



**THE CONTRIBUTION OF INFECTION CONTROL TO MINIMIZING
TUBERCULOSIS TRANSMISSION IN MBARARA MAIN PRISON -
UGANDA**

BY

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DECLARATION

This thesis is a presentation of my original research work. Wherever contributions of others are involved, every effort is made to indicate this clearly, with due reference to the literature, and acknowledgement of collaborative research and discussions.

Signed.....

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APPROVAL

We hereby declare that this thesis is for examination and it has been submitted with our approval.

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DEDICATION

This dissertation is lovingly dedicated to mummy, Mrs. Flora K. Bakesiima (RIP), for support, encouragement, and constant love sustained me throughout the hard times of my life. To my two adorable sons, Swithen Asiimwe and Seth Asiimwe and my supportive wife, Grace Kobusingye Novas Asiimwe for the support emotionally and psychologically.

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LIST OF ABBREVIATIONS

AIDS	Acquired immunodeficiency syndrome
CDC	Centers for disease control and prevention
DR-TB	Drug-resistant tuberculosis
HIV	Human immunodeficiency virus
ICRC	International Committee of the Red Cross
IPT	Isoniazid preventive therapy
LTBI	Latent tuberculosis infection
MDR-TB	Multidrug-resistant tuberculosis
MoH	Ministry of Health
NMS	National Medical Stores
NTLP	National tuberculosis leprosy control program
TB	Tuberculosis
TBIC	TB infection control
UPS	Uganda Prisons Services
UVGI	Ultraviolet germicidal irradiation
WHO	World Health Organization
XDR-TB	Extensively drug-resistant tuberculosis

ABSTRACT

The study, investigated the contribution of infection control measures to minimizing TB transmission in Mbarara main prison. It specifically looked at managerial, administrative and personal protective TB infection control measures on in minimising TB transmission in Mbarara main prison. The study adopted case study design, the study involved top management, staff members and health workers. The study used questionnaires and interviews and data was analysed to obtain descriptive and inferential statistics as well as expressions and narrative statements. In the study it was agreed that there is a positive significant relationship between managerial TBIC measures and TB transmission, also there is a positive significant relationship between administrative TBIC measures and TB transmission and it was also revealed that there is a positive significant relationship between personal TB protective measures TB transmission. It was therefore concluded that the facility has TBIC in place to control and monitor TB transmission, there are TBIC policies but they are not implemented, new inmates are not screened, stakeholders lack training, there is lack on ventilations in wards and personal protective gears. It was therefore recommended that convene meetings regularly, source for funds for capacity building on TBIC, put up isolation unit, put a policy in place for daily reports.

CHAPTER ONE

INTRODUCTION

1.0 Introduction

Tuberculosis (TB) is a major cause of morbidity and mortality in Ugandan prisons. The estimated TB prevalence is 654/100,000; almost double the national prevalence and accounts for 41.2% of the deaths among inmates (Onzivua, 2003). From 2009, TB infection control (TBIC) measures were piloted and scaled up in major prisons (UPS, Work Plan and Budget, 2009), but their contribution remains unknown to-date. This study therefore, was set out to examine the contribution of TBIC in minimizing TB transmission in Mbarara main prison. This chapter represents the background to the study, the statement of the problem, the purpose of the study, the objectives of the study, research questions, the hypothesis, conceptual framework, the scope, significance of the study, justification of the study and operational definition of terms and concepts.

1.1 Background to the Study

1.1.1 Historical background

Globally, TB infection control was neglected in policy and practice (WHO, 2009). Between 1985 and 1993 Centre for Disease Control and Prevention (CDC) and World Health Organization (WHO) noted increases in TB incidences, several outbreaks of TB strains resistant to available drugs (MDR-TB) in hospital and prisons (Pearson, 1992) and an unforeseen increase in the number of TB and HIV co-infected patients as well as an increase in TB cases among immigrants to USA and Europe (CDC, 2012). Health care workers and other patients contracted TB from hospitals (O'Donnell, 2010) as a result of overcrowding and lack of effective TB preventive measures (WHO, 2009). These prompted CDC and WHO to propose practical low

cost policy interventions to reduce the risk of transmission of TB (Scano, 2009) in 1994 and 1999 respectively.

The 1994 CDC policy interventions were implemented in health facilities in the USA and other high income countries (Manangan, 2000) resulting in a decrease in the number of TB outbreaks and health care associated TB transmissions to patients and health workers (Cook, 2003). Also, the different TB control programs were mobilized and they reversed the TB upsurge (MMWR, 2004).

Based on WHO reports, TBIC measures were not being implemented in Sub Saharan Africa and other low income countries. Beginning 2004, WHO and the USA Presidential Emergency Plan For AIDS (PEPFA) stated assisting countries develop individual TBIC guidelines, trained ministry of health leadership on critical elements of TBIC, extended technical advice on building designs of facilities and facilitated the implementation of TBIC measures. PEPFAR provided \$160 million funding for TB/HIV and TBIC activities each year. The WHO and PEPFAR, and other international partners and agencies, developed, piloted and rolled out a TBIC package for facilities i.e. video, job aides, PowerPoint presentations, facility assessments tool and posters (PEPFAR Report, 2013).

Efforts to control TB in Uganda started way back in 1965 when a National Tuberculosis Control Program was established. A combined program for TB and Leprosy was conceived in 1988 and the National TB and Leprosy Program (NTLP) started in 1990. Regardless of the various efforts like identifying case, providing improved diagnostic equipment like microscopes, formulating and disseminating guidelines, availing drugs for initiating patients on correct treatment, TB

remains a major public health problem. The country is among the 22 countries concentrating 80% of the TB burden in the world (Global TB Report, 2013) and since 1995, the case notification rate has been increasing yearly by 10 %. The increase in the disease burden has been fuelled by the onset of HIV, the emergence of MDR-TB and the transmission of TB within health facilities due to overcrowding and poor infrastructural design. This called for prevention strategies for TB since case detection and treatment had failed to eliminate the disease (NTLP Report, 2009).

With support from PEPFAR, the Uganda national TBIC guidelines were developed in 2010 and disseminated. Health workers in 12 pilot districts were trained by the Ministry of Health (MoH) to conduct facility risk assessments, develop TB-IC plans, and implement TB-IC activities. The MoH supported the reorganization of patient flow within health facilities, patient triage, and conducting health education to patients on cough etiquette to minimize TB transmission. In 2012, a review by the MoH of the TB-IC measures in 105 health facilities in the 12 districts revealed 70% of facilities had TB-IC plans, 95% had a TB-IC officer and 85% were separating coughers. Also, 81% were conducting health education on cough etiquette, and 90% were using the intensified case finding tools to assess patients living with HIV/AIDS for TB (WHO, 2013).

1.1.2 Theoretical background

This study was guided by the chain of infection theory credited to Ignaz Semmelweis in 1846 (Siegel, 2007), a basic component of understanding the process of infection, prevention and control of infection which is critical in infection control (Siegel, 2007). Each link in the chain must be present and in sequential order for an infection to occur.

The theory is relevant to this study in that it will help any reader understand the chain of TB infection or the factors/links that promote TB infection and how TBIC measures eliminate one or more of the links/factors. The reader will appreciate that TBIC activities eliminate one of the links in the chain of transmission of TB hence contributing to the reduction in infection in prisons like Mbarara main prison which is one of the main regional prisons in the country with a big prison population.

Understanding the characteristics of each link provides one with methods to prevent the spread of infection and knowledge of methods of self-protection. The links in the chain of infection are (i) an infectious agent, a germ (bacteria, virus, that causes an infection), (ii) reservoir, a place where an infectious agent lives and reproduces (humans, water, animals, food), (iii) portal of exit, a route of escape of a germ from the reservoir (nose and mouth by sneezing), (iv) mode of transmission, the way germs move from the reservoir to the new host (airborne), (v) portal of entry, route through which germ enters its new host e.g. damaged skin, and (vi) a susceptible host, a person who can get sick when they are exposed to a disease causing germ. Elimination of one of the links controls or prevents transmission of infections (Doshi, 2009).

The chain of infection process begins when (1) an infectious germ (2) leaves its host through (3) a portal of exit, (4) is conveyed by some mode of transmission, (5) enters another host through an appropriate portal of entry, and (6) infects a susceptible host. The now-infected susceptible host becomes a new reservoir and the whole process starts over (Siegel, 2007). If any link of the chain of infection can be broken, the spread of infection can be prevented (Doshi, 2009), this is the core function of infection control.

To prevent the spread of TB infection, WHO recommends managerial, administrative and environmental measures as well as personal protective equipment (Dharmadhikari, 2012) which break the links in the chain of TB infection (Damani, 2003). Administrative activities i.e. promptly identifying people with signs of TB, separating them from others and immediately testing them for TB and if proven to be with TB, they are started on treatment immediately, reduce the risk of spreading TB by infected people (CDC, 2012). Environmental controls ensure good ventilation hence reducing the concentration of TB germs (WHO, 2009). Ventilation relies on "free movement" of air through open doors and windows, use of fans or "open ventilation channels" to distribute air when windows and doors are closed and in poorly ventilated areas like prisons, ultra-violet rays, placed at the upper part of a room to avoid harming occupants, is used to kill TB germs. Respiratory protection in form of respirators, if fitted and used properly with no leakages around the face, will greatly reduce the chance of inhaling air with TB germs. Respirators are designed specially to filter TB germs (Jensen, 2005).

The final critical TBIC measure is the managerial activities. This ensures that the above mentioned measures are instituted, implemented, their implementation monitored and their impact evaluated. The measures include: a) having a facility TBIC committee to coordinate TBIC implementation, a facility TBIC plan, a TBIC focal person to enforce TBIC practices, a facility TBIC policy to guide implementation of the TBIC. b) Reorganizing the available spaces and renovating the existing facilities or construction of new ones to optimize implementation of TBIC. c) Periodically conducting on-site surveillance of TB disease among workers and assessing the facility on implementation of TBIC. d) Organizing and conducting health talks on TBIC to health workers, patients and visitors. e) Monitoring and evaluating the set of TBIC measures and f) Participating in research efforts to inform policy development (WHO, 2009).

1.1.3 Conceptual background

Infection control refers to interventions to prevent the transmission of infectious germs from infected persons to others. Infection control measures are based on understanding how different diseases are transmitted (WHO, 2009). Types of infection control precautions include: Standard precautions always be applied when dealing with patients regardless of whether one knows their infection or not. These precautions include hand washing, use of gloves, careful handling equipment and soiled linen, prevention of injuries, regular cleaning and spills management as well as appropriate handling of waste (Keith, 2008). Transmission-based precautions are applied in specific circumstances depending on transmission routes of various diseases e.g. air borne, droplet and contact precautions.

Tuberculosis infection control is a combination of measures aimed at minimizing the risk of TB transmission (defined as the passing of a communicable disease from an infected host individual or group to a conspecific individual or group, regardless of whether the other individual was previously infected) within populations (WHO, 2009). Data from high-income countries demonstrate that a well-designed and managed infection control (IC) program reduces the risk of TB transmission (Leonard, 2006).

For this study therefore, TBIC refers to interventions practiced in prisons to minimize the spread TB germs to other persons, for example from an infected inmate to another, from an infected inmate to a staff, from an infected staff to an inmate and also from an infected staff to a fellow staff.

The WHO recommends four types of infection control measures: managerial measures, administrative measures, proper ventilation and personal protective equipment (WHO, 2009),

these complement each other and should be used in combination. Managerial activities ensure political commitment and leadership. Facility level managerial activities should support and facilitate the implementation of the controls measures.

Administrative controls are strategies that reduce the risk of exposure to infectious TB germs by non-coughing patients. Administrative controls are to identify persons with TB symptoms, separate them into appropriate environment, fast-track them through the health care facility to reduce exposure time to others, and diagnose and treat them with minimal delay. Hospitalization should be reduced or avoided to the greatest extent possible. At facility level, administrative controls play a major role in reducing the risk of TB transmission and are essential for the implementation of other controls i.e. environmental controls and personal protective equipment (Joshi, 2006).

Environmental measures are strategies that reduce the concentration of infectious TB germs in the air by allowing clean air into rooms displacing infectious air. Ventilation should be prioritized by opening windows and doors and using fans. In high-risk settings, like prisons, where optimal ventilation cannot be achieved, properly designed, placed and maintained shielded ultraviolet irradiation devices should complement other measures (Corbett, 2007).

Personal protective equipment e.g. particulate respirators certified as N95 or FFP2 reduce the inhalation of infectious TB germs (McCarthy, 2007). Wearing respirators prevents individuals from inhaling TB germs in areas where the concentration of TB germs in the air cannot be adequately reduced by other measures.

1.1.4 Contextual background

Tuberculosis infection control measures developed for health-care facilities are also applicable to prisons (CDC, 2012). In prisons, the most important activity in TB infection control is efficient detection of TB patients, including those among persons entering the prison and those that arise during detention. A prompt diagnostic evaluation, isolation of those coughing, including transfer out of the facility if well ventilated isolation rooms are not available, and institution of a standard treatment regimen are urgent priorities when suspected cases are encountered (Harries, 1999). If this process is delayed, a substantial number of persons might be exposed as a result of the high congestion that characterizes correctional facilities (Stuckler, 2008).

Prisons in Uganda are overcrowded, currently their holding capacity is at 258%, this is above the actual capacity they were designed for (Ministerial Policy Statements, 2013/2014) and TB is the leading cause of mortality with about 200 deaths annually (Onzivua, 2003). To prevent further infections, in 2009, the Uganda Prisons started screening prisoners for TB upon entry. Those in detention are periodically screened for TB, those infected are isolated and HIV positive inmates with no symptoms are given TB preventive treatment (IPT) (UPS-UNODC, 2008).

Data from high-income countries demonstrates that a well-designed and managed infection control program reduces the risk of TB transmission (Leonard, 2006). The TB infection-control measures recommended by CDC in 1994 were implemented widely in the USA (Manangan, 2000) resulting in a decrease in the number of TB outbreaks reported to CDC (Cook, 2003). In 2004, case rates varied per 100,000 population from 1.0 to 14.6 (CDC, 2005).

In a modelling study that compared how TB infection control measures reduced the transmission of extensively drug-resistant (XDR) TB, defined as TB resistant to all available TB drugs (WHO,

2009), in Tugela Ferry a resource limited hospital in KwaZulu-Natal, South Africa, based on data obtained from the facility (Bock, 2007), it was established that if TBIC measures are not implemented, about 1300 XDR-TB cases could arise in Tugela Ferry by the end of 2012. Implementation of individual TBIC measures had limited effect if implemented alone but implementation of a combination of measures could avert nearly 50% (625 cases) of XDR TB cases over the next 5 years.

1.2 Statement of the problem

Tuberculosis has been documented in Ugandan prisons services (WHO Global TB Report, 2012). Wardens and visitors leave prisons every day and each year a total of 50,000 prisoners pass through Uganda's prisons (UPS Report, 2012). All these people are not subjected to any preventive measure and they bring TB home with them, to their families and neighbours and this could be fatal to them and other people.

To avert TB infections in prisons, from 2009 with the help of the International Committee of the Red Cross (ICRC), Uganda Prisons Services (UPS) started practices in major prisons that has medical screening of prisoners on admission, separating those symptomatic for TB, periodically conducting TB screening exercises, case recording and reporting, screening HIV positive inmates for TB then providing IPT to those with no TB symptoms, laboratory examinations for TB and treating the identified TB cases in accordance with the National guidelines (Human Rights Watch Report, July 2011). National guidelines were also printed and disseminated, for example, occupational health and safety, 2008, and TB Infection Control in Health Care Facilities, Congregate Settings and Households, 2010.

Despite the above measures, the estimated TB prevalence in Ugandan prisons is at 654/100,000 compared to the national prevalence of 154/100,000 population (Global TB Report, 2014) and TB has been documented to be responsible for about 200 deaths among in-mates in all the 235 prisons annually (Byabashaija, 2011). The continuation of such a situation may result into a catastrophe if not controlled hence need for such a study to empirically examine if TB infection control measures minimize the transmission of TB in prisons. This study, therefore, will examine the contribution of infection control in minimizing TB transmission in Mbarara main prison.

1.3 Purpose of the study

The purpose of this study was to investigate the contribution of infection control measures to minimizing TB transmission in Mbarara main prison.

1.4 Specific Objectives of the Study

In order to investigate the study, the researcher was guided by the following specific objectives:

- i. To examine the contribution of managerial TBIC measures to minimizing TB transmission in Mbarara main prison.
- ii. To examine the contribution of administrative TBIC measures to minimizing TB transmission in Mbarara main prison.
- iii. To examine the contribution of environmental TBIC measures to minimizing TB transmission in Mbarara main prison.
- iv. To examine the contribution of PPE in minimizing TB transmission to Mbarara main prison

1.5 Research questions

The study resolved the following questions:

- i. What is the contribution of managerial TBIC measures in minimizing TB transmission to Mbarara main prison?
- ii. What is the contribution of administrative TBIC measures in minimizing TB transmission to Mbarara main prison?
- iii. What is the contribution of environmental TBIC measures in minimizing TB transmission in Mbarara main prison?
- iv. What is the contribution of PPE in minimizing TB transmission in Mbarara main prison?

1.6 Hypotheses

- i. There is a positive significant relationship between managerial TBIC measures and TB transmission in Mbarara main prison?
- ii. Administrative TBIC measures significantly contribute to TB transmission in Mbarara main prison?
- iii. There is a positive a significant relationship between environmental TBIC measures and TB transmission in Mbarara main prison?
- iv. Personal protection equipment significantly minimize the risk of TB transmission in Mbarara main prison?

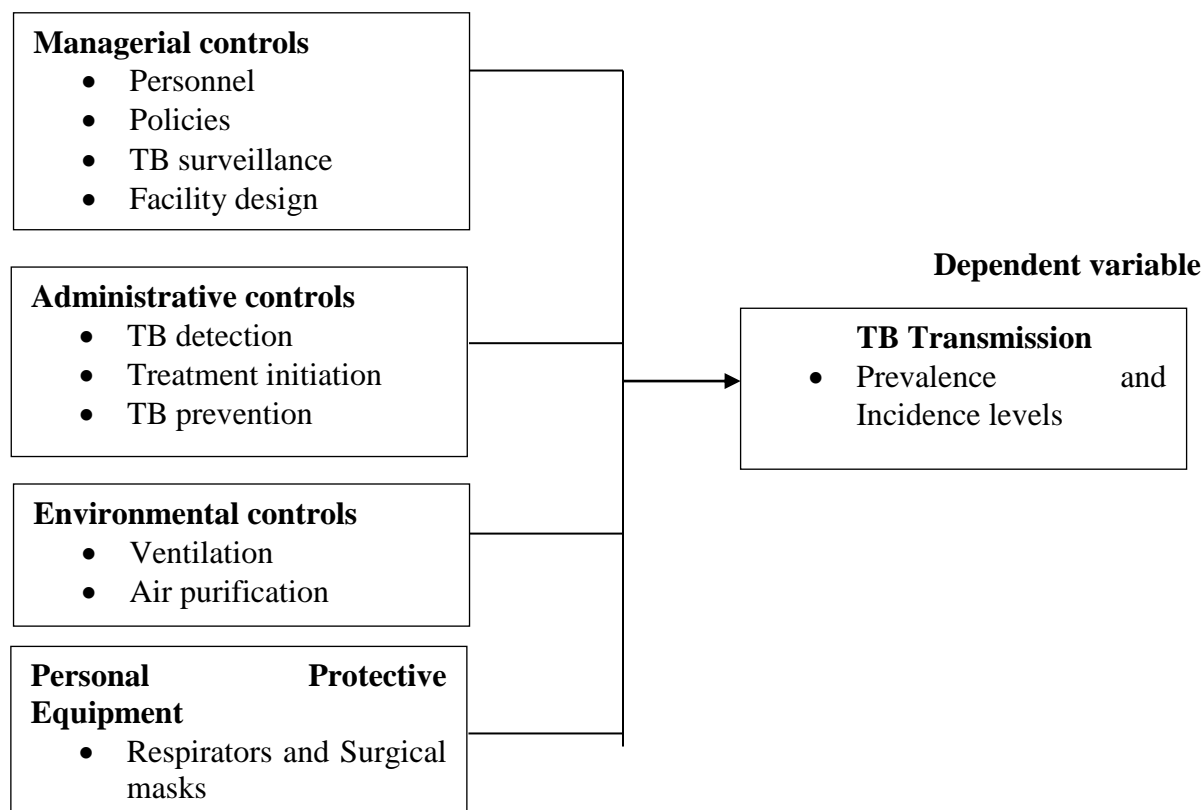
1.7 Conceptual Framework

The research presents both independent and dependent variables. Independent variables in this study are TB infection control measures. The dependant variable is TB transmission. In the conceptual framework the independent variable is organised into managerial controls that look at

the available trained personnel in TB infection control, policies on TB infection control process, surveillance models in place and facility design, these have a positive relationship with the level TB transmission. Also it is conceptualised that in administrative TB controls where TB detection is carried out effectively, treatment is initiation at the earliest time and TB prevention is well carried then TB transmission will be minimized. It is further conceptualised that in environmental controls i.e. with good and adequate ventilation and air purification means as well as availability and use of personal protective equipment like respirators and surgical masks, minimizes the level of TB transmission.

Figure 1: Conceptual framework

Independent Variable



Source: Adopted with modifications from Guidelines for Control of Tuberculosis in Prisons, 2009, TBCTA and International Committee of the Red Cross.

1.8 Significance of the study

Every year 50,000 people pass through Uganda's prisons, however, many prisons present with dangerously unhealthy conditions, ripe for the spread of TB. Prisoners grapple with overcrowding (UPS Report, 2012) which has led to insufficient sleeping space or sleeping in shifts, packing of prisoners together in cells with tiny air vents while their colleagues cough vigorously, limited supply of beds, uniforms, blankets and drugs. Water is also not always available, food, of low nutritional value is served only once a day, small jerry cans used to wash in toilets are also for drinking water and empty tins are used as toilets leaving a terrible smell in the wards. Such conditions have contributed to the spread of diseases, however, medical care is almost non-existent in many prisons and prisoners' health needs are assessed by medically unqualified wardens and officers (Human Rights Watch Report, 2011).

The results of this study are expected to be of value to the following:

Prisons Administration and Employees: The findings of the study are likely to enlighten prisons' employees on WHO recommended TBIC measures and how they contribute to minimizing TB transmission in prisons. Taking into considerations of the recommendations that will be made for this study this could be a basis for handling some of the challenges that are faced by Uganda Prisons Services employees in controlling TB infections in this facility.

Policy makers: As individuals charged with formulating policies especially at the ministries of Health, Justice and constitutional affairs and Internal affairs, their understanding of the importance of TB infection control measures remains a key task for them in reducing the transmission of TB. Therefore, findings from this study may help them in the formulation of better policies to reduce TB in prisons.

Community Members and prisoners: The study findings may enlighten some of the community members of the key TB infection control measures that should be practiced in prisons and their contribution to reducing the risk of transmission of TB in prisons if they are effectively implemented. These will be able to access the information through the resource centre of the prison facility since the researcher intends to leave a copy of the research at the prison facility for library purpose.

Literature source: The issues raised in this study are likely to lead to the involvement of various researchers in generating more knowledge from various perspectives. The findings of this study could form a basis for further research to those interested in finding more on how TB infection control measures can help reduce TB transmission in prisoners.

1.9 Justification of the study

The study aimed at establishing the TBIC measures being practiced in Mbarara main prison; establish if the measures are recommended by the national TB infection control guidelines and determine if the infection control measures practiced have contributed to minimising the transmission of TB in Mbarara main prison.

The study is expected to be a contribution to the Uganda Prisons Services and Ministry of Health body of knowledge in Uganda. Its findings are expected to benefit top management and policy makers of both Uganda Prisons Services and Ministry of Health that they is need for correctional facilities to adopt measures that greatly minimize the risk of transmission of TB.

1.10 Scope of the study

Content scope: The study endeavoured to establish any evidence of TB infection control in Mbarara main prison which forms the independent variable. The study established if there are any reductions in the number of reported TB cases, this forms the dependant variable. The moderating variables are the Ministry of Health Uganda National Guidelines for Tuberculosis Infection Control in Health Care Facilities, Congregate Settings and Households and the Uganda Prisons Services standing orders that guide the principles of doing work.

Time scope: The study covered the time frame from 2009 to 2013 so as to comprehensively follow the infection trends, cure and re-infections of which some of the TB patients fell within the subsequent years because TB treatment lasts for 8 months and more. It is at the start of 2009 that policies on TB infection control were put in place by authorities in Uganda Prisons Services with the help of International Committee of the Red Cross.

Geographical scope: The study focused on the employees of Mbarara main prison especially the officer in charge (O/C), the deputy officer in charge (D/OC) and the medical officers. Permission of a guided tour of the prison wards was sought, to ascertain the environmental controls in place.

1.11 Operational Definitions

Administrative controls: These include policies and procedures which promptly identify potential and known infectious cases of TB, separating and treating them with minimal delay.

Environmental controls: These are ventilation techniques that move and dilute air from TB-patient areas away from people without TB, by maximizing airflow through open windows and doors.

Managerial controls: These are activities that involve assessment, establishing coordinating bodies at all levels and planning and evaluating the performance of infection control interventions.

Mechanical ventilation: Ventilation created using an air supply or an exhaust fan to force air exchange and to drive airflow. Such ventilation works by generating negative or positive pressure in the room to drive air changes. To be effective, all doors and windows must be kept closed, with controlled air leakage into or out of the room.

Personal Protective Equipment (PPEs): These are personal protective equipment, such as respirators and masks that help to protect health workers from airborne transmission of TB.

Respirators: Special type of closely fitted face mask with the capacity to filter particles to protect against inhaling infectious droplet nuclei. The N95 respirator has a filter efficiency level of 95% or more against particulate aerosols free of oil when tested against 0.3 μm particles. The “N” denotes that the mask is not resistant to oil; the “95” refers to a 95% filter efficiency. The FFP2 respirator has a filter efficiency level of 94% or more against 0.4 μm particles and is tested against both oil and non-oil aerosol.

TB infection control: It is a combination of measures aimed at minimizing the risk of TB transmission within a population.

CHAPTER TWO

LITERATURE REVIEW

2.0 Introduction

Prisons carry an increased risk of TB transmission and exposure to inmates, staff and visitors (MMWR,2005).UPS with support from ICRC introduced screening of prisoners for TB upon entry, built the capacity of health workers to diagnose and treat TB patients according to NTLP-MoH guidelines, observe the dose given to patients, screen HIV positive inmates for TB and give IPT to those with no signs and symptoms as well as conduct periodic TB screening (UPS-UNODC, 2008), these are core activities in preventing the transmission of TB. This chapter will present a review of related literature on principles of TBIC and the contribution of the TBIC measures in minimizing TB transmission based on information collected from journals, books and legal instruments.

2.1 Managerial TBIC measures and their contribution to minimizing transmission of TB

Prevention of the spread of TB consists of a mixture of administrative, engineering and respiratory protection controls. Effective TBIC requires all three elements to be in place (Christopher, 2010). The three measures operate at different points in the TB transmission process and complement each other so, where feasible, they should be used as a combination (Uganda TBIC guidelines, 2010). For example, Yanai, (2003) noted that the introduction of multiple administrative, personal, and engineering controls in a hospital in Thailand resulted in a significant drop in the annual rate of latent TB infection (LTBI), the TB infection that has not yet developed into active disease, in health care workers from 9.3% to 2.2%. However, the incidence of TB disease in health workers showed a non-significant increase, from 179 to 252 per 100,000

populations, 1 to 2 years after initiation of these control measures because of the increase in HIV among health care workers which increased the TB incidence despite a fall in new infections.

Basu, (2007) used modelling to describe the potential impact of different administrative and engineering controls in the transmission of XDR-TB in Tugela Ferry. Although there are obviously limitations involved in interpreting modelling data, it is certainly worth noting that it was revealed that a combination of multiple interventions reduced the possible transmission of XDR-TB by nearly 50%, again highlighting the need for an integrated approach to TB prevention.

Although the literature is elaborate on TB infection control in health care facilities, it is silent on the contribution of infection control in minimizing tuberculosis transmission in prisons. This study will strive to fill this gap.

2.1.1 Administrative controls

Administrative control measures serve as the first line of defence against spread of TB. These measures include practices that promptly identify potential and known TB cases, separate and treat them with minimal delay. These controls, aimed at minimizing the exposure of persons to TB germs include triaging i.e. identifying persons with signs of TB, physical separation of TB patients or suspects, educating people on cough etiquette and minimizing time spent in health care settings (WHO, 2009). In one of the studies by Harries, (2002), he evaluated the impact of administrative control measures which were implemented in 40 district and mission hospitals in Malawi, following adoption of TBIC guidelines. Because the guidelines were not uniformly implemented, there was a non-significant decrease in TB prevalence after 1 year of implementing the measures.

Mathew, (2013) evaluated the efficiency of administrative measures in Inner-city hospital in Rio de Janeiro where suspected and confirmed TB patients were isolated, TB tests results were released early from the laboratory and health worker were educated on use of respirators. There was a reduction in the number of health workers that developed TB from 5.8/1000 to 3.7/1000 person per month after implementing the TBIC measures. The most significant reductions were observed in the intensive care unit, from 20.2 to 4.5, and clinical wards, from 10.3 to 6.0. Physicians and nurses had the highest reductions, from 7.6 to 0, from 9.9 to 5.8, respectively.

2.1.2 Environmental controls

Environmental controls are the second tier measure aimed at reducing the concentration of TB germs in the air through free air movement by increasing natural or mechanical ventilation by exhaust fans (Granich, 1999). Opening both windows and doors greatly improves natural ventilation (Escombe, 2007). Rooms should have openings in opposite sides that can be left open on all climates (Directorate General of Health Services, Ministry of Health and Family Welfare, 2010, New Delhi) and the openings should constitute more than 20% of floor area.

Basu (2007) used modelling to describe the potential impact of different administrative and environmental controls in the transmission of XDR-TB in Tugela Ferry, South Africa and noted that Improvements in natural ventilation was one of the most effective single measures in reducing transmission of XDR TB. Additional environmental controls include room-air recirculation units containing HEPA filters or UVGI (Granich, 1999) and negative air ionizers that charge airborne particles resulting in attraction to the ground hence clearance from the air, they also kill bacteria in the air (Fletcher, 2007).

The efficacy of UVGI and negative air ionization was evaluated at Hospital Nacional Dos de Mayo, Lima, Peru where air from an HIV-TB ward was subjected to both UVGI and negative air ionizers. Ionizers prevented 60% of TB infection and 51% of TB disease while UV lights prevented 70% of TB infection and 54% of TB disease meaning UV lights are more protective than ionizers. High Efficiency Particulate Air (HEPA) filters have a demonstrated to filter 99.97% of particles whose diameter is 0.3 micro meters (Vesley. 1995).

Escombe, (2007), compared the impact of natural and mechanical ventilation with negative pressure on reducing the risk of airborne contagion in eight hospitals in Lima, Peru. 5 were of “old fashioned” design built pre-1950, and three of “modern” design, built 1970–1990. In these hospitals 70 naturally ventilated clinical rooms where infectious patients are likely to be encountered were studied. These included respiratory isolation rooms, TB wards, respiratory wards, general medical wards, outpatient consulting rooms, waiting rooms, and emergency departments. These rooms were compared with 12 mechanically ventilated negative-pressure respiratory isolation rooms built after the year 2000. It was discovered that opening windows and doors allowed double the air changes than that of mechanically ventilated negative-pressure rooms ventilated and 18 times that with windows and doors closed. Old fashioned facilities, characterized by large windows and high ceilings, had greater ventilation than modern naturally ventilated rooms. The study predicted that, in mechanically ventilated rooms, 39% of healthy individuals would become infected following 24 hours of exposure to untreated TB patients compared to 33% in modern and 11% in old fashioned naturally ventilated facilities with windows and doors open.

The literature is elaborate on the contribution of the various environmental control measures in minimizing TB infection control in health care facilities but silent on the contribution of the same infection control in minimizing tuberculosis transmission in prisons. This study will strive to fill this gap.

2.1.3 Personal respiratory protective equipment

Respiratory protection refers to the use of respirators (N95 and FFP2) to protect the wearer from infectious droplet nuclei. Surgical masks are mouth and nose covers that prevent expulsion of relatively larger respiratory droplets. Patients should wear surgical masks and health workers should wear particulate respirators (WHO, 2007).

In a study on efficiency of surgical masks on reducing TB transmission performed at the Airborne Infections Research (AIR) Facility in eMalahleni, South Africa. 17 patients with pulmonary MDR-TB in an MDR-TB ward in South Africa wore face masks on alternate days. Ward air was exhausted to two identical chambers, each housing 90 pathogen-free guinea pigs that breathed ward air either when patients wore surgical face masks, intervention group, or when patients did not wear masks, control group. After 3 months, 76.6% control guinea pigs became infected, compared with 40% intervention guinea pigs, representing a 56% decreased risk of TB transmission when patients used masks. In conclusions, surgical face masks on patients with MDR-TB significantly reduced transmission and offer an adjunct measure for reducing TB transmission from infectious patients (Ashwin, 2011). The efficiency of an N95 respirator is 95%, with a real-world face-seal leakage rate of 0-39% (Makhaye, 2007) however, mask use is far more effective when combined with other strategies (Basu, 2007).

2.2 Summary of literature review

Numerous studies have shown that implementation of the recommended TBIC strategies have been associated with reduced outbreaks of TB (Menzies, 2007). Evaluation of the efficacy of TB I-C interventions, however, has been challenging because assessments often focus on process measures, however, reduction in transmission is more difficult to directly attribute causally to TB I-C strategies, although studies using guinea pigs to measure the infectiousness of air have been helpful. Furthermore, because multiple strategies are performed simultaneously, the effectiveness of individual TB I-C measures in reducing TB transmission is difficult to determine.

CHAPTER THREE

METHODOLOGY

3.0 Introduction

The chapter presents the methodology that was used to carry out the study. It presents the research design, study population, sample size, sampling methods, data collection methods and instruments, pretesting of instruments, procedure for data collection validity and reliability, data management and analysis, measurement of variables, ethical considerations and limitations of the study.

3.1 Research Design

The study used a case study design with both qualitative and quantitative approaches to make the findings more robust (Yin, 2004). The case study method was pertinent if a researcher wanted to illuminate a particular situation, to get a close i.e., in-depth and first-hand understanding of it (Shavelsonl, 2002). The case study design enabled the researcher report the actual TB infection control measures practiced and highlight the contribution of the measures in minimizing TB transmission in Mbarara main prison in detail. The quantitative data collection approach was used because it is based on variables with numbers and analyzed using statistical procedures (Creswell, 2003). Qualitative approach was used because it is aimed at getting data expressed in non-numerical terms (Amin, 2005), which data is thematically and descriptively analyzed.

3.2 Study Population

The study was carried out from Uganda Prisons Services of Mbarara main prisons. The study involved a total population of 71, categorized as 11 top management employees of prisons, 51 uniformed employees' and 9 health care workers(Source; UPS HRM department, Kampala). The choice of these people dwelt on the fact that they have been in the institution for a period of time therefore know how infection control has contributed to minimizing TB transmission in Mbarara main prison.

3.3 Sample Size and Selection

In the sampling process, Mugenda and Mugenda (2003), explains that it's impossible to study the whole targeted population and therefore the researcher has to decide on a sampled population. The sample size of the study was 80 as presented below in the table and was determined using Israel (1992) simplified formula as shown below.

$$n = \frac{N}{1 + N(e)^2}$$

Where N= population size

n=sample size

e=level of precision (0.05)

Table 1: Number of participants per category

Category	Population	Sample size	Sampling technique
Top management employees of prisons	11	11	Purposive
Health care workers	9	9	Purposive
Staff (uniformed and none uniformed)	51	45	Simple random
Total respondents	71	65	

Source: Primary Source

The sample size of the study consisted of 11 staff members of prisons management, 45 uniformed staff members and 9 prisons health care workers. As presented in the table above, these figures have been calculated from the main population sample size using the formula as stated above.

3.4 Sample Selection Method

The study used purposive sampling techniques to select top prisons management members and prisons health care workers. These were purposively visited in their respective offices at the prisons organization's headquarters since they are specific and known to the organization. Purposive sampling is a form of non-probability sampling (Polit & Hunglar, 1999, P284) that is used to select respondents that are specific and known. With this type, the sample is hand-picked for the research. Simple random sampling was also used to select uniformed staff members at the prisons offices. Lottery method was used to select uniformed staff members. A list of these people were sought from the human resource office and their names written on pieces of papers, put in a bucket shaken and the first 45 were considered to participate in the study. Random sampling was used because it helps in avoiding bias in selection of respondents.

3.5 Data Collection Methods

The study utilized both qualitative and quantitative data collection methods. Primary data was obtained using questionnaires as well as interviews. Secondary data was sourced from reading literature.

3.5.1 Questionnaire survey method

Questionnaire method involved the use of self-administered questionnaires to respondents in relation to how infection control has contributed to minimizing TB transmission in Mbarara main prison. In seeking for quantitative data, a closed ended questionnaire in a scale (5 likert) form was used. Questionnaire method was used because it helps to investigate motives and feelings in Likert scaling (Creswell, 1994).

3.5.2 Qualitative methods

To obtain qualitative data, interview (appendix 2) and document review (appendix 3) was applied.

3.5.2.1 Interview method

The interview method was used to explore qualitatively the influence of how infection control has contributed to minimizing TB transmission in Mbarara main prison. This method took the option of face to face interviews that sought to provide the required data as specified above. Interview method was used because it provides an excellent opportunity to probe and explore questions (Cress well 1994).

3.5.2.2 Document review method

A document review method was used in sourcing for secondary data in all relevant documents in relation to how infection control has contributed to minimizing TB transmission in Mbarara main prison. These were sourced from TB unit registers, TB laboratory registers, TB suspect registers and other relevant reliable sources.

3.5.2.3 Observation Method

An observation method was used in checking out the existence of key tangible aspects like the nature of ventilation, TB patients registers among others in Mbarara main prison.

3.6.1 Data collection Instruments

The instruments that were used included direct observations checklist (appendix 2), an interview guide (appendix 3) and a documents review guide for the data collected.

3.6.1 Questionnaires

The study used a 5-likert scale questionnaire (appendix 1) which was administered to non-uniformed staff members. The study had one set of questionnaire that were constructed to capture all the necessary information from all categories of respondents in respect to the themes of the study and each objective had at least 10 questions for purposes of intensive analysis of these objectives. The questionnaire was administered door to door since most of the respondents in this category are known. The Likert scale was used since they are very flexible and can be constructed more easily than most other types of attitude scales (Amin, 2005).

3.6.2 Interview guide

Face to face interviews with the help of an interview guide was conducted among top management and prisons health officers. The researcher believes that these people could provide rich information in regard to how infection control has contributed to minimizing TB transmission in Mbarara main prison. Interviews were used, since they are appropriate in providing in-depth data, data required to meet specific objectives, allows clarity in questioning and quite flexible compared to questionnaires.

3.6.3 Document review checklist

The study also carried out reviews of existing documents primarily on minutes of meetings of the TBIC committee, training certificates of the staff in TBIC, TBIC work plan, TB infection surveillance reports and TB screening schedule for staff and in-mates. The TB unit, laboratory and presumptive TB registers were reviewed for secondary data on TB cases, survey reports, strategic plans, minutes and data by other scholars in relation to how infection control has contributed to minimizing TB transmission in Mbarara main prison. This gave an overview of how much has been addressed in this line.

3.6.4 Observation Check list

The study used an observation check list to check for the existence of various aspects that are meant to be used in the TB control process like the existence of registers for example those screened on entry and those screened after wards.

3.7 Validity and reliability

The data collection tools were pretested on a smaller number of respondents from each category of the population to ensure that the questions are accurate and clear in line with each objective of the study thus ensuring validity and reliability.

3.7.1 Validity

The study adopted content validity which is the degree to which data collected using particular instruments represents a specific domain of indicators or content of a particular concept. Validity is the accuracy and meaningfulness of inferences, which are based on research results. It is the degree to which results obtained from the analysis of the data actually represents the phenomenon under study. Therefore validity looks at how accurately represented are the variables of the study (Mugenda, Mugenda 2003). To ensure content validity of instruments the researcher constructed the instruments with all the items that measure variables of the study. The researcher also consulted the supervisor for proper guidance after which the researcher pre-tested the instruments and after pre-testing ambiguous questions were removed or polished so as to remain with the finest data required.

3.7.2 Reliability

The study used Cronbach confident alpha in testing the reliability of instruments. According to Mugenda and Mugenda (2003), reliability refers to the measure of the degree to which research instruments yields consistent results after repeated trials. To ensure the consistency of the research instruments, Cronbach's coefficient alpha (α) was found to be 0.814 above 0.7 and the instrument was considered strong and the researcher proceeded to data collection as the instrument was considered reliable.

3.8 Procedure for Data Collection

The researcher obtained a letter of introduction from Uganda Management Institute (UMI) to help with introductions to various respondents. After the construction of instruments the researcher took them for approval to the supervisor and there after they were taken for pretesting in selected few respondents. The researcher carried out a pilot run on a participating group in the study. Pretesting was done by picking 20 respondents from the study and giving them the same approved questionnaires. Pretesting helped to know whether respondents interpret phrases and questions as the researcher wants them, it also helped obtain a general assessment of respondents' ability to perform required tasks (e.g. recall relevant information, estimate frequency of specific behaviours, etc.) and it also helped obtain ideas for question wording in case rephrasing of the original statements is needed.

3.9 Data Management and Analysis

Data yielded both qualitative and quantitative data. After respondents had answered questionnaires and interviews, raw data was cleaned, sorted and analyzed. Data analysis was done using the Statistical Package for Social Scientists (SPSS), which helped summarize the coded data and produce the required statistics in the study.

3.9.1 Quantitative data

In handling all the objectives of the study, the researcher used a computer package SPSS where data was entered, edited, cleaned and sorted. This program was used to do uni-variate and bi-variate analysis. Uni-variate analysis of these objectives was used to obtain descriptive data in form of frequencies, percentages, mean, variance and standard deviations since it was a five Likert questionnaire and this helped give the general response towards each question in the

Likert scale through the mean values. The relationships among variables were obtained using bivariate and multivariate analysis in form of correlation and regression analysis was used to ascertain the magnitude of effect the dependent variable had on independent variable. In correlation and regression analysis, the level of significance was, $P=0.05$.

3.9.2 Qualitative Data

Data analysis of qualitative data in the four objectives of the study used content analysis where each piece of work answered in the interview guide was read through thoroughly to identify themes where it belonged.

3.10 Measurement of variables

The independent variable in the study was infection control and dependent variable was TB transmission. In the dependent variable, infection control was looked at in regard to managerial controls, administrative controls environmental controls and personal protective equipment. The nominal scale was used in the measurement of variables in a Likert scale format which ranged from 1 to 5, strongly disagree, disagree, not sure, strongly agree and agree respectively.

CHAPTER FOUR

PRESENTATION, INTERPRETATION AND ANALYSIS OF RESULTS

4.1 Introduction

The study examined the contribution of infection control measures to minimizing TB transmission in Mbarara main prison. The study specifically looked at the contribution of managerial, administrative, environmental TBIC measures as well as PPE in minimizing TB transmission in Mbarara main prison. The study first presents qualitative results from interviews in form of quotations and descriptive statements and quotations and then descriptive results from questionnaire in form of mean to show the central tendency of responses in the likert scale questions. In each objective also inferential statistics in form of correlations and regressions are presented to show the nature of relationship between variables and the magnitude of effect the independent variables has on dependent variable. In this chapter also the response rate is presented to show the actual number of respondents that participated in the study from the anticipated number of respondents. The study also presents the background information of respondents to show respondents characteristics in the study and results are presented below.

4.2 Response rate

Table 2: Summary of study response rates

Category	Targeted respondents	No. actually involved	Percentage of response rate
Questionnaire			
Top prison management	11	10	91%
Staff members	45	45	100%
Subtotal	56	55	
Interviews			
Health care workers	9	8	90%
Subtotal	9	8	
Total	65	63	97%

Source: Primary data

The table explains the response rate of this study. A total number of 65 respondents were expected to participate in the study, but 63 respondents actually participated, representing a response rate of 97%. One did not participate in interviews sighting reasons for being and one top official was on an official duty somewhere else. This response rate is above the 60-70% response rate as recommended by the Guttmacher Institute, (2006) for a study to be considered with satisfactory results. To get high response rate there was high routine visit to the facility in order to meet all the appointments as they were made and constantly followed. Therefore, the study results can be relied upon for academic and non-academic purposes.

4.3 Background Information

In establishing the background characteristics of respondents, their gender was established because it would help in establishing the majority sex of respondents that participated in the study and the level of education helped to establish whether respondents would give views that are relevant and useful to the study and results are presented below.

4.3.1 Education Level

The study found out the level of education of respondents that participated in the study and the results are presented in table below.

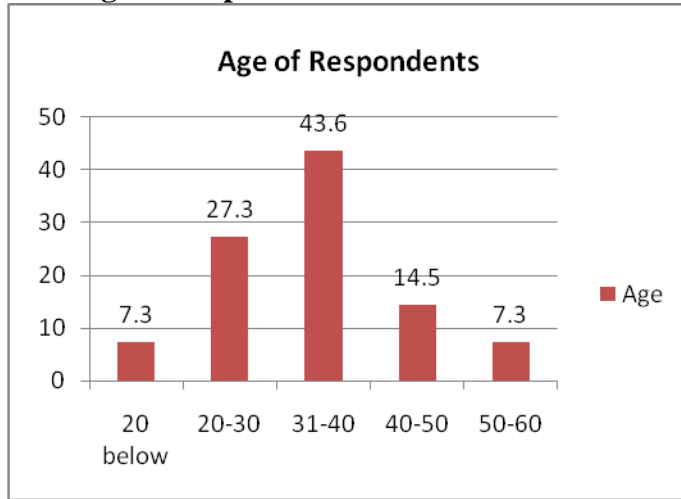
Table 3: Education Level

		Frequency	Valid Percent
Valid	secondary level	28	50.9
	Diploma	23	41.8
	Degree	3	5.5
	Masters	1	1.8
	Total	55	100.0

Source: Field data

In the education level, 50.9% of the respondents that participated in the study had a secondary level of education, 41.8% had diploma level of education, 5.5% had degree level of education and 1.8% had masters level of education. Therefore majority respondents had secondary level of education.

4.3.2 Age of Respondents



Source: Field data

Figure 2: Age of Respondents

From the figure above, it was revealed that 43.6% of respondents were aged between 31-30 years, 27.3% were aged between 20-30 years, 14.5% were aged between 40-50 years and 7.3% were aged between 50-60 and above and below 20 years respectively. From the findings, majority respondents were above the age of 25 years. This implies that participants were mature enough to provide relevant data required for the study and also majority are aware how TB control is done in the prisons facility.

Table 4: Period working with the facility

	Period	Frequency	Valid Percent
Valid	less than 2year	17	30.9
	2 to 4 years	22	40.0
	4 to 6 years	7	12.7
	more than 6 years	9	16.4
	Total	55	100.0

Source: Field data

In the study, it was revealed that 40% had worked in the prisons facility for 2-4 years, 30.9% said they had worked in the facility for less than 2years, whereas 16.4% had worked in the facility for more than 6 years and only 12.7% had worked in the facility for more than 6 years. The implication is that majority had worked in the prisons facility for more than 2 years, hence had good knowledge on how TB is controlled in the facility.

4.4 The Contribution of managerial TBIC measures to minimizing TB transmission in Mbarara main prison

The study examined how managerial TBIC measures contribute to minimizing TB transmission in Mbarara main prison. Respondents were involved in answering questionnaires and interviews. In this study the variable managerial TBIC measures was looked at in regard to personnel, policies, TB surveillance, facility design. Findings from interviews are presented first and then from questionnaires and results are presented below.

4.4.1 Interview Results

In interviews it was revealed that by mandate of ministry of health each prisons facility must have competent and skilled personnel in the TB control process in fact one of the respondents in the health facility commented that “.....*after a mentorship conducted by officials from NTLP, ministry of health, in April 2013, the prisons top management instituted a TBIC committee to*

oversee implementation of TBIC measures, although it is not very active because members do not meet regularly.....”

This implies that the facility implements Ministry of Health guidelines to ensure that there is a TBIC committee constituted by the right personnel to ensure that TB among all staff and inmates is detected at the earliest opportunity and treated early. However, it was revealed that these committee members do not meet regularly and this may increase the risk of TB transmission since the regular planning on the best ways to control the transmission of TB in the prisons facility.

It was also found that there are policies in place that are followed in the process controlling the transmission of TB in the prison as one of the members explained that

in April, 2013 the NTLF officials gave and disseminated the National TBIC guidelines, 2010, the prisons officials follow the guidelines to control TB transmission especially among inmates and other persons that use this facility. However most of these policies are not effectively functional as resources are not enough to implement them.

The facility has copies of the TBIC guidelines, these guide prisons staff on screening inmates and staff for TB, isolating those with signs and symptoms of TB in gazetted rooms, sending the sick prisoners to the laboratory and treating the confirmed TB patients immediately. However the implementation of these policies is greatly challenged by abrupt transfer of staff, the prison lacks an isolation ward for only TB patients, consumables like masks and respirators are not supplied to the prison and the TBIC committee is not very active to periodically review the

implementation of the policy. This leaves a huge challenge in the process to control the transmission of the TB infection in the facility and the country at large.

In the study it was revealed that staff members have been involved in a training regarding TB infection control and one of the health team members explained that

in our effort to ensure surveillance of TB transmission we have managed to train all health workers and other staff members in this facility and the prison has a schedule when all inmates, including those from other smaller prisons in Mbarara region are screened for TB signs and symptoms.

This implies that in an effort to control TB in the facility, staff have been trained on the signs and symptoms of TB and a strictly adhered to schedule is in place. This has helped curb the transmission of TB in the facility because possible inmates with TB are identified and those confirmed by a laboratory test are put on treatment immediately and isolated.

4.4.2 Descriptive results

In descriptive results from the questionnaires, the mean were computed in each question to show the average responses that ranged between 1-5 where; 1-2.4= disagreed, 2.5-3.4=neutral, 3.5-5=agree. In interviews, using thematic content analysis, results were analyzed according to the themes of study. From interviews, expressions and narrations that were relevant to the objectives of the study were captured and presented in their respective themes. Descriptive results are presented first and then triangulated with results from interviews and inferential statistics with correlations and regressions.

Table 5: Managerial TBIC measures to minimizing TB transmission

	Mean	Std. Deviation	N
Everyone is trained on TBIC in this institution	1.80	1.060	55
This institution has a functional and effective TBIC committee	3.73	1.027	55
Staff always give health talks to prisoners, patients and visitors on TBIC	2.44	1.607	55
TB infection risk assessments are done periodically by analysing number of infected with TB and HIV	1.98	1.027	55
Ministry of Health guidelines on TB control, TB infection control and TB/HIV co-management are implemented	2.05	1.433	55
The facility has a TBIC plan	2.07	1.136	55
There are TB registers at screening, diagnosis and treatment centres	2.20	1.177	55
Everyone is screened for TB, their medical records filed and are available	1.96	1.232	55
Everyone is periodically assessed for TB disease, their medical records are filed and available	1.55	.765	55
TB burden is periodically assessed by management to inform decisions on minimizing further TB infections	4.33	.747	55
The prisons wards are so spacious, they are never overcrowding	1.27	.757	55
The health facility is organized by the health workers avoiding overcrowding	1.22	.738	55
Management re-organizes the sleeping space in wards to avoid overcrowding that could increase chances of TB transmission	1.20	.970	55
Designs of prison wards consider prevention of TB transmission	1.44	.536	55
Valid N (listwise)			55

Source: Field data

In the study, it was revealed that there are various measures in place that control the transmission of TB in the facility. In this, it was disagreed that every staff and inmate is trained on TBIC in this institution (mean=1.80). This implies that staff members and inmates are hardly given any training on the best way to handle TB cases in the prisons facility. Therefore it means that staff

members are not trained on TBIC in this facility and this in the long run may result into larger numbers of infections.

In the study, it was agreed that the institution has a functional and effective TBIC committee (mean=3.73). As stipulated by Uganda National TBIC guidelines, every prison should have a TBIC committee to help control the spread of the disease. Despite the existence of this committee, it is not fully functional since the committee members hardly meet.

In the study, respondents disagreed that assessments of the threat of catching TB in the prisons community is done periodically by analyzing the numbers infected with TB (mean=1.98) and it was also disagreed that the staff always give health talks to prisoners, patients and visitors on TBIC (mean=2.44). This implies that the facility does not carry out any periodical assessments to identify new infections, treat them as well as identify ways of how to prevent new infections. This would largely reduce on the number of new infections and also contribute to reduced transmission levels. In the study, it was further revealed that there are no health talks given to prisoners to help them know about how TB is transmitted, treated and prevented.

It was further disagreed that that the facility has a customized TBIC plan (mean=2.07) and a complete and accurately filled registers at points of screening, diagnosis and treatment (mean=2.20). Findings reveal that there is no customized plan on any way of dealing with TB in this facility. The facility only follows ministries of health guidelines are also hardly fully implemented. The registers are in place, though they are not accurately filled to cover all the processes of TBIC process. This leaves a huge gap in effort to effectively control the disease in concentrated population of the prison authority.

In the study, it was disagreed that all prisoners and staff are screened for TB symptoms on the first day they report to the facility so as to document their initial TB status, have medical records filed and available (mean=1.96) and that all prisoners and staff are periodically assessed for TB disease, their medical records are filed and available (mean=1.550). This implies that not all prisoners are screened on entry and periodical assessment done to them for. To those who may be screened on entry no periodical assessments are done to check on their status, instead they are all medically examined like any other patients with any ailment. This does not only lead to increased risk of TB in the facility, but it also increased infection rates.

In the study, it was disagreed that prisons wards are so spacious, they always accommodate any number with no overcrowding (mean=1.27) and also that health facility is organized by the health workers avoiding overcrowding when patients come for health services (mean=1.22). This implies that most ward are not well spaced to comfortably accommodate all inmates. This implies that most facility rooms are overcrowded and can hardly accommodate all. Such overcrowding increases the risk of TB transmission in the facility.

4.4.3 Testing hypothesis one: There is a positive significant relationship between managerial TBIC measures and TB transmission in Mbarara main prison.

Results from a correlation analysis between managerial TBIC measures and TB transmission are presented in the table below.

Table 6: Correlation between managerial measures and TB transmission

Correlations			
		Managerial control	Transmission
Managerial Control	Pearson Correlation	1	.670**
	Sig. (2-tailed)		.000
	N	55	55
Transmission	Pearson Correlation	.670**	1
	Sig. (2-tailed)	.000	
	N	55	55
**. Correlation is significant at the 0.01 level (2-tailed).			

Source: Field data

From the above results, it's clear that there is a positive significant relationship between managerial controls measures and TB transmission. The correlation coefficient of .670 (**) with a significance value of .000 explain the nature of the relationship between the variables. Since the p.value is 0.000 lower than 0.01 the relationship is significant hence supporting hypothesis one which states that “There is a positive significant relationship between managerial TBIC measures and TB transmission in Mbarara main prison”.

4.4.3.1 Regression analysis

A single regression analysis was run between managerial controls measures and TB transmission and results are presented in the table below.

Table 7: A single regression analysis managerial control measures and TB transmission

		R=.670		R² = .449	
Model		Unstandardized Coefficients		Standardized Coefficients	Sig.
		B	Std. Error	Beta	
1	(Constant)	.735	.123		.000
	Managerial control	.248	.038	.670	.000
a. Dependent Variable: transmission					

Source: Field data

The results of the regression analysis in the table above indicate the coefficient of determination $R^2=0.449$ which shows that 44.9% variation in TB transmission is explained by changes in TB managerial controls. This implies that any changes in managerial controls would lead to 44.9% change in TB transmission levels. The results also show that TB managerial controls are significantly related with changes in TB transmission levels ($\beta =0.670$, $p<0.01$). This supports hypothesis one which stated that there is a positive significant relationship between managerial controls and TB transmission in Mbarara main prison. This means that improvement in managerial TB control measures is significantly and positively associated with reduced TB transmission levels.

4.5. To examine the contribution of administrative TBIC measures to minimizing TB transmission in Mbarara main prison.

The study examined contribution of administrative TBIC measures to minimizing TB transmission in Mbarara main prison. Respondents were involved in answering questionnaires and interviews. The variable administrative TBI control measures were looked at in regard to TB detection, treatment initiation, TB prevention.

4.5.1 Interview Results

In interviews, it was revealed that there are various loopholes in TB detection process in the facility especially among new inmates in fact one of the respondents explained that “.... *in our facility here we lack screening of new, immediately on their first day and other routine and regular screening for TB of other inmates in the facility....*”

This therefore implies that inmates are not screened on their first day of entry into the facility, neither is there routine screening of other inmates in the facility. This poses a great danger to

other inmates in the facility to contract the disease. Routine and on entry screening for TB would help to identify and immediately start such inmates on treatment and if effectively done it would significantly lead to reduced levels of TB prevalence in the facility.

It was further revealed that there are significant weaknesses in the TB prevention process as it was revealed that there is less capacity building on TB prevention among inmates and one of the respondents explained that *“...no training is provided to inmates on the best practices of preventing TB amongst themselves and this poses a great danger towards increased TB prevalence rates among inmates...”*

Inmates are not provided with the best practices on the TB prevention transmission process. Training of inmates on the best practices of how to prevent the disease helps them to know to identify those who are coughing un normally and reporting them immediately and helping such people to be started on treatment immediately and other how to deal with other key aspects on TB and this would largely reduce on the prevalence rates of TB in the facility.

4.5.2 Descriptive Results

In questionnaires, the mean were computed in each question to show the mean responses that ranged between 1-5 where; 1-2.4= disagreed, 2.5-3.4=neutral, 3.5-5=agree. In interviews, using thematic content analysis, results were analyzed according to the themes of study. From interviews, expressions and narrations that were relevant to the objectives of the study were captured and presented in their respective themes. Descriptive results are presented first and then supplemented with results from interviews and inferential statistics with correlations and regression results.

Table 8: Administrative TBIC measures to minimizing TB transmission

	Mean	Std. Deviation	N
The facility has active cough monitors who identify coughing patients early	2.00	.839	55
Coughing patients are identified, separated from others and their samples immediately taken to the lab	1.31	.663	55
Patients' samples are immediately examined in the lab and results delivered to doctors	4.16	1.721	55
TB patients are started on correct treatment the day they are diagnosed	4.58	.956	55
The facility always has anti TB medicines	3.98	1.254	55
Health workers treat TB patients immediately and know the correct regimen	4.00	1.374	55
A cough monitor identifies coughing patients and immediately separates them others not coughing	1.05	1.061	55
There is a TB isolation ward	1.98	1.421	55
There is a staff who gives health talks to people on good coughing manners	2.18	1.234	55
There is a staff that counsels all people in the prison to diagnose for TB if they suspect they have TB and HIV testing	2.07	1.230	55
Valid N (listwise)			55

Source: Field data

In the study, it was disagreed that the facility has very active people who look out for and identify prisoners, staff and visitors who are coughing as early as possible (mean=2.00). It was further disagreed that coughing prisoners, staff and visitors identified are given a sample container as soon as they are separated to provide a sputum sample that is immediately taken to the laboratory for tests to be performed on it (mean=1.31). From the disagreements it implies that sick coughing are only identified when they report to the facility clinic for treatment not being identified in any other way like staff members that may keep looking for the coughing individuals.

It was however agreed that the sputum samples from the coughing prisoners, staff and visitors brought to the laboratory are immediately examined for TB germs and the results are delivered to doctors immediately by a laboratory staff (4.16) and the TB patients identified are started on the correct treatment for TB by the health care workers on that very day the prisoner, staff or visitor has been confirmed to have TB (4.58). This implies that the process of examination for those suspected to be having the disease is done faster to help stop the risk and patients are started on the treatment started on treatment to help improve the health of such persons. If effectively done this would reduce significantly on the TB transmission levels in the facility.

In the study it was revealed that in the treatment process it was agreed that the facility is always supplied with all the anti TB medicines that are not expired and it never experiences stock out (mean=3.98). It was further agreed that the health care workers are always on duty to start the newly identified TB patients on TB treatment immediately and are knowledgeable about the correct TB regimen (mean=4.00). This implies that the supply of the TB medicines is well done to the facility and staff members have the willingness to administer such medicines to patients. This willingness and availability of drugs put in place high chances in place of reducing the TB transmission rates in the facility if all TB suspects are identified in time.

However, it was disagreed that always the coughing prisoners, staff and visitors that have been identified by the active cough monitor are immediately taken to a separate area to sit away from others who are not coughing (mean=1.05). It was also disagreed that facility has a separate isolation ward for only TB patients were they are admitted while on treatment so that they do not infect other inmate (mean=1.98). This implies that the facility has no specific isolation wards for

all its TB suspected patients. This poses a big risk to the rest of the facility members and this increases the risk of TB infections among inmates.

In the study, it was disagreed that the facility has a very active member who always gives health talks to prisoners, staff and visitors on cough manners of covering one's mouth while coughing, wearing masks and to avoid spitting (mean=2.18). Also it was disagreed that there is a very active counsellor that gives all prisons staff appropriate information and encourages them to undergo TB diagnostic investigation if they have signs and symptoms suggestive of TB and also information and encouragement to undergo HIV testing (mean=2.07). This implies that the facility has no active information dissemination team that is supposed to be on standby to sensitize facility community members on the key aspects regarding transmission and control of TB. The absence these imply that inmates will have less information regarding the disease and this puts them at high risk of contracting it an aspect that results into dire consequences.

4.5.3 Testing hypothesis Two: Administrative TBI control measures significantly contribute to TB transmission in Mbarara main prison.

Results from a correlation analysis between administrative TBIC measures and TB transmission are presented in the table below.

Table 9: Correlation between Administrative TBI control measures and TB transmission

Correlations			
		transmission	Administrative controls
Transmission	Pearson Correlation	1	.641**
	Sig. (2-tailed)		.000
	N	55	55
Administrative controls	Pearson Correlation	.641**	1
	Sig. (2-tailed)	.000	
	N	55	55
**. Correlation is significant at the 0.01 level (2-tailed).			

Source: Field data

In the study, it was revealed that there is a positive significant relationship between administrative TBIC measures and TB transmission in Mbarara main prison. The correlation coefficient of .641 (**) with a significance value of .000 explain the nature of the relationship between the two variables. Since the p.value is 0.000 lower than 0.01 the relationship is significant hence supporting hypothesis one which states that “There is a positive significant relationship between administrative TBIC measures and TB transmission”.

4.5.3.1 Regression analysis

A single regression analysis was run between administrative control measures and TB transmission and results are presented in the table below.

Table 10: Single regression analysis was run between administrative control measures and TB transmission

		R=.641		R²=.441		
Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig.
		B	Std. Error	Beta		
1	(Constant)	.777	.126		6.173	.000
	Administrative controls	.212	.035	.641	6.076	.000
a. Dependent Variable: transmission						

Source: Field data

From the table above, regression results were obtained with a coefficient of determination $R^2=0.441$ which shows that 44.1 % variation in TB transmission is explained by changes in TB transmission. This implies that any changes in TB administrative control measures would lead to 44.1% chance change in TB transmission levels. In the study results confirm that administrative measures in the TB control process is significantly related to its transmission ($\beta=0.730$, $p<0.01$). This supports hypothesis two which stated that there is “a positive significant relationship between TB control administrative measures and TB transmission in Mbarara main prison”.

4.6 To examine the contribution of environmental TBIC measures to minimizing TB transmission in Mbarara main prison.

In the study, from interviews, expressions and narrations that were relevant to the objectives of the study were captured and presented in their respective themes. Results from interviews and questionnaires were obtained and results are presented below.

4.6.1 Interview Results

In the study, it was revealed that in the effort to control the transmission of TB in the facility, there are both in built ventilation systems in the facility, in this one of the respondents explained that “..... inmates in the facility, when in doors largely survive on in built ventilation systems that include doors, windows and ventilators, however these are not enough to provide enough aeration since the occupants in each room are always many.....”

Therefore that the ventilation in place is not enough to allow inmates comfortably live in the facilities provided to them. This implies that with poor aeration in their respective areas of residence, there are high chances of catching TB in case of any suspects in the facility and this has the potential of largely increasing the TB infection rates.

It was also revealed that the facility does not have the required resources to procure or buy new fans that can help improve on the aeration of the facility; in fact one of the respondents explained that “.....the facility does not have enough resources to buy air conditioning system in all facility accommodation units of inmates”

There is basically lack of resources to improve on the aeration system of the facility. The presence of air conditioned facilities would help in improving on aeration in the facility premises so as to control the transmission of the disease in the facility.

4.6.2 Descriptive Results

The variable environmental TBIC measures were looked in regard to resource availability, resource amounts and resource usage. In questionnaires, the mean were computed in each question to show the mean responses that ranged between 1-5 where; 1-2.4= disagreed, 2.5-

3.4=neutral, 3.5-5=agree. Using thematic content analysis interview, results were analyzed according to the themes of study. Descriptive results are presented first and then triangulated with results from interviews.

Table 11: Descriptive results on the contribution of environmental TBIC measures to minimizing TB transmission

	Mean	Std. Deviation	N
Wards are very well ventilated, they have large windows on opposite walls	2.25	1.308	55
Exhaust fans are installed to extract contaminated air out of wards	2.76	1.360	55
The exhaust fans installed are periodically maintained	2.44	1.058	54
Wards have bulbs emitting ultra violet rays and air circulation system with filters that kill TB germs	3.27	1.326	55
These addition devices installed are routinely serviced and maintained	3.73	1.521	55
Valid N (listwise)			54

Source: Field data

In the study, it was disagreed that all prisoners wards, the isolation ward for prisoners suspected to have TB or those that have not yet been screened for TB, the sickbay and the health facility are well ventilated because they have very large openable windows and ventilators on opposite sides of walls and doors that are kept open during the day (mean=2.25). This implies that the sick bay and the rest of the wards and are not very well ventilated to allow good aeration. Good aeration of these places implies that inmates will be able to avoid contaminated air that may increase the risk of TB transmission.

It was also disagreed that all prisoners wards, the isolation ward for prisoners suspected to have TB or those that have not yet been screened for TB and the sickbay have air purifying devices such as bulbs emitting ultra violet rays and air circulation system with filters to kill TB germ (mean=1.27). This implies that in the effort to enforce environmental TB infection control

measures the facility does not use air purification devices to help in reducing on the air contaminations within the health facility, so as to reduce on the level of TB transmission in the facility.

In the study, it was also disagreed that there are addition devices installed and are routinely serviced and maintained, there is a service schedule, a service contract and the maintenance activities done are documented, filed and are available (mean=3.73). This implies that there are hardly any additional services installed in the prison wards to help in the aeration of the place.

4.6.3 Testing hypothesis Three: There is a positive a significant relationship between environmental TBIC measures and TB transmission in Mbarara main prison.

Results from a correlation analysis between environmental TBI control measures and TB transmission and results are presented in the tables below.

Table 12: Correlation between environment TBIC measures and TB transmissions

Correlations			
		Transmission	Environmental
Transmission	Pearson Correlation	1	.730**
	Sig. (2-tailed)		.000
	N	55	55
Environmental	Pearson Correlation	.730**	1
	Sig. (2-tailed)	.000	
	N	55	55
**. Correlation is significant at the 0.01 level (2-tailed).			

Source: Field data

As indicated in the table above there is a positive significant relationship between environmental TBIC measures and TB transmission. The obtained correlation co-efficiency of .707 (**) with a

significance value of .000, explains the positive nature of relationship that exists between environmental TBI control measures and TB transmission. Since the p.value is 0.000 is smaller than 0.01 the relationship is significant hence supporting hypothesis three that “environmental TBIC measures significantly influences TB transmission in Mbarara main prison”.

4.6.3.1 Regression Analysis

A single regression analysis was run between environmental TBI control measures and TB transmission and results are presented in the table below.

Table 13: Environmental TBIC measures and TB transmission

		R=.730		R²=.534		
		Unstandardized Coefficients		Standardized Coefficients		
Model		B	Std. Error	Beta	t	Sig.
1	(Constant)	.780	.101		7.759	.000
	environmental	.220	.028	.730	7.787	.000
a. Dependent Variable: transmission						

Source: Field data

Results in the regression table above was obtained with a coefficient of determination $R^2=0.534$ which shows that 53.4% variation in TB transmission is explained by changes in environmental TBIC measures. This implies that any changes in environmental TBIC measures would lead to 50% chance change in TB transmission. In the study results confirm that environmental TBIC measures are significantly related to reduced levels of TB transmission ($\beta=0.707$, $p<0.01$). This implies that well ventilated and aerated premises contribute significantly to reduced levels of TB transmission in the facility.

4.7 Personal protection TBIC measures significantly contribute to TB transmission in Mbarara main prison.

The study also established how personal protection TBIC measures have influenced TB transmission and results in both interviews and questionnaires were obtained and are reported below.

4.7.1 Descriptive results on personal protection equipment

Table 14: Results on personal protective equipment

	Mean	Std. Deviation	N
The facility always receives surgical masks and respirators from NMS	4.31	.466	55
Masks are given to coughing patients, respirators to staff managing TB patients	1.45	.503	55
Staff are periodically taken through a respirator fit testing exercise	3.75	1.336	55
Valid N (listwise)			55

Source: Field data

In the study, it was agreed that the facility always receives both surgical masks and respirators from National Medical Stores and these are always available (4.31). This implies that there is a steady and effective in coming of supplies that are supposed to be used in personal protection against TB transmission in this facility. When these aspects are effectively used they hold high level chance of reducing on the transmission of TB infection.

It was also disagreed that surgical masks are strictly given to and are only used by all coughing patients while respirators are strictly given to and are only used by staff especially those escorting TB patients who need referral to a more advanced hospital for TB testing and treatment and visitors to the TB isolation ward (mean=1.45). Not all patients are given surgical masks, but it's a few cases that may be given surgical masks and this leaves the rest of the patients at risk.

It was though agreed that all staff are periodically taken through a respirator fit testing exercise to help determine the respirator model and size that best fits the wearer, this ensures the user knows when the respirator fits properly and confirm that the wearer can don the respirator properly to achieve a good fit (mean=3.75). This implies that though it may take long, but staff members are taken through a respirator for a fit testing exercise which is healthy to minimise new infections.

4.7.2 Testing hypothesis Three: Personal protective equipment significantly minimize the risk of TB transmission in Mbarara main prison.

Results from a correlation analysis between personal protection equipment and TB transmission and results are presented in the tables below.

Table 15: Correlation between Personal protective equipment and TB transmission

Correlations			
		transmission	Personal protective
Transmission	Pearson Correlation	1	.683**
	Sig. (2-tailed)		.000
	N	55	55
Personal protective	Pearson Correlation	.683**	1
	Sig. (2-tailed)	.000	
	N	55	55
**. Correlation is significant at the 0.01 level (2-tailed).			

Source: Field data

As indicated in the table above there is a positive significant relationship between personal protection TBI control measures and TB transmission. The obtained correlation co-efficiency of .683 (**) with a significance value of .000, explaining the positive nature of relationship that exists between Personal protection TBIC measures and TB transmission. Since the p.value is 0.000 is smaller than 0.01.

4.7.2.1 Regression Analysis

A single regression analysis was run between Personal protection TBIC measures and TB transmission results are presented in the table below.

Table 16: Regression analysis was run between Personal protective equipment and TB transmission

		R=.683		R²=.456		
Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig.
		B	Std. Error	Beta		
1	(Constant)	.713	.122		5.831	.000
	Personal protective equipment	.259	.038	.683	6.805	.000
a. Dependent Variable: transmission						

Source: Field data

Results in the regression table above were obtained with a coefficient of determination $R^2=0.456$ which shows that 45.6% variation in regression analysis was run between Personal protection TBIC measures and TB transmission. This implies that use of Personal protective equipment would lead to 45.6% chance change in the level of TB transmission in this facility. Also in the study results confirm that Personal protection equipment significantly related to reduced levels of transmission ($\beta =0.683$, $p<0.01$). This implies an effective usage of personal protection TB infection control measures leads to significant reduction in TB transmission levels.

CHAPTER FIVE

SUMMARY, DISCUSSIONS, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

The study examined the contribution of infection control measures to minimizing TB transmission in Mbarara main prison. The study specifically looked at managerial, administrative and environmental TBIC measures, as well as personal protective equipment to reducing TB transmission in the facility. This chapter presents the summary, discussion, conclusions, and recommendations of the study and these are presented according to the findings in chapter four.

5.2 Summary of Findings

The study, examined the contribution of infection control measures to minimizing TB transmission in Mbarara main prison. The study adopted cross sectional survey design to carry out the research with both qualitative and quantitative approaches. The study looked at how managerial, administrative, environmental TBIC measures, as well as personal protective equipment contribute to reducing the risk of TB transmission in the facility.

5.2.1 Objective one.

There was a positive significant relationship between managerial TBIC measures and TB transmission in Mbarara main prison ($r=0.670$, $p=0.000$) with a regression R^2 of .449. This implies that functional and effectively implemented managerial TBIC measures directly relate to low TB transmission levels in the facility.

5.2.2: Objective two

There was a positive significant relationship between administrative TBIC measures and TB transmission in Mbarara main prison ($r=.641$, $p=0.000$) with a regression R^2 of .441. Therefore, effective implementation of administrative TBIC measures i.e. sick people are screened for TB, those with symptoms are separated from others and the ones confirmed to have TB are initiated on effective treatment immediately, then the transmission levels of TB in the facility is likely to reduce.

In objective three, study findings revealed a positive significant relationship between environmental TBIC measures and TB transmission in Mbarara main prison ($r=0.730$, $p=0.000$) and regression R^2 of .534. This implies that improvement in environmental TBIC measures would significantly reduce the risk of TB transmission levels in the facility.

In objective four; there was a positive significant relationship between personal protective equipment and reduced TB transmission in Mbarara main prison ($r=0.670$, $p=0.000$) with a regression R^2 of .449. This implies that if coughing patients are given surgical masks and they put them on and health care workers are availed with respirators and they use them, the prison will register low TB transmission levels.

5.3 Discussion of Findings

The findings are discussed according to the objectives of the study and details are presented below.

The contribution of managerial TBIC measures to minimizing TB transmission in Mbarara main prison.

Managerial controls measures are significant attributes to reducing TB transmission in prison facilities. In managerial control measures where the facility has well trained personnel that are able to effectively handle all TB cases in facility, then the risk of TB transmission is likely to be significantly reduced in the prison in the long run. This finding is in Yanai (2003) who noted that the introduction of multiple managerial, administrative, personal, and engineering controls in a hospital in Thailand resulted in a significant drop in the annual rate of latent TB infection.

Changes in managerial controls in TB infection control would lead to 44.9% chance change in TB transmission levels. This means that improvement in managerial TBIC measures is significantly and positively associated with reduced TB transmission levels. This finding is in line with Christopher (2010) who asserts that prevention of the spread of TB consists of a mixture of managerial, administrative, engineering and respiratory protection controls. Effective TBIC requires all three elements to be in place.

The facility ensures that there is a TBIC committee that is well composed with the right personnel to ensure that TB among all prisoners is well detected and treated in time among all inmates of the prison facility. However, it was revealed that these committee members do not meet regularly and this may increase the risk of TB transmission since the regular planning on best ways to control the transmission of TB in the prisons facility. In relation to this WHO, (2009) assert that some of the managerial measures include; having a facility TBIC committee to coordinate TBIC implementation, a facility TBIC plan, a TBIC focal person to enforce TBIC practices, a facility TBIC policy to guide implementation of the TBIC.

The availability of TBIC policies that guide management and staff of the prison on TBIC measures to reduce on transmission levels is important in reducing TB infections. However, this study revealed that copies of these policies are not readily availability and their actual implementation is a big challenge. This contradicts WHO (2009) stress that policies and procedures help to implement a set of facility-level managerial activities that include identifying and strengthening the local TBIC committee, develop a facility TBIC plan. Also policies guide on the use of available spaces and renovation of existing facilities or construction of new ones to optimize implementation of controls. Conduct on-site surveillance of TB disease among staff and prisoners and assess the facility to address advocacy, communication and social mobilization (ACSM) for staff, prisoners and visitors, monitor and evaluate the set of TB infection control measures, participate in research efforts.

The effort to ensure that TB transmission is controlled in the facility, staff members have been trained on TBIC, diagnosis and treatment of TB patients such that new infectious patients can easily be identified and effectively managed. This is related to CDC (2005) explains that training staff members and prisoners is essential because of the leadership role they frequently fulfil in infection control. Training and education can increase adherence to TBIC measures because it emphasizes the increased risks posed by an undiagnosed person with TB disease in a health-care such settings and the specific measures to reduce this risk.

The contribution of administrative TBIC measures to minimizing TB transmission in Mbarara main prison.

Administrative TBIC measures are significantly related to TB transmission. Administrative measures involve identifying sick people with symptoms of TB early enough, isolating them and then starting them on treatment immediately. These actions are likely to significantly reduce the

risk of TB transmission in the facility. This finding is in line with Joshi (2006) who asserts that administrative controls are strategies that reduce the risk of exposure to infectious TB germs by non-coughing patients. Administrative controls are to identify persons with TB symptoms, separate them into appropriate environment, fast-track them through the health care facility to reduce exposure time to others, and diagnose and treat them with minimal delay. Hospitalization should be reduced or avoided to the greatest extent possible. At facility level, administrative controls play a major role in reducing the risk of TB transmission and are essential for the implementation of other controls i.e. environmental controls and personal protective equipment.

In TBIC, administrative control measures would lead to 44.1% chance change in TB transmission levels. Therefore this implies that improvement in TB administrative control measures is significantly and positively associated with improved TB transmission in this facility. This finding is in line with in line with Christopher (2010) who explains that prevention of the spread of TB consists of a mixture of administrative, engineering and respiratory protection controls. Effective TBIC requires all three elements to be in place. The three measures operate at different points in the TB transmission process and complement each other so, where feasible, they should be used as a combination.

Identifying new cases of TB is an important aspect. Findings revealed that new inmates are not screened on their first day of entry into the facility, neither is there routine screening of other inmates in the facility. This poses a great danger to other inmates in the facility to contract the disease. Routine and on entry screening for TB would help to identify and immediately start such inmates on treatment and if effectively done it would significantly lead to reduced levels of TB prevalence in the facility. This finding is in line with WHO, (2009) who assert that

administrative control measures serve as the first line of defence against spread of TB. These measures include practices that promptly identify potential and known TB cases, separate and treat them with minimal delay. These controls, aimed at minimizing the exposure of persons to TB germs include triaging i.e. identifying persons with signs of TB, physical separation of TB patients or suspects, educating people on cough etiquette and minimizing time spent in health care settings.

Training is an important aspect that influences the TB control situation. Inmates are not provided with the best practices on the TB prevention transmission process. Training of inmates on the best practices of how to prevent the disease helps them to know to identify those who are coughing un normally and reporting them immediately and helping such people to be started on treatment immediately and other how to deal with other key aspects on TB and this would largely reduce on the prevalence rates of TB in the facility. This findings is line with Mathew, (2013) who evaluated the efficiency of administrative measures in Inner-city hospital in Rio de Janeiro where suspected and confirmed TB patients were isolated, TB tests results were released early from the laboratory and health worker were educated on use of respirators.

In the treatment process, the study revealed that the facility is always supplied with anti-TB medicines and has health care workers administer the correct TB regimen. This implies that the facility is well supplied with TB medicines and health care workers administer the correct treatment to patients hence reducing the TB transmission rates in the facility. This is line with the National TB guidelines of Uganda (2010) that state that early treatment of TB benefits both the community as a whole and the individual patient because after two weeks of treatment, the TB

patient is no longer infectious and that TB treatment involves the use of multiple drugs taken in combination so as to prevent the emergence of drug resistance to any of the drugs.

The contribution of environmental TBIC measures to minimizing TB transmission in Mbarara main prison.

There is a positive significant relationship between environmental TBI control measures and TB transmission. This implies that in situations where there is effective air ventilation and air purification in all wards and other rest areas, then there will be reduced levels TB transmission in the prison facility. This in line with Granich (1999) who asserts that environmental controls are the second tier measure aimed at reducing the concentration of TB germs in the air through free air movement by increasing natural or mechanical ventilation by exhaust fans.

The ventilation in place is not enough to allow inmates comfortably live in the facilities provided to them. This implies that with poor aeration in their respective areas of residence, there are high chances of catching TB in case of any suspects in the facility and this has the potential of largely increasing the TB infection rates. This finding is line with Escombe (2007) who asserts that opening both windows and doors greatly improves natural ventilation. Rooms should have openings in opposite sides that can be left open on all climates and the openings should constitute more than 20% of floor area.

The wards for prisoners and the sickbay are not well ventilated because they may have very large openable windows and doors, and ventilators one side of walls and doors that are kept open only during the day. This implies that the sick bay and the prisoners' wards are not very well ventilated to allow good aeration among these units. Good aeration of these places implies that inmates will be able to avoid contaminated air that may increase the risk of increased TB

transmission. This is in line with Escombe AR, (2007) who compared the impact of natural and mechanical ventilation with negative pressure on reducing the risk of airborne contagion in eight hospitals in Lima, Peru. 5 were of old fashioned design built pre-1950, and three of modern design, built 1970–1990. In these hospitals 70 naturally ventilated clinical rooms where infectious patients are likely to be encountered were studied. These included respiratory isolation rooms, TB wards, respiratory wards, general medical wards, outpatient consulting rooms, waiting rooms, and emergency departments. These rooms were compared with 12 mechanically ventilated negative-pressure respiratory isolation rooms built after the year 2000. It was discovered that opening windows and doors allowed double the air changes than that of mechanically ventilated negative-pressure rooms ventilated 18 times that with windows and doors closed. Old fashioned facilities, characterized by large windows and high ceilings, had greater ventilation than modern naturally ventilated rooms.

Personal protective equipment significantly minimize the risk of TB transmission in Mbarara main prison.

Personal protective equipment are positively related to TB transmission. Therefore effective use of personal protective equipment helps in reducing TB transmission levels in the facility. This finding is related to Ashwin, (2011) who assumes that in a study on efficiency of surgical masks on reducing TB transmission performed at the Airborne Infections Research (AIR) Facility in eMalahleni, South Africa. 17 patients with pulmonary MDR-TB in an MDR-TB ward in South Africa wore face masks on alternate days. Ward air was exhausted to two identical chambers, each housing 90 pathogen-free guinea pigs that breathed ward air either when patients wore surgical face masks, intervention group, or when patients did not wear masks, control group.

After 3 months, 76.6% control guinea pigs became infected, compared with 40% intervention guinea pigs, representing a 56% decreased risk of TB transmission when patients used masks. In conclusions, surgical face masks on patients with MDR-TB significantly reduced transmission and offer an adjunct measure for reducing TB transmission from infectious patients.

In the study, it was discovered that surgical masks and respirators are given to only the coughing patients and staff escorting the coughing patients respectively. Therefore this implies that not all patients are given surgical masks, but it's a few cases that may be given surgical masks and this leaves the rest of the patients at risk. This is relates to WHO (2009) that states health workers may gain additional protection from TB through the use of particulate respirators. Use of particulate respirators is recommended for health workers when caring for patients or those suspected of having infectious TB, visitors should also wear particulate respirators when in enclosed space with infectious cases. Particulate respirators should not be used by patients or people suspected of having infectious TB; rather, surgical masks are appropriate in such cases, to ensure proper cough etiquette.

5.4 Conclusions

From the findings of the study, the following conclusions for each objective were reached as presented below.

The contribution of managerial TBIC measures to minimizing TB transmission in Mbarara main prison.

There are TBIC policies in place but many of them are not functional since they are not effectively implemented by prisons' authority. Lack of implementation of such policies implies that the facility will continue to portray relaxed ways of controlling the infection and this will contribute to increased TB transmission in the facility.

There is limited training on TB surveillance process, where most stakeholders in the facility lack the training and skills of quickly identifying all cases suspected to TB cases. Without such skills, more cases abound to come in the facility.

The contribution of administrative TBIC measures to minimizing TB transmission in Mbarara main prison.

There is no screening of new inmates to the prisons' facility. The TB status of new inmates is checked to help identify all those that are infected, then isolated and started on immediately. The facility lacks this initiative that is significantly important in the effort to control TB transmission in this facility.

In the facility there are generally minimum levels of TB prevention in the facility. The facility has very few strategies in place to control TB infection in the facility. This puts the all the facility members at a big risk of contracting the disease.

The contribution of environmental TBIC measures to minimizing TB transmission in Mbarara main prison.

The facility lacks enough ventilation especially in prisoners' wards. There are no alternative mechanical air conditioner systems in place to help regulate the aeration within the facility. Absence of such increases the risk TB transmission among inmates in a more rapid way which may be more disastrous to lives of inmates.

The contribution of PPE in minimizing TB transmission to Mbarara main prison

The usage of protective equipment among the inmates and other stakeholders in the facility is very limited. Personal protective equipment is not given to all inmates, visitors and employees when using the facility where there are suspected cases.

5.5 Recommendations

From the findings of the study, the following recommendations were made.

The contribution of managerial TBIC measures to minimizing TB transmission in Mbarara main prison.

The prisons authorities of Mbarara main prison should contact ministry of health implementing partners in Mbarara district, like Mbarara-Makerere Joint AIDS Programme (MJAP), seeking for funds to convene meetings for the TBIC committee members and transport the Zonal TB and Leprosy Supervisor (ZTLS) to facilitate the meeting. This will help enable meetings be conducted and the implementation and effectiveness of TBIC measures will be monitored.

The NTLP and UPS top management should institute a committee to monitor the implementation of policies on TB control and prepare periodic reports on implementation of TB control policies.

The NTLP and UPS top management should source for funds for capacity building on TBIC from different implementing partners in the country like Global Fund-Uganda, Medical Sciences for Health (MSH), and ensure that all stakeholders in the TB control process in all prison facilities are given appropriate trainings and refresher trainings on all aspects of TB control and prevention. This will help reduce the infection rates in the prison facilities.

The contribution of administrative TBIC measures to minimizing TB transmission in Mbarara main prison.

The top management of Mbarara main prison should request for daily reports of new inmates and results from the screening exercise. This action will ensure that all new inmates are screened for symptoms of TB on entry, this will help reduce further the risk of TB transmission.

The UPS top management should source for funds from government to have a TB isolation ward for those inmates sick and on treatment for TB and also an isolation ward for those new inmates who have not been screened for TB on entry because of various reason. This will reduce transmission rates in the prison facility because the prison does not have a sickbay for only TB patients, all sick prisoners are confined in the same sickbay and the prison has no isolation ward for those new inmates who are yet to be screened. If a prisoner is not screened, for any reason, they will be mixed with others until the following day.

The contribution of environmental TBIC measures to minimizing TB transmission in Mbarara main prison.

The prisons facility needs to secure funds from government or any development agencies to procure air conditioner systems and install them in wards to improve on aeration since prisoners' wards cannot have windows and doors on opposite sides for security reasons. This will reduce the TB transmission among inmates in a more rapid way which may be more disastrous to lives of inmates.

The contribution of PPE in minimizing TB transmission to Mbarara main prison

The top management of Mbarara main prisoner should put a policy in place for health care workers to give a report on daily consumption of PPE, this can be correlated with the daily screening reports and the TB presumptive register to see if usage matches with the number of coughing patients identified. This will help improve on usage of PPE and subsequently contribute to reducing the risk of TB transmission in the facility.

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APPENDIX I: QUESTIONNAIRE FOR STAFF MEMBERS.

Questionnaire Number.....

Dear respondent,

I am requesting you to fill this questionnaire, which is aimed at collecting data on the contribution of infection control in minimizing tuberculosis transmission in Mbarara main prison. You have been selected to be one of our respondents in this study. Since you work in Mbarara Main Prison, you are in a better position to give the required information. Your opinions are therefore important. I will be very grateful to you for putting time aside to answer this questionnaire. The information provided will be treated with strict confidentiality and shall not be used for any other purpose except for academic purposes. The study will ensure your anonymity and confidentiality. Thank you very much for your cooperation

Instructions

Mark with a tick or an X against the response you think is most appropriate to you.

SECTION A.

Gender of the respondent.

1. Male
2. Female

Education level.

1. Primary level
2. Secondary level
3. Diploma
4. Degree
5. Masters degree
6. Others specify.....

Age of respondent.

1. Below 20 years
2. 20-25

3. 26-30
4. 31-35
5. 36-40
6. 41-45
7. 46-above

For how long have you been serving in Mbarara main prison?

1. Less than 2 years
2. 2 to 4 years
3. 4 to 6 years
4. More than 7 years

For the following questions please tick the number of your choice

Key

1. Strongly Disagree
2. Disagree
3. Not Sure
4. Agree
5. Strongly Agree

SECTION B

MANAGERIAL TBINFECTION CONTROL MEASURES IN MINIMIZING TB TRANSMISSION IN MBARARA MAIN PRISON.

Personnel capacity						
1.	Every staff and inmate is trained on TB infection control in this institution	1	2	3	4	5
2	This institution has a functional and effective TB infection control committee	1	2	3	4	5
3.	The staff always give health talks to prisoners, patients and visitors on TB infection control	1	2	3	4	5
4.	Assessments of the threat of catching TB in the prisons community	1	2	3	4	5

	is done periodically by analysing the numbers infected with TB and HIV					
TB infection control policies						
5.	The facility fully implements the Ministry of Health guidelines/policies on TB control, TB infection control and TB/HIV co-management	1	2	3	4	5
6.	The facility has a customized TB infection control plan	1	2	3	4	5
7.	The facility has complete and accurately filled registers at points of screening, diagnosis and treatment	1	2	3	4	5
TB surveillance						
8.	All prisoners and staff are screened for TB symptoms on the first day they report to the facility so as to document their initial TB status, have medical records filed and available	1	2	3	4	5
9.	All prisoners and staff are periodically assessed for TB disease, their medical records are filed and available	1	2	3	4	5
10.	TB patient data is periodically compiled, assessed, analyzed and used by the management of the facility to know the burden of TB and make decisions on minimizing prevention of further infections during meetings with the TB infection control committee	1	2	3	4	5
Facility design						
11.	The prisons wards are so spacious, they always accommodate any number with no overcrowding	1	2	3	4	5
12.	The health facility is organized by the health workers avoiding overcrowding when patients come for health services	1	2	3	4	5
13.	During the period when prisoners are many, prisons management re-organizes the sleeping arrangement of prisoners in the prisons wards to avoid overcrowding that increases chances of TB transmission	1	2	3	4	5
14.	During construction of prisoner wards, prevention of transmission of TB is always considered	1	2	3	4	5

SECTION C.

ADMINISTRATIVE TB INFECTION CONTROL MEASURES IN MINIMIZING TB TRANSMISSION IN MBARARA MAIN PRISON.

TB detection						
15.	The facility has very active people who look out for and identify prisoners, staff and visitors who are coughing as early as possible	1	2	3	4	5
16.	The coughing prisoners, staff and visitors identified are given a sample container as soon as they are separated to provide a sputum sample that is immediately taken to the laboratory for tests to be performed on it	1	2	3	4	5
17.	The sputum samples from the coughing prisoners, staff and visitors brought to the laboratory are immediately examined for TB germs and the results are delivered to doctors immediately by a laboratory staff	1	2	3	4	5
Treatment initiation						
18.	The TB patients are started on the correct treatment for TB by the health care workers on that very day the prisoner, staff or visitor has been confirmed to have TB	1	2	3	4	5
19.	The facility is always supplied with all the anti TB medicines that are not expired and it never experiences stock out	1	2	3	4	5
20.	The health care workers are always on duty to start the newly identified TB patients on TB treatment immediately and are knowledgeable about the correct TB regimen	1	2	3	4	5
TB prevention						
21.	Always the coughing prisoners, staff and visitors that have been identified by the active cough monitor are immediately taken to a separate area to sit away from others who are not coughing	1	2	3	4	5
22.	The facility has a separate isolation ward for only TB patients were they are admitted while on treatment so that they do not infect other inmates	1	2	3	4	5
23.	The facility has a very active member who always gives health talks to prisoners, staff and visitors on cough manners of covering one's mouth while coughing, wearing masks and to avoid spitting	1	2	3	4	5

24.	There is a very active counsellor that gives all prisons staff appropriate information and encourages them to undergo TB diagnostic investigation if they have signs and symptoms suggestive of TB and also information and encouragement to undergo HIV testing	1	2	3	4	5
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SECTION D.

ENVIRONMENTAL TB INFECTION CONTROL MEASURES IN MINIMIZING TB TRANSMISSION IN MBARARA MAIN PRISON.

Ventilation						
25.	All prisoners wards, the isolation ward for prisoners suspected to have TB or those that have not yet been screened for TB, the sickbay and the health facility are well ventilated because they have very large openable windows and ventilators on opposite sides of walls and doors that are kept open during the day	1	2	3	4	5
26.	All prisoners wards, the isolation ward for prisoners suspected to have TB or those that have not yet been screened for TB and the sickbay have window, ceiling and exhaust fans installed that extract contaminated air when doors and windows are closed especially at night	1	2	3	4	5
27.	The exhaust fans installed are periodically maintained to ensure good ventilation of the rooms, there is a service contract signed and the service reports are filed and available	1	2	3	4	5
Air purification						
28.	All prisoners wards, the isolation ward for prisoners suspected to have TB or those that have not yet been screened for TB and the sickbay have air purifying devices such as bulbs emitting ultra violet rays and air circulation system with filters to kill TB germs	1	2	3	4	5
29.	These addition devices installed are routinely serviced and maintained, there is a service schedule, a service contract and the maintenance activities done are documented, filed and are available	1	2	3	4	5

SECTION E.**PERSONAL PROTECTIVE EQUIPMENT IN MINIMIZING TB TRANSMISSION IN MBARARA MAIN PRISON.**

Respirators and Surgical masks						
30.	The facility always receives both surgical masks and respirators from National Medical Stores and these are always available	1	2	3	4	5
31.	Surgical masks are strictly given to and are only used by all coughing patients while respirators are strictly given to and are only used by staff especially those escorting TB patients who need referral to a more advanced Hospital for TB testing and treatment and visitors to the TB isolation ward	1	2	3	4	5
32.	All staff are periodically taken through a respirator fit testing exercise to help determine the respirator model and size that best fits the wearer, ensure the user knows when the respirator fits properly and confirm that the wearer can don the respirator properly to achieve a good fit	1	2	3	4	5

SECTION F**TUBERCULOSIS TRANSMISSION IN MBARARA MAIN PRISON**

Prevalence and incidence levels						
33	Generally the number of staff and their family members and prisoners diagnosed with TB in Mbarara main prison has been reducing over the years	1	2	3	4	5
34	Generally the number of staff and their family members and prisoners diagnosed as having been reinfected with TB in Mbarara main prison has been reducing over the years	1	2	3	4	5

APPENDIX II: INTERVIEW GUIDE

1. In your opinion, what is your understand of TB infection control?
.....
.....
2. How has the personnel in place (trained and untrained) helped in controlling the transmission of TB in this institution
.....
.....
3. How have Policies in place contributed to the control of TB transmission in this institution
.....
.....
4. How has the design of the various buildings in this institution contributed to the control of TB transmission
.....
.....
5. What are the TB detection measures practiced in this institution and how have they influenced the transmission of TB
.....
.....
6. On average, when is a TB patient started on treatment
.....
.....
7. What TB prevention measures are practiced in this institution
.....
.....
8. What is your view on the ventilation of the various buildings in this institution towards controlling the transmission of TB
.....
.....
9. What additional air purification measures are in place in this institution that control the transmission of TB

.....
.....

10. What are the personal protective equipment available in this institution for controlling the transmission of TB

.....
.....

11. What TB infection control measures are practiced in this institution

.....
.....

12. How have the measures you have outlined above (question 11) contributed towards TB transmission

.....
.....

APPENDIX III: DOCUMENT REVIEW CHECK LIST

The following headings will be used in the document review checking process

Personnel

Policies

TB surveillance

Facility design

TB detection

Treatment initiation

TB prevention

Ventilation

Air purification

Respirators and Surgical masks