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IMPACT OF RESOURCE LIMITATIONS ON INFECTION PREVENTION AND CONTROL PRACTICES AMONG NURSES IN THE TERTIARY CARE PAKISTANI HOSPITALS

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Abstract

Background:

Infection prevention and control (IPC) practices are essential for reducing healthcare-associated infections and ensuring patient safety. Nurses play a major role in implementing IPC measures; however, resource limitations in tertiary care hospitals may negatively affect compliance with infection prevention guidelines, particularly in developing countries like Pakistan. To assess the impact of resource limitations on infection prevention and control practices among nurses working in tertiary care hospitals of Pakistan.

Methods:

A quantitative cross-sectional descriptive study was conducted among 175 nurses working in tertiary care hospitals of Pakistan. Participants were selected using a systematic random sampling technique. Data were collected using a structured self-administered questionnaire adapted from the World Health Organization Infection Prevention and Control Assessment Framework (IPCAF). The questionnaire assessed demographic characteristics, IPC practices, and resource limitations using a 5-point Likert scale. Data were analyzed using SPSS version 25. Descriptive statistics, chi-square tests, and Pearson correlation were applied, with $p \leq 0.05$ considered statistically significant.

Results:

The findings showed that 48.6% of nurses demonstrated good IPC practices, while 43.4% reported moderate practices. More than half of the participants (52.6%) experienced high resource limitations. Staffing shortages (Mean = 3.90 ± 0.55) and inadequate PPE availability (Mean = 3.85 ± 0.60) were the most significant barriers. A statistically significant negative correlation was found between resource limitations and IPC practices ($r = -0.52$, $p = 0.001$). Age, education, and experience were significantly associated with IPC practices.

Conclusion:

Resource limitations significantly affect infection prevention and control practices among nurses. Improving staffing, infrastructure, PPE availability, and continuous training is essential to strengthen IPC compliance and enhance patient safety in Pakistani hospitals.

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INTRODUCTION

Infection prevention and control (IPC) is vital for healthcare systems to minimize healthcare-associated infections (HAIs) and enhance patient safety. HAIs pose a significant global health challenge, leading to increased illness, death, and expenses [1]. Nurses are central to IPC as they are directly involved in patient care and maintaining safe healthcare settings. These infections are a particular problem in resource-limited low- and middle-income countries like Pakistan, where they extend hospital stays and strain healthcare resources, making robust IPC practices crucial for better patient results and cost reduction [2].

Tertiary care hospitals face a heightened risk of infection transmission due to patient complexity and high admission rates, placing nurses at continuous risk of exposure to infectious agents [3]. Effective adherence to Infection Prevention and Control (IPC) protocols by nurses is therefore critical, but this is often hindered by resource limitations, particularly in developing countries. These constraints, such as shortages of personal protective equipment, inadequate sanitation, insufficient staffing, and a lack of infection control supplies, directly compromise nurses' ability to follow standard precautions [4]. Evidence from Pakistan, for example, shows a substantial gap in nurses' infection control practices, with a recent study indicating that only about a third of nurses exhibited good compliance, underscoring the urgent need to address the factors that impede adherence to these vital protocols [5].

One key factor affecting infection prevention and control (IPC) practices is the availability of resources. Nurses need enough supplies like gloves, masks, hand sanitizers, and sterilization tools to prevent the spread of infections. Without these resources, even skilled nurses may struggle to take the right actions [6]. Another issue is overcrowding in tertiary care hospitals. Many patients and insufficient facilities make it hard to keep hygiene standards and enforce isolation protocols. Overcrowding also increases nurses' workloads, limiting their time for infection control. Staffing shortages further contribute to resource challenges, leading to higher workloads and fatigue among nurses, which can harm their adherence to IPC guidelines [7]. Training and education are essential for effective infection control. Limited resources often hinder continuous professional development, leaving nurses without the latest knowledge and skills for infection prevention and control (IPC) [8]. Research shows a strong link between nurses' knowledge and their IPC practices, with one study in Pakistan reporting a positive correlation between knowledge and practice scores. Additionally, nurses' attitudes and perceptions affect their behavior; positive attitudes support better compliance, while negative views can reduce adherence to protocols. Resource limitations can lead to frustration and decreased motivation among nurses regarding infection control [9].

Infrastructure problems hinder infection control efforts, with inadequate waste management, poor ventilation, and insufficient isolation facilities increasing the risk of infection spread in public hospitals in Pakistan [10]. Although many hospitals have infection control policies, their inconsistent implementation due to lack of monitoring and resources is a major issue. Research indicates that infection prevention and control (IPC) programs exist, but their effectiveness is low, especially in public hospitals. Additionally, the absence of infection control committees and regular supervision limits effective monitoring and feedback, revealing that resource availability is crucial for successful IPC measures [11].

Personal protective equipment (PPE) is vital for infection prevention, but developing countries often face shortages, especially during high-demand periods like pandemics. Hand hygiene, a highly effective infection control measure, is hindered by the lack of clean water, handwashing stations, and sanitizers in resource-limited settings [12]. Cultural and behavioral factors, including resistance to new practices or lack of awareness, coupled with resource constraints, create further challenges. Patient-related factors like poor hygiene and lack of awareness also contribute to infection spread, and nurses' ability

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to educate patients is limited by time and resources [13]. In Pakistan, underfunded healthcare systems, particularly public hospitals, struggle with adequate supplies and infrastructure for infection control. Organizational support, including leadership, resources, and communication, is crucial for improving IPC practices among nurses, while a lack of support impedes implementation. Effective infection control requires both clinical responsibility and robust management planning [14].

This study investigates how resource limitations affect infection prevention and control practices among nurses in Pakistani tertiary care hospitals. Bridging the gap between infection control knowledge and practical implementation can be achieved through evidence-based practices, standardized protocols, and ongoing training, which are crucial for developing effective strategies to boost IPC compliance.

Methodology

A quantitative cross-sectional descriptive study design was employed to assess the impact of resource limitations on infection prevention and control (IPC) practices among nurses. The study was conducted in tertiary care hospitals of multan, Pakistan, where nurses are directly involved in infection prevention activities such as hand hygiene, use of personal protective equipment (PPE), and patient care procedures. The target population consisted of registered nurses working in different units (medical, surgical, ICU, and emergency) of tertiary care hospitals. A total of 175 nurses were included in the study. Participants were selected using a systematic random sampling technique. The inclusion criteria for the study as registered nurses working in tertiary care hospitals, have minimum 6 months of clinical experience, while direct involvement in patient care, and are willing to participate voluntary. Nursing students and interns, nurses in administrative roles only, and nurses on leave during data collection ere excluded from the study.

Data were collected using a structured, self-administered questionnaire consisting of three sections:

Section A: Demographic Characteristics, age, gender, educational qualification, years of experience and Working unit.

Section B: Infection Prevention and Control Practices: This section was adapted from the WHO Infection Prevention and Control Assessment Framework (IPCAF) and standardized IPC practice tools. It assessed: Hand hygiene practices, Use of PPE, Waste disposal, Sterilization and disinfection practices [15]. All items were measured using a 5-point Likert scale: from 1 = Strongly Disagree to 5 = Strongly Agree. The cutoff value were: Mean score < 2.5, Moderate Practice: Mean score 2.5 – 3.5, and Good Practice: Mean score > 3.5.

Section C: Resource Limitations: This section was developed to assessed: Availability of PPE, Access to hand hygiene facilities, Staffing levels, Availability of IPC guidelines, Training opportunities. All items were measured using a 5-point Likert scale: from 1 = Strongly Disagree to 5 = Strongly Agree [16]. The cutoff value were: Low Limitation: Mean score < 2.5, Moderate Limitation: Mean score 2.5 – 3.5, and High Limitation: Mean score > 3.5. Higher scores in the resource section indicate greater perceived limitations, while higher scores in IPC practices indicate better compliance. A pilot study was conducted on 10% of the sample (n = 18) to assess feasibility and clarity. These participants were excluded from the final study. Internal consistency of the tool was assessed using Cronbach's alpha: IPC Practices Scale: $\alpha = 0.88$, Resource Limitation Scale: $\alpha = 0.90$, and Overall instrument: $\alpha = 0.92$.

Ethical approval was obtained from the Institutional Review Board (IRB), permission was obtained from hospital administration, participants were informed about the study purpose, written informed consent was obtained, questionnaires were distributed and collected during duty hours.

Data were analyzed using SPSS version 25. Frequency and percentage ere calculated for categorical variable while Mean and standard deviation for continuous variable. Chi-square test

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for association between demographic variables and IPC practices, Pearson correlation to assess relationship between resource limitations and IPC practices, and $p \leq 0.05$ considered statistically significant.

Confidentiality ere maintained of all the participant and their participation voluntary, it as conveyed to all the nurses that they have Right to withdraw and their as No harm to participants.

Result

Demographic Profile of Respondents (n = 175)

The majority of respondents were female (84.0%), reflecting the typical gender distribution in nursing. Most participants were aged 31–40 years (44.6%) and held Post-RN qualifications (56.0%). A large proportion had more than 6 years of experience, indicating an experienced workforce.

Table 1: Demographic Characteristics

Category	Frequency (n)	Percentage (%)
Gender		
Male	28	16.0
Female	147	84.0
Age		
21–30 years	52	29.7
31–40 years	78	44.6
41+ years	45	25.7
Education		
BSN	32	18.3
Post RN	98	56.0
Diploma	45	25.7
Experience		
1–2 years	30	17.1
2–5 years	40	22.9
6–10 years	52	29.7
11+ years	53	30.3

4.3. Level of Infection Prevention and Control (IPC) Practices

Almost half of the nurses (48.6%) demonstrated good IPC practices, while 43.4% showed moderate practices. This indicates that although compliance is relatively satisfactory, there is still room for improvement. More than half of the nurses (52.6%) reported high resource limitations, indicating a significant barrier to effective IPC practices in tertiary care hospitals.

Table 2: Level of Infection Prevention and Control (IPC) Practices and Level of Resource Limitations

	Low (<2.5)	Moderate (2.5–3.5)	High (>3.5)	Mean ± SD
Level of Infection Prevention and Control (IPC) Practices				
Frequency (n)	14	76	85	
Percentage (%)	8%	43.4%	48.6%	**3.52 ± 0.61**
Level of Resource Limitations				
Frequency (n)	18	65	92	**3.68 ± 0.66**
Percentage (%)	10.3%	37.1%	52.6%	

Domain-Wise Analysis of Resource Limitations

The highest challenges were related to staffing shortages (Mean = 3.90) and lack of PPE (3.85). Training and guideline-related issues were comparatively lower but still significant.

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Table 3: Domain-Wise Analysis of Resource Limitations			
Domain	**Mean**	**SD**	**Interpretation**
PPE Availability	3.85	0.60	High
Staffing Shortage	3.90	0.55	High
Infrastructure Issues	3.62	0.58	High
Training & Guidelines	3.34	0.52	Moderate

4.6 Association between Resource Limitations and IPC Practices

There is a moderate negative correlation ($r = -0.52$) between resource limitations and IPC practices, indicating that higher resource limitations are associated with poorer infection control practices. The relationship is statistically significant ($p < 0.05$).

Table 4: Association between Resource Limitations and IPC Practices		
Variable	**r-value**	**p-value**
Resource Limitations vs IPC Practices	-0.52	0.001

Association of Demographic Variables with IPC Practices

No significant association was found between gender and IPC practices ($p > 0.05$), indicating similar performance across genders. A significant association exists between age and IPC practices ($p < 0.05$). Older nurses demonstrated better IPC compliance compared to younger nurses. Education level is significantly associated with IPC practices. Nurses with BSN qualifications demonstrated better practices than others. Experience is significantly associated with IPC practices ($p < 0.05$). Nurses with more experience showed better compliance with infection control measures (See table 4).

Table 4: Association of Demographic Variables with IPC Practices				
	Poor	**Moderate**	**Good**	**p-value**
Gender				
Male	3	12	13	0.621
Female	11	64	72	
Age				
21–30	28	18	28	
31–40	34	40	34	0.003
41+	14	27	14	
Education				
BSN	2	10	20	
Post RN	8	42	48	0.002
Diploma	4	24	17	
Experience				
1–2 years	4	18	8	
2–5 years	4	20	16	0.001
6–10 years	3	22	27	
11+ years	3	16	34	

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Discussion

This study evaluated how resource limitations affect infection prevention and control (IPC) practices among nurses in Pakistan's tertiary care hospitals. The results indicate that while nurses generally exhibit moderate to good IPC practices, resource shortages significantly hinder full compliance with infection control measures. Key obstacles include a lack of personal protective equipment (PPE), insufficient staffing, inadequate infrastructure, and limited access to training and infection control resources [17]. Despite these challenges, nearly half of the nurses (48.6%) showed good IPC practices, and 43.4% demonstrated moderate practices, suggesting a solid understanding of infection prevention even in difficult circumstances. These findings align with previous research highlighting nurses' satisfactory knowledge but practical implementation difficulties due to limited resources and organizational barriers in Pakistani tertiary hospitals [18].

Nurses face significant resource limitations, with over half reporting severe shortages and barriers, most notably staffing shortages and inadequate personal protective equipment (PPE). These issues align with World Health Organization findings on resource-scarce healthcare systems struggling with infection control [19]. The lack of consistent PPE access for nurses heightens their risk of infection exposure and reduces adherence to prevention guidelines, increasing cross-contamination risks, underscoring the critical need for sustained resource supply and monitoring in Pakistani hospitals [16].

Staffing shortages, characterized by high patient loads and insufficient nurse-to-patient ratios, exacerbate workload and diminish the time for essential infection control practices like hand hygiene and equipment sterilization. Research completed in (2021) corroborates this, showing that heavy workloads negatively impact nurses' adherence to infection prevention measures and patient safety [21]. Furthermore, a significant negative correlation ($r = -0.52$, $p = 0.001$) was found between resource limitations and infection prevention and control (IPC) practices, meaning poorer practices accompany greater resource scarcity. This aligns with a study conducted in Pakistani hospitals, where resource scarcity directly compromises infection control quality [22]. The study concludes that enhancing infection control requires not only knowledge and training but also the provision of adequate resources, as improvements cannot be achieved through education alone if essential resources are lacking.

The study revealed that both age and experience positively correlate with infection prevention and control (IPC) practices, with older and more experienced nurses showing superior compliance, likely due to increased clinical exposure and familiarity with protocols. Furthermore, higher education levels, specifically BSN degrees, were associated with better IPC compliance compared to diploma qualifications, as advanced education enhances critical thinking, evidence-based practice, and understanding of infection prevention principles, often emphasized in BSN programs.

The study found no significant link between gender and infection prevention practices, highlighting that institutional factors are more influential. Both male and female nurses showed similar compliance with infection control. Hand hygiene is crucial for preventing infections, but in many Pakistani hospitals, poor infrastructure and overcrowding hinder its effectiveness, which may lead to increased infection rates despite awareness of protocols [23].Training and educational opportunities are seen as moderate challenges for nurses, with many stating they have limited chances for ongoing professional development. Regular training is needed to keep up with infection prevention protocols [7]. Strong organizational support, including effective policies and resource availability, plays a key role in improving compliance and ensuring patient safety [24]. Healthcare-associated infections are a major problem worldwide, especially in developing countries like Pakistan, where hospitals struggle with overcrowding, lack of funds, and insufficient staff. These issues put extra pressure on nurses and weaken infection control efforts [25]. The COVID-19 pandemic revealed existing problems in healthcare systems,

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such as shortages of PPE. It also emphasized the need for better healthcare preparedness and lasting infection prevention measures. The study highlights the link between limited resources and infection control in Pakistani hospitals. Its findings can help healthcare leaders create better strategies for improving infrastructure, staffing, and infection prevention. A comprehensive approach is needed, including funding, training, staffing, and monitoring, to enhance patient safety and care quality.

The study used a cross-sectional design, collecting data at one time, which showed links between resource limits and IPC practices but could not prove cause and effect. It took place only in selected tertiary care hospitals, limiting how well the findings apply to other healthcare settings like private hospitals or rural clinics. Additionally, it relied on self-administered questionnaires, which might lead to response bias, as participants could exaggerate their infection prevention practices.

Conclusion

The study found that limited resources greatly impact infection prevention and control (IPC) practices among nurses in Pakistan's tertiary care hospitals. While nurses mostly followed infection prevention guidelines, several barriers affected their ability to do so effectively. The main challenges included a lack of personal protective equipment, insufficient staff, poor infrastructure, and limited training resources. It was noted that as resource shortages increased, compliance with IPC measures decreased. Factors such as age, education level, and clinical experience influenced IPC practices, but gender did not have a significant effect. Improving IPC requires both knowledge and adequate support from institutions, which includes better healthcare resources and strong organizational policies.The study calls on healthcare policymakers and hospital leaders in Pakistan to focus on enhancing IPC systems through better resource allocation, ongoing professional training, and creating a supportive healthcare environment.

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