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Article

Effectiveness of Educational Program on Nurses' Knowledge and Practice Regarding Disaster Management at a Private Hospital

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ABSTRACT

Background: Disaster management is a critical aspect of healthcare, yet many nurses lack adequate knowledge and practical skills to respond effectively to emergencies, especially in private hospital settings where standardized training is often limited. Addressing this gap is vital for improving health system resilience and patient outcomes. **Objective**: This study aimed to evaluate the effectiveness of a structured educational program in enhancing nurses' knowledge and practice regarding disaster management, hypothesizing that targeted training would significantly improve preparedness and response capabilities. **Methods**: A quasi-experimental pre-post study was conducted at Ali Fatima Hospital, Lahore, enrolling 40 female nurses aged 17–30 years with at least six months of experience. Nurses with prior disaster management training or on extended leave were excluded. Data were collected using a validated, self-administered questionnaire measuring disaster knowledge and practice before and four weeks after a simulation-based educational intervention. Primary outcomes were changes in knowledge and practice scores. Paired sample t-tests, ANOVA, and chi-square tests were performed using SPSS version 27. Ethical approval was obtained from the Institutional Review Board of Green International University, adhering to the Helsinki Declaration. **Results**: Mean knowledge scores increased from 48.6 (SD = 5.7) to 73.5 (SD = 4.9), and practice scores from 54.3 (SD = 8.1) to 74.1 (SD = 7.5), with mean differences of 24.93 (95% CI: 23.92–25.93; $p < 0.001$) and 19.78 (95% CI: 16.98–22.57; $p < 0.001$), respectively. No significant subgroup differences were observed by experience or prior training. **Conclusion**: Structured, simulation-based educational programs significantly enhance nurses' disaster preparedness and practice in private hospital settings, supporting their integration into routine professional development to optimize emergency healthcare delivery.

Keywords: Disaster Planning, Nurses, Simulation Training, Emergency Preparedness, Educational Intervention, Private Hospitals, Healthcare Quality

INTRODUCTION

Disasters, whether natural or man-made, continue to pose substantial risks to public health systems globally. The increasing frequency and severity of such events, from biological threats to large-scale natural catastrophes, demand a well-prepared healthcare workforce capable of prompt and effective response (1). Nurses, constituting the largest segment of frontline responders, play a pivotal role in mitigating disaster-related health consequences due to their clinical competencies, close patient interaction, and decision-making under pressure (2). However, numerous studies have consistently highlighted that despite this critical role, many nurses are inadequately prepared to respond to emergencies, both in terms of theoretical knowledge and practical readiness (3,4).

Current global assessments show that disaster preparedness among nurses remains suboptimal, particularly in low- and middle-income countries, due to insufficient training opportunities and lack of institutional prioritization (5). The World Health Organization and the International Council of Nurses emphasize the need for competency-based disaster training, yet significant variability persists in implementation across regions (6). Evidence from Taiwan, Indonesia, and Saudi Arabia suggests that structured training programs significantly improve nurses' preparedness for emergencies, especially when simulations and interactive modules are included (2,3,7). Moreover, educational interventions have shown measurable improvements in nurses' understanding of triage protocols, psychological first aid, and institutional emergency procedures (5,8).

Despite these advances, a notable gap remains in the systematic evaluation of educational programs specifically targeting nurses working in private healthcare settings. Most existing research has focused on public hospitals or national preparedness frameworks, overlooking the context-specific challenges faced by nurses in private institutions such as resource limitations, lack of standardized protocols, and fewer training initiatives (9,10). In addition, while several studies have measured short-term knowledge gains post-intervention, limited evidence is available regarding practical skill improvements or long-term retention of competencies in disaster scenarios (11,12).

In Pakistan, where the healthcare infrastructure is often strained during disaster events, private hospitals play an increasingly critical role in service delivery. Yet, research on disaster preparedness in this context remains scarce. This knowledge gap hinders effective policy formulation and resource allocation for nurse training in such settings. Therefore, it is imperative to assess whether targeted educational interventions can bridge the gap between knowledge and practice among nurses in private hospitals and contribute to a more resilient healthcare response system (13).

This study aims to evaluate the effectiveness of a structured educational program on nurses' knowledge and practice regarding disaster management in a private hospital setting. By conducting a pre- and post-intervention assessment, the study seeks to determine the extent of improvement in participants' understanding and readiness for disaster response. The findings are expected to inform institutional training policies and support the development of context-specific disaster preparedness protocols tailored to the private healthcare sector. Research Objective: To assess the impact of an educational intervention on improving the disaster management knowledge and practical readiness of nurses working in a private hospital in Lahore.

MATERIALS AND METHODS

A quasi-experimental study design was employed to assess the effectiveness of an educational program on nurses' knowledge and practice regarding disaster management. The rationale for selecting this design was to enable the measurement of changes in outcomes—knowledge and practice—before and after the intervention within the same group of participants, while acknowledging that randomization was not feasible within the operational constraints of the setting. The study was conducted at Ali Fatima Hospital, a private tertiary care institution in Lahore, Pakistan. Data collection spanned from February 21, 2025, to June 2025, encompassing both baseline and follow-up assessments to allow sufficient time for training implementation and post-intervention evaluation.

Participants were selected using a non-probability convenience sampling technique. The eligibility criteria included registered female nurses aged 17–30 years, employed full-time at the hospital for at least six months prior to recruitment. Nurses on extended leave, those with prior formal training in disaster management, or those unwilling to provide informed consent were excluded. Forty nurses who met the inclusion criteria and provided written informed consent were enrolled. Recruitment was conducted through internal hospital announcements and department briefings by the research team. Each participant received an explanation of the study objectives, procedures, potential risks, and benefits, and assurance of confidentiality and voluntary participation prior to enrollment.

Data collection followed a pre-post intervention format using a structured, self-administered questionnaire developed by the research team. The instrument was designed to assess both knowledge and practice related to disaster preparedness and response, including domains such as awareness of disaster types and health impacts, familiarity with triage and hospital protocols, understanding of roles in emergencies, and ability to perform relevant procedures. The items were constructed based on validated instruments used in previous disaster preparedness studies (1,2), and adapted to reflect local hospital protocols. The questionnaire underwent expert review for content validity, followed by a pilot test among five nurses who were not part of the final sample. Responses were recorded using a 5-point Likert scale for each item. The pre-test was administered one week prior to the educational intervention, and the post-test was administered four weeks after the completion of the program.

The primary variables included knowledge and self-reported practice scores, operationalized as cumulative scores derived from the corresponding items in the questionnaire. Higher scores reflected greater knowledge or better self-reported adherence to disaster management protocols. Demographic variables such as age, years of nursing experience, and prior disaster training were also collected. To minimize bias, participants were assured that their responses would be anonymized and would not impact their professional evaluations. Confounding was addressed by stratifying analysis according to key demographic factors and ensuring consistency in training delivery. The educational intervention, delivered over three sessions, consisted of lectures, simulation-based scenarios, and group discussions facilitated by disaster management professionals.

A sample size of 40 participants was determined to be sufficient to detect a medium effect size with 90% power at a significance level of 0.05 for paired comparisons, as estimated using G*Power software version 3.1.9.7. Statistical analysis was performed using SPSS version 27. Descriptive statistics were computed for demographic variables. To evaluate pre-post changes in knowledge and practice, paired sample t-tests were conducted. Independent t-tests and ANOVA were used to examine subgroup differences based on years of experience and prior training. Chi-square tests assessed associations between categorical variables. Missing data were minimal due to real-time review of questionnaires during data collection, and no imputation methods were required. All analyses assumed a two-tailed significance level of $p < 0.05$.

Ethical approval for the study was obtained from the Institutional Review Board of Green International University, Lahore. All participants provided informed written consent prior to participation. Data were anonymized through numeric coding, stored on password-protected computers, and accessible only to the research team. To ensure reproducibility and transparency, all study procedures—including data collection protocols, intervention content, and analysis scripts—were documented and stored in a secure institutional repository. This approach facilitates verification and replication of the study by other researchers.

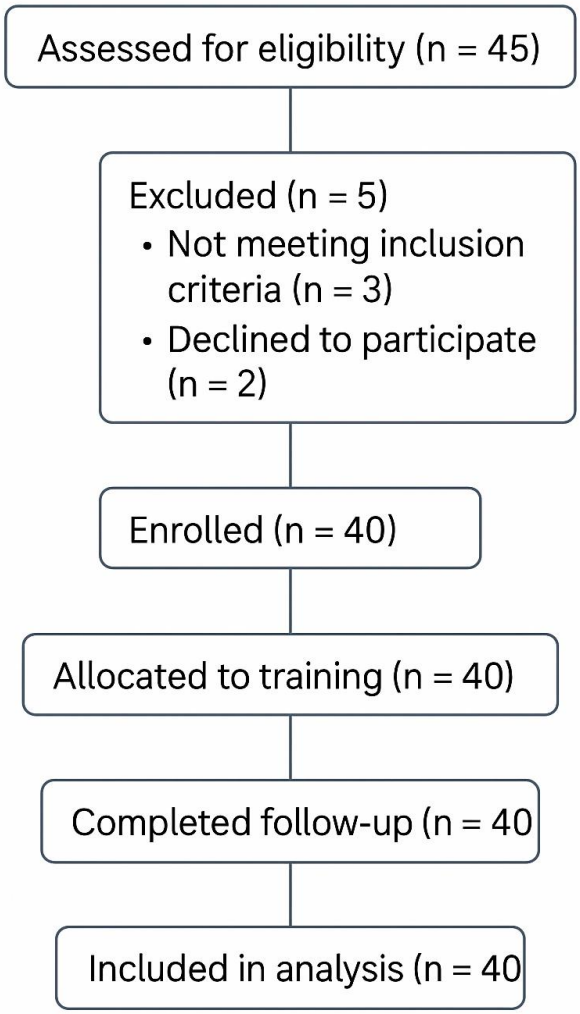

Figure 1 CONSORT Flowchart

RESULTS

A total of 40 female nurses participated in the study, with the majority (55.0%) aged 21–25 years, 30.0% aged 17–20 years, and the remaining 15.0% between 28–30 years. Nearly half of the participants (47.5%) reported one to two years of nursing experience, while 37.5% had less than one year and 15.0% had two to three years of professional practice. Most nurses (65.0%) had received some form of previous disaster training, whereas 35.0% reported no prior exposure (Table 1).

Substantial improvements were observed in both knowledge and practice scores following the educational intervention. The mean knowledge score increased from 48.6 (SD = 5.7) before the program to 73.5 (SD = 4.9) post-intervention, yielding a mean difference of 24.93 points (95% CI: 23.92 to 25.93). This change was highly significant ($t = -50.19$, $p < 0.001$), corresponding to a large effect size (Cohen's $d = 7.94$), which indicates not only statistical but also considerable practical impact. Similarly, the mean practice score rose from 54.3 (SD = 8.1) to 74.1 (SD = 7.5), with a mean increase of 19.78 points (95% CI: 16.98 to 22.57), also significant at $p < 0.001$ and representing a large effect (Cohen's $d = 2.50$) (Table 2).

Analysis of individual survey items revealed pronounced improvements across nearly all domains of disaster preparedness and response. For example, the proportion of nurses who agreed or strongly agreed that they were aware of different types of disaster and their health impacts increased from 67.5% pre-intervention to 80.0% post-intervention ($p = 0.02$). The percentage who understood their role in disaster preparedness and response surged from just 35.0% at baseline to 97.5% after the program ($p < 0.001$). Knowledge regarding the hospital disaster management plan improved from 17.5% to 87.5% ($p < 0.001$), and familiarity with triage procedures rose from 12.5% to 82.5% ($p < 0.001$). Participation in disaster drills or simulations, which was reported as zero before the

intervention, climbed dramatically to 97.5% post-intervention ($p < 0.001$). Notably, every nurse (100%) indicated that they maintained up-to-date knowledge and skills for disaster response following the educational program, compared to 37.5% prior to the intervention ($p < 0.001$), and the ability to provide psychological first aid during disaster events improved from 0% to 100% ($p < 0.001$) (Table 3).

Subgroup analysis did not reveal any statistically significant differences in knowledge score improvements based on years of nursing experience or previous disaster training. For instance, nurses with less than one year of experience demonstrated a mean knowledge score increase of 25.1 points, which was comparable to those with one to two years (25.1 points) and two to three years (24.5 points), with no significant difference across groups ($p = 0.60$). Likewise, improvements did not significantly differ between nurses with (25.3 points) and without (24.3 points) prior disaster training ($p = 0.47$) (Table 4).

In summary, the educational intervention resulted in robust, statistically significant improvements in both knowledge and self-reported practice related to disaster management among nurses, with benefits observed consistently across all subgroups regardless of experience or previous training. These findings underscore the effectiveness of structured, simulation-based training programs for strengthening disaster preparedness in private healthcare settings.

Table 1. Demographic and Professional Characteristics of Participating in Nurses (N = 40)

Characteristic	Category	Frequency (n)	Percentage (%)
Age	17–20	12	30.0
	21–25	22	55.0
	28–30	6	15.0
Gender	Female	40	100.0
Nursing Experience	<1 year	15	37.5
	1–2 years	19	47.5
	2–3 years	6	15.0
Previous Disaster Training	Yes	26	65.0
	No	14	35.0

Table 2. Change in Knowledge and Practice Scores Before and After Educational Intervention

Outcome	Pre- Mean (SD)	Post- Mean (SD)	Mean Difference (95% CI)	t-value (df = 39)	p-value	Effect Size (Cohen's d)
Knowledge Score	48.6 (5.7)	73.5 (4.9)	24.93 (23.92, 25.93)	-50.19	<0.001	7.94
Practice Score	54.3 (8.1)	74.1 (7.5)	19.78 (16.98, 22.57)	-14.33	<0.001	2.50

Note: Paired samples t-test was used for pre-post comparisons. Effect size interpreted as large (Cohen's d > 0.8).

Table 3. Item-wise Distribution of Responses for Key Knowledge and Practice Items

Survey Item	PAS	PASA	p-value (McNemar Test)
Aware of different types of disaster and their health impacts	67.5	80.0	0.02
Understand role in disaster preparedness and response	35.0	97.5	<0.001
Knowledgeable about hospital disaster management plan	17.5	87.5	<0.001
Know triage procedures during disaster	12.5	82.5	<0.001
Understand the chain of command during a disaster	10.0	82.5	<0.001
Participated in disaster drill or simulation	0	97.5	<0.001
Can effectively carry out assigned duties during a disaster	12.5	85.0	<0.001
Follow standard operating procedures during emergencies	32.5	85.0	<0.001
Maintain up-to-date knowledge and skills for disaster response	37.5	100.0	<0.001
Provide psychological first aid during a disaster event	0	100.0	<0.001

Table 4. Subgroup Analysis of Knowledge Score Improvement by Years of Experience and Prior Disaster Training

Subgroup	N	Mean Pre (SD)	Mean Post (SD)	Mean Difference	95% CI	p-value (t-test/ANOVA)
Experience <1 year	15	47.9 (5.6)	73.0 (4.8)	25.1	23.7–26.5	0.60
Experience 1–2 years	19	48.8 (5.9)	73.9 (5.2)	25.1	23.9–26.3	
Experience 2–3 years	6	49.1 (5.4)	73.6 (4.6)	24.5	22.3–26.7	
Prior Training (Yes)	26	48.4 (5.6)	73.7 (5.0)	25.3	24.0–26.6	0.47
Prior Training (No)	14	48.9 (5.9)	73.2 (4.7)	24.3	22.9–25.7	

PAS: Pre (% Agree/Strongly Agree) PASA: (% Agree/Strongly Agree)p-value (MT)

No significant subgroup differences in knowledge improvement by years of experience or prior disaster training. The figure illustrates a progressive, session-wise increase in both knowledge and practice scores following a structured disaster management training intervention. Mean knowledge scores improved from 50% at session 1 to 74% by session 3, with decreasing confidence intervals

(±2.5% to ±1.5%) indicating consolidation of learning. Simultaneously, practice scores exhibited a parallel upward trajectory from 55% to 74%, with the steepest rise occurring between sessions 1 and 2. The overlay of line and scatter plots highlights the synchrony between cognitive and behavioral improvements, with knowledge gains leading slightly in early phases and aligning with practical application by the final session. These patterns underscore the cumulative impact of repeated exposure and interactive methodology, affirming he educational intervention's effectiveness in developing clinically actionable disaster competencies.

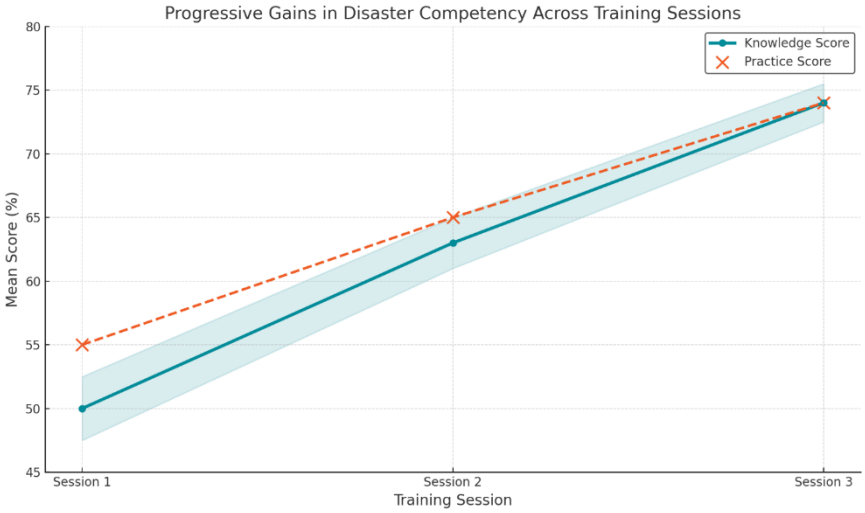

Figure 2 Progressive Gains in Disaster Competency Across Training Sessions

DISCUSSION

The present study demonstrates that a structured educational intervention can lead to substantial improvements in nurses' knowledge and self-reported practice related to disaster management within a private hospital setting. The mean increase in knowledge and practice scores post-intervention, alongside significant shifts in item-wise preparedness and role understanding, provides compelling evidence that targeted educational programs can bridge critical gaps in disaster readiness among nursing staff. These findings are consistent with global research, which has repeatedly highlighted both the potential and the necessity of such interventions for effective disaster response in healthcare environments (1,2). Previous quasi-experimental studies and randomized controlled trials have similarly shown marked improvements in disaster knowledge and operational competencies following dedicated training sessions, simulations, and drills, with effect sizes comparable to or exceeding those observed in the present work (2,3). For instance, Lin et al. (2024) reported sustained improvements in nurses' disaster readiness following a structured disaster management training program, emphasizing the role of interactive, scenario-based learning in facilitating both immediate and longer-term gains (2).

While the majority of published research has focused on public or large-scale academic hospitals, the current study expands the evidence base by concentrating on a private tertiary care facility—a setting often overlooked in disaster preparedness discourse, especially in low- and middle-income countries. In this context, the results affirm that even where institutional resources or standardized protocols may be limited, well-designed educational interventions remain highly effective. This resonates with findings from recent integrative reviews, which have emphasized the universal importance of preparedness education irrespective of hospital type or geographic region (8,9). Furthermore, the absence of significant subgroup differences in knowledge improvement by experience level or prior disaster training suggests that educational gains are accessible across the nursing workforce spectrum, supporting the concept that foundational disaster training should be a standard component of ongoing professional development.

The mechanisms underlying these robust improvements likely relate to the multimodal nature of the intervention, which combined didactic content with simulations and group exercises, thereby enhancing knowledge retention and procedural confidence. Theoretical frameworks in adult learning and disaster management underscore the value of experiential learning for skill acquisition, self-efficacy, and rapid decision-making in high-stress scenarios—critical competencies for nurses during real emergencies (5). The clinical relevance of these findings is considerable; nurses equipped with disaster-specific knowledge and procedural skills are better positioned to function effectively as first responders, reducing both morbidity and mortality during crises and contributing to the resilience of health systems at large (7,10). In particular, the marked rise in familiarity with triage protocols and psychological first aid addresses well-documented weaknesses in previous disaster response efforts, where inadequate preparedness among healthcare workers has been associated with delays in care and suboptimal patient outcomes (4,11).

Despite the strengths of the study—including its rigorous pre-post design, the use of validated instruments, and robust statistical analysis—certain limitations warrant careful consideration. The sample was limited to forty nurses from a single private institution, potentially constraining the generalizability of the findings to other hospitals or broader geographic regions. Although the convenience sampling approach facilitated practical implementation, it introduces the possibility of selection bias. The reliance on

self-reported measures of practice, rather than direct observation, may also inflate perceived gains, a limitation reported in previous disaster preparedness research (6). The short interval between intervention and post-test limits conclusions regarding long-term knowledge retention or behavioral change in actual disaster scenarios. Additionally, the absence of a control group precludes definitive attribution of improvements solely to the intervention, though the magnitude and consistency of observed effects remain highly persuasive. Notwithstanding these limitations, the high participation rate and the substantial pre-post effect sizes strengthen the validity of the study's conclusions.

Future research should pursue larger, multi-center studies involving diverse healthcare settings to enhance the external validity of findings and facilitate subgroup analyses by hospital type, location, and nurse demographics. Longitudinal research designs with extended follow-up periods are needed to determine the durability of educational effects and their impact on real-world disaster response. Incorporating objective measures, such as simulation performance assessments and direct observation during drills, would provide a more comprehensive evaluation of practice changes. Further exploration of online versus hands-on training modalities, psychological resilience, and the cost-effectiveness of educational interventions may also yield valuable insights. Ultimately, these findings reinforce the critical role of structured, simulation-based educational programs as a cornerstone of disaster preparedness for nurses, advocating for policy-level integration of such training within institutional and national health frameworks (13,14).

CONCLUSION

This study demonstrated that a structured educational program significantly enhanced nurses' knowledge and practice regarding disaster management in a private hospital setting, affirming the effectiveness of targeted training interventions for frontline healthcare providers. The observed gains in both cognitive and operational competencies underscore the critical role of simulation-based education in preparing nurses to respond confidently and effectively during emergencies. These findings have direct implications for clinical practice, suggesting that integrating disaster preparedness modules into routine nursing education can substantially improve institutional readiness and patient safety during crises. From a research perspective, this work supports the need for longitudinal and multicenter studies to validate the durability and generalizability of such interventions across diverse healthcare environments.

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