Article

Effect of Educational Program on Nurses' Knowledge and Practice About Influenza Vaccines

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ABSTRACT

Background: Influenza poses a substantial risk to healthcare workers, yet vaccination rates among nurses remain suboptimal due to persistent knowledge gaps and behavioral barriers. Addressing these deficits through focused educational programs is essential to enhance infection control and patient safety. **Objective**: This study aimed to evaluate the effectiveness of a structured educational intervention in improving nurses' knowledge and practices related to influenza vaccination, with the expectation of measurable gains in both domains. **Methods**: A quasi-experimental study was conducted among nurses at a tertiary hospital in Lahore, Pakistan (n = 40). Eligible participants included registered nurses and nursing students directly involved in patient care; physicians and allied staff were excluded. Data were collected before and two weeks after the intervention using a validated questionnaire assessing knowledge and practice. The program comprised interactive sessions covering vaccine efficacy, guidelines, and misconceptions. The study protocol was approved by the Green International University IRB, adhering to the Helsinki Declaration. Paired t-tests and descriptive statistics were performed using SPSS version 27 to compare pre- and post-intervention outcomes. **Results**: Post-intervention, knowledge scores increased by a mean of 5.13 points (95% CI: 4.29–5.96, p < 0.001), and practice scores improved by 21.93 points (95% CI: 20.02–23.83, p < 0.001). The proportion of nurses demonstrating correct knowledge and optimal vaccination practices rose from less than one-third to over 75%, representing significant clinical and behavioral improvement. **Conclusion**: A brief, structured educational intervention substantially enhanced nurses' knowledge and preventive practices regarding influenza vaccination. Incorporating such programs into routine professional development can drive higher vaccine uptake and bolster infection prevention in healthcare settings.

Keywords: Influenza Vaccines, Nurses, Health Knowledge, Attitudes, Practice, Educational Intervention, Infection Control

INTRODUCTION

Influenza continues to represent a persistent and significant health challenge within healthcare settings, where the burden of disease is amplified due to constant exposure and high-risk patient populations. Despite the widespread recognition of the dangers posed by influenza and the availability of effective vaccines, uptake among healthcare workers—particularly nurses—remains notably inadequate in many countries (1). Existing literature highlights a clear discrepancy between knowledge and practice; for instance, in Italy, only 36% of healthcare workers received the influenza vaccine, while in Pakistan, although 67% of healthcare workers were aware of influenza vaccination, just 51% demonstrated adherence to recommended practices (1). Interventions such as targeted educational programs have been shown to bridge this gap, as evidenced by increased vaccine coverage from 27.6% to 49.5% following structured education in one cohort, underscoring that

knowledge alone is insufficient without concurrent behavioral change (1). International experiences reinforce the multifactorial nature of this issue. In Australia, a combination of mandatory vaccination policies, accessible vaccination services, and public health campaigns has effectively raised vaccination rates among healthcare professionals, providing a replicable model for other contexts (2).

Parallel efforts among pediatric populations in Italy—utilizing parent education, school-based vaccination drives, and reminders—have also led to improved coverage, suggesting the value of multifaceted approaches across age groups (3). Authoritative guidance, such as the recommendations of the Advisory Committee on Immunization Practices (ACIP), continues to prioritize influenza vaccination as the principal means to reduce illness and complications, particularly

emphasizing high-risk groups and the critical timing of vaccination efforts (4). The advent of the COVID-19 pandemic further complicated influenza vaccination dynamics. Although awareness of vaccines increased, the post-pandemic period witnessed declines in vaccination rates in certain regions due to renewed misinformation and insufficient promotion, as reported in areas such as Chengdu, China. Conversely, in countries like Kyrgyzstan, the pandemic improved understanding but highlighted ongoing challenges around trust and accessibility (5). Among healthcare trainees, knowledge gaps and negative attitudes are also prevalent, with studies from Greece demonstrating that only students in advanced years exhibited adequate knowledge and positive attitudes, reinforcing the need for early and continued education within curricula (6).

Global initiatives such as the Partnership for Influenza Vaccine Introduction (PIVI) illustrate the growing emphasis on supporting vaccination programs in low- and middle-income countries by fostering cross-sector collaboration, providing technical support, and building sustainable, routine immunization strategies—efforts critical to pandemic preparedness and resilient healthcare systems (7). Despite accumulating evidence supporting the impact of educational interventions, persistent barriers—ranging from institutional inertia to individual misconceptions—continue to undermine vaccination efforts among nurses, a frontline workforce integral to patient care and infection control. In Pakistan and similar settings, research reveals a persistent gap between what is known about influenza vaccination and what is practiced, complicated by misinformation, variable institutional support, and limited professional development opportunities (1,5,11). Addressing these barriers by embedding vaccine-focused education within professional training and fostering a culture of evidence-based practice may be key to improving vaccination rates and, by extension, patient safety outcomes.

Given this context, the present study aims to rigorously assess whether a structured educational program can effectively enhance nurses' knowledge and practical engagement with influenza vaccination. By evaluating changes in knowledge and practice before and after the intervention, this research seeks to address critical gaps in current understanding and provide actionable insights for integrating vaccine education into routine professional development for nurses. The objective is to determine if such targeted education can produce measurable improvements in both the cognitive and behavioral domains of influenza prevention among nursing staff, thereby informing policy and educational strategies to reduce influenza-related morbidity and mortality in healthcare settings.

MATERIALS AND METHODS

This quasi-experimental study was designed to evaluate the effectiveness of an educational intervention on nurses' knowledge and practices regarding influenza vaccination. The research was conducted at a tertiary care hospital affiliated with the School of Nursing, Green International University, Lahore, Pakistan, spanning a period of six months from January to June 2024. The hospital setting provided a controlled environment in which to observe and measure both baseline and post-

intervention outcomes among the nursing staff working in intensive care units and other relevant clinical departments.

Participants were selected using random sampling from the roster of registered nurses employed at the institution. Eligibility criteria included currently employed nurses, nursing students in clinical rotations, and head nurses with direct patient care responsibilities; all participants were required to have at least basic proficiency in the local language to ensure comprehension of the study materials. Exclusion criteria comprised physicians, allied healthcare staff such as technicians, and administrative personnel without direct patient contact. The rationale for this selection was to target those most likely to administer and advocate for influenza vaccination within clinical practice.

Recruitment involved dissemination of study information through departmental meetings and notices. Interested participants were provided with detailed information about the study objectives, procedures, potential risks, and benefits. Written informed consent was obtained from each participant prior to enrollment. The study was reviewed and approved by the institutional review board of Green International University (approval number: GIU/IRB/2023/111), and all procedures were conducted in accordance with the ethical principles of the Declaration of Helsinki. Participant anonymity and confidentiality were rigorously maintained by assigning unique study identifiers and securely storing all data in password-protected digital files.

The intervention consisted of a structured educational program focused on influenza and influenza vaccination, developed in collaboration with infectious disease specialists and experienced nurse educators. The program content covered epidemiology, pathophysiology, vaccine types, vaccination guidelines, myths and misconceptions, and strategies for effective patient and peer communication regarding vaccination. Delivery involved interactive lectures, printed handouts, and practical demonstrations, conducted in small group sessions to facilitate engagement. Each session lasted approximately 90 minutes and was scheduled to minimize disruption of routine clinical duties. Attendance was monitored to ensure uniform exposure.

Data were collected at two points: immediately before the intervention and two weeks following its completion. The primary data collection instrument was a validated, self-administered questionnaire composed of two sections: one assessing knowledge and the other practice regarding influenza vaccination. The knowledge section included multiple-choice and true/false questions directly mapped to the educational content, while the practice section used a Likert scale to quantify the frequency of preventive behaviors such as hand hygiene, mask usage, and vaccine advocacy. The questionnaire demonstrated strong internal consistency in pilot testing (Cronbach's alpha >0.80). Demographic data including age, gender, educational background, and years of professional experience were also collected. Operational definitions were established for key variables. Knowledge was defined as the correct response rate to factual questions about influenza and its vaccination, with higher scores indicating greater knowledge. Practice was operationalized as self-reported frequency of

recommended preventive behaviors. The main outcomes were the mean difference in knowledge and practice scores pre- and post-intervention. To minimize bias, random sampling was employed, and the questionnaires were administered and collected by research staff not involved in delivering the educational intervention. Potential confounders such as baseline educational level and prior vaccination experience were recorded and later adjusted for in statistical analyses. Missing data were handled using complete case analysis, with the proportion of missing responses reported and their potential impact assessed. No imputation was performed.

The required sample size was calculated using Slovin's formula ($n = N / (1 + N * e^2)$), based on the hospital's nursing population of 60 and an acceptable margin of error of 0.05, yielding a minimum sample size of 40 participants. This ensured adequate power to detect a clinically meaningful difference between pre- and post-intervention scores. Data entry was independently verified by two investigators to ensure accuracy and reproducibility. Statistical analyses were conducted using SPSS version 27 (IBM Corp., Armonk, NY, USA).

Paired t-tests were used to compare pre- and post-intervention scores for both knowledge and practice, with a two-tailed significance threshold set at $p < 0.01$ for primary outcomes. The normality of score distributions was assessed using the Shapiro-Wilk test. Subgroup analyses were conducted based on age, years of experience, and prior influenza vaccination status. Adjustments for potential confounders were made using multiple linear regression where appropriate. All records and datasets generated during the study are securely stored and available for audit to ensure transparency and reproducibility. The protocol, survey instruments, and analysis code can be shared with other researchers upon reasonable requests to promote open scientific exchange and facilitate replication in other settings.

RESULTS

The study population comprised 40 nurses, all of whom were female, reflecting the gender distribution in the selected clinical setting. The majority of participants were young professionals, with 55% being under the age of 25, while the remaining 45% fell within the 25–34 age group. Every participant held the position of staff nurse and possessed at least a bachelor's degree in nursing, indicating a relatively homogenous group in terms of professional qualifications. Additionally, all nurses reported between zero and nine years of clinical experience and had completed between zero and twenty-five hours of work-related training in the previous year. This consistency in educational attainment and experience helped minimize the potential influence of demographic variability on study outcomes. A core objective of the study was to evaluate shifts in nurses' knowledge regarding influenza and its vaccination as a result of the educational program. Prior to the intervention, knowledge levels were strikingly low. For instance, only 32.5% of participants recognized the effectiveness of influenza vaccination in preventing flu, and just 30% were aware of World Health Organization (WHO) guidelines recommending vaccination for health workers.

After the educational intervention, these proportions surged to 80% for vaccine effectiveness and 80% for guideline awareness, with mean increases of nearly 50 percentage points in both areas. Awareness of the WHO advisory committee's role, understanding of the vaccine's inability to provide total protection, and knowledge about coverage against other upper respiratory tract infections (URTIs) also saw statistically significant gains. Of particular note, awareness that the vaccine cannot cause the flu, and that it contains only inactivated (not live) viruses, improved by more than 50 percentage points each, indicating the intervention's effectiveness in dispelling persistent misconceptions.

The p-values for all knowledge comparisons were less than 0.001, with confidence intervals for changes excluding zero, confirming the statistical and practical significance of the improvements. These findings are reinforced by a large effect size, with Cohen's d approaching 2.0, reflecting a substantial impact of the educational intervention on knowledge. In addition to knowledge, the intervention targeted actual preventive practices. Before the training, preventive behaviors were rare. For example, only 10% of nurses reported that they even occasionally visited a medical facility when experiencing respiratory symptoms; more than half never did so. Mask usage and hand hygiene were also infrequent, with 57.5% never wearing a mask and 55% seldom washing hands before and after patient contact.

Table 1. Demographic Characteristics of Study Participants (n = 40)

Variable	Frequency (n)	Percentage (%)
Gender		
Female	40	100.0
Age Group		
<25	22	55.0
25–34	18	45.0
Professional Title		
Staff Nurse	40	100.0
Education Level		
Bachelor's Degree	40	100.0
Years of Experience		
0–9	40	100.0
Work-related Training (hours)		
0–25	40	100.0

Table 2. Changes in Knowledge about Influenza Vaccination Pre- and Post-Intervention (n = 40)

Question	Pre-Intervention n (%)	Post-Intervention n (%)	Mean Difference (Δ%)	95% CI for Δ%	p-value
Knows influenza vaccine is effective in preventing flu	13 (32.5)	32 (80.0)	+47.5	32.6, 62.4	<0.001
Aware of WHO guidelines for health worker influenza vaccination	12 (30.0)	32 (80.0)	+50.0	35.5, 64.5	<0.001
Familiar with WHO advisory committee's guidelines on vaccination practices	11 (27.5)	29 (72.5)	+45.0	30.5, 59.5	<0.001
Knows vaccine does not provide complete flu protection	12 (30.0)	30 (75.0)	+45.0	30.5, 59.5	<0.001
Knows immunization protects against other URTIs	10 (25.0)	32 (80.0)	+55.0	41.5, 68.5	<0.001
Aware that vaccine can reduce medical expenses	8 (20.0)	29 (72.5)	+52.5	37.8, 67.2	<0.001
Knows vaccine does not cause flu	11 (27.5)	32 (80.0)	+52.5	37.8, 67.2	<0.001
Knows healthcare provider may infect patient	10 (25.0)	30 (75.0)	+50.0	35.5, 64.5	<0.001
Aware that influenza vaccine is composed of inactivated viruses	9 (22.5)	32 (80.0)	+57.5	44.6, 70.4	<0.001
Knows inactivated vaccine does not contain live viruses	10 (25.0)	33 (82.5)	+57.5	44.6, 70.4	<0.001

Table 3. Changes in Preventive Practice Behaviors Pre- and Post-Intervention (n = 40)

Practice Behavior	Pre-Intervention (%) (VF/F/O/R/N)	Post-Intervention (%) (VF/F/O/R/N)	Mean Score Pre	Mean Score Post	Mean Difference	95% CI for Δ	p-value
Visit medical facility with symptoms	0/0/10/35/55	55/30/7.5/5/2.5	1.25	4.28	+3.03	2.78, 3.28	<0.001
Wear a mask during symptoms	0/0/10/32.5/57.5	55/20/12.5/7.5/5	1.20	4.12	+2.92	2.65, 3.19	<0.001
Wash hands before and after patient contact	0/0/15/30/55	55/22.5/7.5/7.5/7.5	1.35	4.10	+2.75	2.49, 3.01	<0.001
Advises others to get vaccinated	0/0/10/20/70	60/25/7.5/5/2.5	1.10	4.35	+3.25	2.99, 3.51	<0.001
Has received influenza vaccination	0/0/12.5/22.5/65	60/20/10/7.5/2.5	1.13	4.30	+3.17	2.91, 3.43	<0.001
Regularly receives influenza vaccination	0/0/15/20/65	57.5/27.5/5/5/5	1.15	4.27	+3.12	2.87, 3.37	<0.001
Family received influenza vaccination program	0/0/15/20/65	67.5/20/5/5/2.5	1.15	4.45	+3.30	3.04, 3.56	<0.001
Attends influenza prevention programs	0/0/20/20/60	42.5/42.5/10/2.5/2.5	1.20	4.22	+3.02	2.76, 3.28	<0.001

Table 4. Paired Samples t-Test for Knowledge Scores Pre- and Post-Intervention

Comparison	Mean Difference	SD	SE	95% CI (Lower, Upper)	t-value	df	p-value	Cohen's d (Effect Size)
Pre vs. Post	–5.13	2.62	0.41	–5.96, –4.29	–12.36	39	<0.001	1.98 (large)

Table 5. Paired Samples t-Test for Practice Scores Pre- and Post-Intervention

Comparison	Mean Difference	SD	SE	95% CI (Lower, Upper)	t-value	df	p-value	Cohen's d (Effect Size)
Pre vs. Post	21.93	5.95	0.94	20.02, 23.83	23.29	39	<0.001	3.68 (large)

Vaccination uptake and advocacy were similarly low, with most participants never having received or recommended the influenza vaccine, and only 15% reporting occasional or better adherence to regular vaccination. Following the educational

program, these behaviors changed markedly. The percentage of nurses who visited medical facilities for respiratory symptoms "very frequently" jumped from 0% to 55%, and the use of masks and proper hand hygiene both saw similar improvements, with more than half of the nurses adopting these practices "very frequently." Vaccination advocacy and uptake improved dramatically as well; 60% of participants began recommending and receiving the influenza vaccine on a very regular basis, compared to less than 15% pre-intervention. These positive trends extended to participants' families, as 67.5% of nurses reported that family members received regular influenza vaccinations after the intervention. Each of these changes was statistically significant, with mean behavioral score increases exceeding three points on a five-point scale, and effect sizes indicating very large practical significance. Statistical analysis using paired samples t-tests confirmed the robustness of these findings. The mean knowledge score improved by 5.13 points (SD 2.62), with a 95% confidence interval ranging from -5.96 to -4.29 and a t-value of -12.36 ($p < 0.001$), reflecting a highly significant effect. Similarly, the mean difference in practice scores was 21.93 points (SD 5.95), with a confidence interval of 20.02 to 23.83 and a t-value of 23.29 ($p < 0.001$). The Cohen's d for these analyses were 1.98 for knowledge and 3.68 for practice, both indicating exceptionally large effect sizes. The narrow confidence intervals and extremely low p-values reinforce the reliability of the observed changes. Together, these findings provide compelling evidence that a focused educational intervention can dramatically improve both the knowledge and practical behaviors of nurses regarding influenza vaccination. The consistency of results across multiple knowledge items and behavioral practices, coupled with the magnitude and statistical significance of the changes, underscores the potential value of integrating such educational programs into standard nursing training and ongoing professional development. The large improvements, observed in both individual and group-level analyses, suggest that structured, evidence-based training not only increases factual understanding but also translates into real-world behavioral change—an essential step for public health advancement and patient safety in healthcare settings

DISCUSSION

The present study demonstrates that a structured educational intervention can lead to significant improvements in both knowledge and practice among nurses regarding influenza vaccination. These results reinforce and extend the findings of prior research, which has consistently highlighted the gap between vaccine-related knowledge and the translation of that knowledge into clinical practice among healthcare workers (1,5). The magnitude of change observed in this study—in which correct knowledge of vaccine efficacy and awareness of WHO recommendations increased by nearly 50 percentage points, and "very frequent" preventive behaviors surged from negligible to majority levels—underscores the transformative potential of focused, evidence-based training. Such gains are in agreement with previous systematic reviews and interventional studies reporting substantial, though sometimes more modest, improvements following educational interventions (1,3).

In comparative perspective, the rise in vaccine advocacy and uptake found here mirrors experiences from settings such as Australia, where a combination of mandatory policies and educational outreach was associated with higher influenza vaccination rates among healthcare staff (2). Similarly, Italian and Greek studies have emphasized the importance of early and repeated education to combat persistent myths and raise compliance, particularly among less experienced healthcare workers (3,6). The present results not only confirm these findings but suggest that, even in resource-limited contexts such as Pakistan, short, targeted educational programs can rapidly overcome barriers rooted in misconception and hesitancy. Notably, the dramatic correction of specific misunderstandings—such as the belief that the influenza vaccine contains live virus or can cause the flu—directly addresses persistent sources of reluctance highlighted in global literature (4,7).

Theoretical implications of these findings are significant. This study supports behavior change models positing that knowledge acquisition is a prerequisite, but not alone sufficient, for altering clinical behavior; structured educational interventions that are interactive, context-specific, and immediately relevant to practice have the power to close the "knowledge–practice gap" that so often undermines public health efforts (1,9). Furthermore, the observed improvements in both personal and family vaccination practices suggest that education has a ripple effect, potentially expanding benefits beyond the immediate professional context and contributing to wider community protection. The improvements seen here are especially relevant in the post-COVID era, where vaccine fatigue and misinformation remain formidable obstacles (5,10). Integrating routine, evidence-based vaccine education into ongoing professional development and pre-licensure curricula may therefore serve as a powerful strategy for sustaining and extending these gains.

The strengths of this study include its use of validated, standardized assessment instruments, a robust quasi-experimental design, and rigorous statistical analysis, all of which contribute to the reliability and reproducibility of the findings. Random sampling and blinding of assessors to the intervention reduced the risk of selection and information bias, while the focus on ICU and frontline nursing staff ensured the clinical relevance of the results. However, limitations should be acknowledged. The single-center design and homogeneity of the study population—a relatively young, exclusively female cohort with uniform educational backgrounds—limit the generalizability of the results to broader or more diverse healthcare settings. The sample size, while calculated to ensure statistical power within the institutional context, restricts the ability to explore nuanced subgroup effects or interactions. Additionally, the study relied on self-reported data for behavioral outcomes, introducing the possibility of social desirability bias. The short follow-up period precludes conclusions about the durability of the observed changes, and external factors such as administrative support and vaccine availability were not controlled.

Despite these constraints, the study provides a compelling rationale for the adoption of targeted educational interventions as a means to improve influenza vaccination rates among nurses and, by extension, to enhance infection prevention and patient

safety. Future research should seek to validate these findings in larger, multi-center studies, ideally employing randomized controlled designs and longer-term follow-up to assess the persistence of knowledge and behavioral gains. Further work might also examine the relative contributions of different educational modalities, the role of institutional leadership, and the impact of integrating digital or peer-led components (2,5,11). Finally, exploring strategies to sustain and scale such interventions—particularly in resource-constrained environments—remains a critical avenue for investigation.

In conclusion, this study substantiates the pivotal role of education in strengthening nurses' knowledge and practices related to influenza vaccination, demonstrating that even brief, focused interventions can generate meaningful improvements. These findings contribute to the global evidence base supporting investment in healthcare worker education as a cornerstone of effective vaccine policy, pandemic preparedness, and holistic patient care (7,8).

CONCLUSION

This study establishes that a targeted educational program significantly enhances nurses' knowledge and practical behaviors regarding influenza vaccination, directly addressing the gap highlighted in the study's title and objective. The observed improvements in both vaccine-related understanding and adherence to preventive practices have important implications for human healthcare, as empowering nurses with accurate knowledge and skills can increase vaccination uptake, strengthen infection control, and improve patient safety in high-risk clinical settings. Clinically, integrating such educational interventions into routine nursing education and professional development can foster a more proactive, evidence-based approach to influenza prevention among healthcare workers. Future research should evaluate the long-term sustainability and scalability of these interventions across diverse healthcare environments to maximize their impact on public health outcomes.

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