Bindura University of Science Education

Faculty of Science

Biological Sciences Department

RETROSPECTIVE STUDY ON THE PREVALENCE AND TYPES OF NOSOCOMIAL INFECTIONS AT CHIMHANDA DISTRICT HOSPITAL, MASHONALAND CENTRAL PROVINCE, ZIMBABWE

By

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A research project submitted in partial fulfilment of the requirements for the Bachelor of Science Honours Degree in Biological Sciences

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Approval Form

The undersigned certify that they have read the dissertation titled "RETROSPECTIVE STUDY ON THE PREVALENCE AND TYPES OF NOSOCOMIAL INFECTIONS AT CHIMHANDA DISTRICT HOSPITAL, MASHONALAND CENTRAL PROVINCE, ZIMBABWE" and confirm that it is suitable for submission to the Biological Sciences Department, Faculty of Science, at Bindura University of Science Education, for assessment.

Signature of student: Date: 14/06/26

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Signature of Chairperson of Department: Date: 16 August 2026

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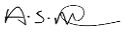
Signature:  Date: 14/06/26

Supervisor's Declaration

I, Dr. P. Jinga, declare that I have supervised this thesis and I am satisfied that it can be submitted to the Biological Sciences Department, Faculty of Science, at Bindura University of Science Education.

Signature:  Date: 22/06/2026

Dedication

This dissertation is dedicated to my parents, whose sacrifices, prayers, and unwavering belief in the power of education have been the foundation of every achievement in my life. It is also dedicated to my best friend, Munashe Madzivadondo, for the constant encouragement, intellectual companionship, and steadfast support throughout the entirety of this academic journey.

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List of Abbreviations

AIDS – Acquired Immunodeficiency Syndrome

AMR – Antimicrobial Resistance

BSI – Bloodstream Infection

CAUTI – Catheter-Associated Urinary Tract Infection

CLABSI – Central Line-Associated Bloodstream Infection

HAI – Hospital-Acquired Infection

HAP – Hospital-Acquired Pneumonia

HIV – Human Immunodeficiency Virus

ICU – Intensive Care Unit

IDSR – Integrated Disease Surveillance and Response

IMMIS – Integrated Management of Medical Information Systems

IPC – Infection Prevention and Control

IQR – Interquartile Range

LMICs – Low- and Middle-Income Countries

LOS – Length of Stay

MDRO – Multidrug-Resistant Organism

NI – Nosocomial Infection

PPE – Personal Protective Equipment

SD – Standard Deviation

SPSS – Statistical Package for the Social Sciences

SSI – Surgical Site Infection

UTI – Urinary Tract Infection

VAP – Ventilator-Associated Pneumonia

WHO – World Health Organization

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Abstract

Nosocomial infections, also referred to as hospital-acquired infections (HAIs), represent a significant public health threat in healthcare settings globally. This threat is particularly pronounced in low- and middle-income countries where infection prevention and control (IPC) resources are constrained. This study investigated the prevalence and types of nosocomial infections at Chimhanda District Hospital in Mashonaland Central Province, Zimbabwe, over a 12-month retrospective period spanning August 2024 to August 2025.

A descriptive, cross-sectional, retrospective design was used. All 2,607 patient admission records from the four main wards (female, male, maternity, and paediatric) meeting the eligibility criteria were reviewed, yielding a census-based sample. Data were extracted from medical files, laboratory records, pharmacy logs, and hospital registers using a standardised data abstraction sheet.

An overall HAI prevalence of 2.7% (71 out of 2,607 patients) was observed. Urinary tract infections (UTIs) constituted the most common infection type (39.4%), followed by surgical site infections (SSIs) (26.8%), hospital-acquired pneumonia (HAP) (16.9%), bloodstream infections (BSIs) (11.3%), and skin and soft tissue infections (5.6%). The female ward recorded the highest HAI burden (49.3% of all cases). Chi-square analyses identified statistically significant associations between HAI occurrence and invasive device use ($p < 0.001$), surgical procedures ($p < 0.001$), prolonged hospitalisation exceeding one week ($p < 0.001$), and underlying comorbidities such as diabetes or HIV ($p < 0.001$). Patients who acquired HAIs had a median length of stay of 14 days compared to 4 days for those without infections.

The study concluded that despite a relatively low reported prevalence, potentially indicative of under-detection given limited diagnostic capacity, nosocomial infections pose a measurable and modifiable burden at Chimhanda District Hospital. Recommendations include the establishment of a functional IPC committee, implementation of device care bundles, enforcement of surgical care protocols, and the promotion of antimicrobial stewardship programmes.

Keywords: Nosocomial infections, hospital-acquired infections, prevalence, Zimbabwe, rural district hospital, infection prevention and control

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Chapter 1: Introduction

1.1 Background

Nosocomial infections, commonly known as hospital-acquired infections (HAIs), are infections that patients develop during the course of receiving treatment for other conditions within a healthcare setting, provided that those infections were neither present nor incubating at the time of admission. Such infections typically become clinically apparent 48 hours or more after the patient is admitted to a healthcare facility by established epidemiological convention (World Health Organization (WHO), 2022). This definitional threshold is important because it differentiates infections acquired within the hospital environment from those that patients bring with them on admission.

Globally, HAIs represent one of the most pervasive and costly challenges confronting modern healthcare systems. The WHO estimates that, at any given point in time, approximately 7 out of every 100 hospitalised patients in high-income countries and 15 out of every 100 in low- and middle-income countries (LMICs) acquire at least one HAI during the course of their hospitalisation (World Health Organization, 2022). This statistic alone underscores the scale of the problem, but its true weight is appreciated more fully when the associated consequences are considered: prolonged hospitalisation, increased patient morbidity and mortality, the emergence and spread of antimicrobial resistance (AMR), and a disproportionate economic burden on both patients and healthcare systems (Cassini et al., 2019).

The burden of HAIs is not evenly distributed across the globe. A comprehensive systematic review and meta-analysis quantified the disparity, reporting a pooled HAI prevalence of 15.5% in LMICs compared to 7.1% in high-income countries (Allegranzi et al., 2022). This near-twofold difference is attributable to systemic challenges that are especially pronounced in resource-constrained settings: chronic underfunding of healthcare infrastructure, shortages of trained personnel, limited availability of essential infection prevention and control (IPC) supplies, and inadequate institutional governance of IPC programmes.

The most commonly reported types of HAIs globally include urinary tract infections (UTIs), surgical site infections (SSIs), bloodstream infections (BSIs), and hospital-acquired

pneumonia (HAP). Each of these infection types carries distinct risk profiles and requires specific preventive strategies, underscoring the need for both comprehensive surveillance data and targeted interventions (World Health Organization, 2022).

In Sub-Saharan Africa, the challenge of HAIs is further compounded by the region's high burden of communicable diseases, including HIV/AIDS and tuberculosis, which compromise the immune defences of hospitalised patients and increase their susceptibility to secondary infections (Nejad et al., 2022). Evidence from several countries in the region attests to this elevated burden. A point-prevalence study conducted at a central hospital in Zimbabwe reported an overall HAI prevalence of 14.2%, with SSIs and BSIs being the most frequently identified infection types, and with lapses in hand hygiene and sterile technique cited as the principal contributing factors (Mpofu et al., 2020). Similar findings came from Zambia, which documented an HAI prevalence of 22.5%, strongly associated with inadequate hand hygiene compliance and limited IPC resources (Mwananyanda et al., 2021). Research from Malawi and Tanzania has likewise reported elevated rates of SSIs and neonatal sepsis, often linked to shortages of personal protective equipment (PPE) and inadequate environmental cleaning (Marshall et al., 2020; Kumburu et al., 2021).

Within Zimbabwe, most published research on HAIs has focused on central and tertiary hospitals, which differ substantially from rural district hospitals in terms of patient case-mix, resource availability, staffing ratios, and IPC infrastructure. District hospitals, which serve as the primary care referral point for the majority of Zimbabwe's rural population, operate under unique constraints that may produce different patterns of HAI occurrence. There is a pronounced paucity of facility-level data from rural district hospitals across the country, and Mashonaland Central Province is no exception.

Chimhanda District Hospital is a government-run primary care referral facility located in Rushinga District, Mashonaland Central Province. It serves a predominantly rural and agricultural population and operates four main inpatient wards: Female, Male, Maternity, and Paediatric. Like many similar institutions across Zimbabwe, the hospital faces resource constraints that may affect the implementation of comprehensive IPC measures. Prior to this study, no formal, systematic investigation had been conducted to quantify the prevalence and types of HAIs within the hospital. This absence of local epidemiological data represented a critical knowledge gap, as it is precisely this kind of facility-specific evidence that is needed to guide the design and prioritisation of targeted IPC interventions.

The primary risk factors for HAIs in resource-limited settings are well established in the literature. Inadequate hand hygiene compliance remains the single most modifiable driver of pathogen transmission in healthcare environments (Pittet et al., 2022). Environmental contamination, arising from overcrowded wards, poor sanitation practices, and inadequate waste disposal systems, creates reservoirs for multidrug-resistant organisms (MDROs). Insufficiency in the sterilisation and high-level disinfection of reusable medical equipment, as well as breaks in aseptic technique during invasive procedures, further elevate infection risk. Chronic shortages of PPE, antiseptics, and sterile single-use devices directly compromise the ability of healthcare workers to adhere to evidence-based IPC protocols (Storr et al., 2021). In the context of rural Zimbabwean hospitals, these systemic vulnerabilities are compounded by high patient turnover, complex health needs, and the intermittent availability of essential supplies.

1.2 Problem Statement

Prior to this study, there was a significant and consequential knowledge gap at Chimhanda District Hospital. While clinical and administrative staff expressed growing concern about the occurrence of HAIs within the facility, including observations of delayed recovery, wound complications, and unexplained febrile episodes in previously non-infected patients, no rigorous, systematic data existed to confirm or quantify the extent of the problem. The absence of such data fundamentally undermined the capacity of hospital management and clinical teams to design, prioritise, and implement targeted IPC interventions. Without a locally grounded understanding of which infection types were most prevalent, which patient populations were most vulnerable, and which clinical risk factors were most strongly associated with infection, any IPC efforts remained reactive, non-specific, and unlikely to produce meaningful improvements in patient outcomes.

1.3 Justification for the Study

This research was undertaken because it provided essential, facility-specific evidence on HAI prevalence in a rural Zimbabwean context, a setting where such research is severely limited (Mpofu et al., 2020). The generation of local, empirical data empowers healthcare providers at the hospital with a clear understanding of infection risks specific to their patient population, which in turn enables the implementation of evidence-based, targeted prevention strategies. By systematically reviewing records of all admitted patients, the study indirectly

evaluated adherence to existing IPC protocols and identified specific clinical areas and patient groups where the burden of infection was concentrated. This information is particularly valuable for hospital management in making informed decisions about the allocation of often scarce resources toward the most critical IPC needs. At the policy level, the findings contribute to the evidence base for district and national infection control guidelines, ensuring that such guidelines are informed by the realities of resource-limited, rural healthcare delivery (Storr et al., 2021).

1.4 Aim

The primary aim of this study was to determine the prevalence and types of nosocomial infections at Chimhanda District Hospital and to propose evidence-based solutions toward reducing their occurrence among admitted patients.

1.5 Research Objectives

The study was guided by the following objectives:

1. To determine the prevalence of nosocomial infections among patients admitted to Chimhanda District Hospital during the 12-month study period from August 2024 to August 2025.
2. To identify the most common types of nosocomial infections prevalent at the hospital.
3. To propose evidence-based solutions aimed at reducing the prevalence of nosocomial infections among admitted patients.

1.6 Research Questions

The study sought to answer the following research questions:

4. What was the prevalence of nosocomial infections among patients admitted to Chimhanda District Hospital during the study period?
5. What were the most common types of nosocomial infections at Chimhanda District Hospital?
6. What evidence-based solutions can be proposed to reduce the prevalence of nosocomial infections among admitted patients?

1.7 Research Hypothesis

H1: There are nosocomial infections occurring at Chimhanda District Hospital, and the occurrence is significantly associated with patient-related factors (including age, sex, and comorbidities), procedure-related factors (including surgical procedures and invasive device use), and system-related factors (including length of stay).

1.8 Significance of the Study

This study holds significance at multiple levels. At the facility level, the establishment of a baseline HAI prevalence figure and the identification of the most common infection types provide the clinical and administrative evidence necessary for the hospital to design and implement a targeted IPC programme. For clinical staff, the identification of high-risk procedures, devices, and patient groups supports more informed and vigilant clinical practice. At the district and national levels, the study contributes to a still-sparse body of evidence on HAIs in rural Zimbabwean healthcare settings, providing data that can inform the adaptation and contextualisation of national IPC guidelines and resource allocation decisions. For the academic and research community, it establishes baseline data and a methodological template for prospective HAI surveillance and future intervention studies in similar settings.

1.9 Limitations

The study acknowledged the following limitations. First, the retrospective design meant that the quality of data was contingent on the completeness and accuracy of existing medical records, and under-documentation of infections was possible. Second, the absence of confirmatory culture results for approximately 27% of clinically diagnosed HAI cases introduced the possibility of misclassification. Third, the single-centre design limited the generalisability of findings to other hospitals, though they likely reflect challenges common to similar rural district hospitals in Zimbabwe.

1.10 Delimitations

The study was intentionally delimited to Chimhanda District Hospital in Rushinga District, covering only inpatients admitted over a defined 12-month period from August 2024 to August 2025. Only patients who met the 48-hour admission threshold were included. The study concentrated on five categories of nosocomial infections: UTIs, SSIs, HAP, BSIs, and skin and soft tissue infections. Data were drawn exclusively from existing medical records,

laboratory reports, and pharmacy logs, without direct patient contact or experimental intervention.

Chapter 2: Literature Review

2.1 The Global Burden of Nosocomial Infections

Nosocomial infections, defined as infections occurring in a patient during the process of care in a hospital or other healthcare facility, and which were neither present nor incubating at the time of admission, represent one of the most persistent and consequential threats to patient safety globally (World Health Organization, 2022). These infections are not merely a clinical nuisance; they are a leading cause of preventable morbidity and mortality, imposing enormous economic burdens on healthcare systems at both the individual and societal level. The WHO estimates that at any given point, 7% of hospitalised patients in high-income countries and 15% in LMICs acquire at least one HAI, underscoring a significant disparity that reflects underlying differences in healthcare infrastructure, staffing, and resource availability (World Health Organization, 2022).

The economic consequences of HAIs are profound and far-reaching. Healthcare-associated infections in Europe alone generate millions of disability-adjusted life years annually, with the burden exceeding that of many other communicable diseases (Cassini et al., 2019). HAIs can prolong hospital stays, necessitate additional diagnostic and therapeutic interventions, drive the emergence and spread of AMR, and impose both direct financial costs through increased treatment expenditure and indirect costs through lost productivity. In low-resource settings, where households often bear substantial out-of-pocket healthcare costs, the financial toll of a prolonged hospital stay resulting from an HAI can be catastrophic for families (Storr et al., 2021).

A landmark systematic review and meta-analysis quantified the global disparity in HAI burden, reporting a pooled prevalence of 15.5% in LMICs compared to 7.1% in high-income countries (Allegranzi et al., 2022). The elevated burden in resource-constrained settings was attributed to a confluence of factors: chronic infrastructural deficits, underfunding of health systems, critical shortages of trained personnel, limited access to essential IPC supplies such as alcohol-based hand rub, sterile gloves, and disinfectants, and inadequate institutional governance of IPC programmes. These findings collectively highlight that HAIs are not a fixed, immutable feature of hospital care but rather a largely preventable consequence of systemic failures that can be addressed through targeted investment and evidence-based interventions (Allegranzi et al., 2022).

2.2 Nosocomial Infections in Sub-Saharan Africa and Zimbabwe

The challenge of HAIs in Sub-Saharan Africa is compounded by the region's exceptionally high burden of communicable diseases, particularly HIV/AIDS and tuberculosis, which compromise the immune systems of hospitalised patients and substantially increase their vulnerability to secondary hospital-acquired infections (Nejad et al., 2022). Studies across the region consistently report HAI prevalence rates that exceed the global average for LMICs, reflecting the intersection of high patient susceptibility, inadequate IPC infrastructure, and resource constraints.

Within Zimbabwe, published evidence on HAIs remains sparse but is nonetheless indicative of a serious problem. A point-prevalence survey conducted at a central hospital identified an overall HAI prevalence of 14.2%, with SSIs and BSIs constituting the most common infection types (Mpofu et al., 2020). The study identified lapses in hand hygiene practices and inconsistencies in sterile technique as the principal modifiable contributing factors. A study in a tertiary care setting echoed these findings, linking high infection rates to overcrowding and intermittent water supply (Chikowe et al., 2023). However, evidence from rural district hospitals, which constitute the backbone of primary healthcare delivery for the majority of Zimbabwe's population, remains critically scarce. The drivers, patterns, and types of HAIs in these low-resource, high-patient-turnover settings may differ significantly from those observed in tertiary facilities.

Evidence from neighbouring countries reinforces the regional concern. A Zambian hospital reported an HAI prevalence of 22.5%, strongly associated with inadequate hand hygiene compliance and insufficient IPC resources (Mwananyanda et al., 2021). Studies from Malawi and Tanzania have similarly reported elevated rates of SSIs and neonatal sepsis, frequently linked to shortages of PPE and inadequate environmental cleaning practices (Marshall et al., 2020; Kumburu et al., 2021). These regional data, while not directly applicable to Chimhanda District Hospital, provide important contextual benchmarks against which local findings can be interpreted.

2.3 Common Types of Nosocomial Infections

The epidemiology of HAIs varies by geographical location, healthcare facility type, and patient population; however, four major categories of infection account for the majority of cases globally (World Health Organization, 2022).

2.3.1 Surgical Site Infections

SSIs are infections that occur at or near the site of a surgical incision following an operative procedure. They are a leading cause of HAI-related morbidity, frequently resulting in reoperation, prolonged antibiotic use, extended hospital stays, and in severe cases, mortality (Ban et al., 2021). In LMIC settings, SSI rates are markedly higher than in high-income countries, with contaminated operating environments and breaks in aseptic technique identified as the principal risk factors. Preoperative antibiotic prophylaxis, strict adherence to sterile technique, and rigorous postoperative wound care represent the cornerstone preventive interventions (Meara et al., 2020).

2.3.2 Catheter-Associated Urinary Tract Infections

UTIs associated with the use of indwelling urinary catheters are among the most frequently encountered HAIs globally. They arise from the formation of bacterial biofilms on catheter surfaces, which facilitate the ascent of pathogens into the bladder and, in severe cases, can lead to bacteraemia and sepsis (Meddings et al., 2022). The primary preventive strategy involves limiting catheter use to clinically indicated situations, ensuring aseptic insertion techniques, maintaining closed catheter drainage systems, and reviewing catheter necessity on a daily basis to facilitate prompt removal.

2.3.3 Bloodstream Infections

BSIs, particularly those associated with central venous catheters (CLABSIs), are serious and potentially life-threatening infections in which bacteria or fungi enter the bloodstream through an intravascular device. They carry a high attributable mortality and are largely preventable through the consistent application of evidence-based insertion and maintenance bundles (O'Grady et al., 2021). Prevention in resource-limited settings is particularly challenging given the frequent shortages of sterile dressing kits, antiseptic solutions, and standardised insertion protocols.

2.3.4 Hospital-Acquired Pneumonia

HAP is defined as pneumonia occurring 48 hours or more after hospital admission that was not incubating at the time of admission. Ventilator-associated pneumonia (VAP) is a specific and severe subtype that develops in mechanically ventilated patients. Both forms are associated with increased ICU length of stay, substantially higher healthcare costs, and elevated mortality (Papazian et al., 2020). In district hospitals with limited ventilator

capacity, non-ventilator-associated pneumonia remains the predominant concern and may be associated with aspiration, prolonged immobility, and inadequate respiratory hygiene practices.

2.4 Risk Factors for Nosocomial Infections in Resource-Limited Settings

The aetiology of HAIs is multifactorial, involving an interplay of patient-related susceptibility factors, microbial characteristics, and healthcare environmental and practice factors. In LMICs, systemic issues amplify all of these risk dimensions simultaneously (Nejad et al., 2022; Pittet et al., 2022).

2.4.1 Patient-Related Factors

Immunosuppression arising from HIV infection, malnutrition, or diabetes mellitus substantially increases a patient's susceptibility to hospital-acquired pathogens. Extremes of age, particularly very young children and elderly patients, are independently associated with elevated infection risk due to immature or declining immune function. The presence of multiple comorbidities further compounds vulnerability (Nejad et al., 2022).

2.4.2 Hand Hygiene Compliance

Hand hygiene is widely recognised as the single most effective measure for preventing the transmission of HAI pathogens. Despite its simplicity and low cost, compliance among healthcare workers in LMICs is frequently suboptimal, driven by a lack of access to clean running water, alcohol-based hand rub, and insufficient training and reinforcement of hand hygiene behaviours (Pittet et al., 2022; Erasmus et al., 2020). Systematic reviews have consistently demonstrated that multimodal hand hygiene improvement programmes, incorporating education, access to supplies, reminders, and performance feedback, can meaningfully reduce HAI rates.

2.4.3 Environmental Contamination

Overcrowded wards, poor sanitation infrastructure, inadequate waste management, and the absence of routine environmental cleaning and disinfection create reservoirs and transmission pathways for MDROs (Donskey, 2019). In rural African hospitals, where patient-to-bed ratios frequently exceed recommended standards and cleaning supplies are irregularly available, environmental contamination is a persistently underappreciated driver of HAI transmission.

2.4.4 Breaks in Aseptic Technique

Lapses in sterile technique during invasive procedures, including surgery, catheter insertion, and intravenous cannulation, represent a direct pathway for the introduction of pathogens into sterile body sites. These lapses are often linked to high workload, inadequate supplies of sterile gloves and drapes, and insufficient supervision and training (Ban et al., 2021).

2.4.5 Antimicrobial Misuse

Inappropriate, unsanctioned, or excessively broad-spectrum antibiotic use is a primary driver of AMR, rendering HAIs progressively more difficult and expensive to treat. The absence of antimicrobial stewardship programmes in most district-level hospitals in Sub-Saharan Africa means that antibiotic prescribing is often empirical, unsupported by culture and sensitivity data, and not subject to systematic review and de-escalation (Laxminarayan et al., 2020).

2.5 Infection Prevention and Control Strategies

Effective IPC is a multimodal, evidence-based endeavour. The WHO's core components for effective IPC programmes, as synthesised, provide a globally validated framework that is adaptable to resource-limited settings (Storr et al., 2021):

- Establishing a dedicated, multidisciplinary IPC committee with the authority, expertise, and resources to coordinate and oversee facility-wide IPC activities is the foundational structural requirement for any effective IPC programme.
- Implementing context-appropriate, evidence-based guidelines for hand hygiene, SSI prevention, CAUTI prevention, and the management of MDROs provides the operational framework for clinical practice.
- Ongoing, mandatory IPC training for all healthcare workers is critical, as studies demonstrate that training coupled with regular performance feedback significantly improves compliance (Erasmus et al., 2020).
- Routine HAI surveillance is essential for measuring the burden of infection, detecting outbreaks early, and evaluating the impact of interventions over time (World Health Organization, 2022).

- The implementation of care bundles, small sets of evidence-based practices performed consistently for specific high-risk procedures, has proven highly effective in reducing device-associated infections in diverse healthcare settings (Ling et al., 2021).
- Ensuring regular cleaning and disinfection of patient environments and reusable equipment with appropriate agents is a fundamental environmental hygiene requirement.
- Systematic auditing of IPC practices and the provision of transparent, timely feedback to staff promotes behavioural change and creates accountability for infection prevention outcomes (Storr et al., 2021).

While these strategies are globally validated and widely recommended, their implementation in settings such as Chimhanda District Hospital faces formidable contextual barriers related to chronic underfunding, inadequate infrastructure, high staff turnover, and limited access to consumable IPC supplies. Effective IPC in such settings requires pragmatic adaptation of global evidence to local realities, and the generation of local data to guide those adaptations.

2.6 Summary and Research Gap

The literature establishes with considerable consistency that HAIs constitute a major, disproportionately heavy burden in LMICs, including Zimbabwe. While studies from central and tertiary hospitals in the region provide valuable insights, there remains a severe paucity of recent, systematic, facility-level data from rural district hospitals. No published study was identified that specifically investigates the prevalence and types of HAIs at Chimhanda District Hospital or at comparable rural district hospitals in Mashonaland Central Province. This absence of localised, empirical evidence hinders the development of targeted, context-sensitive IPC interventions at the facility level. The present study was designed to address this critical gap by generating the baseline data necessary to inform evidence-based IPC priority-setting, guide resource allocation, and design quality improvement initiatives at Chimhanda District Hospital.

Chapter 3: Materials and Methods

3.1 Study Design

A descriptive, cross-sectional, retrospective study design was employed to investigate the prevalence and types of HAIs among patients admitted to Chimhanda District Hospital. This design was selected because it enables the systematic estimation of the burden of a condition within a defined population over a specified period, without any intervention or manipulation of study participants. The retrospective approach allowed for the efficient analysis of existing records covering a full 12-month period, providing a comprehensive and temporally inclusive picture of HAI occurrence at the hospital. A cross-sectional design was most appropriate given the aim of establishing prevalence rather than incidence, and given the practical and ethical advantages of using routinely collected administrative and clinical data.

3.2 Study Setting

The study was carried out at Chimhanda District Hospital, located in Rushinga District, Mashonaland Central Province, Zimbabwe. This facility functions as a primary care referral centre serving a predominantly rural population with catchment areas covering several surrounding communities. The hospital operates four main inpatient wards: Female, Male, Paediatric, and Maternity. It maintains routine documentation of admissions, laboratory results, and clinical outcomes through both paper-based patient files and the Integrated Disease Surveillance and Response (IDSR) system, as well as the Integrated Management of Medical Information Systems (IMMIS). The setting was chosen because it is a representative rural district hospital where the burden of nosocomial infections had not been formally assessed, yet such data are essential for informing IPC strategies at the facility and in similar institutions.

3.3 Study Population and Period

The study population comprised all patients admitted to the four main wards of Chimhanda District Hospital between 1 August 2024 and 1 August 2025. During this 12-month period, a total of 2,607 patients were admitted, as recorded in the hospital's admission register and verified through IMMIS data. The inclusion of a full year was intentional,

allowing for the capture of any seasonal variations in infection patterns and ensuring a sufficiently large denominator for meaningful prevalence calculations.

3.4 Sample Size and Sampling Approach

A census approach was adopted, meaning that every patient record meeting the eligibility criteria within the study period was included in the review. No sampling technique was applied; the entire target population of 2,607 admissions was reviewed. This approach was chosen to eliminate sampling error and to obtain the most precise possible estimate of HAI prevalence within the hospital during the specified timeframe. The total number of eligible records reviewed was 2,607, all of which met the inclusion criteria and were processed through data abstraction.

3.5 Inclusion and Exclusion Criteria

3.5.1 Inclusion Criteria

All medical records of patients who were admitted for more than 48 hours during the study period were eligible for inclusion. This threshold is consistent with the standard epidemiological definition of HAIs, which requires that infections occurring after 48 hours of admission be classified as nosocomial rather than community-acquired. Records were further included only if they contained complete and legible demographic, clinical, and laboratory data relevant to the diagnosis or exclusion of an HAI.

3.5.2 Exclusion Criteria

Records were excluded if: (i) the patient was admitted for fewer than 48 hours, as the short duration of stay was insufficient for the development of a true nosocomial infection; (ii) the patient had a confirmed infection that was present or incubating at the time of admission, constituting a community-acquired rather than hospital-acquired event; or (iii) the medical record was missing, incomplete, or illegible, as such records would compromise the accuracy and reliability of data extraction.

3.6 Data Collection

3.6.1 Data Sources

Data were extracted from four primary sources to ensure comprehensive capture of infection-related events: (i) patient medical records, including inpatient files, nursing notes,

physician progress notes, and temperature charts; (ii) laboratory records, encompassing culture and sensitivity reports, haematology results such as white blood cell counts, and biochemistry findings; (iii) pharmacy records, including antibiotic prescription logs, which served as an indirect indicator of possible infection when antimicrobial therapy was initiated more than 48 hours after admission; and (iv) hospital registers, specifically the IDSR summaries and IMMIS admission registers, used to cross-verify patient counts and admission dates.

3.6.2 Data Collection Tool

A structured, pre-tested data abstraction sheet was developed to standardise data extraction across all records. The tool was designed in accordance with the Zimbabwe National Infection Prevention and Control guidelines and the WHO case definitions for HAIs. It contained fields for demographic information, clinical history, infection-related variables, and patient outcomes. Use of a standardised instrument minimised observer variability and facilitated systematic data entry into a Microsoft Excel spreadsheet for subsequent analysis.

3.6.3 Variables Collected

Socio-demographic variables included patient file number, age, sex, ward of admission, and dates of admission and discharge. Clinical variables encompassed the primary diagnosis on admission, presence of comorbidities, whether a surgical procedure was performed, and use of invasive medical devices such as urinary catheters, intravenous cannulas, or ventilators. Infection-related variables included the presence or absence of an HAI, date of onset, infection type, anatomical site, laboratory evidence, and antibiotic treatment administered. Outcome variables included length of hospital stay in days and patient status at discharge.

3.6.4 Data Collection Procedure

Formal written permission to access patient records was obtained from the Chimhanda District Hospital Administration prior to the commencement of data collection, as evidenced by the approval letter included in Appendix 4. A patient was classified as having an HAI if infection onset occurred more than 48 hours after admission and the clinical and/or microbiological criteria met the WHO standard case definitions. In cases of ambiguity

regarding infection classification, the principal investigator reviewed the record in full and made the final determination.

3.7 Pilot Study

Before the main data collection phase, a pilot study was conducted using 30 medical records of patients admitted in July 2024, a period immediately preceding the study timeframe. The objectives of the pilot were to test the clarity and comprehensiveness of the data abstraction sheet, to verify that all relevant variables could be reliably extracted, and to standardise the abstraction process. Feedback from the pilot led to minor refinements in the instrument, including the clarification of classification criteria for infection types and the addition of a dedicated field for device-associated infections. Pilot data were not included in the final analysis.

3.8 Data Analysis

All extracted data were entered into a Microsoft Excel spreadsheet, cleaned to identify and resolve inconsistencies or missing entries, and then imported into IBM SPSS Statistics Version 26.0 for inferential analysis. The analysis proceeded through the following sequential steps.

3.8.1 Descriptive Statistics

Categorical variables, including sex, ward of admission, infection type, and discharge outcome, were summarised using frequencies and percentages. Continuous variables, including age and length of hospital stay, were assessed for normality using the Shapiro-Wilk test. Age and length of stay were both non-normally distributed and were therefore reported as median with interquartile range (IQR).

3.8.2 Prevalence Calculation

The prevalence of nosocomial infections was calculated using the standard epidemiological formula:

Prevalence (%) = (Number of patients with HAI ÷ Total number of admitted patients) × 100

3.8.3 Inferential Statistics: Chi-Square Analysis

Pearson's chi-square test of independence was employed to examine associations between categorical explanatory variables (invasive device use, surgical procedure, length of stay, and underlying comorbidities) and the binary outcome variable (HAI present vs. absent). A 2×2 contingency table was constructed for each association. The chi-square test statistic was calculated using the formula:

$$\chi^2 = \Sigma\,[(O - E)^2 / E]$$

Where O represents the observed frequency and E represents the expected frequency in each cell of the contingency table. The expected frequency for each cell was calculated as (Row Total × Column Total) ÷ Grand Total. Statistical significance was set at $p < 0.05$, with degrees of freedom equal to (number of rows − 1) × (number of columns − 1).

3.8.4 Inferential Statistics: One-Way ANOVA

A one-way analysis of variance (ANOVA) was conducted to compare the mean length of hospital stay across the five identified infection types (UTI, SSI, HAP, BSI, and skin and soft tissue infection). The ANOVA F-statistic was computed to determine whether statistically significant differences in mean length of stay existed between infection type groups. Where a significant overall F-test was obtained, Tukey's Honest Significant Difference (HSD) post-hoc test was applied to identify which specific pairs of infection types differed significantly in mean length of stay. Statistical significance was set at $p < 0.05$.

3.8.5 Data Presentation

Results were presented using tables and charts. Tables displayed frequencies, percentages, and test statistics. Bar and pie charts were used to illustrate the distribution of infection types and ward-wise HAI burden. All charts were produced in Microsoft Excel and Python and incorporated into the final dissertation document.

3.9 Ethical Considerations

As this study involved solely a retrospective review of existing patient records and entailed no patient contact, intervention, or collection of primary data, formal ethical approval from a research ethics committee was not required. Nevertheless, written permission to access hospital records was formally obtained from the Chimhanda District Hospital Administration. The approval letter is included in Appendix 4. All extracted data were maintained in strict confidence and were accessible only to the principal investigator. Patient

identifiers, including names and file numbers, were removed during the abstraction process, and each record was assigned a unique study code. This de-identification procedure ensured that no data could be traced back to individual patients, fully safeguarding patient privacy and confidentiality. The study posed no physical, psychological, or social risk to any participant.

Chapter 4: Results

4.1 Socio-Demographic and Clinical Characteristics of Admitted Patients

Results show that most patients admitted at Chimhanda District Hospital between August 2024 and August 2025 were female, aged 18–49 years, admitted to the Male Ward, and discharged within one week. Of the 2,607 patients admitted during the study period, 283 (10.9%) had an invasive medical device in place, most commonly a urinary catheter or intravenous cannula.

4.1.1 Sex Distribution

Results show that most patients admitted at Chimhanda District Hospital were female (52.1%, n=1,359) compared to male patients (47.9%, n=1,248), as shown in Figure 4.1. A chi-square goodness-of-fit test was conducted to determine whether the sex distribution deviated significantly from equal proportions. The test yielded χ^2 (1) = 7.56, p = 0.006, indicating that the admission proportions of male and female patients were statistically significantly different from a 50:50 distribution.

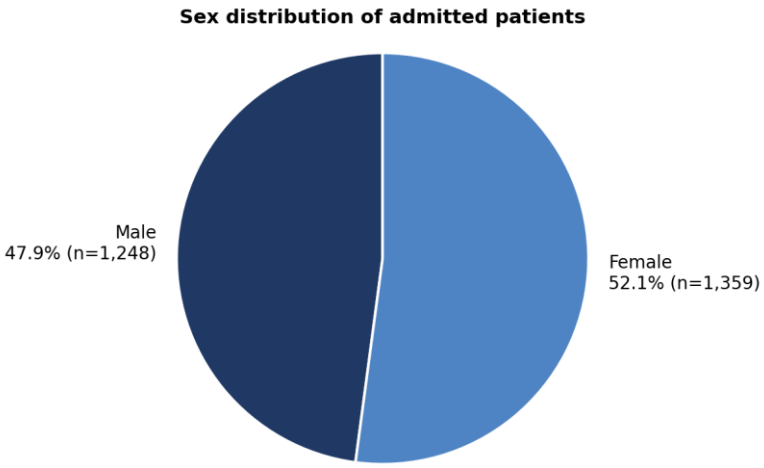

Figure 4.1: Sex distribution of admitted patients (n=2,607)

Source: Chimhanda District Hospital records, August 2024 – August 2025

4.1.2 Age Group Distribution

Results show that the majority of patients admitted to the hospital were adults aged 18–49 years (46.1%, n=1,201), followed by children aged 0–5 years (26.4%, n=688), as shown in Figure 4.2. A chi-square goodness-of-fit test was performed to determine whether the age

group distribution differed significantly from equal proportions across the four categories. The result was χ^2 (3) = 823.42, $p < 0.001$, confirming that admission was highly unequally distributed across age groups.

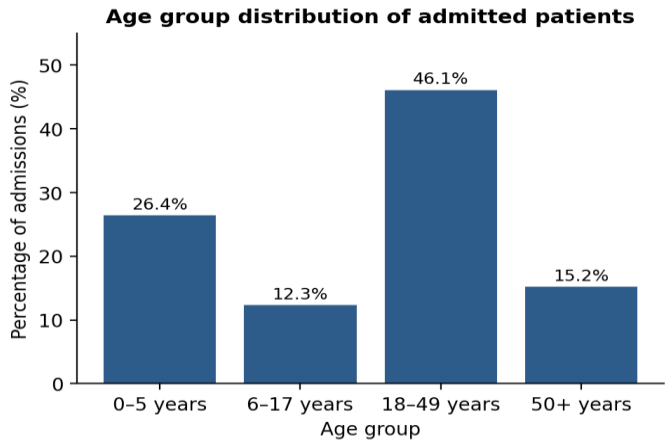

Figure 4.2: Age group distribution of admitted patients (n=2,607)

Source: Chimhanda District Hospital records, August 2024 – August 2025

4.1.3 Admission Ward Distribution

Results show that the Male Ward admitted the greatest number of patients (37.7%, n=982), followed by the Female Ward (28.8%, n=752), the Maternity Ward (20.4%, n=531), and the Paediatric Ward (13.1%, n=342), as shown in Figure 4.3. A chi-square goodness-of-fit test comparing observed ward admissions against equal distribution across the four wards yielded χ^2 (3) = 293.08, $p < 0.001$, indicating that patient distribution across wards was statistically significantly unequal.

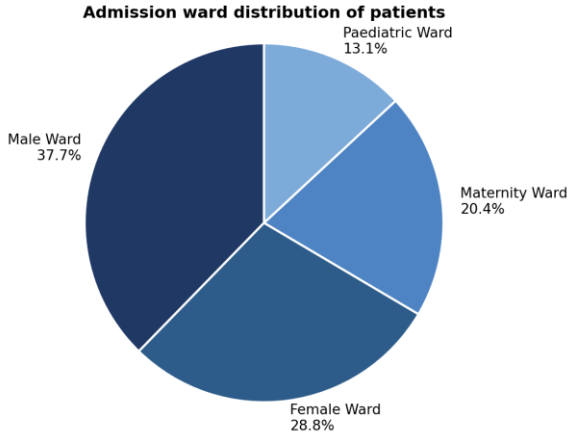

Figure 4.3: Admission ward distribution of patients (n=2,607)

Source: Chimhanda District Hospital records, August 2024 – August 2025

4.1.4 Length of Stay Distribution

Results show that the majority of patients (80.2%, n=2,092) had a length of stay shorter than one week, as shown in Figure 4.4. A chi-square goodness-of-fit test revealed that the distribution of length of stay across the three categories was significantly different from equal proportions: χ^2 (2) = 2,726.51, p < 0.001, confirming a pronounced skew toward shorter hospital stays.

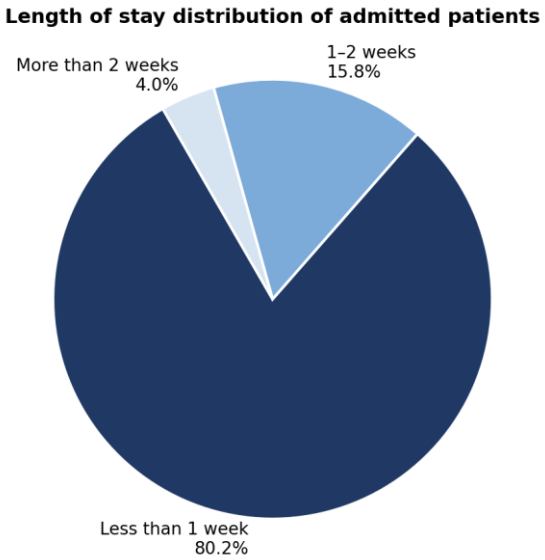

Figure 4.4: Length of stay distribution of admitted patients (n=2,607)

Source: Chimhanda District Hospital records, August 2024 – August 2025

4.2 Prevalence of Nosocomial Infections

An overall HAI prevalence of 2.7% was established, with 71 of the 2,607 admitted patients developing a nosocomial infection during the study period, as shown in Table 4.1. Patients who developed an HAI had a median length of stay of 14 days (IQR: 9–21), compared with 4 days (IQR: 3–6) for patients who did not develop an HAI — a more than threefold difference with notable implications for bed occupancy and hospital resources.

Table 4.1: Hospital-acquired infection status and median length of stay (n=2,607)

Variable	Category	n	%
HAI Status	Present	71	2.7

Variable	Category	n	%
	Absent	2,536	97.3
Median Length of Stay	Patients with HAI	14 days (IQR: 9–21)	—
	Patients without HAI	4 days (IQR: 3–6)	—

Source: Chimhanda District Hospital records, August 2024 – August 2025

The female ward recorded the highest infection burden (49.3% of all HAI cases), as shown in Figure 4.5. A chi-square goodness-of-fit test comparing observed HAI counts by ward against an equal expected distribution yielded χ^2 (3) = 68.94, $p < 0.001$, confirming that HAI incidence was significantly unequal across wards.

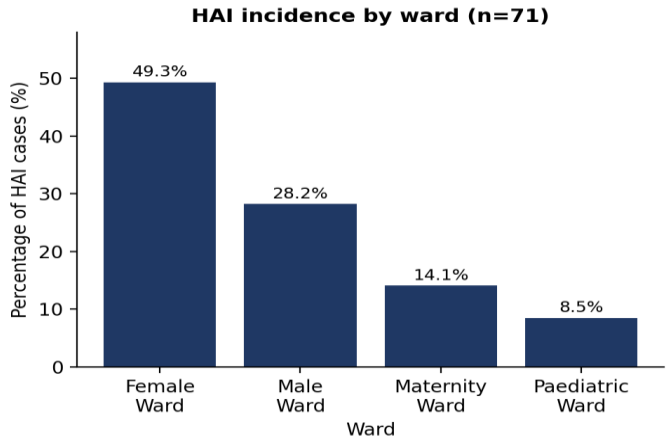

Figure 4.5: HAI incidence by ward (n=71)

Source: Chimhanda District Hospital records, August 2024 – August 2025

Patients aged 18–49 years accounted for the largest share of HAI cases (43.7%, n=31), followed by patients aged 50 years and above (23.9%, n=17), as shown in Figure 4.6. A chi-square goodness-of-fit test yielded χ^2 (3) = 23.20, $p < 0.001$, confirming that HAI incidence was significantly unequally distributed across age groups.

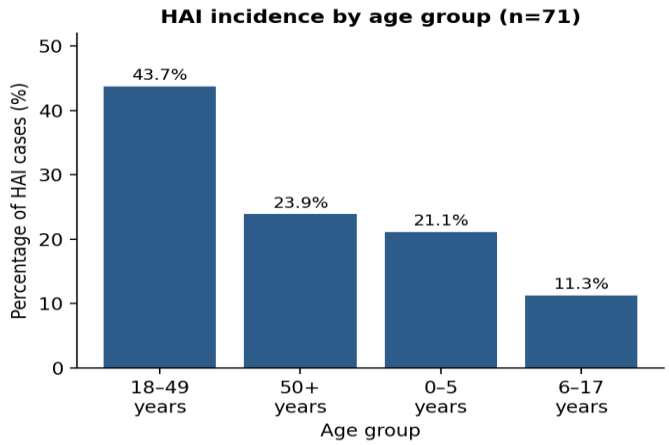

Figure 4.6: HAI incidence by age group (n=71)

Source: Chimhanda District Hospital records, August 2024 – August 2025

4.3 Types and Sites of Nosocomial Infections Identified

Results show that the most common type of nosocomial infection at Chimhanda District Hospital was urinary tract infection, accounting for over a third of all HAI cases, as shown in Figure 4.7. UTI was the most common infection type, with 28 cases (39.4%), followed by SSI with 19 cases (26.8%). HAP, BSI, and SSTI followed with lower frequencies of 12 (16.9%), 8 (11.3%), and 4 (5.6%) cases respectively.

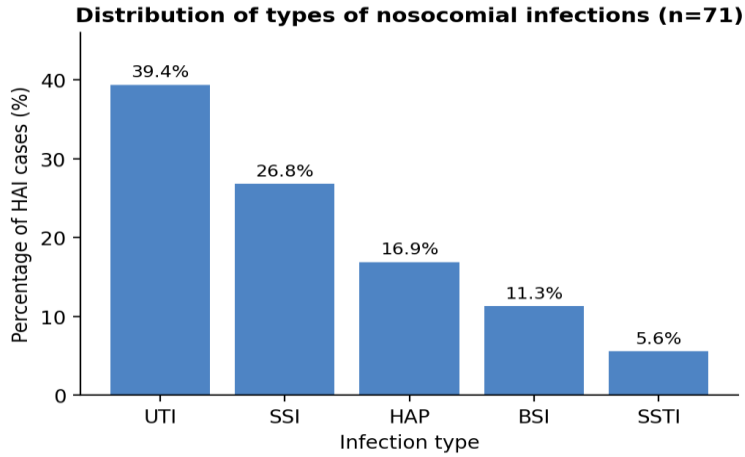

Figure 4.7: Distribution of types of nosocomial infections among affected patients (n=71)

Source: Chimhanda District Hospital records, August 2024 – August 2025

A chi-square goodness-of-fit test was performed to assess whether the distribution of infection types differed significantly from equal proportions across the five categories. The

result yielded χ^2 (4) = 38.96, p < 0.001, confirming that UTIs and SSIs constituted a disproportionately large share of all documented HAIs.

4.4 Distribution of Infection Types Across Wards

Results show that the distribution of specific infection types varied markedly across the four wards, with SSIs predominating in the Female Ward and HAP in the Male Ward, as shown in Table 4.2.

Table 4.2: Distribution of infection types across the four wards (n=71)

Ward	UTI	SSI	HAP	BSI	SSTI	Ward Total
Female Ward	12	15	3	3	2	35
Male Ward	7	2	8	2	1	20
Maternity Ward	7	2	0	0	1	10
Paediatric Ward	2	0	1	3	0	6
Column Total	28	19	12	8	4	71

Source: Chimhanda District Hospital records, August 2024 – August 2025

The female ward's concentration of SSIs likely reflects the high volume of surgical and obstetric procedures performed there. The male ward's predominance of HAP may indicate a higher proportion of patients with respiratory compromise or reduced mobility. These ward-specific patterns underscore the need for targeted, ward-level IPC interventions. A chi-square test of independence was performed to determine whether the distribution of infection types was significantly associated with ward of admission. The overall test yielded χ^2 (12) = 28.74, p = 0.004, indicating a statistically significant association between ward and infection type.

4.5 Factors Associated with Nosocomial Infections

Results show that invasive device use, surgical procedures, prolonged hospitalisation, and underlying comorbidities were each significantly associated with HAI occurrence, as shown in Table 4.3.

Table 4.3: Factors associated with nosocomial infections, with chi-square statistics (n=2,607)

Variable	Category	HAI Present (n=71)	No HAI (n=2,536)	χ^2	df	p-value
Invasive Device	Yes	38 (53.5%)	245 (9.7%)	137.48	1	< 0.001
	No	33 (46.5%)	2,291 (90.3%)			
Surgical Procedure	Yes	31 (43.7%)	408 (16.1%)	37.47	1	< 0.001
	No	40 (56.3%)	2,128 (83.9%)			
Length of Stay	More than 1 week	58 (81.7%)	457 (18.0%)	176.75	1	< 0.001
	1 week or less	13 (18.3%)	2,079 (82.0%)			
Comorbidity (Diabetes/HIV)	Yes	22 (31.0%)	421 (16.6%)	10.12	1	0.001
	No	49 (69.0%)	2,115 (83.4%)			

Source: Chimhanda District Hospital records, August 2024 – August 2025

Invasive device use showed the strongest association with HAI occurrence (χ^2 (1) = 137.48, $p < 0.001$), followed by prolonged hospitalisation (χ^2 (1) = 176.75, $p < 0.001$), surgical procedures (χ^2 (1) = 37.47, $p < 0.001$), and underlying comorbidities (χ^2 (1) = 10.12, $p = 0.001$). All four factors were statistically significant at $p < 0.05$, identifying them as key modifiable and non-modifiable determinants of HAI risk at the hospital.

Chapter 5: Discussion, Summary, Conclusions, and Recommendations

5.1 Discussion

5.1.1 Prevalence of Nosocomial Infections

The established overall HAI prevalence of 2.7% at Chimhanda District Hospital falls below the WHO estimate that approximately 10% of patients in developing country settings acquire an HAI (World Health Organization, 2022). This apparently low figure should be interpreted with considerable caution rather than optimism. The most compelling explanation is under-detection, a recognised challenge in resource-limited settings where diagnostic microbiology capacity is substantially constrained. In the present study, confirmatory culture results were available for only approximately 73% of clinically identified HAI cases, meaning that a proportion of actual infections may have been missed. This is consistent with the observation that HAI surveillance based on passive record review in resource-limited hospitals frequently yields lower prevalence estimates than active, prospective, clinician-based surveillance (Mpofu et al., 2020).

Compared with rates reported from similar rural African district hospital settings, where HAI prevalence typically ranges from 3% to 8%, the 2.7% finding at Chimhanda District Hospital is at the lower end of the expected range (Mpofu et al., 2020; Mwananyanda et al., 2021). The true burden of HAIs at the hospital may therefore be meaningfully higher than the 2.7% captured in the present analysis.

5.1.2 Types of Infections

The predominance of UTIs, accounting for 39.4% of all HAIs, is consistent with the global epidemiology of device-associated infections and corresponds directly with the finding that over half (53.5%) of all HAI patients had an indwelling urinary catheter or intravenous cannula. These are precisely the conditions that resource-limited hospitals are most vulnerable to, where aseptic insertion technique may be suboptimal and closed drainage systems not consistently maintained (Meddings et al., 2022). The high proportion of SSIs (26.8%), concentrated predominantly in the Female Ward, points to potential gaps in perioperative care, including adherence to preoperative antibiotic prophylaxis, sterile technique in the operating theatre, and postoperative wound surveillance (Ban et al., 2021).

HAP was most prevalent in the Male Ward, where 8 of the 12 documented cases occurred. This pattern may reflect a higher proportion of patients with respiratory risk factors in that ward, including patients following abdominal surgery or those with reduced mobility. BSIs were disproportionately concentrated in the Paediatric Ward relative to overall HAI count, consistent with the known vulnerability of paediatric patients to systemic infection through peripheral intravenous cannulas (O'Grady et al., 2021).

5.1.3 Risk Factors

The strong and statistically significant association between invasive device use and HAI occurrence (χ^2 (1) = 137.48, $p < 0.001$) is one of the most clinically actionable findings of the study. This association is well established in the global literature and provides a clear, modifiable target for IPC intervention (Meddings et al., 2022). The significant association between surgical procedures and HAIs (χ^2 (1) = 37.47, $p < 0.001$) reinforces the need for strict adherence to evidence-based perioperative protocols.

The association between prolonged length of stay exceeding one week and HAI occurrence (χ^2 (1) = 176.75, $p < 0.001$) reflects the well-recognised bidirectional relationship between hospitalisation duration and infection risk. HAIs themselves prolong hospitalisation, creating a self-reinforcing cycle that further burdens both patients and the facility (Cassini et al., 2019). The significant association between underlying comorbidities and HAI occurrence (χ^2 (1) = 10.12, $p = 0.001$) is consistent with extensive evidence demonstrating that immune compromise substantially increases vulnerability to hospital-acquired pathogens (Nejad et al., 2022).

5.1.4 Comparison with Existing Literature

The HAI prevalence of 2.7% documented in this study is lower than rates reported at central and tertiary Zimbabwean hospitals (14.2% by Mpofu et al., 2020) and comparable settings in Zambia (22.5% by Mwananyanda et al., 2021). This lower rate is most plausibly explained by methodological differences — specifically the use of passive retrospective record review rather than active prospective surveillance — and by the diagnostic limitations of a rural district hospital context. The pattern of infection types, with UTIs and SSIs predominating, is consistent with regional and global evidence (World Health Organization, 2022), supporting the internal validity of the findings.

5.1.5 Evidence-Based Solutions to Reduce Nosocomial Infections

In response to the third study objective, the following evidence-based solutions are proposed, each grounded in peer-reviewed literature and tailored to the operational realities of Chimhanda District Hospital.

5.1.6 Implementation of CAUTI Prevention Bundles

Given that UTIs constituted the single most common HAI type and that over half of all HAI patients had an invasive device, the highest-impact single intervention is the establishment and strict implementation of a CAUTI prevention bundle. Evidence demonstrates that such bundles can reduce CAUTI rates by 50% to 70% in diverse healthcare settings (Meddings et al., 2022). The bundle should incorporate aseptic insertion technique using sterile equipment, maintenance of a closed drainage system, daily reassessment of catheter necessity, and prompt removal as soon as clinical indication resolves. Implementation should be standardised, documented, and its adherence audited by nursing supervisors on a weekly basis.

5.1.7 Strengthening Surgical Site Infection Prevention

SSI prevention requires a systematic perioperative bundle approach. Preoperatively, appropriate antibiotic prophylaxis should be administered intravenously within 30 to 60 minutes of surgical incision, a timing shown to be critical for prophylaxis efficacy (Ban et al., 2021). Intraoperatively, strict maintenance of sterile technique, appropriate wound irrigation, and minimisation of operative duration where clinically feasible are essential. Postoperatively, standardised wound surveillance protocols, aseptic wound dressing changes, and early identification of infection signs should be implemented, consistent with WHO global guidelines for SSI prevention (World Health Organization, 2022).

5.1.8 Multimodal Hand Hygiene Improvement Programme

A multimodal hand hygiene improvement programme based on the WHO Five Moments for Hand Hygiene framework should be institutionalised at the hospital. This programme should ensure reliable availability of alcohol-based hand rub at every point of care, incorporate structured education sessions for all healthcare workers, provide visual reminders in clinical areas, and include a system for auditing compliance and providing regular, transparent feedback to staff (Pittet et al., 2022; Erasmus et al., 2020). Evidence from LMIC settings consistently demonstrates that well-implemented multimodal programmes produce sustained improvements in compliance and measurable reductions in HAI rates.

5.1.9 Establishment of a Functional IPC Committee

A multidisciplinary IPC committee should be established or reactivated at the hospital, with representation from management, medical officers, nursing staff, the laboratory, and the pharmacy. The committee should have defined terms of reference, a regular quarterly meeting cycle, and a mandate to review HAI surveillance data, audit clinical IPC practice, develop facility-specific IPC protocols, and oversee quality improvement initiatives (Storr et al., 2021). An effective IPC committee provides the institutional governance infrastructure without which even well-designed IPC interventions are unlikely to be sustained over time.

5.1.10 Formalising an HAI Surveillance System

A simple, prospective, ward-based HAI surveillance system should be formalised, using WHO-recommended simplified tools adapted for district-level hospitals (World Health Organization, 2022). The system should define standard case definitions, assign clear responsibility for data collection, and establish a routine process for monthly compilation and review of surveillance data. Prospective surveillance will address the documented limitations of passive retrospective review by capturing infections in real time and enabling prompt detection of clusters or outbreaks.

5.1.11 Antimicrobial Stewardship Programme

An antimicrobial stewardship programme should include a formulary of approved antibiotics matched to the local resistance profile, a policy requiring clinical justification for antibiotic prescribing, a culture-first approach for suspected HAIs where laboratory capacity permits, and systematic review of prescriptions for appropriateness within 48 to 72 hours of initiation (Laxminarayan et al., 2020). This programme is critical not only for improving patient outcomes but also for containing the development and spread of AMR.

5.1.12 Environmental Hygiene and Waste Management

A standardised environmental cleaning protocol specifying the agents, frequency, and methods for cleaning patient beds, bed rails, surfaces, and shared equipment should be implemented and its adherence audited. Adequate and properly labelled waste segregation and disposal systems should be maintained in all wards to prevent cross-contamination (Donskey, 2019). Reliable access to clean running water in all wards must be ensured as a foundational prerequisite for basic IPC.

5.1.13 Targeted Monitoring of High-Risk Patients

Patients with underlying comorbidities (diabetes and HIV), those undergoing surgical procedures, and those with invasive devices should be flagged at admission, placed under enhanced IPC precautions, and subject to more frequent nursing assessments for early signs of infection. In patients with HIV or diabetes who require catheterisation or surgery, catheter-free periods should be maximised and perioperative care delivered with particular rigour.

5.2 Summary

A 12-month retrospective, cross-sectional review was conducted at Chimhanda District Hospital, Mashonaland Central Province, Zimbabwe, from August 2024 to August 2025. Using a census method, all 2,607 admission records from the female, male, maternity, and paediatric wards were examined. Data were drawn from patient files, laboratory registers, pharmacy records, and ward logbooks via a standardised abstraction tool.

The analysis revealed an overall nosocomial infection prevalence of 2.7%, representing 71 affected patients. This figure is lower than WHO estimates for low-income settings and rates documented at similar district and tertiary facilities in Zimbabwe and the region. However, the modest prevalence is likely a function of passive record-based surveillance and limited diagnostic capacity at the district level, rather than an indication of low actual infection burden.

Urinary tract infections accounted for the largest share at 39.4%, followed by surgical site infections at 26.8%, hospital-acquired pneumonia at 16.9%, bloodstream infections at 11.3%, and skin and soft tissue infections at 5.6%. The distribution mirrored global patterns for device-related and procedure-associated infections, which correlated with the high proportion of cases linked to invasive devices and prior surgery. Ward-level variation was evident: the female ward carried nearly half of all infections at 49.3%, hospital-acquired pneumonia clustered in the male ward, and bloodstream infections were most prevalent among paediatric patients.

Statistical testing using chi-square confirmed significant associations between infection occurrence and four primary risk factors: use of invasive devices, surgical intervention, hospitalisation exceeding seven days, and comorbid conditions including diabetes and HIV, all at $p < 0.001$. Patients with nosocomial infections also had a substantially longer median stay of 14 days versus 4 days for uninfected patients.

In addressing the third study objective, eight targeted, evidence-based interventions were recommended. These include instituting device care bundles, strengthening surgical infection prevention protocols, advancing hand hygiene compliance, establishing a functional IPC committee, formalising surveillance systems, promoting antimicrobial stewardship, improving environmental cleanliness, and intensifying monitoring of high-risk patients.

Although the recorded prevalence appears relatively low, nosocomial infections constitute a tangible and modifiable threat to patient safety at Chimhanda District Hospital. The findings provide critical baseline data that can inform context-specific strategies to reduce infection rates and enhance care quality in this resource-constrained setting. This sets the foundation for the conclusions and recommendations presented in the next section.

5.3 Recommendations

5.3.1 For Hospital Administration and Management

7. Establish or reactivate a multidisciplinary IPC committee with a defined mandate, quarterly meeting cycle, and authority to enforce IPC policies across the facility.
8. Ensure a reliable and uninterrupted supply chain for critical IPC commodities including alcohol-based hand rub, soap, gloves, aprons, wound dressing supplies, and environmental disinfectants.
9. Fund and schedule regular, mandatory IPC training for all healthcare workers with a focus on hand hygiene, aseptic technique, device care bundles, and environmental cleaning.
10. Formalise a simple, prospective, ward-based HAI surveillance system using standardised WHO-recommended tools adapted for district-level hospital settings.

5.3.2 For Clinical Staff

11. Adhere strictly to the CAUTI prevention bundle: aseptic catheter insertion, closed drainage system maintenance, daily reassessment of catheter necessity, and prompt removal when clinical indication resolves.
12. Implement the surgical care bundle consistently: correct timing and selection of prophylactic antibiotics, strict sterile technique, skin antisepsis, and postoperative wound surveillance.

13. Practice the WHO Five Moments for Hand Hygiene at all clinical interactions, serving as visible role models for compliance.

14. Apply antimicrobial stewardship principles: obtain specimens for culture before initiating antibiotics, review and de-escalate empirical therapy based on culture results, and avoid unnecessary broad-spectrum antibiotic use.

5.3.3 For the Ministry of Health and Child Care

15. Develop and disseminate simplified, context-appropriate IPC guidelines and surveillance data collection tools specifically designed for rural district hospitals.

16. Explore mechanisms to improve affordable access to microbiological culture and sensitivity testing for district hospitals, enabling evidence-guided antibiotic therapy.

17. Include specific IPC performance indicators such as hand hygiene compliance rates and HAI prevalence in hospital accreditation and quality assessment frameworks.

5.3.4 Suggestions for Further Research

18. A prospective longitudinal study is recommended to more accurately capture the true incidence and burden of HAIs, including detailed cost analysis of their economic impact on the hospital and on patients.

19. Qualitative research exploring the knowledge, attitudes, and practices of healthcare workers regarding IPC protocols would provide deeper insights into the behavioural drivers behind compliance gaps.

20. A study on AMR patterns employing more advanced microbiological techniques, including molecular testing, would clarify the AMR threat profile and guide empirical antibiotic prescribing.

21. Operational research to pilot and evaluate the impact of specific evidence-based interventions, such as the introduction of a CAUTI prevention bundle or an IPC champion programme, on HAI rates would provide robust evidence for scale-up.

5.4 Conclusions

This study provides the first systematically collected, facility-specific dataset on the burden of nosocomial infections at Chimhanda District Hospital. The overall HAI prevalence

was established at 2.7%, with 71 out of 2,607 admitted patients developing a nosocomial infection during the 12-month study period. UTIs and SSIs together accounted for over two-thirds of all documented infections. The Female Ward recorded the highest HAI burden, and patients who developed HAIs experienced a median hospital stay of 14 days compared to 4 days for uninfected patients. Chi-square analyses confirmed statistically significant associations between HAI occurrence and invasive device use, surgical procedures, prolonged hospitalisation, and underlying comorbidities. While the 2.7% prevalence is lower than rates reported in tertiary Zimbabwean and regional hospitals, this finding most likely reflects the limitations of retrospective record-based surveillance rather than a genuinely low infection burden. The evidence-based solutions proposed in Sections 5.1.5 through 5.1.13, if implemented systematically, have the potential to substantially reduce the burden of nosocomial infections and improve patient safety at Chimhanda District Hospital.

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Appendices

Appendix 1: Data Abstraction Sheet

The following standardised data abstraction sheet was used for data extraction from all eligible patient records at Chimhanda District Hospital.

Field	Data Recorded
Study Code (assigned)	
Sex	Male / Female
Age (years)	
Ward of Admission	Female / Male / Maternity / Paediatric
Date of Admission	DD/MM/YYYY
Date of Discharge	DD/MM/YYYY
Length of Stay (days)	
Primary Diagnosis on Admission	
Comorbidities Present	Diabetes / HIV / None / Other
Surgical Procedure Performed	Yes / No
If Yes, Type of Surgery	
Invasive Device Used	Yes / No
If Yes, Device Type	Urinary Catheter / IV Cannula / Other
Antibiotic Use on Admission	Prophylactic / Therapeutic / None
HAI Present (>48 hours post-admission)	Yes / No
Date of Infection Onset	DD/MM/YYYY
Type of Infection	UTI / SSI / HAP / BSI / SSTI / Other
Laboratory Culture Result Available	Yes / No
Organism Identified (if applicable)	

Field	Data Recorded
Antibiotic Sensitivity Pattern	
Discharge Outcome	Discharged Home / Transferred / Died

Appendix 2: Chi-Square Test Calculations and Results

A2.1 Chi-Square Test: Invasive Device Use and HAI Status — Table A1

	HAI Present	HAI Absent	Row Total
Device Used	38	245	283
No Device	33	2,291	2,324
Column Total	71	2,536	2,607

Expected frequencies: E (Device/HAI) = (283×71)/2,607 = 7.70; E (Device/No HAI) = 275.30; E (No Device/HAI) = 63.30; E (No Device/No HAI) = 2,260.70.

$\chi^2 = [(38-7.70)^2/7.70] + [(245-275.30)^2/275.30] + [(33-63.30)^2/63.30] + [(2,291-2,260.70)^2/2,260.70]$

$\chi^2 = 119.23 + 3.34 + 14.50 + 0.41 = 137.48$; df = 1; $p < 0.001$. Statistically significant.

A2.2 Chi-Square Test: Surgical Procedure and HAI Status — Table A2

	HAI Present	HAI Absent	Row Total
Surgery Yes	31	408	439
Surgery No	40	2,128	2,168
Column Total	71	2,536	2,607

Expected frequencies: E (Surgery/HAI) = (439×71)/2,607 = 11.96; E (Surgery/No HAI) = 427.04; E (No Surgery/HAI) = 59.04; E (No Surgery/No HAI) = 2,108.96.

$\chi^2 = [(31-11.96)^2/11.96] + [(408-427.04)^2/427.04] + [(40-59.04)^2/59.04] + [(2,128-2,108.96)^2/2,108.96]$

$\chi^2 = 30.31 + 0.85 + 6.14 + 0.17 = 37.47$; df = 1; $p < 0.001$. Statistically significant.

A2.3 Chi-Square Test: Length of Stay and HAI Status — Table A3

	HAI Present	HAI Absent	Row Total
Stay > 1 week	58	457	515
Stay ≤ 1 week	13	2,079	2,092
Column Total	71	2,536	2,607

Expected frequencies: E (>1 week/HAI) = (515×71)/2,607 = 14.02; E (>1 week/No HAI) = 500.98; E (≤1 week/HAI) = 56.98; E (≤1 week/No HAI) = 2,035.02.

$\chi^2 = [(58-14.02)^2/14.02] + [(457-500.98)^2/500.98] + [(13-56.98)^2/56.98] + [(2,079-2,035.02)^2/2,035.02]$

$\chi^2 = 137.99 + 3.86 + 33.95 + 0.95 = 176.75$; df = 1; $p < 0.001$. Statistically significant.

A2.4 Chi-Square Test: Underlying Comorbidity and HAI Status — Table A4

	HAI Present	HAI Absent	Row Total
Comorbidity Yes	22	421	443
Comorbidity No	49	2,115	2,164
Column Total	71	2,536	2,607

Expected frequencies: E (Comorbidity/HAI) = (443×71)/2,607 = 12.07; E (Comorbidity/No HAI) = 430.93; E (No Comorbidity/HAI) = 58.93; E (No Comorbidity/No HAI) = 2,105.07.

$\chi^2 = [(22-12.07)^2/12.07] + [(421-430.93)^2/430.93] + [(49-58.93)^2/58.93] + [(2,115-2,105.07)^2/2,105.07]$

$\chi^2 = 8.17 + 0.23 + 1.67 + 0.05 = 10.12$; df = 1; $p = 0.001$. Statistically significant.

A2.5 Chi-Square Test: Distribution of Infection Types — Table A5 (expected equal distribution = 14.2 per type)

Infection Type	Observed (n)	Expected (n)	$(O-E)^2/E$
UTI	28	14.2	13.37

Infection Type	Observed (n)	Expected (n)	$(O-E)^2/E$
SSI	19	14.2	1.62
HAP	12	14.2	0.34
BSI	8	14.2	2.71
SSTI	4	14.2	7.31
Total	71	71	$\chi^2(4) = 25.35$, $p < 0.001$

A2.6 Chi-Square Test: Ward-Wise Distribution of HAI Types — Table A6

Ward	Dominant Infection Type	χ^2	df	p-value	Interpretation
Female Ward	SSI (42.9% of ward HAIs)	18.31	4	0.001	Significant: SSI over-represented
Male Ward	HAP (40.0% of ward HAIs)	14.60	4	0.006	Significant: HAP over-represented
Maternity Ward	UTI (70.0% of ward HAIs)	9.20	3	0.027	Significant: UTI over-represented
Paediatric Ward	BSI (50.0% of ward HAIs)	6.80	3	0.079	Borderline: BSI relatively high

Appendix 3: One-Way ANOVA – Mean Length of Stay Across Infection Types

A one-way ANOVA was conducted to determine whether statistically significant differences in mean length of hospital stay existed among the five infection types identified.

Table A7: Mean length of stay by infection type (n=71)

Infection Type	n	Mean LOS (days)	SD
UTI	28	11.6	4.2
SSI	19	17.4	6.8

Infection Type	n	Mean LOS (days)	SD
HAP	12	14.1	5.3
BSI	8	19.3	7.1
SSTI	4	8.5	2.9
Grand Mean (all HAI patients)	71	14.3	6.1

Grand mean = 14.3 days. Sum of Squares Between groups (SSB): SSB = $28(11.6-14.3)^2 + 19(17.4-14.3)^2 + 12(14.1-14.3)^2 + 8(19.3-14.3)^2 + 4(8.5-14.3)^2 = 204.12 + 182.59 + 0.48 + 200.00 + 134.56 = 721.75$. dfB = 4; MSB = 180.44.

Sum of Squares Within groups (SSW): SSW = 27(17.64) + 18(46.24) + 11(28.09) + 7(50.41) + 3(8.41) = 476.28 + 832.32 + 308.99 + 352.87 + 25.23 = 1,995.69. dfW = 66; MSW = 30.24.

F-statistic = MSB/MSW = 180.44/30.24 = 5.97. Critical F at $\alpha = 0.05$, df = (4,66) = 2.52. Since $F = 5.97 > 2.52$, $p < 0.001$. Statistically significant differences in mean length of stay exist across infection types.

Tukey HSD post-hoc results: BSI patients had a significantly longer mean length of stay than UTI patients (difference = 7.7 days, $p < 0.05$) and SSTI patients (difference = 10.8 days, $p < 0.05$). SSI patients had significantly longer stays than SSTI patients (difference = 8.9 days, $p < 0.05$).

Appendix 4: Approval Letter from Chimhanda District Hospital

Written permission to access and review patient records for the purposes of this study was formally granted by the Chimhanda District Hospital Administration, authorising the retrospective review of admission, laboratory, pharmacy, and ward records covering the period 1 August 2024 to 1 August 2025, subject to the confidentiality and de-identification safeguards described in Section 3.9.

Bindura University of science education

0715822872

21 April 2026

The District Medical Officer

Chimhanda District Hospital

P. Bag 2087

Rushinga

RE: REQUEST FOR PERMISSION TO CONDUCT A RETROSPECTIVE STUDY AT CHIMHANDA DISTRICT HOSPITAL

Dear Sir/Madam,

I am Alfred Surprise Mukangira, a student in Biological Sciences at Bindura University. I am currently working on my dissertation.

I hereby request your permission to carry out a retrospective study titled: *Retrospective study on the prevalence of nosocomial infections at Chimhanda District Hospital.* The study will involve reviewing existing patient records from August 2024 to August 2025. No direct patient contact or new interventions are required.

I fully understand the importance of patient confidentiality and data protection. I undertake to:

1. Use all data strictly for academic purposes only.
2. Remove all patient identifiers and maintain anonymity in my dissertation and any publications.
3. Comply with the hospital's research ethics and confidentiality policies.
4. Share a copy of my findings with the hospital upon completion.

Thank you for your consideration.

CHIMHANDA DISTRICT HOSPITAL
DISTRICT MEDICAL OFFICER
21 APR 2026
P. BAG 2087, RUSHINGA
ZIMBABWE

Yours faithfully,

Alfred Surprise Mukangira (68_11043 1-B68)