

Original Article

Impact of Nursing Student Involvement in Case Finding on Healthcare-Associated Infection Reporting Rates: A Quasi-Experimental Study

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Abstract

Background: Healthcare-associated Infection (HAI) case finding and reporting remain major surveillance challenge. Innovative methods could improve infection prevention programs.

Objectives: This quasi-experimental study evaluated the impact of involving nursing internship students in HAI case finding and reporting at Taleghani Hospital, Kermanshah University of Medical Sciences.

Methods: Ninety nursing internship students were selected via convenience sampling to report HAI signs while providing care in general, neurosurgical, and orthopedic wards. The intervention took place during the first semester of the 2020–2021 academic year. HAIs were reported using the Hospital Infection Detection Form. Student reports were compared with routine nurse reports. HAI counts during the intervention were also compared with pre- and post-intervention periods. Data were analyzed using chi-square tests and Poisson regression in SPSS 24.

Results: No significant differences were found between student-reported and nurse-reported urinary tract infections, surgical site infections, or total HAIs ($p > 0.05$). Reported HAIs were 12 pre-interventions, increased to 49 during intervention, and declined to 14 post-interventions. The HAI incidence rate per 1,000 patient-days was 4.62 pre-intervention, 16.44 during intervention, and 5.56 post-intervention ($p < 0.001$).

Conclusion: Involving nursing students in case finding significantly increased reported HAIs, suggesting a cost-effective approach to enhance early detection and reporting. Further research is needed to strengthen the evidence supporting nursing student participation in HAI case finding.

Implications for Nursing and Midwifery Preventive Care

- Healthcare-associated infections are a major global concern.
- Unreliable HAI data necessitate new initiatives for accurate measurement and reporting.
- Nursing interns can help implement hospital infection prevention and control measures.



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Introduction

Healthcare-associated infections (HAIs) are a major challenge for healthcare systems worldwide [1]. HAIs contribute to prolonged hospitalization, excess mortality, and substantial economic costs [2]. HAI prevalence is approximately 7% in developed and 15% in developing countries [3]. The reported incidence of HAIs in Iran varies substantially, from 30.4% [4] to 2.95% [1]. This difference in HAI rates may stem from inaccurate case-finding and reporting in the Iranian Nosocomial Infection Surveillance System (INISS) [1,5]. This inaccurate data compromises healthcare quality, undermines infection management, and leads to flawed policy, ultimately endangering patient safety [2].

Despite the critical need for novel HAI detection, reporting, and monitoring methods [2, 6]. There is a significant gap in research on innovative surveillance strategies, particularly within Iranian hospitals [2]. Enhancing HAI reporting requires the engagement of front-line personnel. The successful application of an Infection Control Link Nurse (ICLN) model in some Iranian hospitals demonstrates its efficacy in improving case identification [2]. Consequently, nursing students, who spend considerable time at the patient's bedside during clinical rotations, represent a promising yet underutilized resource for augmenting HAI surveillance [7].

However, the specific impact of involving nursing students in infection reporting on HAI case-finding remains unclear. Therefore, this study assessed the effect of nursing student participation on HAI case identification.

Objectives

This study aimed to assess the impact of nursing students' involvement in HAI case-finding and reporting.

Methods

Study Design

This quasi-experimental study was conducted at Taleghani Hospital, an academic trauma centre affiliated with Kermanshah University of Medical

Sciences (KUMS). The study took place during the first semester of the 2020–2021 academic year in four wards: General Surgery, two Orthopedic wards, and Neurosurgery.

Participants

The study population comprised 90 fourth-year nursing students (52 in the seventh semester and 38 in the eighth semester) scheduled to complete their internship at Taleghani Hospital in Kermanshah. The nursing school divided these students into groups of seven or nine. Due to the limited number of eligible students, a census sampling approach was used, including all 90 students; therefore, no formal sample size calculation was performed.

Inclusion Criteria

1. Enrollment as a nursing internship student
2. Willingness to participate as a case finder while providing patient care.

Exclusion Criteria

No exclusion criteria were applied.

All members of the study population were invited to participate, and every student agreed.

Interventions

At the start of each group's two-week internship rotation, students attended a two-hour, lecture-based workshop on HAIs held in a classroom at Taleghani Hospital. The training content was prepared based on the CDC's standard definitions for diagnosing four types of hospital-acquired infections and the Hospital Infection Control Surveillance System book. The workshop was delivered using PowerPoint slides and standardized educational materials prepared in accordance with these sources. It included the following: (1) signs and symptoms of major HAI types, urinary tract infection (UTI), surgical site infection (SSI), bloodstream infection (BSI), and pneumonia, and (2) procedures for completing and submitting the HAIs Detection Form to the Infection Control Nurse (ICN). The students' mentor routinely conducted the workshop, and no post-workshop evaluation was performed. The mentor was an assistant professor in the Medical-Surgical Nursing Department with 2 years of

experience as a hospital infection-control supervisor, teaching experience in hospital infection-control courses, and a record of several research studies and publications in the field of infection control.

Following the workshop, each student group received several printed copies of the Healthcare-Associated Infections (HAIs) Detection Form. While providing patient care, nursing students who observed signs or symptoms suggestive of an HAI completed the HAIs Detection Form and submitted it to their instructor. The instructor then reviewed the forms to ensure that all necessary data were present and personally forwarded them to the hospital Infection Control Nurse (ICN). Subsequently, the ICN evaluated the patient for the presence of any HAI. In parallel, routine HAI case finding continued: if ward nurses observed signs or symptoms of HAIs in a patient, they completed the HAI Detection Form and sent it to the ICN. The ICN subsequently assessed the patient and either verified the HAI or ruled it out.

Comparison

During the intervention period, the number of SSIs, UTIs, and total HAIs reported by nursing students was compared with those reported by ward nurses. To assess the intervention's effect on routine detection, the incidence rate ratios of UTIs, SSIs, and total HAIs during the intervention were compared with those during the pre- (three months) and post-intervention (three months) periods.

Outcomes

The primary outcomes were the numbers of reported UTIs, SSIs, and total HAIs. BSIs and PNU were not included as outcomes because no cases were reported in the study wards.

Data Collection

Data were collected using the HAIs Detection Form, developed and approved by the ICDC for HAI detection and reporting. The HAIs Detection Form includes patient identifiers (name, gender, medical record number, national identification number), admission dates, admitting ward, details and dates of invasive procedures and surgeries, signs and

symptoms related to pneumonia, UTI, BSI, and SSI, culture results, radiology findings, and prescribed antibiotics with any modifications. Students completed all demographic information listed on the form and marked the corresponding items if patients showed signs or symptoms of infection.

Since these forms were submitted to the Infection Control Nurse (ICN) and archived in the infection prevention and control office, access to identifiable patient information was restricted to the instructor, the ICN, and authorized personnel of the infection prevention and control office. Patient confidentiality was preserved in accordance with hospital policies. The form's validity and reliability were confirmed by infection control experts at the Iranian Ministry of Health [8]. Given the study setting, case finding focused on SSIs and UTIs; therefore, the HAI detection form was modified to emphasize these infections. In this study, "suspected HAI cases" referred to patients who presented clinical signs or symptoms suggestive of healthcare-associated infection and required further evaluation. "HAIs not confirmed" referred to suspected cases that were evaluated but did not meet the national diagnostic criteria after clinical assessment.

The Infection Control Nurse then provided the research team with data collected during the intervention period, as well as data extracted from the Iranian Nosocomial Infection Surveillance System for the three months before and after the intervention. Finally, the number of patients admitted to the study wards was obtained from the hospital admission and discharge unit to calculate the incidence rate. This systematic approach ensured that relevant data were used for analysis while patient confidentiality remained protected throughout the process.

Data Analysis

The collected data were entered into SPSS version 24. Descriptive statistics were presented as frequencies and rates per 1,000 patient-days for HAIs, UTIs, and SSIs across three study periods: pre-intervention, intervention, and post-intervention. Infection rates were calculated as follows:

Rate per 1,000 patient-days = (Number of infections/Patient-days) $\times$ 1000

For comparisons between nurses and students during the intervention period, Fisher's exact test was applied. Because the numbers of infections reported by the two groups were analyzed as independent counts rather than paired observations for the same patients, Fisher's exact test was considered appropriate.

This test was also preferred because the expected frequency in one of the cells of the contingency table was less than 5.

To compare infection rates between the study period and the comparison periods, incidence rate ratios (IRRs) with 95% confidence intervals (CIs) were estimated using Poisson regression. The significance of differences in infection frequencies across periods was assessed using the Chi-square test with Yates' correction. A two-tailed p -value < 0.05 was considered statistically significant throughout the analyses.

Result

During the intervention period, nurses reported 1 UTI, while students reported 2 UTIs, indicating a 50% higher reporting rate among students. Fisher's exact test indicated no statistically significant difference in the number of UTIs reported between nurses and students ($p = 1.0$) [Table 1].

Table 1 presents the number of SSIs reported by students and nurses during the intervention period. In the first month, both groups reported an identical number of SSI cases. During the second month, however, student-reported SSIs increased substantially, followed by a decline in subsequent months. By contrast, nurses' reports remained stable initially, rose significantly in the third month, and then decreased in the final month of intervention. Overall, the total number of SSIs reported by nurses and students was equal for the intervention period. Fisher's exact test showed no statistically significant difference in reporting rates between the two groups ($p = 1.0$).

Table 1. Comparison of Reported UTI and SSI Cases by Nurses and Students During the Intervention Period

Type of HAIs	Reporting Sources	Month of Intervention				Total HAI reported	Total of patients	Odds Ratio	p
		November	December	January	February				
UTI	Nurses	0	1	0	0	1	2981	0.49	1
	Student	0	2	0	0	2	2981		
SSI	Nurses	3	3	10	7	23	2981	1	1
	Student	3	10	6	4	23	2981		
Number of patients		773	772	725	711				

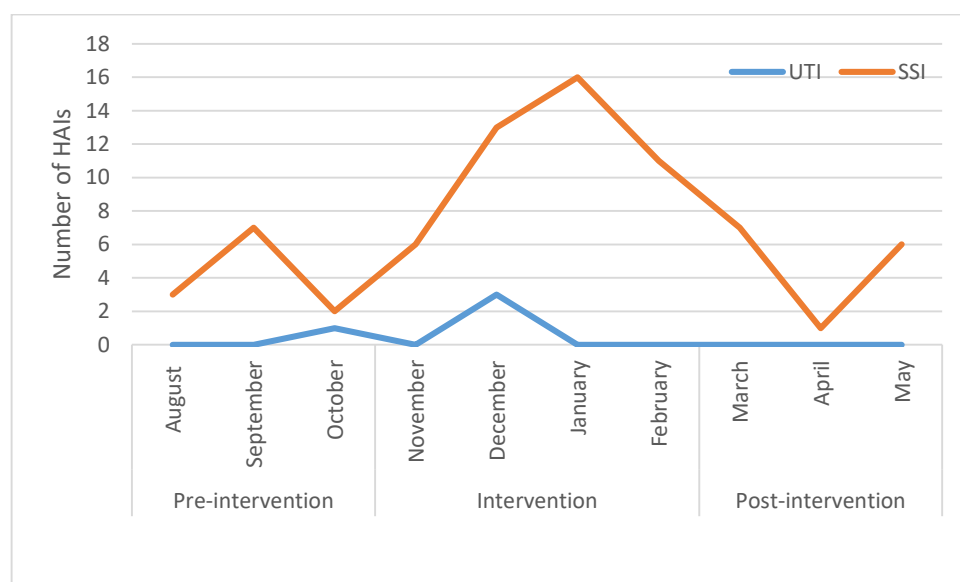


Figure 1. Comparing Number of Reported HAIs Pre-, During, and Post the Intervention Period

Table 2. Reported UTI, SSI, and Total HAI Cases Pre-, During, and Post the Intervention Period

Period	UTI	SSI	HAI	Number of patients in wards	UTI Rate	SSI Rate	HAI Rate
Pre-intervention	1	12	13	2814	0.35	4.26	4.62
Intervention	3	46	49	2981	1.01	15.43	16.44
Post-intervention	0	14	14	2518	0.00	5.56	5.56

Table 3. Comparison of Clinical Effect-Size Measures during the Intervention Period Compared to Pre- and Post-Intervention Periods

Comparison	UTI (IRR)	SSI (IRR)	Total HAI (IRR) (CI)	Percent of differences	χ^2	<i>p</i>
Intervention	2.83	3.62	3.56 (1.94, 6.54)	256	28.67	<0.001
Pre-intervention						
Post-intervention	<0.001	0.36	0.34 (0.19, 0.61)	66.2	25.84	<0.001
Intervention						
Post / pre-intervention	<0.001	1.30	1.20(0.56, 2.57)	20.3	0.58	0.446

According to [Table 2](#), the number of reported UTIs and SSIs during the intervention period was significantly higher than in both the pre- and post-intervention periods. Importantly, following the intervention, HAI incidence declined sharply, with the post-intervention rate approximately one-third that observed during the intervention.

Comparison of clinical effect-size measures revealed that the incidence rate of HAIs during the intervention period was 256% higher than during the pre-intervention period (IRR = 3.56, 95% CI: 1.94–6.54), a statistically significant difference ($p < 0.001$).

Following the intervention, the number of reported HAIs decreased by approximately 66% compared with the intervention period (IRR = 0.34, 95% CI: 0.19–0.61; $p < 0.001$). In the post-intervention phase, the HAI incidence remained about 20% higher than the pre-intervention baseline (IRR = 1.20, 95% CI: 0.56–2.57); however, this difference was not statistically significant ($p = 0.446$) [[Table 3](#)].

[Figure 1](#) presents the numbers of UTIs and SSIs during pre-, during-, and post-intervention periods. As shown, during the intervention period, the number of reported SSIs was significantly higher than in the comparison period.

Discussion

This study investigated the impact of involving nursing students in HAI case finding. Overall, there were no statistically significant differences in the numbers of UTIs and SSIs reported by students and by nurses. However, students reported UTI rates 50% higher than those of nurses. For SSIs, the number of HAI cases reported by students increased sharply during the first and second months and then declined. This decrease may be attributable to several factors, including students' absence from the hospital on weekends and reduced ward attendance during the semester break, which likely diminished opportunities to identify and report SSIs.

Gloud et al. found that nursing students demonstrated good theoretical knowledge of infection prevention and control but also reported low compliance with infection prevention practices [9]. There is a paucity of research on engaging nursing students in infection prevention and control, particularly for HAI case finding. Future research should evaluate the effect of formally involving nursing students in infection prevention and control activities. The study found a significant increase in the number of SSIs reported by nurses during the third and fourth months of the intervention. This increase may indicate an association between student involvement and nurse reporting. One possible explanation is that nurses interacted with students when patients showed signs or symptoms suggestive of HAIs and subsequently reported these cases to the ICN. Nevertheless, nurse awareness or related mediating variables were not directly measured in this study, so causal effects cannot be concluded.

When nurses are actively involved in HAI reporting, important outcomes, such as earlier detection, more timely treatment, and reduced costs, can be expected [2]. This finding is consistent with the literature, which emphasizes the critical role of accurate, timely HAI reporting for effective infection control and the need to strengthen detection and reporting mechanisms [2, 10]. Existing studies also underscore the importance of fostering a culture of transparent reporting in healthcare facilities to overcome reluctance to report HAIs and thereby improve data reliability [6, 11].

During the intervention period, the SSI detection rate increased from 4.26 to 15.43 and then declined to 5.56 in the post-intervention period. The incidence rate ratio comparing the intervention period with the pre-intervention and post-intervention periods indicates a significant increase in HAI detection during the intervention. This finding is consistent with recent evidence from the COVID-19 era, suggesting that involving student nurses in infection control may improve adherence to prevention protocols and help address staffing shortages [12].

The UTI detection rate also rose during the intervention and fell sharply in the post-intervention period. Although absolute UTI rates were low across periods, the incidence rate ratio for UTIs was significantly higher during the intervention period than during the pre- and post-intervention periods. As noted in the literature, UTIs are more common in intensive care units, where patients are often catheterized for prolonged periods [1, 13]. Further research across diverse institutions and patient populations is needed to clarify the impact of student participation on UTI surveillance.

The overall reported HAI rate increased substantially during the intervention period compared with the pre-intervention and post-intervention periods. This finding suggests a possible association between nursing students' involvement in HAI surveillance and increased case detection. It also suggests that involving student nurses in surveillance may contribute to more comprehensive identification of HAIs, thereby improving the quality of infection-control data. Students may serve as valuable case finders, particularly in settings where clinical staff are overburdened and may miss cases. This finding adds to the evidence supporting the use of innovative strategies to strengthen HAI surveillance and enhance patient safety [2, 5, 14].

Evidence indicates that nursing students have good knowledge of infection prevention and control, particularly standard precautions and hand hygiene [15]. Given their near-constant presence in clinical settings, student nurses may represent a valuable resource for improving both the quantity and quality of HAI reporting. Their participation may therefore help close gaps in infection detection. Engaging

student nurses in surveillance may also bring fresh perspectives that improve infection-control processes.

Several limitations should be acknowledged. In this study, only the number of reported patients was compared across the pre-intervention, intervention, and post-intervention periods; baseline patient or ward characteristics were not systematically assessed.

Therefore, potential differences in case mix, ward composition, or other contextual factors across periods could not be evaluated and may have influenced the observed reporting patterns. In addition, we cannot fully rule out the influence of unmeasured concurrent changes in infection-control practices, staffing, surveillance intensity, or hospital policies during the study period. The single-center design and relatively short follow-up period also limit the generalizability and long-term interpretation of the findings.

Future studies should not only compare the number of reported patients across study periods, but also systematically assess and report baseline patient and ward characteristics to improve comparability between groups or time periods. In addition, researchers should document any concurrent changes in infection-control practice, staffing, surveillance procedures, or hospital policies during implementation, and, where possible, control for these factors in the analysis. Multi-center studies with longer follow-up periods would further strengthen the evidence and improve generalizability.

Conclusion

Inclusion of nursing students in HAI surveillance was associated with a significant increase in reported HAIs during the intervention period, suggesting a beneficial effect on case detection. Nevertheless, further research is needed to build stronger evidence for integrating nursing students into infection prevention and control programs.

Policymakers and educational administrators may consider applying these findings to familiarize students with HAI surveillance, promote early case

detection, and increase HAI reporting cost-effectively.

Ethical Considerations

The study received ethical approval from the Ethics Committee at Kermanshah University of Medical Sciences ([IR.KUMS.REC.1401.489](#)).

Students were fully informed of the study objectives. Although the workshop formed part of student training, case finding and HAI reporting were voluntary; students gave verbal consent to participate.

Participants were instructed on patient data confidentiality and data security procedures.

All methods were conducted in accordance with relevant guidelines.

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Conflict of Interest

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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Authors' Contributions

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All authors read and approved the final manuscript.

Artificial intelligence utilization for article writing

The authors used ChatGPT-4 (OpenAI) to summarize and rewrite portions of the text. All outputs were reviewed, edited, and approved by the authors, who bear full responsibility for the final content.

Data Availability Statement

The data are available from the corresponding author upon reasonable request.

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