

Effectiveness of a Planned Teaching Programme on Knowledge and Attitude Regarding Spill Management among Nursing Students in a Selected Nursing Institute of Ranchi, Jharkhand: A Quasi-Experimental Study

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ABSTRACT

Healthcare professionals, especially nursing students during their clinical postings are at risk of exposure to biological, chemical, mercury, and radiological spills encountered in healthcare settings. Insufficient knowledge and inappropriate spill management practices may contribute to occupational injuries, healthcare-associated infections, and environmental contamination. Educational interventions play a crucial role in enhancing students' understanding and fostering safe spill management practices. This study was conducted to evaluate the effectiveness of a planned teaching programme on nursing students' knowledge and attitude regarding hospital spill management and to examine the association between pre-test knowledge scores and selected demographic variables.

A quasi-experimental one-group pre-test and post-test design was employed among 100 nursing students selected through convenience sampling from a nursing institute in Ranchi, Jharkhand. Data were collected using a structured knowledge questionnaire and a five-point Likert attitude scale. Descriptive statistics, including frequency, percentage, mean, and standard deviation, were used to summarize the data. The effectiveness of the intervention was analyzed using the Wilcoxon signed-rank test, while the association between pre-test knowledge and demographic variables was determined using the Chi-square test. A p-value of less than 0.05 was considered statistically significant.

At baseline, only 2% of participants demonstrated excellent knowledge, while 43% had good knowledge and 19% had average knowledge. Following the planned teaching programme, 93% of the participants attained excellent knowledge, whereas the remaining 7% achieved very good knowledge. The post-intervention improvement in both knowledge and attitude scores was highly statistically significant ($p < 0.001$). Furthermore, no significant association was identified between baseline knowledge and the selected demographic variables.

The findings indicate that the planned teaching programme was highly effective in improving nursing students' knowledge and attitude toward hospital spill management. Integrating structured educational sessions and regular competency-based training into nursing education may enhance infection prevention measures, promote safe spill handling practices, and strengthen occupational safety within healthcare settings.

Keywords: Spill management, Nursing students, Planned teaching programme, Occupational exposure, Infection prevention, Knowledge, Attitude

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Introduction

Hospital spill management is an essential aspect of infection prevention and control, occupational safety and environmental protection within healthcare facilities. Hospitals routinely use and store hazardous materials such as blood and body fluids, chemicals, cytotoxic drugs, radioactive substances, and mercury-containing devices. Accidental release of these materials may expose healthcare personnel, patients, attendants, and the surrounding environment to biological and chemical hazards, thereby increasing the risk of infections, toxic exposure, and environmental pollution.

Timely and appropriate management of hospital spills is therefore critical for minimizing these risks. Effective spill response includes immediate identification of the spill, restricting access to the affected area, using appropriate personal protective equipment (PPE), applying suitable disinfectants or neutralizing agents, safely collecting contaminated materials, segregating waste according to

biomedical waste management guidelines, and documenting the incident. Strict adherence to institutional protocols and standard operating procedures ensures effective containment of hazards while reducing the possibility of cross-contamination and occupational injuries.

Healthcare organizations are increasingly emphasizing patient safety and workplace safety through comprehensive infection control programmes. Spill management forms an integral part of these programmes because even a single improperly managed spill can compromise the safety of healthcare workers and patients. Establishing a culture of safety requires continuous reinforcement of standard precautions, regular monitoring of compliance, and prompt reporting of spill-related incidents. Such measures not only reduce preventable risks but also improve the overall quality of healthcare services.

The increasing complexity of healthcare delivery has also led to greater use of hazardous medications, advanced

diagnostic procedures, and specialized laboratory investigations. Consequently, healthcare professionals are more likely to encounter different types of spills during routine clinical practice. Preparedness to respond appropriately in such situations depends on adequate theoretical knowledge, practical skills, and confidence. Educational institutions therefore have a responsibility to equip future healthcare professionals with the competencies required to manage these emergencies effectively before they enter independent clinical practice.

Regular in-service education, availability of spill management kits, periodic mock drills, and continuous evaluation of spill response practices are important strategies for maintaining preparedness within healthcare institutions. These measures enhance the confidence and competence of healthcare personnel, ensuring rapid and safe management of spill incidents. A well-implemented spill management programme contributes not only to occupational safety but also to regulatory compliance and improved patient care outcomes.

Nursing students represent a particularly important group for spill management education because they participate actively in patient care during clinical postings while still developing their professional competencies. Their limited clinical experience and unfamiliarity with emergency spill response procedures may increase their vulnerability to occupational exposure. Therefore, improving their knowledge and developing a positive attitude

toward spill management are essential for promoting safe clinical practice and professional accountability.

International infection prevention and occupational safety guidelines consistently emphasize the importance of standard precautions and evidence-based spill management practices to minimize exposure to infectious and hazardous materials. Appropriate handling of blood, body fluid, chemical, mercury, and other hazardous spills plays a significant role in preventing disease transmission, protecting healthcare personnel, and maintaining a safe clinical environment.

Previous studies conducted among nursing students have reported that their knowledge regarding spill management is often inadequate to moderate, indicating the need for structured educational interventions. Planned teaching programmes have demonstrated positive outcomes by improving knowledge, strengthening attitudes, and enhancing students' readiness to respond appropriately to spill-related incidents in clinical settings.

Despite the growing importance of spill management in healthcare, limited research has explored the effectiveness of educational interventions among nursing students in Jharkhand. Generating evidence in this area is essential to identify existing knowledge gaps and support the integration of structured spill management training into nursing education. Therefore, the present study was undertaken to evaluate the effectiveness of a planned teaching

programme on knowledge and attitude regarding spill management among nursing students.

Objectives

Primary Objective;-To evaluate the effectiveness of a planned teaching programme on knowledge and attitude regarding spill management among nursing students.

Secondary Objectives

1. To assess the pre-test level of knowledge regarding spill management.
2. To assess the post-test level of knowledge and attitude after implementation of the planned teaching programme.
3. To determine the association between pre-test knowledge scores and selected demographic variables.

Materials and Methods

Study Design

A quantitative, quasi-experimental one-group pre-test and post-test design was used to determine the effectiveness of a structured planned teaching programme in improving nursing students' knowledge and attitude toward hospital spill management.

Study Setting

The research was carried out at a selected nursing institute located in Ranchi, Jharkhand, where undergraduate nursing students receive theoretical instruction and clinical training.

Study Population

The study population consisted of undergraduate nursing students pursuing

professional nursing education at the selected institute.

Sample Size

A total of **100 undergraduate nursing students** who fulfilled the eligibility criteria were included in the study.

Sampling Technique

A convenience sampling method was adopted to recruit nursing students who met the inclusion criteria and were available and willing to participate throughout the data collection phase.

Inclusion Criteria

- Nursing students who voluntarily agreed to participate in the study.
- Nursing students who were present during the period of data collection.
- Nursing students who were able to read, understand, and respond to the study questionnaire.

Exclusion Criteria

- Students absent during data collection.
- Students unwilling to participate.

Study Instrument

Data collection consisted of three sections:

- Section I: Demographic characteristics
- Section II: Structured knowledge questionnaire regarding spill management
- Section III: Five-point Likert attitude scale

The questionnaire was validated by subject experts before administration.

Intervention

Before the educational intervention, all participants completed a pre-test to

assess their baseline knowledge and attitude regarding hospital spill management. Following the pre-test, a structured planned teaching programme was implemented by the investigator. The educational session included comprehensive information on the management of biological, chemical, mercury, and radiological spills commonly encountered in healthcare settings. Topics such as the classification of hospital spills, immediate response measures, proper use of spill management kits, selection and use of appropriate personal protective equipment (PPE), infection prevention and control practices, biomedical waste segregation, and standard operating procedures for spill management were discussed in detail. The programme was delivered using interactive lecture sessions supported by audio-visual teaching aids, including PowerPoint presentations, illustrations, and demonstrations to facilitate better understanding. Participants were encouraged to ask questions and actively engage in discussions throughout the session. Real-life clinical scenarios were incorporated to improve practical understanding and reinforce learning. Adequate time was provided for clarification of doubts and revision of key concepts. After completion of the teaching programme, the participants underwent a post-test using the same data collection instruments to evaluate changes in their knowledge and attitude following the intervention.

Statistical Analysis

The collected data were systematically coded, verified for completeness, and entered into Microsoft Excel before being exported to the Statistical Package for the Social Sciences (SPSS) for analysis. Both descriptive and inferential statistical methods were employed to interpret the findings. Descriptive statistics, including frequency, percentage, mean, and standard deviation, were used to summarize participants' demographic characteristics as well as their knowledge and attitude scores. The normality of the data distribution was assessed prior to selecting appropriate statistical tests. As the data did not follow a normal distribution, non-parametric statistical tests were applied. The Wilcoxon signed-rank test was used to compare pre-test and post-test knowledge and attitude scores and determine the effectiveness of the planned teaching programme. Associations between baseline knowledge scores and selected demographic variables were examined using the Chi-square test. Statistical significance was considered at a p-value of less than 0.05, and all tests were interpreted at a 95% confidence level.

Ethical Considerations

Ethical principles were strictly observed throughout the conduct of the study. Prior administrative approval was obtained from the concerned institutional authorities before initiating data collection. The study objectives, procedures, potential benefits, and participants' rights were explained

clearly to all eligible nursing students. Written informed consent was obtained from each participant before enrolment in the study. Participation was entirely voluntary, and participants were informed that they could withdraw from the study at any stage without any academic or personal consequences. Confidentiality of the collected information was ensured by assigning identification codes instead of recording participants' names. The anonymity and privacy of all participants were maintained during data collection, analysis, and reporting of the findings. The information collected was used exclusively for research purposes and was stored securely to prevent unauthorized access. The study adhered to the ethical principles of respect for persons, beneficence, non-maleficence, and justice in accordance with accepted guidelines for biomedical and health research involving human participants.

Results

The study included **100 undergraduate nursing students** who fulfilled the eligibility criteria and consented to participate. Information related to their demographic and academic background was collected to describe the study population and examine its relationship with baseline knowledge of spill management. The variables assessed comprised age, year of study, previous exposure to spill management training, prior awareness of spill management practices, and clinical experience in the radiology department as well as the central laboratory/blood bank. These

characteristics provided an overview of the participants' educational and clinical backgrounds. Understanding these factors was important for interpreting the findings and identifying whether prior academic or clinical exposure had any influence on their knowledge before the intervention.

Pre-test Knowledge and Attitude

The baseline assessment demonstrated that participants possessed different levels of knowledge regarding hospital spill management. Among the 100 nursing students, **43%** exhibited good knowledge, **33%** demonstrated very good knowledge, **19%** had an average level of knowledge, **3%** showed marginal knowledge, and only **2%** achieved an excellent knowledge score. The findings indicate that although a substantial proportion of students had satisfactory theoretical understanding, important knowledge gaps still existed in several areas of spill management. These observations emphasized the need for a structured educational programme to strengthen their competency before independent clinical practice.

The assessment of attitude revealed that nursing students generally had a positive perception of hospital spill management. Most participants (**59%**) strongly agreed and **40%** agreed with favourable statements related to spill management, whereas only **1%** expressed a neutral opinion. None of the participants demonstrated an unfavourable attitude. The predominance of positive attitudes suggests that students acknowledged the significance of spill management in

maintaining infection control, occupational safety, and patient care. This positive outlook provided an encouraging basis for implementing the planned teaching programme and enhancing their knowledge and practical preparedness through educational intervention.

Table 1. Distribution of Participants According to Pre-test Knowledge and Attitude

Knowledge Level	n (%)
Excellent	2 (2%)
Very Good	33 (33%)
Good	43 (43%)
Average	19 (19%)
Marginal	3 (3%)

Effectiveness of the Planned Teaching Programme

The findings demonstrated a considerable improvement in participants' knowledge and attitude following the implementation of the planned teaching programme on hospital spill management. Comparison of the pre-test and post-test results indicated that the educational intervention had a positive impact on the participants' understanding of spill management principles and their attitude toward safe spill handling practices. These findings suggest that structured educational programmes can effectively enhance learning outcomes among nursing students.

The median knowledge score increased from **10.0 (SD = 2.31)** before the

intervention to **19.0 (SD = 1.60)** after the teaching programme, reflecting a substantial gain in knowledge. Likewise, the median attitude score improved from **39 (SD = 3.19)** in the pre-test to **44 (SD = 2.63)** in the post-test, indicating a more favourable attitude toward hospital spill management following the educational session. The reduction in standard deviation in the post-test also suggests greater consistency in participants' performance after receiving the intervention.

Attitude Level	n (%)
Strongly Disagree	0 (0%)
Disagree	0 (0%)
Neutral	1 (1%)
Agree	40 (40%)
Strongly Agree	59 (59%)

Statistical analysis using the Wilcoxon signed-rank test confirmed that the observed improvements were statistically significant. A significant difference was found between the pre-test and post-test knowledge scores (**p = 0.020**) as well as attitude scores (**p = 0.001**), demonstrating the effectiveness of the planned teaching programme. These results indicate that the intervention successfully improved participants' knowledge while reinforcing positive attitudes toward appropriate spill management practices. Overall, the study findings highlight the value of structured teaching programmes in preparing nursing students for safe clinical practice. Strengthening knowledge through organized educational sessions not only improves

theoretical understanding but also encourages the development of appropriate attitudes required for effective spill management, infection prevention, and occupational safety within healthcare settings.

Table 2. Comparison of Pre-test and Post-test Scores

Variable	Pre-test Median (SD)	Post-test Median (SD)	Statistical Test	p value
Knowledge	10.0 (2.31)	19.0 (1.60)	Wilcoxon Signed-Rank	0.020
Attitude	39 (3.19)	44 (2.63)	Wilcoxon Signed-Rank	0.01

Interpretation

Table X presents a comparison of the pre-test and post-test knowledge and attitude scores of nursing students following the implementation of the planned teaching programme on hospital spill management. The median knowledge score increased from **10.0 (SD = 2.31)** during the pre-test to **19.0 (SD = 1.60)** in the post-test, indicating a substantial improvement in participants' understanding of spill management principles. Similarly, the median attitude score improved from **39 (SD = 3.19)** before the intervention to **44 (SD = 2.63)** after the teaching programme, reflecting a more favourable attitude toward spill management practices.

The effectiveness of the intervention was evaluated using the **Wilcoxon Signed-Rank Test**, which demonstrated statistically significant differences between the pre-test and post-test scores for both variables. The improvement in knowledge was found to be significant (**p = 0.020**), while the change in attitude was highly significant (**p = 0.001**). These findings indicate that the planned teaching programme had a positive impact on both the cognitive and attitudinal aspects of spill management among nursing students.

Overall, the results support the effectiveness of structured educational interventions in enhancing nursing students' preparedness for the safe management of hospital spills. The observed improvement suggests that incorporating regular competency-based spill management training into nursing education can strengthen infection prevention practices, improve occupational safety, and enhance the quality of patient care in clinical settings.

Association between Knowledge and Demographic Variables

The Chi-square test demonstrated a significant association between age and baseline knowledge regarding spill management (**p = 0.021**), suggesting that knowledge levels varied across different age groups. In contrast, no significant association was found between baseline knowledge and other selected demographic variables, such as year of study, previous spill management training, prior information on spill

management, or previous clinical postings in the radiology department and central laboratory/blood bank ($p > 0.05$).

Table 3. Association between Baseline Knowledge and Demographic Variables

Variables	χ^2	d f	P value	Interpretation
Age	9.62	3	0.021	Significant
Year of study	2.11	2	0.350	Not significant
Previous spill management training	0.04	1	0.834	Not significant
Prior information regarding spill management	3.61	2	0.058	Not significant
Previous Clinical Posting in Radiology Dept.	3.61	2	0.058	Not significant
Previous clinical posting in the Central Laboratory/Blood Bank	1.46	1	0.227	Not significant

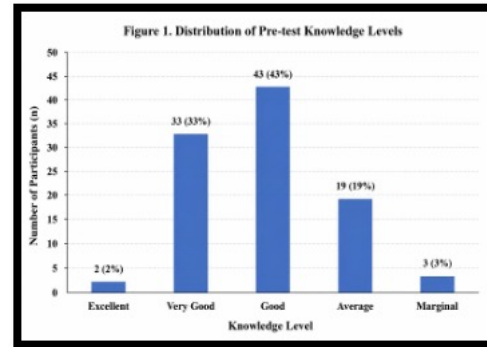


Figure 1. Distribution of pre-test knowledge levels.

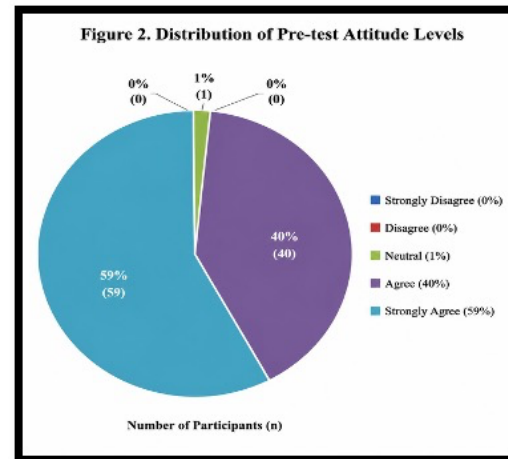


Figure 2. Distribution of pre-test attitude levels.

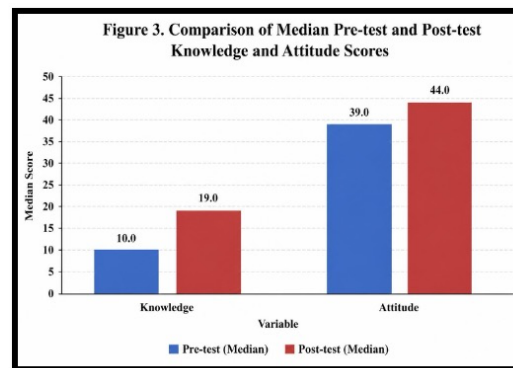


Figure 3. Comparison of median pre-test and post-test knowledge and attitude scores.

Discussion

The present study was undertaken to determine the effectiveness of a structured planned teaching programme

in improving nursing students' knowledge and attitude regarding hospital spill management. The findings demonstrated a statistically significant increase in both knowledge and attitude scores following the educational intervention, indicating that a well-designed teaching programme can effectively enhance students' understanding of spill management and encourage positive attitudes toward safe clinical practices.

The pre-intervention assessment showed that although a considerable proportion of participants possessed good or very good knowledge, deficiencies were still evident in several important components of spill management. This finding suggests that theoretical instruction received during routine academic teaching may not be sufficient to equip nursing students with comprehensive knowledge required for managing biological, chemical, mercury, and radiological spills in clinical settings. Similar observations have been reported in earlier studies, where nursing students demonstrated only moderate competency in spill management and infection prevention practices, emphasizing the need for additional structured educational interventions.

A marked improvement in knowledge was observed after the implementation of the planned teaching programme. The increase in post-test scores indicates that the educational intervention successfully strengthened participants' understanding of spill identification, appropriate response measures, use of personal

protective equipment, spill kit utilization, biomedical waste management, and standard operating procedures. The positive outcome may be attributed to the systematic presentation of evidence-based content, interactive teaching strategies, audio-visual learning resources, and opportunities for discussion, all of which facilitated better comprehension and retention of information.

The intervention also produced a significant improvement in participants' attitudes toward hospital spill management. A positive professional attitude is an essential component of safe nursing practice because it influences adherence to infection prevention guidelines, appropriate use of personal protective equipment, prompt reporting of spill incidents, and compliance with institutional safety protocols. Strengthening students' attitudes during their educational preparation is likely to promote responsible professional behaviour and improve occupational safety when they enter clinical practice.

The findings further highlight the importance of integrating competency-based spill management education into undergraduate nursing curricula. Regular educational sessions, practical demonstrations, simulation-based learning, and periodic refresher training can reinforce theoretical knowledge and improve students' confidence in managing spill-related emergencies. Such initiatives have the potential to reduce occupational hazards, minimize

healthcare-associated infections, and enhance patient safety.

Overall, the results of the present study confirm that a structured planned teaching programme is an effective educational strategy for improving both knowledge and attitude regarding hospital spill management among nursing students. Incorporating similar educational interventions into routine nursing education and clinical orientation programmes may contribute to better infection prevention practices, safer healthcare environments, and improved quality of patient care.

Limitations

Although the present study generated valuable findings, certain limitations should be considered while interpreting the results. The study was conducted among nursing students from a single educational institution, which may limit the generalizability of the findings to other nursing colleges or healthcare settings. Participants were selected using a convenience sampling technique, thereby increasing the possibility of selection bias and limiting the representativeness of the sample.

The study adopted a one-group pre-test and post-test design without a control group, making it difficult to completely rule out the influence of external factors on the observed outcomes. Furthermore, the post-test was administered shortly after completion of the intervention; therefore, the long-term retention of knowledge and sustainability of attitude changes could not be evaluated. The relatively small sample size may also

have influenced the precision of the findings. In addition, self-administered questionnaires were used for data collection, which may have introduced response bias due to participants providing socially desirable answers. Variations in previous clinical exposure and learning experiences among participants were not controlled and may have influenced baseline knowledge levels. Since the intervention was delivered in a single educational setting, institutional teaching methods and learning environments may have affected the outcomes. Future research should consider multicentre studies involving larger and more diverse samples to improve the external validity of the findings.

Another limitation was that the study focused exclusively on knowledge and attitude and did not evaluate participants' actual spill management practices or clinical performance through direct observation or objective skill assessment. Consequently, it could not determine whether the improvement in knowledge and attitude translated into safe and appropriate spill management during clinical practice. Future investigations employing randomized controlled designs, longer follow-up periods, simulation-based assessments, and observational methods would provide stronger evidence regarding the effectiveness and long-term impact of spill management training among nursing students.

Nursing Implications

The findings of the present study emphasize the need to strengthen spill management education within undergraduate nursing curricula. Integrating structured educational programmes on hospital spill management can improve nursing students' understanding of infection prevention, occupational safety, and environmental protection. Competency-based training, supported by regular assessments, can reinforce theoretical knowledge and ensure that students are adequately prepared to manage different types of hospital spills during clinical practice.

Simulation-based learning, practical demonstrations, and mock spill management drills should be incorporated into nursing education to enhance psychomotor skills, critical thinking, and decision-making abilities. Healthcare institutions should ensure the availability of spill management kits and provide routine orientation regarding their proper use along with institutional standard operating procedures. Periodic continuing education programmes, workshops, and refresher training should also be organized for nursing students and practicing healthcare professionals to maintain competency and keep them updated with current infection prevention guidelines. Strengthening collaboration between nursing educational institutions and healthcare organizations can facilitate the development of standardized spill management training modules. Such

initiatives will contribute to improved patient safety, reduced occupational exposure, better compliance with infection control practices, and the establishment of a strong culture of safety within healthcare settings.

Conclusion

The present study demonstrated that the structured planned teaching programme was effective in enhancing nursing students' knowledge and attitude regarding hospital spill management. A statistically significant improvement was observed following the educational intervention, indicating that organized and evidence-based teaching strategies can successfully address existing knowledge gaps and promote positive attitudes toward safe spill management practices.

The findings underscore the importance of incorporating structured spill management education into undergraduate nursing programmes as an essential component of infection prevention and occupational safety training. Regular educational sessions, competency-based assessments, simulation exercises, and practical demonstrations can further strengthen students' preparedness to respond appropriately to spill-related incidents encountered during clinical practice.

Improving knowledge and fostering positive attitudes among nursing students are likely to enhance adherence to standard precautions, encourage the appropriate use of personal protective equipment, and promote compliance with institutional safety protocols.

Ultimately, investing in continuous spill management education can contribute to safer healthcare environments, minimize occupational hazards, reduce the risk of healthcare-associated infections, and improve the overall quality of patient care. Furthermore, sustained educational initiatives and periodic refresher programmes will help ensure that future nursing professionals remain competent and confident in managing hazardous spill incidents effectively throughout their professional careers.

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