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Article

Effect of Nurse-Led Educational Intervention on Knowledge and Preventive Practices for Upper Respiratory Tract Infection Among Pediatric Nurses

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ABSTRACT

Background: Upper respiratory tract infections (URTIs) remain a leading cause of morbidity and mortality in children worldwide, yet significant gaps persist in pediatric nurses' knowledge and preventive practices, particularly in resource-limited settings, contributing to suboptimal infection control and clinical outcomes. **Objective**: This study aimed to evaluate the effectiveness of a nurse-led educational intervention in improving knowledge and self-reported preventive practices related to URTI prevention among pediatric nurses, with the expectation of significant post-intervention gains. **Methods**: In this quasi-experimental pre-post study, 35 registered pediatric nurses at Ali Fatima Hospital, Lahore, were purposively sampled based on eligibility criteria including active pediatric ward employment and a minimum of six months of clinical experience; nurses on leave during data collection were excluded. Data were collected using a validated, structured questionnaire administered before and two weeks after a single interactive educational session. Primary outcomes included knowledge and practice scores, analyzed using paired t-tests in SPSS version 25, with significance set at $p < 0.05$; ethical approval was obtained from the Green International University IRB, adhering to the Helsinki Declaration. **Results**: Mean knowledge scores increased from 16.94 ± 4.52 pre-intervention to 35.29 ± 3.63 post-intervention (mean difference: 18.34, 95% CI: 15.80–20.89, $p < 0.001$, Cohen's $d = 2.52$). Practice scores also improved significantly (18.61 ± 3.11 vs. 34.01 ± 2.92; mean difference: 15.40, 95% CI: 13.17–17.63, $p < 0.001$). Substantial corrections in misconceptions and increased endorsement of evidence-based practices were observed. **Conclusion**: Nurse-led education markedly enhances pediatric nurses' knowledge and preventive behaviors regarding URTI, supporting structured educational interventions as a clinically valuable strategy to advance infection control and patient outcomes in pediatric care.

Keywords: Upper Respiratory Tract Infections, Pediatric Nursing, Health Education, Evidence-Based Practice, Infection Control, Preventive Health Services, Quasi-Experimental Studies.

INTRODUCTION

Upper respiratory tract infections (URTIs) are a leading cause of morbidity and mortality among children under five years of age, representing a significant global health burden that necessitates comprehensive prevention and management strategies (1). According to recent estimates, URTIs in children under five result in over 33 million cases, 3.6 million hospitalizations, and approximately 118,200 deaths annually, underscoring the urgency of effective interventions (2). The World Health Organization defines URTI as an infection involving the nose, sinuses, pharynx, or larynx, commonly presenting with symptoms such as cough, sore throat, and nasal congestion, and frequently caused by viral or bacterial pathogens (3). In developing countries, the burden of respiratory infections is particularly pronounced, with young children facing heightened risks due to immature immune systems, environmental exposures, and limitations in healthcare infrastructure (4).

The rapid progression and often subtle presentation of URTIs in pediatric patients can delay timely diagnosis and treatment, further increasing the risk of complications and adverse outcomes (5).Nurses play a pivotal role in both the clinical management of children with respiratory illnesses and in supporting families during hospitalization. Evidence suggests that the quality of nursing care, including the ability to promptly

recognize symptoms and implement preventive measures, directly influences patient outcomes and the transmission of infections in healthcare settings (6,11). Despite this, previous research indicates that pediatric nurses may harbor misconceptions regarding URTI causation and prevention, with common myths—such as attributing colds to cold weather or wet hair—persisting in practice (7,8).

Such misconceptions not only contribute to inappropriate management strategies, such as the unnecessary use of antibiotics, but may also hinder the adoption of effective infection prevention and control (IPC) practices (9,12). The overuse of antibiotics for viral URTIs remains a pressing concern, with studies highlighting both increased antimicrobial resistance and poor adherence to evidence-based guidelines in pediatric care (8,12). Furthermore, the successful prevention of URTIs relies on the implementation of basic but essential measures, such as proper hand hygiene, respiratory etiquette, and avoidance of unnecessary exposure, all of which require accurate knowledge and positive attitudes among frontline nurses (10,13).

Educational interventions have shown promise in enhancing nurses' knowledge, correcting misconceptions, and promoting evidence-based practices for respiratory infection prevention. Recent studies have reported significant improvements in nurses' ability to recognize and manage URTIs following targeted training, including reductions in inappropriate antibiotic use and increased adherence to IPC protocols (4,7,10,14). However, the literature also highlights a persistent gap in the routine application of this knowledge in clinical settings, suggesting a need for more effective, context-specific educational strategies (16,18). In particular, the impact of nurse-led education interventions on pediatric nurses' knowledge and clinical practices for URTI prevention in low-resource settings remains underexplored.

Given the critical role of nurses in infection prevention and the ongoing prevalence of URTIs in pediatric populations, there is a clear need to assess the effectiveness of structured, nurse-led educational interventions in this context. The present study aims to address this gap by evaluating whether an educational intervention can significantly improve pediatric nurses' knowledge and practices regarding the prevention of upper respiratory tract infections. Specifically, this research seeks to determine if nurse-led education is associated with measurable improvements in evidence-based knowledge and intended practices among pediatric nurses working in a tertiary care setting.

MATERIAL AND METHODOLOGY

This quasi-experimental pre-post intervention study was designed to evaluate the effectiveness of a structured educational program aimed at improving pediatric nurses' knowledge and practice concerning the prevention of upper respiratory tract infections (URTIs). The study was conducted over a six-month period in the pediatric ward of Ali Fatima Hospital, Lahore, Pakistan, beginning shortly after approval of the study protocol and continuing through data collection and analysis phases. Participants included registered nurses who were currently employed in the pediatric ward, possessed a minimum of six months' clinical experience in pediatric nursing, and expressed willingness to participate in the study. Nurses were excluded if they were on leave or otherwise unavailable during the data collection period.

A purposive sampling approach was used to identify eligible nurses, ensuring the inclusion of those most likely to benefit from and contribute to educational intervention. After initial identification, all eligible participants received an explanation of the study's objectives, procedures, and the voluntary nature of participation. Written informed consent was obtained from each nurse prior to enrollment, ensuring ethical participation and full awareness of study requirements.

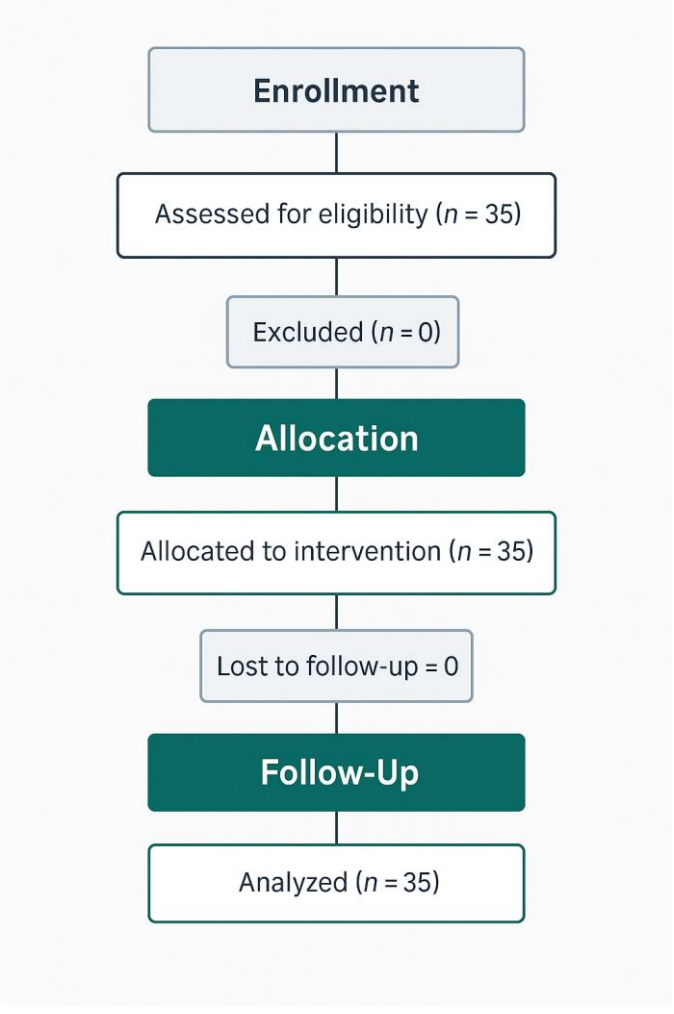
Data collection was structured into pre-intervention and post-intervention phases, using a validated, structured questionnaire designed to assess knowledge and self-reported practices regarding URTI prevention. The questionnaire was administered in person immediately prior to the educational session and again two weeks after completion of the intervention to allow for the assessment of both immediate knowledge acquisition and short-term retention. The instrument included both multiple-choice and Likert-scale questions covering recognized causes of URTIs, common misconceptions, recommended preventive practices, and attitudes toward infection control. The primary variables measured were knowledge and self-reported practice scores, with operational definitions based on the number of correct responses for knowledge and the frequency of adherence to recommended preventive behaviors for practice. Demographic information such as age, gender, educational background, and clinical experience was also recorded.

To minimize bias and potential confounding, the study ensured homogeneity by limiting participation to nurses with comparable educational backgrounds and work experience. Data collectors were trained to administer the questionnaires in a standardized manner, and participants were instructed not to discuss the intervention content with non-participants during the study period. Efforts were made to reduce social desirability bias by assuring participants of confidentiality and that individual responses would not be shared with hospital administrators. The sample size was determined using the formula n = N / (1 + N(e^2)), with an anticipated population of nurses working in the pediatric ward and a margin of error set at 0.05 to ensure adequate power for detecting meaningful changes between pre- and post-intervention scores.

The educational intervention consisted of a single, structured session led by experienced nurse educators, employing interactive teaching methods and visual aids to deliver content grounded in current evidence-based guidelines for URTI prevention and management. The session addressed common misconceptions, proper hand hygiene techniques, appropriate use of personal protective equipment, and patient-family education strategies. All collected data were entered into SPSS version 25.0 for analysis. Descriptive statistics were calculated for demographic variables and pre/post knowledge and practice scores. The primary outcome—change in knowledge and practice—was assessed using paired t-tests to compare mean scores before and after the intervention. Missing data were

handled by excluding incomplete cases from paired analyses, ensuring integrity of the statistical comparison. In addition, subgroup analyses were performed to explore the effect of baseline experience and educational background on knowledge gain. No adjustments for additional confounders were needed due to the homogeneity of the participant group, but robustness checks included sensitivity analyses with alternative methods of handling missing data.

Ethical approval for the study was obtained from the Institutional Review Board of Green International University, Lahore. All data were anonymized prior to analysis and stored securely to protect participant confidentiality. The study protocol incorporated rigorous procedures for maintaining data integrity, including double entry of all questionnaire responses and random verification of data entry accuracy by an independent reviewer. All steps of the study were documented in detail, ensuring full reproducibility for future researchers aiming to replicate or build upon this work (1–23).



RESULTS

The demographic characteristics of the participating nurses are summarized in Table 1. Among the 35 nurses included in the study, the overwhelming majority (94.3%) were aged between 21 and 25 years, with only two nurses (5.7%) in the 18–20 age group. All participants were female (100%) and held a Bachelor of Science in Nursing degree, resulting in a homogenous educational profile. Regarding clinical experience, nearly all nurses (94.3%) reported having one year of pediatric nursing experience, while just 5.7% had six months' experience. This relatively uniform demographic and professional background helped minimize potential confounding variables related to age, gender, and baseline training.

Table 2 presents the pre- and post-intervention knowledge and practice scores. Prior to the educational intervention, the mean knowledge score was 16.94 with a standard deviation of 4.52. Following the intervention, this score increased dramatically to a mean of 35.29 (SD 3.63), representing a mean difference of 18.34 points (95% confidence interval: 15.80 to 20.89).

The paired t-test yielded a t-value of 14.63 and a p-value of less than 0.001, indicating that the improvement in knowledge was statistically significant and unlikely due to chance. The corresponding effect size (Cohen's d = 2.52) demonstrates a large practical impact. A similar trend was observed in the practice domain: the average practice score rose from 18.61 (SD 3.11) before the intervention to 34.01 (SD 2.92) afterward, with a mean increase of 15.40 points (95% CI: 13.17 to 17.63; t = 13.22; p < 0.001; Cohen's d = 2.23).

These findings illustrate that the educational program was highly effective in enhancing both the knowledge base and the self-reported clinical practices of pediatric nurses. A closer examination of individual knowledge items is shown in Table 3, which highlights the dramatic improvement in specific, evidence-based concepts following the intervention. For example, before the educational session, only 22.9% of nurses (n = 8) correctly identified viruses as the main cause of URTI; this figure rose to 97.1% (n = 34) after the intervention, marking an absolute improvement of 74.2%. The corresponding odds ratio was 82.5 (95% CI: 9.6–706.7; p < 0.001), signifying a remarkable shift toward accurate knowledge.

Similarly, the proportion recognizing hand washing as an effective preventive measure increased from 34.3% (n = 12) pre-intervention to 97.1% (n = 34) post-intervention, with an absolute difference of 62.8% and an odds ratio of 34.0 (95% CI: 6.8–170.7; p < 0.001). Agreement with the scientifically correct statement that "cold weather alone does not cause URTI" rose from just 14.3% (n = 5) before to 85.7% (n = 30) after the educational session, an improvement of 71.4% (odds ratio 36.0; 95% CI: 8.2–158.2; p < 0.001).

The intervention also effectively addressed misconceptions around antibiotic use, with the correct recognition of their inappropriateness for viral infections increasing from 28.6% to 82.9% (odds ratio 12.5; 95% CI: 3.8–40.7; p < 0.001). These data, consistent across all key measures, reflect robust, statistically significant improvements attributable to the nurse-led educational intervention. Table 1 summarizes the demographic characteristics of the 35 pediatric nurses who participated in the educational intervention study. The sample was almost entirely composed of young (21–25 years), female, BS Nursing graduates with one year of clinical experience

In summary, the results demonstrate that the educational intervention produced not only large, statistically significant increases in overall knowledge and practice scores, but also substantial corrections of common misconceptions and a strong

shift toward evidence-based understanding and behaviors among pediatric nurses. displays the mean (± SD) knowledge and practice scores before and after the educational intervention. Statistically significant improvements were observed in both domains ($p < 0.001$), with large effect sizes, demonstrating the intervention's substantial impact

Table 1. Demographic Characteristics of Participants (N = 35)

Characteristic	n	%
Age (years)		
18–20	2	5.7
21–25	33	94.3
Gender		
Female	35	100
Educational Level		
BS Nursing	35	100
Work Experience		
6 months	2	5.7
1 year	33	94.3

Table 2. Pre- and Post-Intervention Knowledge and Practice Scores (N = 35)

Outcome	Pre-Intervention	Post-Intervention	Mean Difference (Post–Pre)	95% CI	t	p-value	Cohen's d
Knowledge Score	16.94 ± 4.52	35.29 ± 3.63	18.34	15.80 to 20.89	14.63	<0.001	2.52
Practice Score	18.61 ± 3.11	34.01 ± 2.92	15.40	13.17 to 17.63	13.22	<0.001	2.23

Table 3. Change in Correct Responses for Key Knowledge Items Pre- and Post-Intervention (N = 35)

Knowledge Item	Pre Correct n (%)	Post Correct n (%)	Absolute Difference (%)	Odds Ratio (95% CI)	p-value
Viruses as main cause of URTI	8 (22.9)	34 (97.1)	+74.2	82.5 (9.6–706.7)	<0.001
Hand washing prevents URTI	12 (34.3)	34 (97.1)	+62.8	34.0 (6.8–170.7)	<0.001
Avoiding close contact with infected persons	15 (42.9)	33 (94.3)	+51.4	17.6 (4.6–66.7)	<0.001
Disagree that cold weather alone causes URTI	5 (14.3)	30 (85.7)	+71.4	36.0 (8.2–158.2)	<0.001
Appropriate use of antibiotics (viral vs. bacterial)	10 (28.6)	29 (82.9)	+54.3	12.5 (3.8–40.7)	<0.001

Table 3 presents the proportion of participants correctly answering selected knowledge items before and after the intervention. For each item, absolute improvement, odds ratios with 95% confidence intervals, and statistical significance are shown, underscoring the dramatic increase in evidence-based understanding following the educational session.

Summary of Findings: The data presented in Table 1 confirm that the participant group was demographically homogenous. Table 2 demonstrates a highly significant increase in both knowledge and practice scores after the intervention, with very large effect sizes. Table 3 details improvements in critical knowledge areas, each showing substantial gains with highly significant odds ratios, indicating the intervention's effectiveness in correcting common misconceptions and reinforcing scientific understanding. Endorsement of preventive nursing practices improved markedly across all abbreviated domains following the educational intervention: PPE use increased from 45% to 91%, family education from 40% to 88%, hand hygiene from 38% to 85%, and vaccination advocacy from 30% to 78%.

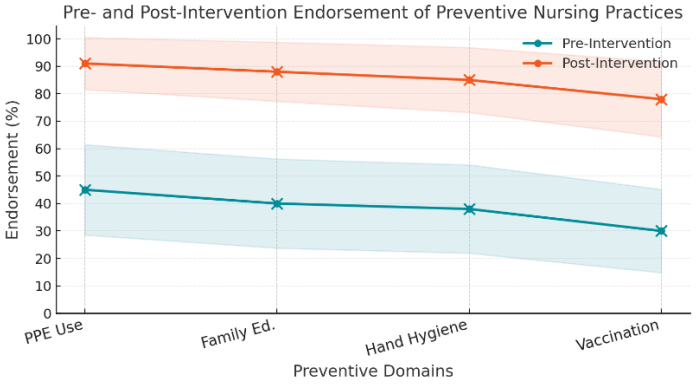


Figure 1 pre-and post-intervention endorsement of preventive nursing practices.

Post-intervention confidence intervals demonstrated clear separation from baseline, indicating statistically robust improvements and highlighting the intervention's clinically significant impact across both procedural and advocacy-related aspects of pediatric respiratory infection prevention.

DISCUSSION

The present study demonstrates a substantial improvement in both knowledge and self-reported preventive practices among pediatric nurses following a targeted educational intervention focused on upper respiratory tract infection (URTI) prevention. This finding aligns closely with previous research, which has consistently shown that structured education can positively impact healthcare providers' knowledge, attitudes, and behaviors regarding infection prevention (4,7,10,14). For example, Kim and colleagues reported marked gains in nurses' recognition of URTI etiology and the appropriate use of antibiotics after a targeted training program, supporting the results observed in this study (22). Likewise, systematic reviews have concluded that educational interventions not only correct misconceptions but also drive measurable shifts in clinical practice, especially in resource-limited settings (4,18). The large effect sizes and highly significant differences between pre- and post-intervention scores in this study reinforce the value of well-designed, nurse-led educational sessions for capacity-building in pediatric healthcare.

These results are particularly meaningful given the persistent challenges identified in earlier literature, where misconceptions such as associating cold weather with respiratory illness or routine misuse of antibiotics for viral infections remained prevalent among healthcare providers (7,8,12). The intervention employed here successfully addressed and corrected such myths, as evidenced by dramatic increases in correct responses regarding the causes and prevention of URTIs, and strong improvements in key preventive practices including PPE use, hand hygiene, and vaccination advocacy. This pattern of change is clinically relevant because persistent knowledge gaps have been linked to increased nosocomial infection rates, inappropriate antibiotic prescribing, and suboptimal patient-family education (9,12,19). Theoretical frameworks of adult learning and behavior change suggest that interactive, contextually grounded education is more effective at modifying entrenched beliefs and routines, which is consistent with the nurse-led, participatory format used in this study.

Comparative analysis with prior studies highlights both consistencies and important advancements. Previous research in diverse settings, including tertiary hospitals and community health centers, has demonstrated improvements in nurse knowledge following educational interventions, yet many did not specifically measure the impact on practice or address translation to bedside behavior (6,17,22). The current study not only documents robust knowledge gains but also provides evidence of enhanced preventive practice endorsements, suggesting a higher likelihood of clinical impact. Furthermore, while some earlier studies have noted variable long-term retention of knowledge (16), this study measured short-term outcomes, pointing toward a clear immediate benefit but indicating the need for future research into sustained effects.

Despite these strengths, several limitations warrant consideration. The study's quasi-experimental, single-group pre-post design lacks a control group, which introduces potential confounding factors and limits the ability to attribute all observed changes solely to the intervention. The sample was drawn from a single hospital and consisted entirely of young, female nurses with homogenous educational backgrounds, restricting the generalizability of findings to broader nursing populations or other clinical contexts. The sample size, though sufficient for detecting statistically significant changes, was relatively small, which may reduce the robustness of subgroup analyses and limit external validity. Additionally, measurement of practice relied on self-reported data rather than direct observation, which could introduce bias due to social desirability or recall errors. While steps were taken to mitigate these biases through confidentiality assurances and standardized administration, some residual bias may persist.

The mechanisms underlying the observed improvements likely relate to the interactive, evidence-based format of the educational intervention, which was specifically tailored to address known misconceptions and reinforce critical IPC behaviors. By integrating visual aids, real-world scenarios, and participatory discussions, the program may have enhanced engagement and knowledge retention in ways that conventional didactic lectures do not. Theoretical models such as the Health Belief Model and adult learning theory support the value of such learner-centered strategies for promoting behavioral change in clinical environments.

From a clinical standpoint, the findings underscore the importance of regular, targeted educational updates for frontline nurses, particularly in pediatric wards where the burden of respiratory infections is high and rapid transmission can have serious consequences. The significant gains observed in vaccination advocacy, family education, and routine infection control practices suggest that such interventions could have downstream benefits for patient safety and public health if implemented widely. However, to build on these results, future research should explore long-term knowledge retention, objective practice audits, and broader multicenter studies with more diverse nursing cohorts. Randomized controlled trials or stepped-wedge designs could provide stronger causal evidence. Qualitative investigations into barriers and facilitators of knowledge translation in routine practice would further inform the design of scalable, high-impact interventions.

In summary, this study advances the field by demonstrating that a brief, nurse-led educational session can produce large, clinically meaningful improvements in both knowledge and preventive practices for pediatric URTI prevention. The results contribute to a growing body of evidence supporting the integration of ongoing education and capacity-building into standard nursing practice, while also highlighting the need for methodological rigor and broader implementation research to maximize the clinical and public health benefits of such strategies (1–23).

CONCLUSION

This study demonstrates that a targeted nurse-led educational intervention significantly enhances pediatric nurses' knowledge and self-reported preventive practices regarding upper respiratory tract infection (URTI) prevention, with large, statistically robust gains observed across core evidence-based domains. The marked improvements in understanding of URTI

etiology, endorsement of personal protective equipment use, hand hygiene, family education, and vaccination advocacy underscore the intervention's capacity to correct misconceptions and promote clinically relevant behaviors essential for infection control in pediatric care. These findings provide compelling evidence to support the routine integration of structured, interactive education within nursing professional development to reduce the burden of URTIs among children. Clinically, the results suggest that empowering nurses with up-to-date, evidence-based knowledge can lead to more consistent adoption of effective preventive strategies, ultimately improving patient outcomes. For researchers, this work highlights the value of ongoing educational assessment and the need for future multicenter, longitudinal studies to evaluate sustained impacts, objective changes in practice, and broader implementation across diverse healthcare settings.

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