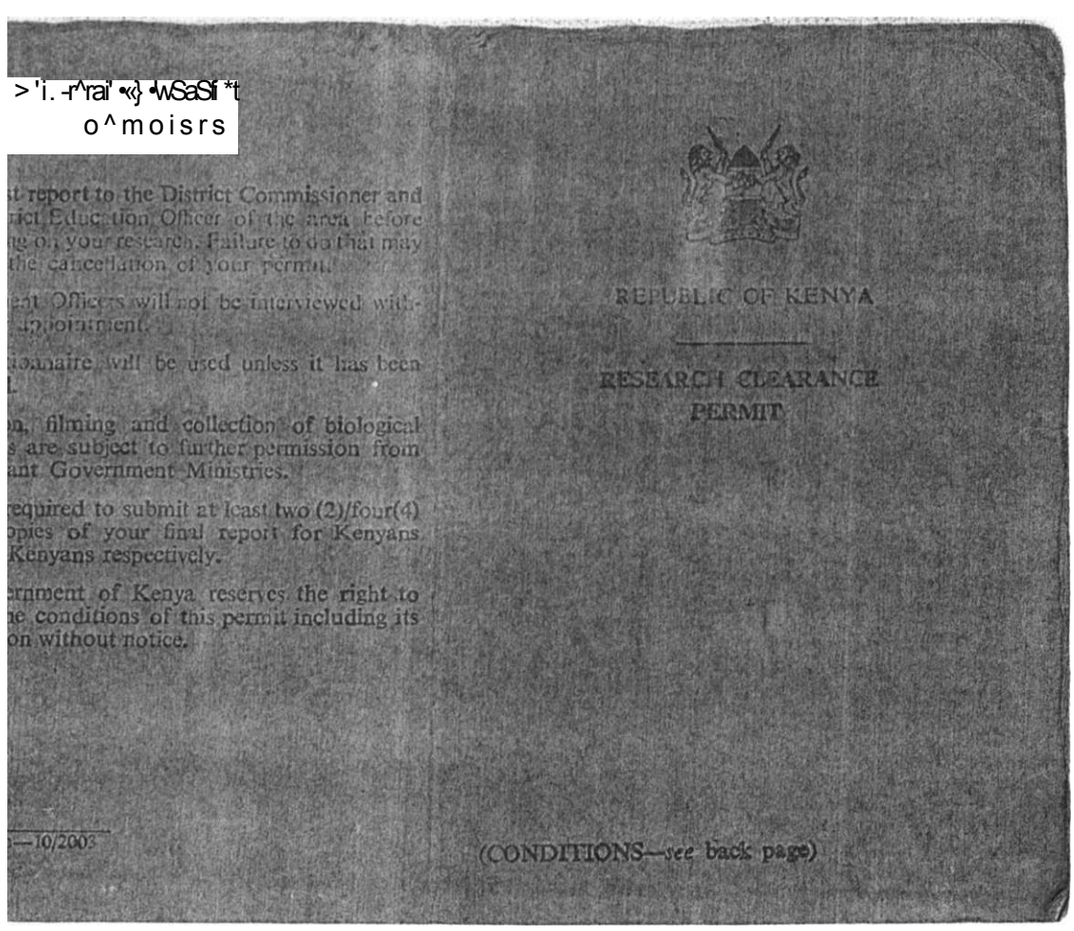
m > m \

r...miim....

A?plkxini's /.For: ... P c n . ^ a ^ ^ ,

^ r y of Eduction

Technology



> 'i. -r^rai' •«} •wSaSfi *t

o^moisrs

it report to the District Commissioner and rict Education Officer of the area before ng on your research. Failure to do that may the cancellation of your permit.

eat Officers will not be interviewed with- appointment.

ionnaire will be used unless it has been

n, filming and collection of biological s are subject to further permission from ant Government Ministries.

required to submit at least two (2)/four(4) pies of your final report for Kenyans Kenyans respectively.

ernment of Kenya reserves the right to ne conditions of this permit including its on without notice.

—10/2003

REPUBLIC OF KENYA

RESEARCH CLEARANCE PERMIT

(CONDITIONS—see back page)

MINISTRY OF HEALTH

Telegrams: "MINHEALTH" Nairobi
Telephone: Nairobi 717077
Fax: 271 3234

AFYA HOUSE
CATHEDRAL ROAD
P.O. BOX 30016
NAIROBI

12 January 2004

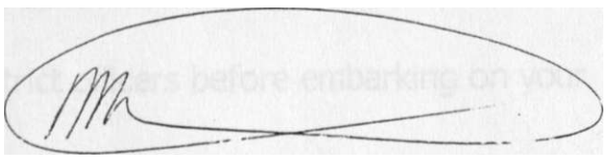
MED/GEN/1

Medical Superintendents
y/ KIAMBU
V THIKA
s/ TIGONI

DR. PETER MUCHIRJ WAITHAKA - MPH STUDENT
AT THE UNIVERSITY OF NAIROBI

The above post-graduate doctor wishes to undertake study of Infection Control and Prevention Practices in Public Maternity Units in Kenya at your hospitals.

Please assist him where possible.



DS F.M.KIM;JU
FOR: DIRECTOR OF MEDICAL SERVICES

cc

DMS

Provincial Medical Officer
CENTRAL

OFFICE OF THE PRESIDENT

Telegrams:
Telephone: **Nairobi 333551**
When replying please quote

Ref. NC ED; 12/'4fl' MXIX/109

PROVINCIAL COMMISSIONER
NAIROBI AREA
P.O. Box 30124-00100
NAIROBI

.16.th.P^e.^r..2003.... 20

All District Officers
NAIROBI AREA

RE: RESEARCH AUTHORIZATION
MR. PETER MUCHINA WAITHAKA

You have been authorized to conduct research on infection control and prevention practices in Public Maternity Units within Nairobi area.

Report to the respective District officers before embarking on your research projects.

The authority expires on 31st July 2004.

JOSPHAT SAGERO

PROVINCIAL COMMISSIONER
* NAIROBI AREA *
P.O. Box 30124, NAIROBI

For: PROVINCIAL COMMISSIONER
NAIROBI AREA.

KENYATTA NATIONAL HOSPITAL
Hospital Rd. along, Ngong Rd.
P.O. Box 20723, Nairobi.

Tel: 726300-9
Fax: 725272
Telegrams: "MEDSUP", Nairobi.
Email: **KNHplan@Ken.Healthnet.org**

Ref: KNH-ERC/01/2154 **Date: 12 February 2004**

Mr. Waithaka P Muchina
Dept. of Community Health
Faculty of Medicine
University of Nairobi

Dear Mr. Waithaka

RESEARCH PROPOSAL ' INFECTION CONTROL AND PREVENTION PRACTICES IN PUBLIC MATERNITY UNITS IN KENYA" (P142/11/2003)

This is to inform you that the Kenyatta National Hospital Ethics and Research Committee has reviewed and **approved** the revised version of your above cited research proposal for the period 12 February 2004 - 11 February 2005. You will be required to request for a renewal of the approval if you intend to continue with the study beyond the deadline given.

On behalf of the Committee, I wish you fruitful research and look forward to receiving a summary of the research findings upon completion of the study.

This information will form part of database that will be consulted in future when processing related research study so as to minimize chances of study duplication.

Yours sincerely,

PROF. A N GUANTAI
SECRETARY,.KNH-ERC

Cc Prof. K M Bhatt, Chairperson, KNH-ERC
The Deputy Director (C/S), KNH
The Dean, Faculty of Medicine, UON
The Chairman, Dept. of Community Health, UON
CMRO
Supervisors: Dr. Njoroge P K, Dept. of Community Health, UON
Dr. L Nyabola, Dept. of Community Health, UON
Dr. GRevathi, Dept. of Laboratory Medicine, KNH

Waithaka Peter Muchina.
Department of Community Health,
Faculty of Medicine,
University of Nairobi,
P.O. Box 19676,
Nairobi.
25th February 2004.

The Head of Department,
Obstetrics and Gynecology,
Kenyatta National Hospital,
P.O. Box 20723,
Nairobi.

Dear Sir,

RE: REQUEST FOR AUTHORITY TO CONDUCT MY THESIS STUDY ON " INFECTION CONTROL AND PREVENTION PRACTICES IN PUBLIC MATERNITY UNITS IN KENYA" IN THE OBSTETRICS AND GYNECOLOGY DEPARTMENT

I am a postgraduate student pursuing Master of Public Health (MPH) degree course, in the Department of Community Health University of Nairobi.

1 intend to conduct the study in five institutions namely Kenyatta National Hospital, Pumwani Maternity Hospital, Kiambu and Thika District Hospitals and Tigoni Sub district Hospital.

The study is descriptive in design and study tools include a checklist on infection control (ICP) practices, a questionnaire to members of staff, a disinfectant In-use test and records review (Copies of the tools are attached).

The Kenyatta National Hospital Ethical and Research Committee has reviewed the study proposal and approved it; a copy is attached.

The Deputy Director Clinical Services has also approved for the study to be conducted in the Hospital; a copy is attached.

Kindly I request for your authority to proceed with the implementation of the study tools in the labor ward and post natal wards. The study is to take place for 12 weeks in the months of February to May 2004.

Sincerely

Waithaka P.M.
MPH II

Authority granted
27/2/04

PUMWANI MATERNITY HOSPITAL

Tel: 02/6763291-4
Fax: 02/6762965

P.O. Box 42849
Code: 00100- GPO
Nairobi.

PUMWANI MATERNITY HOSPITAL RESEARCH AND ETHICAL REVIEW COMMITTEE

MR. PETER M. WAITHAKA
UNIVERSITY OF NAIROBI
DEPT. OF COMMUNITY HEALTH

JAN. 21CT 2004

RE: APPROVAL OF RESEARCH

It is our pleasure to inform you that your proposal entitled "*Infection Control and Prevention Practices In Public Maternity Units in Kenya* " has been reviewed and approved by the Pumwani Maternity Hospital Research and Ethics Committee.

The proposal has been reviewed on the research merit, ethical considerations, sampling, methodology and relevance to the care at our institution. The PMH -REC requires that you be supervised by a member of our management staff in the field to be studied. Your supervisor will be Dr. vi^^ftUy Please get in touch with him/her before you begin for him/her to orientate you.

The REC also requires that you **submit a copy of your final study/ thesis** on completion of research.

All the best as you carry out your research.

UNIVERSITY OF NAIROBI
MEDICAL LIBtiAMV

SJGNED:-

MEDICAL SUPERINTENDENT ---------- DATE---------22/1/04.

CHAIRMAN PMH RERC----------