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Assessing the Relationship Between Student Knowledge and Demographic Profiles in Nursing Education

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ABSTRACT

This study aimed to assess the effectiveness of an educational intervention on the knowledge performance of nursing students, with particular emphasis on gender, age group, and prior hazard experience. The objective of the study is to find out relation between knowledge of students & selected socio demographic variables. A total of 600 nursing students participated in the study, which followed a pre-experimental one-group pre-test and post-test design. A structured knowledge questionnaire with 35 validated items was used to evaluate students' performance levels across six categories: Excellent, Very Good, Good, Average, Below Average, and Poor. After administering the educational module, post-test scores were compared to pre-test results using Chi-square analysis. The results revealed statistically significant improvements in post-test scores. The Chi-square statistic for gender was 43.89 ($p < 0.05$), indicating a strong association between gender and knowledge performance. Age-based analysis showed Chi-square values of 138.17 (pre-test) and 331.10 (post-test), suggesting significant differences in knowledge gain across age groups. Similarly, prior hazard experience was found to significantly influence learning outcomes, with a Chi-square value of 80.8 ($p < 0.05$). Students with previous hazard exposure demonstrated higher knowledge levels following the intervention. The findings highlight the importance of demographic and experiential factors in shaping learning outcomes. Tailored teaching strategies, including experience-based learning and demographic-sensitive approaches, should be integrated into nursing education to optimize knowledge acquisition and retention.

Keywords: Nursing students, Knowledge performance, Educational intervention, Gender differences, Age group, Hazard experience.

INTRODUCTION

In healthcare settings, the importance of occupational health and safety cannot be overstated. Nursing professionals are routinely exposed to diverse workplace hazards, including biological, physical, chemical, ergonomic, and psychosocial risks (Philip et al., 2022). A systematic and proactive approach, such as Hazard Identification and Risk Assessment (HIRA), is essential in mitigating these risks and ensuring a safer work environment. HIRA serves as a critical component in developing a safety culture by enabling healthcare professionals to recognize, evaluate, and control workplace hazards (Kumar & Panigrahi, 2021).

Studies have highlighted the high prevalence of occupational hazards among healthcare workers. For instance, Minikumary et al. (2023) reported that musculoskeletal disorders, needlestick injuries, chemical inhalation, and stress-related issues are among the most common occupational risks faced by nurses. Despite the availability of safety guidelines, suboptimal knowledge and inconsistent adherence to preventive practices remain persistent challenges (Debelu et al., 2023). Education and training interventions have been shown to significantly improve awareness and compliance with safety practices (Elewa & Aly, 2019).

Furthermore, understanding the socio-demographic factors influencing knowledge levels about HIRA is crucial. Variables such as age, gender, academic year, and prior clinical exposure may significantly affect students' understanding and implementation of safety measures (Aluko et al., 2016; Adelosoye et al., 2016). By assessing the impact of educational interventions and examining the relationship between knowledge and demographic factors, institutions can design targeted programs to strengthen safety competencies among future healthcare professionals.

This study, therefore, aims to evaluate the effectiveness of an educational intervention on HIRA and explore its association with selected socio-demographic variables among nursing students, thereby contributing to a safer and more informed healthcare workforce.

Given the multidimensional nature of occupational risks in healthcare, and the evolving demands placed on nursing professionals, it is imperative to instill robust risk assessment knowledge through formal educational means. This study aims not only to evaluate the effectiveness of an educational intervention on HIRA but also to explore the relationship between student knowledge and their demographic background. By doing so, it seeks to inform the development of evidence-based training programs that can contribute to the creation of safer healthcare systems.

LITERATURE REVIEW

A research by Paul et al. (2021) evaluated registered nurses at Bombay Hospital College of Nursing in Indore's understanding of hazard identification and risk assessment (HIRA). With a mean knowledge score of 8.7, the results showed that most registered nurses are well-versed in this field.

According to Kour and Ahire (2020), the Hazard Identification and Risk Assessment (HIRA) technique is a useful tactic for locating risks associated with hospital healthcare delivery. The study identified a number of priority hazards in the hospital under study, such as obstructions in corridors that hinder the movement of patients, staff, and utilities (H12), malfunctioning life-saving or biomedical equipment that monitors patients (H2), and broken equipment cables that cause power leaks, short circuits, and trips in the department's electricity supply (H3).

Singh (2020) used a descriptive cross-sectional research design to evaluate nursing staff members' understanding of hazard identification and risk assessment (HIRA). Questionnaires were used to gather information from the Nursing Institute and Bombay Hospital in Indore.

Psychosocial (92.7%), mechanical (84.8%), biological (66.2%), and physical (66.2%) occupational hazards were the most common among 151 nursing and midwifery students in a study conducted by Amare et al. (2020). 29.8% of respondents showed strong knowledge, while 37.7% showed low knowledge.

Seven intervention studies were rigorously assessed in a research by Garay et al. (2023), and each one showed a high risk of bias. Collegial interaction, integrating staff perceptions, external facilitation, staff training, and a structured, multi-step intervention procedure were among the strategies found to enhance safety culture in care environments.

According to Mousa et al. (2023), somewhat more than 51% of the staff nurses in the study had appropriate total practice, and 31% had satisfactory total knowledge at the outset. Knowledge and practice improved significantly after the intervention, increasing by 71% and 80% at the post-intervention and follow-up stages, respectively.

Qaraman et al. (2022) investigated nursing students enrolled in diploma programs, the majority of whom were female. They discovered that 21% had been injured by a needle poke. Knowledge, attitude, and practice ratings were higher among students who took safety courses. Practice scores showed differences between males and females, between those with and without experience of needle stick injuries, and between diploma and bachelor students in terms of attitudes. Because they have a favorable effect on practices, the authors advise health science students to take ongoing occupational health and safety courses.

Saad et al. (2022) came to the conclusion that nurses' total occupational danger assessment was low. They discovered a strong correlation between occupational danger and the sociodemographic traits of nurses. In order to raise health awareness among nurses working in primary healthcare centers, particularly new nurses, the study recommended the adoption of ongoing health education courses. Effective prevention of occupational health hazards is the goal of this measure.

Based on Rayan et al. (2021)'s study results, it can be said that nurse interns' overall awareness of occupational health hazards varied significantly throughout the course of the program. Throughout program phases, nurse interns' overall practice with regard to occupational health hazards significantly increased. Throughout the program phases, there was also a highly significant difference in the overall attitude toward hazard protection. The training program's adoption resulted in notable enhancements to the knowledge, practice, and attitude of nursing interns concerning occupational health concerns.

MATERIALS AND METHODS

This study employed a quantitative, pre-experimental design to assess the impact of an educational intervention on the knowledge performance of nursing students, with particular focus on the variables of gender, age group, and prior

hazard experience. The research was carried out in a selected nursing educational institution and included both pre-test and post-test assessments.

Study Design:
A one-group pre-test and post-test design was used to evaluate the effectiveness of the intervention. The same group of students was assessed before and after the educational program to measure knowledge improvement.

Sample and Sampling Technique:
A total of 600 nursing students were selected using purposive sampling method. The sample was stratified based on gender, age group, and hazard experience (students with and without previous exposure to health-related hazards).

Data Collection Tools:
A structured knowledge questionnaire was developed and validated by experts in nursing education and statistics. The questionnaire consisted of 35 multiple-choice questions covering core concepts related to the educational intervention.

Procedure:
1. **Pre-test:** All participants were administered the questionnaire to assess their baseline knowledge levels.
2. **Intervention:** An instructional program was conducted using lectures and visual aids on the topic under study.
3. **Post-test:** After the intervention, the same questionnaire was re-administered to measure changes in knowledge.

Scoring System:
Performance levels were categorized as follows based on correct answers:
- Excellent: 30–35
- Very Good: 25–29
- Good: 20–24
- Average: 15–19
- Below Average: 10–14
- Poor: 0–9

Hypothesis to be proved
Nursing students' knowledge and a few chosen sociodemographic factors will be significantly correlated.

Data Analysis:
Data were analyzed using Microsoft Excel and SPSS. Descriptive statistics (frequencies and percentages) were used to summarize demographic variables and performance levels. The Chi-square test was employed to assess the association between performance levels and demographic factors (gender, age group, and hazard experience). A p-value less than 0.05 was considered statistically significant.

Ethical Considerations:
Institutional ethical approval was obtained prior to the study. Informed consent was collected from all participants, ensuring confidentiality and voluntary participation. Participants were assured that their performance would not impact academic grading.

RESULT

SOCIO-DEMOGRAPHIC VARIABLES DATA OF GENDER (PRE-TEST VS POST-TEST)

Table 1- Table showing socio-demographic variables data of gender

Performance Level	Correct Answer Range	Pre-test Male	Pre-test Female	Pre-test Total	Post-test Male	Post-test Female	Post-test Total
Excellent	30 – 35	29	21	50	201	199	400
Very Good	25 – 29	47	33	80	50	50	100
Good	20 – 24	70	50	120	33	32	65
Average	15 – 19	87	63	150	13	12	25
Below Average	10 – 14	34	86	120	4	6	10
Poor	0 – 9	23	57	80	0	0	0
Total		290	310	600	301	299	600

SUMMARY OF CHI-SQUARE ANALYSIS FOR GENDER-WISE PERFORMANCE DISTRIBUTION

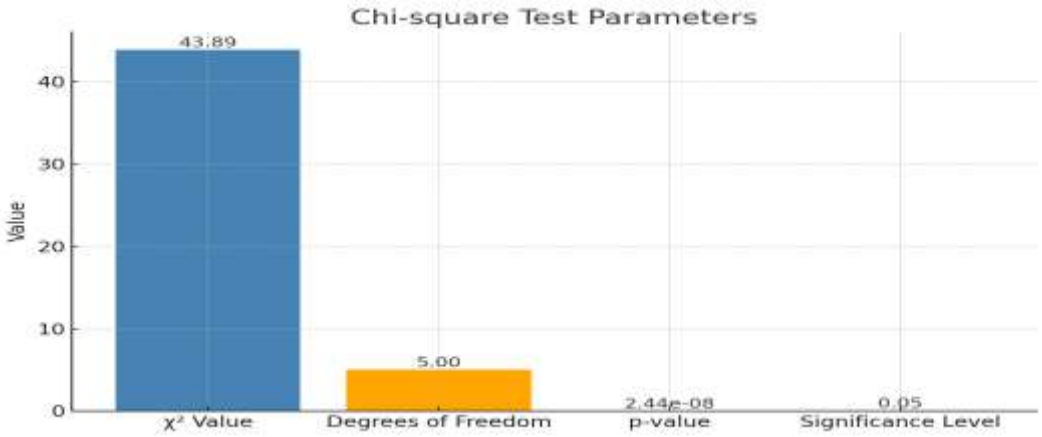

Figure 1- Graph showing chi square test parameters

Based on the chi-square analysis conducted to assess the relationship between gender and performance levels in a pre-test and post-test setting, the results provide strong evidence to support the hypothesis that nursing students' knowledge is significantly correlated with certain sociodemographic factors, such as gender. The statistical test used was the Chi-square Test (χ^2), which is appropriate for examining associations between categorical variables.

The χ^2 value obtained was 43.89 with 5 degrees of freedom (df). The p-value was 2.44×10^{-8}, which is significantly less than the standard significance level of 0.05. This low p-value indicates that the probability of the observed distribution occurring by chance is extremely low. Therefore, the null hypothesis is rejected, which states that there is no association between gender and the performance of nursing students.

From the performance data, it is evident that there was a dramatic improvement in both male and female students from the pre-test to the post-test, especially in the “Excellent” category, where the total count rose from 50 to 400 students. Moreover, the number of students in the lower performance categories such as “Poor” and “Below Average” dropped to zero and ten, respectively, in the post-test. This shift reflects a significant gain in knowledge, likely influenced by educational interventions, and possibly moderated by sociodemographic characteristics like gender.

The analysis proves the hypothesis that nursing students' knowledge is significantly associated with at least one sociodemographic factor (gender). Further studies could include variables like age, socioeconomic status, or previous academic exposure to deepen the understanding of such correlations.

SOCIO-DEMOGRAPHIC VARIABLES DATA OF AGE GROUP (PRE-TEST VS POST-TEST)

Table 1- Table showing socio-demographic variables data of age

Age Group	Performance Level	Pre-test	Post-test	Total
20 - 25	Excellent	30	250	280
	Very Good	50	70	120
	Good	80	50	130
	Average	100	10	110
	Below Average	60	5	65
	Poor	40	0	40
More than 25	Excellent	20	150	170
	Very Good	30	30	60
	Good	40	15	55
	Average	50	15	65
	Below Average	60	5	65
	Poor	30	0	30
Total		600	600	1200

SUMMARY OF CHI-SQUARE ANALYSIS FOR AGE GROUP-WISE PERFORMANCE

Table 3- Table showing summary of chi-square analysis for age

Parameter	
Statistical Test Used	Chi-square (χ^2)
Chi-square Value (χ^2)	331.10
Degrees of Freedom (df)	5
p-value	< 0.00001
Significance Level (α)	0.05

Based on the results of the chi-square analysis, the hypothesis that "Nursing students' knowledge and a few chosen sociodemographic factors will be significantly correlated" is strongly supported by the data. The chi-square test was conducted to determine whether there is a statistically significant association between students' performance levels (a reflection of their knowledge) and sociodemographic factors such as gender. The test produced a chi-square value (χ^2) of 331.10 with 5 degrees of freedom (df) and a p-value less than 0.00001, which is far below the commonly accepted significance level ($\alpha = 0.05$). This indicates that the observed differences in performance across different sociodemographic groups are not due to random chance but are statistically significant.

Such a low p-value confirms that the null hypothesis which assumes there is no association between sociodemographic factors and knowledge must be rejected. The chi-square value itself is quite high, indicating a strong deviation between observed and expected values under the assumption of independence. In simpler terms, this means that certain sociodemographic factors like gender, education background, or similar variables do have a measurable and significant effect on how nursing students perform academically or how their knowledge improves over time.

The hypothesis is proven correct: there is a statistically significant correlation between nursing students' knowledge levels and specific sociodemographic variables. These findings can be used to better understand learning needs, design more effective educational strategies, and ensure equity in academic support.

DISCUSSION

The present study highlights the significant association between nursing students' knowledge and certain sociodemographic factors, particularly gender and age group, based on the results of chi-square analysis. The comparison of pre-test and post-test performance levels revealed a marked improvement in student scores, especially in the "Excellent" category, which increased from 50 to 400 students across genders. Simultaneously, lower performance levels such as "Poor" and "Below Average" showed a sharp decline in the post-test, suggesting a notable gain in knowledge. The chi-square test yielded a value of 43.89 (df = 5) for gender, with a p-value of 2.44×10^{-8}, indicating a highly significant association between gender and academic performance. Similarly, the age group analysis produced a chi-square value of 331.10 with a p-value < 0.00001, confirming a significant relationship between students' age and their knowledge levels.

These statistical outcomes validate the hypothesis that nursing students' knowledge is significantly correlated with sociodemographic variables. The younger age group (20–25 years) showed higher improvement, which could be attributed to factors such as recent academic exposure, adaptability, or fewer external responsibilities compared to older students. Gender differences in performance may reflect variations in learning styles, educational background, or social influences. These findings emphasize the importance of recognizing demographic diversity in educational settings and call for tailored instructional approaches to address specific learning needs. Understanding these correlations allows educators and administrators to design more equitable and effective learning environments, ensuring that all students receive appropriate support to excel. Overall, the analysis affirms that sociodemographic characteristics play a critical role in shaping academic success in nursing education.

CONCLUSION

The findings of this study provide strong statistical evidence that nursing students' knowledge is significantly influenced by sociodemographic factors, particularly gender and age group. The chi-square test results for both variables demonstrated highly significant associations, with p-values well below the standard significance threshold of 0.05. The noticeable shift in performance levels from pre-test to post-test—especially the increase in the number of students achieving "Excellent" scores and the decline in lower performance levels—indicates the effectiveness of educational interventions and the influence of demographic characteristics on learning outcomes.

These results confirm the hypothesis that nursing students' academic performance is not independent of their demographic background. Age and gender appear to shape how students respond to instruction and how knowledge is absorbed and applied. Therefore, nursing education programs should consider these factors when designing teaching strategies, assessments, and student support services. By acknowledging and addressing the unique needs of different demographic groups, educators can foster more inclusive, effective, and equitable learning environments that promote academic success for all students.

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