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St. Paul's Hospital Millennium Medical College**

Undergraduate Study Program

School of Public Health

**Prevalence, Associated Factors and Outcome of Hospital-Acquired Infections Among
Patients Admitted to The Internal Medicine Wards at SPHMMC from September 2024
to August, 2025**

By Bezawit Nega Addisu (Medical Intern)

A thesis submitted to undergraduate study program school of Public Health, St. Paul's Hospital Millennium Medical College in Partial Fulfillment of the Requirements for the Degree of B.Sc. in Medicine.

March 27, 2026

Addis Ababa, Ethiopia

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DECLARATION

I, the undersigned, declare that the thesis comprises my own work. In compliance with internationally accepted practices, I have acknowledged and refereed all materials used in this work. I understand that non-adherence to the principles of academic honesty and integrity, misrepresentation/ fabrication of any idea/data/fact/source will constitute sufficient ground for disciplinary action by the college and can also evoke penal action from the sources which have not been properly cited or acknowledged.

Name of the student: Bezawit Nega

Signature: _____

Date of submission: March 27,2026

Place: Addis Ababa, Ethiopia

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Abbreviations and Acronyms

BSI- Blood Stream Infection

CKD- Chronic Kidney Disease

DM- Diabetes Mellitus

HAI- Hospital Acquired Infection

HAP- Hospital Acquired Pneumonia

HDU- High Dependence Unit

ICU- Intensive Care Unit

LMICs- low- and middle-income countries

SPHMMC-St. Paul's Hospital Millennium Medical College

SSI- Surgical Site Infection

UTI- Urinary Tract Infection

VAP- Ventilator Associated Pneumonia

Abstract

Background

Hospital-acquired infection (HAI) defined as an infection occurring 48 hours or more after admission, is a major cause of illness and death among hospitalized patients, especially in low- and middle-income countries(LMICs)(1).

Objectives

The objective of this study is to determine the prevalence, outcome and associated factors of hospital acquired infection among patients admitted to the Internal Medicine Wards at St. Paul's Hospital Millennium Medical College from September 2024- August 2025.

Methodology

A retrospective record cross-sectional study was conducted with a sample size of 422. Data was collected from patient charts using checklist and analyzed by using SPSS version 21.

Result

Out of the 422 participants 53.6% were female and the mean age of participants was 47.8 ± 17.8 years. The prevalence of HAIs was 9.7%. BSIs were the most common type of HAI (43.9%), followed by UTI (36.6%) and HAP (19.5%). The majority of HAI cases were admitted to the nephrology ward (34.2%), followed by pulmonology (22%) and the transition ward (19.5%). Mechanical ventilation was significantly associated with HAIs. Patients who used it had around two times higher odds of developing HAIs compared to those who did not use (AOR = 2.044, 95% CI: 1.008–2.634, $p < 0.05$). Among patients diagnosed with HAI 68.3% of the cases resolved, while 24.4% had prolonged stay and 7.3% were dead.

Conclusion

The prevalence of HAIs in this study was slightly lower when compared to other studies in Ethiopia. Among types of HAIs, BSIs were found to be the most common. Although most patients with HAIs recovered, HAIs contribute to prolonged hospital stays and mortality, showing the need for strong infection prevention practices.

Recommendation

Routine monitoring of HAI should be strengthened to reduce their burden and improve patient outcomes

Keywords: Hospital-acquired infection, prevalence, clinical outcomes, internal medicine wards, bloodstream infection, length of hospital stay, Ethiopia

1. Introduction

1.1 Background

Hospital acquired infection (HAI) is a significant cause of morbidity and mortality globally, with increased burden in low- and middle-income countries (LMICs).(2,3) It is defined as an infection that occurs 48 hours or more after hospital admission and was not incubating at the time of admission.(4) HAI often results from exposure to contaminated medical equipment, or the use of invasive devices.(5)

The risk of HAIs has been calculated to be relatively 2-20 times higher in developing countries than that of developed countries. The highest cases of HAIs reported from hospitals in the Eastern Mediterranean and South East Asia Regions are 11.8% and 10.0% respectively. (6) Some reasons for high burden of HAIs on LMICs might be inadequate infrastructure, weak protocol implementation, poor hand hygiene promotion, and antibiotic regulation.(6) About 35% to 55% of HAIs could be prevented regardless of the economic status of the country.(6)

Some of the major risk factors for developing HAIs in LMICs identified are use of mechanical ventilation, use of central venous catheter, comorbidities and sedation. (7) Incidence of HAIs is highest in large teaching or academic hospitals. Patients in Internal Medicine wards, especially those with chronic medical illness, long hospital stays, invasive medical device exposure, and antibiotics overuse, are at increased risk of developing HAIs.(8,9)

Despite its clinical relevance, data on the burden of HAI in Ethiopia, particularly at the ward level, remains limited. At St. Paul's Hospital Millennium Medical College (SPHMMC), no recent data exists on the prevalence of HAI in the Internal Medicine Ward.

This study seeks to fill that gap by determining the prevalence and outcomes of HAIs among patients admitted to the Internal Medicine Ward over a 12-month period. The findings will support the hospital infection control efforts and guide future clinical and policy decisions.

1.2 Statement of the Problem

HAI is one of the most common and serious infections occurring related to hospital admission which contributes greatly to morbidity, prolonged hospital stays, increased antibiotic use, and healthcare costs.(10) It is often associated with poor patient outcomes, especially in patients with chronic diseases of whom many are found in Internal Medicine wards.(11)

At SPHMMC a major tertiary teaching hospital in Ethiopia, the burden of HAI remains poorly documented. Despite its clinical importance, there is limited local data on the prevalence, risk factors, and outcomes of HAIs among patients, especially patients in the Internal Medicine Ward.

The absence of updated and ward specific surveillance data makes it difficult for clinicians and hospital administrators to monitor the depth of the problem and plan infection prevention methods.(6) In addition to this, without reliable data, budget breakdown and programs that advocate appropriate use of antibiotic may be ignored or ineffective. Therefore, there is a need to assess the prevalence of HAIs among patients admitted to the Internal Medicine Wards at SPHMMC which helps to generate evidence that can guide clinical and public health interventions.

A key gap identified in the literature, is that existing data from Ethiopia predominantly focus on ICUs, surgical wards or pediatric wards, while information on HAIs in internal medicine wards is scarce. In addition to this, there is no adequate data on the prevalence of HAIs among specific wards such as cardiac, pulmonology, neurology, GI and nephrology.

1.3 Significance of the study

This study will generate essential data on the burden HAIs at one of Ethiopia's largest tertiary hospitals. By providing valuable insights into the prevalence and patterns and outcomes of HAI at SPHMMC, the findings can support the development of targeted infection prevention strategies, improve patient safety, and promote more efficient use of hospital resources, ultimately enhancing patient outcomes.

In addition, the study can serve as a foundational reference for future research and help inform policy decisions related to hospital infection control.

2. Literature review

Introduction

HAIs, also known as nosocomial infections, are infections that patients acquire during their stay in a hospital which were not present or incubating at the time of admission. These infections occurs 48 hours or more after hospital admission.(12) HAIs encompass a variety of infections, including HAP, surgical site infections(SSI), urinary tract infections(UTI), and bloodstream infections(BSI), and they have adverse risk for patient safety and are also associated with poor healthcare outcomes.(13) This literature review summarizes current evidence on prevalence and health outcomes of HAIs, with a focus on low-resource settings such as Ethiopia.

The global prevalence of HAIs is still concerning the public health society, with different rates reported across different regions. A systematic review and meta analysis indicated an overall HAI prevalence of 0.14%, with a yearly increase of 0.06%.(14) east africa19.7%

Studies reveal that the overall prevalence of HAIs across LMICs was 22%, with regional differences: 37% in the South-East Asian Region, 25% in Africa, and 14% in Europe. (15) There is a difference in the incidence of HAIs between high-income countries(HICs) and LMICs. For example, in developed countries, 7 out of every 100 hospitalized individuals develop HAI, while in LMICs this number increases to 15 per 100 patients.(16) SSIs had the highest prevalence among infection types at 27%, followed by HAP at 23% and UTIs at 22%.(15) HAIs prolong hospital stays, create disability, increased patient morbidity and mortality.(17)

The prevalence of HAIs in Africa is 0.27%, which is the highest rate globally. This prevalence is very concerning in central Africa compared to other regions of the continent.(18) When comparing this with data from Ethiopia, there are differences, including differences between regions and hospital wards, the prevalence in pediatric wards or ICUs tends to be higher, while general internal medicine ward data is not adequate.(17) In nations classified as developing, the extent of the issue continues to be significantly undervalued or, in some cases unrecognized, primarily due to the complicated nature of HAI diagnosis and the necessity for specialized knowledge and resources to conduct surveillances that can generate data for intervention strategies.(19)

In Ethiopia, the burden of HAIs is substantial and consistent across different regions, reflecting systemic challenges within the healthcare system. Studies from two major teaching hospitals, Wolaita Sodo University Comprehensive Specialized Hospital and Hawassa University Comprehensive Specialized Hospital reported a mean HAI prevalence of 11.9%.(8,20) This finding is similar with a study carried out in the Amhara regional state of Ethiopia, which documented an HAI prevalence of 14.9% with HAP being the most frequent type.(21)

Conclusion

The literature highlights that HAIs are a burden world wide especially in low income countries such as Ethiopia. SSIs, HAPs, and UTIs remain the most prevalent HAI types. However, there is a clear lack of ward level data on HAI prevalence and outcomes. To address these limitations, this research aims to fill the knowledge gap by determining the prevalence and outcomes of HAI specifically among adult patients admitted to the Internal Medicine Ward at SPHMMC over a 12-month period. The study's findings will provide valuable evidence to design infection prevention policies, improve patient safety, and contribute to the national information on HAIs in Ethiopia.

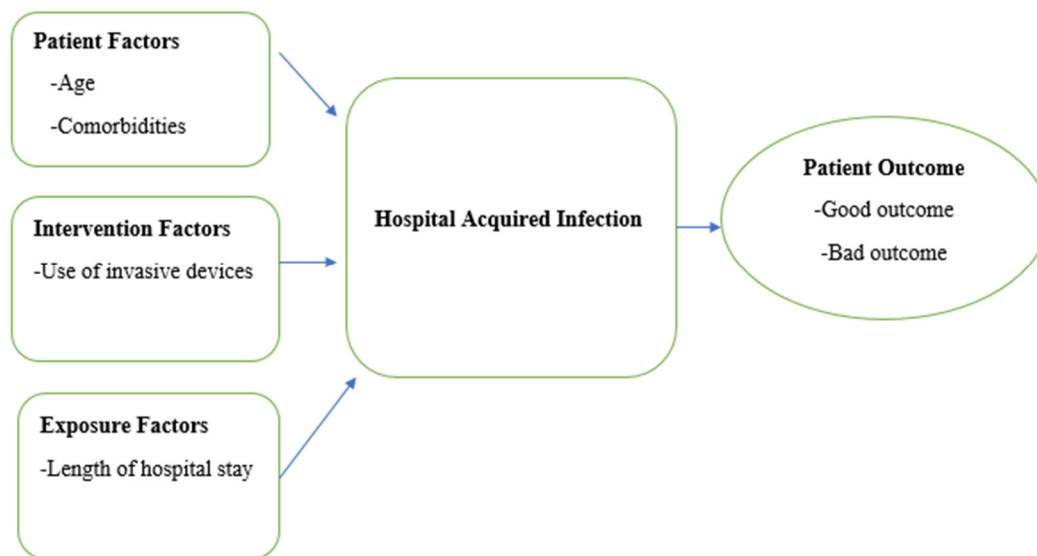


Figure 1

3. Objectives

General Objectives

To assess the prevalence and outcomes of HAIs among patients admitted to the Internal Medicine Wards at SPHMMC from September 2024 to August 2025.

Specific Objectives

1. To determine the prevalence of HAIs among patients admitted to the Internal Medicine Ward at SPHMMC from September 2024 to August 2025.
2. To identify clinical outcomes of HAIs such as mortality rate and total hospital stay.
3. To determine the association between risk factors and prevalence of HAIs.

4. Methodology

4.1 Study Area / Setting

This study was conducted at SPHMMC, a teaching tertiary public hospital located in Addis Ababa, Ethiopia. As one of the largest specialized national referral hospitals in the country, SPHMMC provides various medical, surgical, and critical care services. The hospital's catchment area extends beyond Addis Ababa, serving as a referral center for complex cases from across various regions of Ethiopia. The hospital treats an average of 200,000 patients annually, with a catchment population of more than 5 million.(22) This results in a patient population with advanced stages of disease.

The study was conducted within the Department of Internal Medicine. This department has six specialized units: High Dependency Unit (HDU), Pulmonology/Hematology, Nephrology, Cardiac/Endocrine, Neuro/Gastroenterology, and a transition ward. With a total capacity of approximately 160 beds, the department manages a high volume of adult patients presenting with a wide spectrum of acute and chronic medical conditions.

4.2 Study Design

This study used a record cross-sectional study design.

4.3 Source and Study Population

Source population consists of adult patients admitted to the Internal Medicine Wards of SPHMMC during the study period.

The study population include adult patients (≥ 18 years old) admitted to the Internal Medicine Ward of SPHMMC between September 1, 2024, and August 31, 2025, who meet the inclusion criteria.

4.4. Eligibility criteria

Inclusion Criteria:

1. Patients aged ≥ 18 years old.
2. Patients admitted for ≥ 48 hours during the study period.

Exclusion Criteria:

1. Patients diagnosed with pneumonia, UTI and BSI within the first 48 hours of admission.
2. Incomplete medical records or charts with missing key variables.

4.5 Sample Size and Sampling procedure

$$n = \frac{Z^2 \times p \times (1-p)}{d^2}$$

$$n = \frac{(1.96)^2 \times 0.5 \times (1-0.5)}{(0.05)^2}$$

$$n = 384$$

1. Additional 10% for non-response or incomplete data

$n_{\text{final}} = 246 + (0.10 \times 384) = 422$
--

n = required sample size

Z = Z-score for the desired confidence level

p = estimated prevalence

d = margin of error (5%)

Although some studies report the prevalence of HAI ranging from 10% to 31% in various settings, there is limited ward-specific data for the Internal Medicine Ward at SPHMMC. Given this variability and to make sure adequate sample size for precise estimation, a prevalence p of 50% was used in the sample size calculation as a conservative estimate. This approach maximizes the required sample size and thereby improves the reliability of our prevalence estimate.

A systematic random sampling technique was used to select patient charts for review from the admission logbook. The sampling interval (k) was calculated based on the total number of eligible admissions during the study period.

4.6 Variables of the Study

2. **Dependent Variable:**

- ✓ Presence or absence of HAI.
- ✓ Outcomes related to HAI (mortality, length of hospital stay)

3. **Independent Variables:**

- ✓ Age, sex
- ✓ Duration of hospital stay
- ✓ Presence of comorbidities (DM, CKD)
- ✓ Use of invasive devices (nasogastric tube)
- ✓ Prior antibiotic use

4.7 Operational Definitions

Hospital acquired infection: Infections acquired during hospital care after 48 hours of admission, which are not present or incubating at admission.(4)

Hospital acquired pneumonia: Pneumonia that develops 48 hours or more after hospital admission and was not present at the time of admission.(4)

Surgical site infection: Any purulent discharge, abscess, or spreading cellulitis at the surgical site during the month after the operation.(4)

Urinary tract infection: Positive urine culture with at least 105 bacteria/ml, with or without clinical symptoms.(4)

Bloodstream infection: Laboratory confirmed bacteremia not related to an infection at another site occurring ≥ 48 hours after admission. (22)

Prevalence of hospital acquired infection: The proportion of patients who developed HAI out of the total number of eligible admissions during the study period.(4)

Prolonged hospital stays: The length of stay greater than or equal to the 75th percentile of hospital stay among patients with HAIs.

4.8 Data collection procedures

A prepared checklist was used to collect important information such as age, sex, ward, comorbidities, length of stay, use of invasive devices, surgical procedure, culture result and outcome from patients' medical charts and test results. The checklist was adopted from previous similar studies and standardized guidelines. Data was collected by 3 trained medical students, supervised by the investigator. Before starting data collection, the data collectors were trained and pilot test was carried out on a small sample of patient charts using the checklist. During and after data collection, regular cross checks was done for identifying missing and inconsistent data entries. Incomplete records were excluded from the research after cross checking from the primary source.

4.9 Data processing and analysis

The collected data was cleaned on excel. After thorough data cleaning and validation, the dataset was analyzed by using SPSS version 21. Descriptive statistics was done to summarize the demographic and clinical characteristics of the study population. Frequencies and percentages was used for categorical variables such as sex, presence of comorbidities, and use of invasive devices. Mean and standard deviation was calculated for age and median was calculated for length of hospital stay.

The prevalence of HAIs was calculated as the proportion of patients who develop HAI out of the total eligible admissions during the study period. The prevalence was reported with 95% confidence intervals to express the precision of the estimate.

To identify factors associated with HAIs, inferential statistical analysis was used. Initially, binary logistic regression analysis was done to test the association between each independent variable and the outcome variable. Variables with a p-value <0.2 in the bivariate analysis were considered candidates for multivariable logistic regression analysis. Multivariable logistic regression analysis was done to control for potential confounders and identify independent predictors of HAIs. Adjusted odds ratios with 95% confidence intervals were used to measure the strength of association. A p-value of <0.05 was considered statistically significant.

For outcome assessment among HAI patients, descriptive analysis calculates the in hospital mortality among HAI patients and median length of hospital stay. These outcomes are reported

only for HAI patients, providing understanding into the clinical burden and prognosis of HAIs in the study population. Results are presented using tables and graphs to effectively communicate key outcome findings.

4.10 Ethical Considerations

Letter of ethical clearance was obtained from the institutional review board of SPHMMC.

Permission to conduct the research was waived from the research ethics committee.

Confidentiality of the patient is maintained. Data collected is used only for this research. Since this is an observational study, there is minimal to no physical to psychological risk to participants.

4.11 Dissemination of Results

The findings of this study will be submitted to the SPHMMC School of Public Health and Department of Internal Medicine as part of the thesis requirement. Additionally, results will be shared with hospital leadership to inform about the burden and outcome of HAIs which will contribute to development of infection prevention policies. Efforts will also be made to present the findings at academic conferences and publish in peer reviewed journals to contribute to the wider body of knowledge on HAIs in Ethiopia.

5. Results

Introduction

A total of 422 patient records were collected from SPHMMC electronic medical record system to be included in this analysis. This section presents the findings of the study which aimed to determine the prevalence and types of HAI at internal medicine wards of SPHMMC and describe their outcomes including death and length of hospital stay.

Socio-demographic characteristics

Table 1

Sociodemographic variables	Options	Frequency	Percent
Age	18-32	108	25.6
	33-46	103	24.4
	47-60	101	23.9
	61-74	78	18.5
	≥75	32	7.6
Sex	Male	226	53.6
	Female	196	46.4

The age of participants ranged from 18 to 96 years with a mean age of 47.8 ± 17.8 years.

Majority of individuals included in the study were in the age group 18–32 years, representing 108 (25.6%), followed by 33–46 years with 103 (24.4%). Participants aged 47–60 years were 101 (23.9%) and those in the 61–74 years group were 78 (18.5%). The smallest category was participants aged ≥ 75 years, which accounted for 32 (7.6%).

Male participants were 226 (53.6%), while female participants accounted for 196 (46.4%) of the study population.

The overall findings show a slightly higher proportion of male participants and a balanced distribution across adult age groups, with a gradual decline in representation among older age categories.

Prevalence of hospital acquired infections

Out of the 422 patients included in the study, 41 of them developed at least one HAI, giving a prevalence of 9.7% (95% CI: 6.9%–12.5%). The remaining 381 patients (90.3%) did not develop any kind of HAI during their hospital stay. This shows that approximately 1 in 10 patients admitted will acquire HAIs.

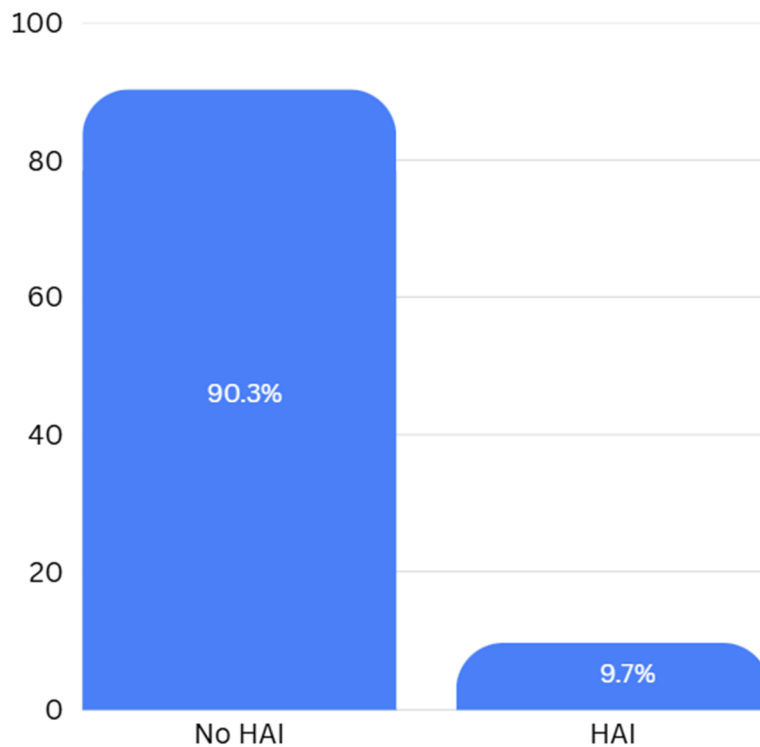


Figure 2: Prevalence of hospital-acquired infections

Types of hospital acquired infections

Blood stream infections are the most common types of HAI accounting for 43.9%(n=18), followed by urinary tract infections and hospital acquired pneumonia comprising 36.6%(n=15) and 19.5%(n=8) respectively.

Table 2

Types of HAI	Frequency	% among HAI	% of total population
BSI	18	43.9	3.6
UTI	15	36.0	4.3
HAP	8	19.5	1.9
Total	41	100	9.7

Ward distribution of patients with HAI

Most patients with HAI diagnosis were admitted to the Nephrology ward (34.2%), followed by Pulmonology (22%) and Transition ward (19.5%). Admissions to the Cardiac ward accounted for 14.6%, while fewer patients were admitted to Neurology/Gastrointestinal ward (7.32%) and HDU (2.4%).

Table 3

Wards	HAI Types						Total	
	UTI		BSI		HAP			
	Frequen cy	Percen tage	Frequen cy	Percent age	Freque ncy	Perce ntage	Frequ ency	Perce ntage
Nephrology	6	14.6	7	17.1	1	2.4	14	34.2
Pulmonology	5	12.2	2	4.9	2	4.9	9	22.0
Transition	2	4.9	4	9.8	2	4.9	8	19.5
Cardiac	1	2.4	4	9.8	1	2.4	6	14.6
Neuro/GI	0	0.0	1	2.4	2	4.9	3	7.32
HDU	1	2.4	0	0.0	0	0.0	1	2.4
Total	15	36.6	18	43.9	8	19.5	41	100

Length of stay in HAI patients

The mean length of hospital stay was 13.1 days (95% CI 10.3–15.8), with a median of 10 days and an interquartile range of 11 days. The shortest stay was 1 day and the longest was 37 days (range 36 days). The distribution of length of stay was right-skewed (skewness 1.18, kurtosis 0.75), indicating that a smaller number of patients had considerably longer admissions.

Table 4

Length of hospital stay in days	Mean	13.05	
	95% Confidence Interval for Mean	Lower Bound	10.33
		Upper Bound	15.77
	5% Trimmed Mean	12.47	
	Median	10.00	
	Variance	74.148	
	Std. Deviation	8.611	
	Minimum	1	
	Maximum	37	
	Range	36	
	Interquartile Range	11	
	Skewness	1.176	
	Kurtosis	.749	

Presence of comorbidities

Table 5

Comorbidities	Frequency	Percent
Diabetes Mellitus	84	19.9
Chronic Kidney Disease	70	16.6
Cardiac Disease	56	13.3
Hypertension	50	11.8
Immunosuppression	18	4.3
Others	67	15.9
No comorbidity	332	78.7

Among the total 422 participants, 332(78.7%) had no documented comorbidity, while 90(21.3%) had at least 1 comorbidity. Diabetes Mellitus was the most frequently identified comorbidity, observed in 84 patients (19.9%). Following is chronic kidney disease and cardiac diseases reported in 70 patients (16.6%) and 56 patients (13.3%) respectively. Hypertension was observed in 50 patients (11.8%), while immunosuppression was not that common reported in 18 patients (4.3%). 67 patients had other comorbid conditions.

Use of invasive device

Table 6

Invasive device	No HAI		HAI		Total	
	Frequency	Percentage	Frequency	Percentage		
None	269	70.6	10	24.4	279	66.1
NG Tube	43	11.3	9	22.0	52	12.3
Urinary Catheter	60	15.7	16	39.0	76	18.0
Mechanical Ventilation	6	1.6	3	7.3	9	2.1
Central Venous Catheter	3	0.8	3	7.3	6	1.4
Total	381	100	41	100	422	100

Out of the 422 patients included in the study, 279(66.1%) did not use any invasive device during their hospital stay. Among these, 10 patients (24.4%) developed HAIs. Among patients who used invasive devices, urinary catheter was the most frequently used followed by NG tube (52, 12.3%) and mechanical ventilation (9, 2.1%). Central venous catheter. The least commonly used invasive device was central venous catheter (6, 1.4%).

Regarding HAI distribution, patients with urinary catheter hold the highest number of HAI cases with 16 (39.0%) patients acquiring the infection, followed by patients with NG tube (9, 22.0%). Patients on mechanical ventilation and central venous catheter each contributed equally to HAI cases (3, 7.3% each). Overall, HAIs were more frequent among patients with invasive device exposure compared to those without device use.

Table 7

	UTI	BSI	HAP	Total
None	2	5	3	10
NG Tube	1	6	2	9
Urinary Catheter	11	5	0	16
Mechanical Ventilation	0	0	3	3
Central Venous Catheter	1	2	0	3
Total	15	18	8	41

As portrayed on Table 7, urinary catheter use is associated with the highest number of UTI cases (11), while NG tube use was mainly associated with BSI (6 cases). From the participants who developed HAI, patients on mechanical ventilation developed HAP (3 cases). Patients with central venous catheter developed UTI (1 case) and BSI (2 cases). In general, BSI was the predominant infection type across most device categories.

Association of invasive devices with HAI

Table 8

	P value	Odds Ratio	95% C.I. for Odds Ratio	
			Lower	Upper
Use of invasive device	.000	6.285	3.045	12.972
Use of NG tube	.054	2.204	.986	4.929
Use of urinary catheter	.000	3.413	1.720	6.774
Use of mechanical ventilation	.115	2.921	.770	11.075
Use of central venous catheter	.006	9.921	1.935	50.874

Use of invasive devices was significantly associated with HAIs. Patients who used any invasive devices had higher odds of developing HAI compared to those who did not use invasive devices (AOR = 6.29, 95% CI: 3.05–12.97, $p < 0.001$). Use of urinary catheter (AOR = 3.41, 95% CI: 1.72–6.77) and use of central venous catheter (AOR = 9.92, 95% CI: 1.94–50.87) were strongly associated with increased odds of HAI. But NG tube use (AOR = 2.20, 95% CI: 0.99–4.93, $p = 0.054$) and mechanical ventilation use (AOR = 2.92, 95% CI: 0.77–11.08, $p = 0.115$) were not significant predictors of HAI.

Association of comorbid conditions with HAI

Table 9

Comorbidities	P value	OR	95% CI for OR	
			Lower	Upper
Diabetes Mellitus	.538	.267	0.042	1.684
Chronic Kidney Disease	.731	.818	.260	2.573
Cardiac Disease	.998	.000	.000	
Hypertension	.553	1.358	.493	3.742
Immunosuppression	.094	.167	.021	1.354
Others	.835	1.102	.442	2.746

Binary logistic regression was performed to assess the association between comorbidities and HAI. The result indicated that comorbidities were not statistically significant predictors of HAI ($p = 0.538$).

Association of age with HAI

Table 10

Age	P value	Odds Ratio	95% CI for Odds Ratio	
			Lower	Upper
33-46	.824	1.200	.242	5.957
47-60	.655	1.436	.294	7.017
61-74	.313	2.216	.473	10.391
≥ 75	.408	1.957	.399	9.604

Binary logistic regression was conducted to assess the association between age category and HAI. The overall model showed that age category was not a statistically significant predictor of HAI ($p = 0.628$).

Compared with the reference age group, none of the age categories showed a significant association with HAI. Age of 33-46 had an odds ratio of 1.20 (95% CI: 0.242–5.957, $p = 0.824$), age category 47-60 had an OR of 1.44 (95% CI: 0.294–7.017, $p = 0.655$), age category 61-74 had an OR of 2.22 (95% CI: 0.473–10.391, $p = 0.313$), and age category ≥ 74 had an OR of 1.96 (95% CI: 0.399–9.604, $p = 0.408$). Although some age groups showed higher odds of HAI compared with the reference group, the associations were not statistically significant.

Multivariable analysis of factors associated with HAIs

Table 11

Factors associated	P value	Odds Ratio	95% CI for OR	
			Lower	Upper
Diabetes Mellitus	.106	3.855	.752	19.759
Chronic Kidney Disease	.314	2.430	.432	13.679
Cardiac Disease	.102	15.621	.581	419.807
Hypertension	.999	.000	.000	.
Immunosuppression	.077	5.969	.825	43.214
Others	.998	.000	.000	.
Use of NG tube	.637	.577	.059	.991
Use of Urinary Catheter	.194	.304	.050	.759
Use of Mechanical Ventilation	.000	2.044	1.008	2.634
Use of Central Venous Catheter	.263	.372	.066	.330

In the multivariable logistic regression analysis, the association between selected comorbidities, invasive device use and HAIs was assessed while controlling for potential confounders.

The results showed that mechanical ventilation was significantly associated with HAIs. Patients who used mechanical ventilation had around two times higher odds of developing HAIs compared to those who did not use (AOR = 2.044, 95% CI: 1.008–2.634, $p < 0.05$). This shows that mechanical ventilation is an independent risk factor for HAIs in the study population.

All other variables, including diabetes mellitus, chronic kidney disease, cardiac disease, immunosuppression, use of nasogastric tube, urinary catheter, and central venous catheter, were not statistically significant predictors of HAIs in the adjusted model ($p > 0.05$).

Overall, the findings indicate that mechanical ventilation is the only significant independent predictor of HAIs, while other examined factors did not show statistically significant associations after adjustment for confounders.

Clinical outcomes among HAI patients

Among patients diagnosed with HAI 68.3% of the cases resolved, while 24.4% had prolonged stay and 7.3% were dead.

Prolonged hospital stay is a length of hospital stay exceeding the 75th percentile of hospital stay duration among patients diagnosed with hospital-acquired infection. In this study, the 75th percentile of length of stay was 17.5 days; therefore, hospital stays longer than 17.5 days were considered prolonged.

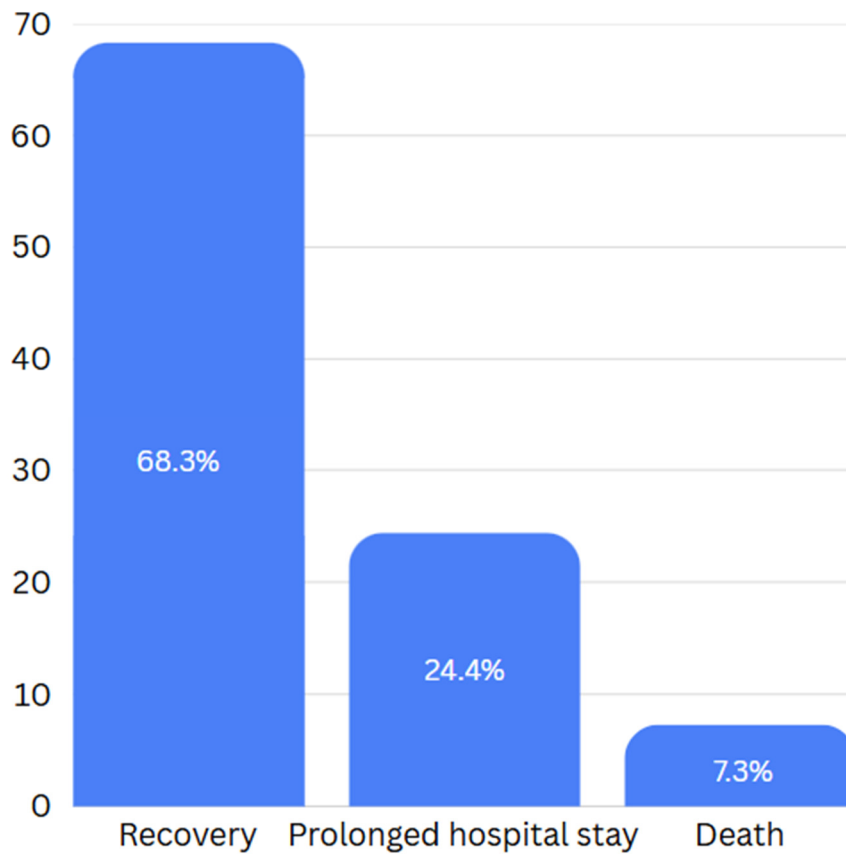


Figure 3

6. Discussion

This study found the prevalence of HAI among patients admitted to SPHMMC Internal Medicine Wards to be 9.7%. A study done at Hawassa comprehensive hospital reported that the prevalence of HAI was 11.9 % (n=49) (95%CI: 8.7-15.7).(8) Similarly, a study done in two teaching hospitals in the Amhara region which reported the prevalence of HAI to be 14.5%. (18)

This study reported a relatively lower prevalence and the reason for this might be temporal differences between the studies. Possible under detection or underreporting of HAIs in one setting compared to the other could also have a role in this variation.

Among the HAIs, BSIs were the most common, followed by UTI and HAP. A study done in Hawassa university comprehensive specialized hospital similarly reported the commonest HAI type to be BSI and SSI.(24) The similarity in result might be due to comparable hospital settings and similar exposures such as exposure to invasive devices. The lower occurrence of SSIs in the present study might be due to the focus on patients admitted to internal medicine ward in this study.

Most patients with HAI diagnosis were admitted to the Nephrology ward (34.2%), followed by Pulmonology (22%) and Transition ward (19.5%). Studies done in Ethiopia that compared the prevalence of HAIs among specific wards in the department of internal medicine were not found.

In this study, mechanical ventilation was significantly associated with HAIs. Patients who used mechanical ventilation had around two times higher odds of developing HAIs compared to those who did not use (AOR = 2.044, 95% CI: 1.008–2.634, $p < 0.05$). A study done in Slovakia reported that the risk of developing hospital-acquired pneumonia is ten times higher in patients on mechanical ventilation.(25) Findings in another study also reports that, patients who were on mechanical ventilator support for more than 14 days were 3.2 times higher chance of developing HAIs (AOR: 3.2, 95% CI: 1.4–7.2).(26)

In this study all other variables, including age, comorbidities, use of nasogastric tube, urinary catheter, and central venous catheter, were not statistically significant predictors of HAIs. This is similar to some previous studies that have reported no significant relationship between

demographic and clinical factors. However, a systematic review and meta-analysis, reported that for every one-year increase in age, the prevalence of HAI decreases by 0.04. (12). The difference may be explained by differences in study population characteristics, healthcare settings, and infection prevention practices across different studies.

The outcome of most patients was recovery (68.3%) (95% CI: 63.9%–72.8%), but a large proportion (24.3%) of patients had prolonged hospital stay and a smaller proportion (7.3%) resulted in mortality. Similarly, a study done at Jimma shows a twofold increment in death in patients who developed HAIs. (27) This shows that the burden of HAIs is significant in various parts of the country.

This study found the mean hospital stay to be 13.1 days, showing increased burden on both patients and the healthcare system. Similar study conducted in tertiary hospital in Ethiopia also reported six additional days of hospital stay in patients with HAIs. (28) In a study conducted in Scotland the median length of hospital stay for HAI patients was 30 days. (29) Shorter length of stay in low income countries like Ethiopia might be due to earlier discharge due to resource limitations and bed shortages.

Limitation and Strength

This study has various limitations, including the use of retrospective EMR review resulting in incomplete or missing data. The research was done at 1 hospital which might limit the generalizability of the findings. Some of the strengths include having a relatively large sample size of 422 patients and the representation of ward-specific data which is rare in Ethiopia.

7. Conclusion and Recommendation

This study identified the prevalence, types, and outcomes of HAIs among patients admitted to the internal medicine wards of SPHMMC. The overall prevalence of HAI was found to be 9.7%, indicating that HAIs remain an important clinical problem in the study setting. Among the identified infections, BSI was the most common type, followed by UTI and HAP.

The findings also showed that HAIs contribute significantly to poor clinical outcomes, including prolonged hospital stay and mortality. Patients with HAI had higher odds of developing a bad outcome compared to those without HAI, showing that HAIs are an important determinants of unfavorable hospital outcomes.

In conclusion, HAIs continue to create considerable burden on patients and the healthcare system in internal medicine wards. Strengthening infection prevention and control practices, improving early detection, and ensuring effective management strategies are essential to reduce the occurrence and impact of HAIs.

Routine surveillance and monitoring of HAIs at the ward level should be strengthened as prevalence and cause of HAIs vary across different wards and hospitals. In addition, targeted attention should be given to the prevention and management of common HAIs such as BSI, UTI and HAP as they are the top 3 commonest causes of HAIs in SPHMMC internal medicine wards as identified by this study.

For future studies I recommend the use of prospective study designs as it will allow better data quality and it will establish a temporal relationship. A multi-center study will improve generalizability and will enable the researcher to compare effectiveness of infection prevention measures among different hospital settings.

8. References

1. Maki G, Zervos M. Health Care – Acquired Infections in Low- and Middle - Income Countries and the Role of Infection Prevention and Control Hospital infections Infection control Antibiotic resistance LMIC. Infectious Disease Clinics of NA. 2021;35(3):827–39. doi:10.1016/j.idc.2021.04.014
2. Maki G, Zervos M. Health Care–Acquired Infections in Low- and Middle-Income Countries and the Role of Infection Prevention and Control. Infect Dis Clin North Am. 2021 Sep 1;35(3):827. doi:10.1016/J.IDC.2021.04.014 PubMed PMID: 34362546.
3. Balasubramanian R, Van Boeckel TP, Carmeli Y, Cosgrove S, Laxminarayan R. Global incidence in hospital-associated infections resistant to antibiotics: An analysis of point prevalence surveys from 99 countries. PLoS Med. 2023 Jun 1;20(6):e1004178. doi:10.1371/JOURNAL.PMED.1004178 PubMed PMID: 37310933.
4. Organization WH. Prevention of hospital-acquired infections A practical guide 2nd edition [Internet]. [cited 2025 Sep 9]. Available from: <http://www.who.int/emc>
5. Weldegebreal F, Admassu D, Meaza D, Asfaw M. Non-critical healthcare tools as a potential source of healthcare-acquired bacterial infections in eastern Ethiopia: A hospital-based cross-sectional study. SAGE Open Med. 2019 Jan 1;7:2050312118822627. doi:10.1177/2050312118822627 PubMed PMID: 30693084.
6. Shahida SM, Islam A, Dey BR, Islam F, Venkatesh K, Goodman A, et al. Hospital Acquired Infections in Low and Middle Income Countries: Root Cause Analysis and the Development of Infection Control Practices in Bangladesh. Open J Obstet Gynecol. 2016 Jan 21;6(1):28–39. doi:10.4236/ojog.2016.61004
7. Shrestha SK, Trotter A, Shrestha PK. Epidemiology and Risk Factors of Healthcare-Associated Infections in Critically Ill Patients in a Tertiary Care Teaching Hospital in Nepal: A Prospective Cohort Study. Infect Dis. 2022 Jan;15:11786337211071120. doi:10.1177/11786337211071120 PubMed PMID: 35095279.
8. Melakie G, Mengistie E, Ashenaa T. Associated Factors Among Patients Admitted, at Hawassa University Comprehensive Specialized Hospital Getachew Melakie 1, Embialle Mengistie2, Tesfaye Ashenaa3 [Internet]. 2022. doi:10.21203/rs.3.rs-1399139/v1
9. Marecos KM, Rivela LE, Méndez GI. Hospital-acquired pneumonia in patients hospitalized in the Intensive Care Unit of a National Hospital of Paraguay. The Egyptian Journal of Bronchology. 2025 Apr 17;19(1). doi:10.1186/S43168-025-00389-Z
10. Raoofi S, Kan FP, Rafiei S, Hosseinipalangi Z, Mejareh ZN, Khani S, et al. Global prevalence of nosocomial infection: A systematic review and meta-analysis. PLoS One. 2023 Jan 1;18(1):e0274248. doi:10.1371/JOURNAL.PONE.0274248 PubMed PMID: 36706112.
11. Kassam MI, Silago V, Damiano P, Wajanga B, Seni J, Mshana SE, et al. Patterns and outcomes of health-care associated infections in the medical wards at Bugando medical centre: a longitudinal cohort study. Antimicrob Resist Infect Control. 2023 Dec 1;12(1):139. doi:10.1186/S13756-023-01345-6 PubMed PMID: 38049911.

12. Monegro AF, Muppidi V, Regunath H. Hospital-Acquired Infections(Archived). Patient Safety: A Case-based Innovative Playbook for Safer Care: Second Edititon. 2023 Feb 12;183–98. doi:10.1007/978-3-031-35933-0_13 PubMed PMID: 28722887.
13. Bhaskar Pandey, Preeti Yadav, Praveen Kumar Dubey, Jagdish Kakadiya. Clinical Practices of Antimicrobial Drugs in Various Hospital-Acquired Infections- A Review Article. Deleted Journal. 2024 Dec 20;3(1):35–45. doi:10.62373/PUJHSR.2024.110
14. Raoofi S, Kan FP, Rafiei S, Hosseinipalangi Z, Mejareh ZN, Khani S, et al. Global prevalence of nosocomial infection: A systematic review and meta-analysis. PLoS One. 2023 Jan 27;18(1):e0274248–e0274248. doi:10.1371/JOURNAL.PONE.0274248 PubMed PMID: 36706112.
15. Odoom A, Tetteh-Quarcoo PB, Donkor ES. Prevalence of Hospital-Acquired Infections in Low- and Middle-Income Countries: Systematic Review and Meta-Analysis [Internet]. 2024 Sep 27. doi:10.20944/PREPRINTS202409.2163.V1
16. Odoom A, Tetteh-quarcoo PB, Donkor ES. Prevalence of Hospital-Acquired Infections in Low- and Middle-Income Countries : Systematic Review and. 2024. doi:10.20944/preprints202409.2163.v1
17. Tassew SG, Woldu MA, Degu WA, Shibeshi W. Management of hospital-acquired infections among patients hospitalized at Zewditu memorial hospital, Addis Ababa, Ethiopia: A prospective cross-sectional study. PLoS One. 2020 Apr 1;15(4):e0231949. doi:10.1371/JOURNAL.PONE.0231949 PubMed PMID: 32330164.
18. Raoofi S, Kan FP, Rafiei S, Hosseinipalangi Z, Mejareh ZN, Khani S, et al. Global prevalence of nosocomial infection: A systematic review and meta-analysis. PLoS One. 2023 Jan 27;18(1):e0274248–e0274248. doi:10.1371/JOURNAL.PONE.0274248 PubMed PMID: 36706112.
19. Nejad SB, Allegranzi B, Syed SB, Ellisc B, Pittet D. Health-care-associated infection in Africa: a systematic review. Bull World Health Organ. 2011 Oct 1;89(10):757–65. doi:10.2471/BLT.11.088179 PubMed PMID: 22084514.
20. Atalay YA, Gebeyehu NA, Gelaw KA. The prevalence of hospital acquired infection and associated factors among patients admitted at Wolaita Sodo University Comprehensive Specialized Hospital, in Ethiopia. IP Journal of Nutrition, Metabolism and Health Science. 2024 May 15;7(1):43–50. doi:10.18231/J.IJNMHS.2024.008
21. Yallew WW, Kumie A, Yehuala FM. Point prevalence of hospital-acquired infections in two teaching hospitals of Amhara region in Ethiopia. Drug Healthc Patient Saf. 2016 Aug 23;8:71–6. doi:10.2147/DHPS.S107344, PubMed PMID: 27601932.
22. St. Paul’s Millennium Hospital | Hakim Ethiopia [Internet]. [cited 2025 Sep 10]. Available from: <https://hakimethio.org/facility/st-pauls-millennium-hospital/>
23. Yallew WW, Kumie A, Yehuala FM. Point prevalence of hospital-acquired infections in two teaching hospitals of Amhara region in Ethiopia. Drug Healthc Patient Saf. 2016;8:71–6. doi:10.2147/DHPS.S107344 PubMed PMID: 27601932.

24. Mengistie E, Ashena T, Seman B. Prevalence of Hospital Acquired Infection and Associated Factors Among Patients Admitted , at Hawassa University Comprehensive Specialized Hospital Getachew Melakie 1 , Embialle Mengistie2 , University Dep. 2022.
25. Hlinkova S, Moraucikova E, Strzelecka A, Mrazova M, Littva V. Ventilator-Associated Pneumonia in Intensive Care Units: A Comparison of Pre-Pandemic and COVID-19 Periods. *Journal of Clinical Medicine* 2025, Vol 14,. 2025 Feb 4;14(3). doi:10.3390/jcm14031000
26. Tegegne EM, Chekol Gete B, Demissie DB. Prevalence of ventilator-associated pneumonia and associated factors among intubated adult patients admitted in public hospitals in Addis Ababa, Ethiopia: a facility-based retrospective study design. *Front Med (Lausanne)*. 2025;12. doi:10.3389/fmed.2025.1500901
27. Ali S, Birhane M, Bekele S, Kibru G, Teshager L, Yilma Y, et al. Healthcare associated infection and its risk factors among patients admitted to a tertiary hospital in Ethiopia: longitudinal study. *Antimicrob Resist Infect Control*. 2018 Jan 5;7(1):2. doi:10.1186/s13756-017-0298-5
28. Jima SA, Gerete TB, Hailu FB, Ayane GB, Jatu MG, Hardido TG, et al. Prevalence and associated factors of nosocomial infection among children admitted at Jimma Medical Center, Southwest Ethiopia: a retrospective study. *Front Pediatr*. 2025 Apr 4;13:1485334. doi:10.3389/FPED.2025.1485334/BIBTEX
29. Graves N, Weinhold D, Tong E, Birrell F, Doidge S, Ramritu P, et al. Impact of healthcare-associated infection on length of stay. *Journal of Hospital Infection*. 2021 Aug 1;114(3):23–31. doi:10.1086/512642 PubMed PMID: 17326018.
30. CDC, Nceqid, DHQP. National Healthcare Safety Network (NHSN) Patient Safety Component Manual [Internet]. [cited 2025 Sep 10]. Available from: www.cdc.gov/nhsn
31. Development and implementation of national action plans for infection prevention and control: practical guide [Internet]. [cited 2025 Sep 10]. Available from: <https://www.who.int/publications/i/item/9789240111943>

Annex and Declaration

No.	Variable	Response Options
1	Patient MRN	Numeric
2	Patient Code	Unique assigned code
3	Age	Numeric (years)
4	Sex	1=Male, 2=Female
5	Date of Admission	Date (DD/MM/YYYY)
6	Ward	1=HDU, 2=Pulmonology/Hematology, 3=Nephrology, 4=Cardiac/Endocrine, 5=Neuro/Gastroenterology, 6=Transition Ward
7	Length of Hospital Stay (days)	Numeric
8	Signs/Symptoms at Diagnosis	Fever (Temp>38°C): 0=No, 1=Yes; Purulent sputum: 0=No, 1=Yes; Leukocytosis (>10,000): 0=No, 1=Yes; Hypoxia (SpO2<90%): 0=No, 1=Yes
9	Culture, if done	0=No culture, 1=Positive, 2=Negative
10	HAI Diagnosis	0=No, 1=Yes
11	Type of HAI	1=SSI, 2=UTI, 3=Bloodstream Infection, 4=Hospital-Acquired Pneumonia, 5=Other (specify)
12	Outcome	1=Resolved with therapy, 2=Prolonged hospital stay, 3=Contributed to death, 4=Unknown/No clear effect
13	Date of Discharge or Death	Date (DD/MM/YYYY)

(30,31)

DECLARATION

I, the undersigned, declare that the thesis comprises my own work. In compliance with internationally accepted practices, I have acknowledged and refereed all materials used in this work. I understand that non-adherence to the principles of academic honesty and integrity, misrepresentation/ fabrication of any idea/data/fact/source will constitute sufficient ground for disciplinary action by the college and can also evoke penal action from the sources which have not been properly cited or acknowledged.

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