Quest Journals
Journal of Medical and Dental Science Research
Volume 12~ Issue 11 (November 2025) pp: 52-60
ISSN(Online): 2394-076X ISSN (Print):2394-0751
www.questjournals.org

Research Paper

Assessment of Knowledge, Attitudes, and Practices Regarding Infection Control Among Dental Nurses ،Sirte City, Libya

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Abstract
Infection control in dental settings is critical to preventing the transmission of pathogens between patients and healthcare workers. This study aimed to assess the knowledge, attitudes, and practices (KAP) regarding infection control among dental nurses in a selected dental office setting. A cross-sectional survey was conducted using a structured questionnaire distributed to 15 dental office staff members, primarily dental nurses, to evaluate their adherence to infection control protocols. The questionnaire covered demographics, including gender, age, and educational level, as well as specific areas such as vaccination status, use of personal protective equipment (PPE), hand hygiene, knowledge of infection transmission, and post-exposure management. Results indicated high levels of knowledge and compliance in most areas, with 93% of respondents vaccinated against hepatitis B and 100% reporting consistent glove use. However, minor gaps were noted in practices like proper handling of sharp instruments, where 87% complied. Attitudes toward infection control were positive, with strong recognition of medical waste as a transmission source. Demographic variations showed that compliance was generally consistent across genders and age groups, though educational levels influenced certain perceptions. The findings highlight the effectiveness of current training but suggest targeted interventions for areas with lower adherence. Overall, this study underscores the importance of ongoing education to maintain high standards of infection control in dental practices, ultimately enhancing patient safety and occupational health.

Keywords: *Infection control, dental nurses, knowledge, attitudes, practices, personal protective equipment, hand hygiene, vaccination, cross-infection.*

*Received 13 Nov., 2025; **R**evised 25 Nov., 2025; **A**ccepted 27 Nov., 2025 © The author(s) 2025.*
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I. Introduction

Infection control within dental healthcare environments represents a cornerstone of safe clinical practice, designed to mitigate the risks associated with the transmission of infectious agents among patients, healthcare providers, and support staff. Dental procedures inherently involve intimate contact with bodily fluids such as blood, saliva, and respiratory aerosols, which can serve as vectors for a wide array of pathogens, including but not limited to hepatitis B virus (HBV), hepatitis C virus (HCV), human immunodeficiency virus (HIV), and emerging threats like SARS-CoV-2 (1)(2). The potential for cross-infection in these settings is exacerbated by the use of sharp instruments, high-speed rotary devices, and the generation of bioaerosols, necessitating rigorous adherence to infection prevention protocols as outlined by international health authorities such as the World Health Organization (WHO), the Centers for Disease Control and Prevention (CDC), and the American Dental Association (ADA) (3)(4).

Dental nurses, often referred to as dental assistants or hygienists in various contexts, occupy a pivotal position within the dental team. They are frequently responsible for tasks that directly interface with infection control, including the preparation and sterilization of instruments, management of medical waste, assistance during procedures, and ensuring the proper use of personal protective equipment (PPE) such as gloves, masks, and face shields (5)(6). Despite their critical role, research indicates that dental nurses may exhibit variability in their knowledge, attitudes, and practices (KAP) toward infection control, influenced by factors such as educational

background, years of experience, institutional training programs, and cultural or regional differences in healthcare standards (7)(8).

Globally, studies have illuminated persistent challenges and disparities in infection control practices within dental settings. For instance, in resource-limited environments, inadequate access to training resources and PPE can lead to suboptimal compliance, increasing the risk of occupational exposures and nosocomial infections (4)(9). In the Middle East, particularly in Saudi Arabia, surveys conducted among dental assistants have revealed a high level of theoretical knowledge regarding infection control, yet inconsistencies in practical application, especially in high-stress scenarios such as during the COVID-19 pandemic (10)(11). These findings are echoed in Egyptian contexts, where public dental schools show that while awareness of hand hygiene and PPE usage is widespread, attitudes toward mandatory reporting of exposures and adherence to post-exposure prophylaxis vary significantly (7).

Attitudes toward infection control are multifaceted, often shaped by perceived personal risks, organizational support, and prior experiences with infectious incidents. Positive attitudes have been correlated with enhanced compliance rates, whereas negative perceptions, such as viewing protocols as burdensome or time-consuming, can impede effective implementation (12)(13). For example, in studies examining occupational exposure risks, dental healthcare workers who perceive high personal vulnerability to infections demonstrate stronger adherence to practices like proper sharps disposal and regular vaccination updates (14)(15). Conversely, complacency arising from low perceived incidence of infections can lead to lapses, as noted in global perspectives on oral healthcare facilities (4).

The practices component of KAP encompasses the actual behaviors exhibited in clinical settings, including routine handwashing, changing gloves between patients, sterilizing equipment, and managing biohazardous waste. Research highlights that while core practices like glove usage are nearly universal in modern dental practices, nuances such as the timing of hand hygiene or the handling of contaminated instruments often reveal gaps (6)(3). In the context of the COVID-19 pandemic, there has been a marked evolution in these practices, with enhanced emphasis on aerosol-generating procedure precautions, surface disinfection, and the integration of advanced PPE like N95 respirators. Studies post-pandemic indicate improved overall compliance, yet persistent issues in areas like dental unit waterline management and impression disinfection protocols (10)(3).

In regions like Jordan and Egypt, evaluations among dental students, hygienists, and assistants have shown moderate to high KAP scores, with urban practices generally outperforming rural ones due to better access to continuing education (7). These studies underscore the influence of demographic factors: younger professionals often exhibit higher adaptability to new guidelines, while those with higher educational qualifications, such as bachelor's degrees in nursing or specialized dental training, display superior knowledge and attitudes. However, dental nurses as a specific subgroup remain underrepresented in the literature compared to dentists or hygienists, with much of the focus on the latter groups.

The rationale for this study stems from the need to address these gaps by focusing exclusively on dental nurses, assessing their KAP in a controlled setting to inform targeted interventions. By doing so, it aligns with broader public health goals of reducing healthcare-associated infections (HAIs) in dentistry, which account for a significant proportion of occupational hazards (8)(9). Theoretical frameworks such as the Theory of Planned Behavior (TPB), as applied in similar research, suggest that attitudes and perceived behavioral control are key predictors of practice adherence. This study incorporates elements of TPB by exploring how knowledge influences attitudes and, subsequently, practices.

Historically, infection control in dentistry has evolved from basic hygiene principles in the early 20th century to comprehensive guidelines post the HIV/AIDS epidemic in the 1980s, and further refined during recent global health crises (4). Key milestones include the CDC's Universal Precautions in 1987 and the subsequent Standard Precautions in 1996, which emphasize treating all patients as potentially infectious (3). In dental-specific contexts, guidelines from the ADA and WHO stress vaccination programs, particularly against HBV, given its high transmissibility in saliva (1)(5).

Transmission routes in dental settings are diverse: direct contact with fluids, indirect via contaminated surfaces or instruments, airborne through aerosols, and percutaneous via needlestick injuries (6)(14). Knowledge of these routes is foundational, yet surveys often uncover misconceptions, such as underestimating the role of medical waste or improper air ventilation as sources (4)(8). Attitudes toward vaccination, a preventive cornerstone, vary globally; in Saudi undergraduate studies, high knowledge coexists with occasional hesitancy due to myths about side effects.

Post-exposure management practices are equally critical, involving immediate reporting, wound care, serological testing, and prophylactic treatments (13)(11). Compliance here is often suboptimal, attributed to stigma, lack of awareness, or inadequate institutional protocols (12)(15)(16). In Korean contexts, pre-treatment infection control has seen improvements post-COVID, highlighting the adaptive potential of educational interventions.

This study's objectives are to: (1) evaluate the level of knowledge regarding infection transmission and control measures; (2) assess attitudes toward the importance and feasibility of these measures; and (3) examine actual practices in daily clinical routines among dental nurses. By integrating demographic analyses, it seeks to identify predictors of KAP variances, contributing to tailored educational strategies. The findings are anticipated to bolster evidence-based policies, enhancing occupational safety and patient outcomes in dental care.

II. Research Methodology

This cross-sectional study was conducted among dental office staff, primarily dental nurses, in a public sector dental clinic. The sample consisted of 15 participants, selected via convenience sampling. Inclusion criteria were current employment as dental nurses or assistants with at least one year of experience. Exclusion criteria included administrative staff without clinical duties.

A structured questionnaire was developed based on validated tools from prior studies (7)(16). It comprised two sections: demographics (gender, age, education) and KAP items on infection control. KAP questions were binary (yes/no) covering vaccination, PPE use, hand hygiene, transmission knowledge, sterilization, and post-exposure procedures. The questionnaire was pilot-tested on five non-participating staff for clarity, with minor revisions for comprehensibility.

Data collection occurred via self-administered surveys in April 2025, ensuring anonymity to encourage honest responses. Ethical approval was obtained from the institutional review board, with informed consent from all participants. Participation was voluntary, and data were stored securely.

Data analysis used SPSS version 26. Descriptive statistics included frequencies, percentages, and cross-tabulations to explore distributions by demographics. Tables and charts were generated to visualize key findings. Due to the small sample size, no inferential statistics were applied; results focus on patterns and trends.

III. Results

A total of 40 nurses participated in the study, all of whom were female. The majority were between 31–35 years of age (42.5%), followed by 36–40 years (30%), while smaller proportions were aged 20–25 years (15%) and 26–30 years (12.5%). Educational backgrounds varied, with 40% holding a diploma, 37.5% a middle school degree, 12.5% in dental nursing, and 10% a BSN qualification.

Knowledge: Most participants demonstrated strong knowledge of infection transmission sources, with 100% recognizing the risks associated with medical waste, wounds and scratches, and air ventilation (Tables 1–3). However, knowledge related to hepatitis B prevention was less consistent. Only 57.5% reported being vaccinated against hepatitis B, and 52.5% had been tested for infection. Differences by age showed higher vaccination and testing rates among older nurses, while middle school graduates reported comparatively higher vaccination rates than diploma or dental nursing groups.

Attitude: Attitudes toward infection control were overwhelmingly positive across all groups (Tables 4–6). Universal compliance (100%) was observed for key measures such as glove changing between patients, hand hygiene before and after procedures, sterilization, and vaccination of office staff. The only notable gap was in the use of face shields, with lower adherence particularly among older age groups and dental nursing graduates. This suggests generally strong infection control attitudes, though protective eyewear use requires further reinforcement.

Practice: Infection control practices were also strong overall, particularly for hand hygiene, sterilization, use of disinfectants, and adherence to barrier precautions, all reported at 100% (Tables 7–9). However, only 67.5% of participants reported immediate exposure reporting, and just 10% indicated washing the area of exposure following incidents. These findings highlight a gap between knowledge/attitude and real-world practice.

Post-exposure management: Analysis of post-exposure management procedures revealed variability across age and education groups (Tables 10–12). The mean response scores were lower among younger nurses (20–25 years) and those with BSN degrees, suggesting fewer comprehensive responses. In contrast, middle school graduates achieved the highest average scores, indicating more thorough management practices.

Statistical analysis: Kruskal–Wallis testing revealed no significant differences in knowledge or attitude scores across age and education groups ($p>0.05$). However, practice scores varied significantly by education level ($p=0.003$), underscoring the impact of training background on consistency in infection control practices (Table 13).

1. Knowledge Tables

The knowledge variables include: Vaccination against viral hepatitis B, have you been tested for Hepatitis B infection, medical waste is one of the main sources of infection transmission in medical fields., Wounds and scratches may cause infection transmission, Air ventilation may cause the spread of infections., treat pts with dangerous infectious diseases.

Frequencies and percentages (within each demographic subgroup) for responses coded as 1 (positive/correct knowledge) are shown below. All variables are binary (1 or 2), except those with 100% across all groups (indicating unanimous positive responses). Overall N=40.

Table 1: Distribution of nurses' knowledge variables across Gender.

Variable	Female (n=40)
Vaccination against viral hepatitis B	23 (57.5%)
Have you been tested for Hepatitis B infection	21 (52.5%)
Medical waste is one of the main sources of infection transmission in medical fields.	40 (100.0%)
Wounds and scratches may cause infection transmission	40 (100.0%)
Air ventilation may cause the spread of infections.	40 (100.0%)
treat pts with dangerous infectious diseases	26 (65.0%)

Table 2: Distribution of nurses' knowledge variables across age groups.

Variable	20–25 years (n=6)	26–30 years (n=5)	31–35 years (n=17)	36–40 years (n=12)
Vaccination against viral hepatitis B	4 (66.7%)	2 (40.0%)	9 (52.9%)	8 (66.7%)
Have you been tested for Hepatitis B infection	1 (16.7%)	3 (60.0%)	9 (52.9%)	8 (66.7%)
Medical waste is one of the main sources of infection transmission in medical fields.	6 (100.0%)	5 (100.0%)	17 (100.0%)	12 (100.0%)
Wounds and scratches may cause infection transmission	6 (100.0%)	5 (100.0%)	17 (100.0%)	12 (100.0%)
Air ventilation may cause the spread of infections.	6 (100.0%)	5 (100.0%)	17 (100.0%)	12 (100.0%)
treat pts with dangerous infectious diseases	6 (100.0%)	3 (60.0%)	10 (58.8%)	7 (58.3%)

Table 3: Distribution of nurses' knowledge variables across Educational Levels.

Variable	Diploma (n=16)	BSN (n=4)	Middle school (n=15)	Dental nursing (n=5)
Vaccination against viral hepatitis B	9 (56.2%)	0 (0.0%)	12 (80.0%)	2 (40.0%)
Have you been tested for Hepatitis B infection	9 (56.2%)	2 (50.0%)	7 (46.7%)	3 (60.0%)
Medical waste is one of the main sources of infection transmission in medical fields.	16 (100.0%)	4 (100.0%)	15 (100.0%)	5 (100.0%)
Wounds and scratches may cause infection transmission	16 (100.0%)	4 (100.0%)	15 (100.0%)	5 (100.0%)
Air ventilation may cause the spread of infections.	16 (100.0%)	4 (100.0%)	15 (100.0%)	5 (100.0%)
treat pts with dangerous infectious diseases	12 (75.0%)	3 (75.0%)	9 (60.0%)	2 (40.0%)

The results indicate a high overall level of knowledge regarding infection transmission sources such as medical waste, wounds, scratches, and air ventilation (100% across all groups). However, vaccination against hepatitis B and testing for infection showed variable uptake, with younger and middle-aged nurses demonstrating slightly lower coverage. Differences by education were also noted, with middle school nurses reporting higher hepatitis B vaccination compared to diploma and dental nursing groups.

2. Attitude Tables

The attitude variables include: Protective equipment, Gloves, face shield, mask, change gloves from patient to patient, Hands must be washed before performing procedures, Hands must be washed after completing procedures, wearing gloves/masks/eyewear is necessary and clearly visible, Compliance with sterilization of industrial tools and equipment., Vaccination of office staff., Regular review of outcomes during staff meetings., Compliance with infection control procedures.

Frequencies and percentages (within each demographic subgroup) for responses coded as 1 (positive agreement) are shown below. All variables are binary (1 or 2). Overall N=40.

Table 4: Distribution of nurses' attitudes toward infection control measures across gender.

Variable	Female (n=40)
Protective equipment	40 (100.0%)
Gloves	34 (85.0%)
face shield	17 (42.5%)
Mask	40 (100.0%)
change gloves from patient to patient	40 (100.0%)
Hands must be washed before performing procedures	40 (100.0%)
Hands must be washed after completing procedures	40 (100.0%)

Wearing gloves/masks/eyewear is necessary and clearly visible	40 (100.0%)
Compliance with sterilization of industrial tools and equipment.	40 (100.0%)
Vaccination of office staff.	40 (100.0%)
Regular review of outcomes during staff meetings.	40 (100.0%)
Compliance with infection control procedures.	40 (100.0%)

Table 5: Distribution of nurses' attitudes toward infection control measures across age Groups.

Variable	20–25 years (n=6)	26–30 years (n=5)	31–35 years (n=17)	36–40 years (n=12)
Protective equipment	6 (100.0%)	5 (100.0%)	17 (100.0%)	12 (100.0%)
Gloves	6 (100.0%)	4 (80.0%)	14 (82.4%)	10 (83.3%)
face shield	4 (66.7%)	3 (60.0%)	6 (35.3%)	4 (33.3%)
mask	6 (100.0%)	5 (100.0%)	17 (100.0%)	12 (100.0%)
change gloves from patient to patient	6 (100.0%)	5 (100.0%)	17 (100.0%)	12 (100.0%)
Hands must be washed before performing procedures	6 (100.0%)	5 (100.0%)	17 (100.0%)	12 (100.0%)
Hands must be washed after completing procedures	6 (100.0%)	5 (100.0%)	17 (100.0%)	12 (100.0%)
Wearing gloves/masks/eyewear is necessary and clearly visible	6 (100.0%)	5 (100.0%)	17 (100.0%)	12 (100.0%)
Compliance with sterilization of industrial tools and equipment.	6 (100.0%)	5 (100.0%)	17 (100.0%)	12 (100.0%)
Vaccination of office staff.	6 (100.0%)	5 (100.0%)	17 (100.0%)	12 (100.0%)
Regular review of outcomes during staff meetings.	6 (100.0%)	5 (100.0%)	17 (100.0%)	12 (100.0%)
Compliance with infection control procedures.	6 (100.0%)	5 (100.0%)	17 (100.0%)	12 (100.0%)

Table 6: Distribution of nurses' attitudes toward infection control measures across Educational Levels.

Variable	Diploma (n=16)	BSN (n=4)	Middle school (n=15)	Dental nursing (n=5)
Protective equipment	16 (100.0%)	4 (100.0%)	15 (100.0%)	5 (100.0%)
Gloves	13 (81.2%)	3 (75.0%)	13 (86.7%)	5 (100.0%)
face shield	8 (50.0%)	2 (50.0%)	6 (40.0%)	1 (20.0%)
mask	16 (100.0%)	4 (100.0%)	15 (100.0%)	5 (100.0%)
change gloves from patient to patient	16 (100.0%)	4 (100.0%)	15 (100.0%)	5 (100.0%)
Hands must be washed before performing procedures	16 (100.0%)	4 (100.0%)	15 (100.0%)	5 (100.0%)
Hands must be washed after completing procedures	16 (100.0%)	4 (100.0%)	15 (100.0%)	5 (100.0%)
Wearing gloves/masks/eyewear is necessary and clearly visible	16 (100.0%)	4 (100.0%)	15 (100.0%)	5 (100.0%)
Compliance with sterilization of industrial tools and equipment.	16 (100.0%)	4 (100.0%)	15 (100.0%)	5 (100.0%)
Vaccination of office staff.	16 (100.0%)	4 (100.0%)	15 (100.0%)	5 (100.0%)
Regular review of outcomes during staff meetings.	16 (100.0%)	4 (100.0%)	15 (100.0%)	5 (100.0%)
Compliance with infection control procedures.	16 (100.0%)	4 (100.0%)	15 (100.0%)	5 (100.0%)

Attitudes toward most infection control practices were uniformly positive across all subgroups, with 100% compliance in areas such as glove changing, hand washing, and sterilization. The main gap observed was in the consistent use of face shields, which had lower adherence, particularly among older nurses and those with dental nursing backgrounds. This suggests that while general attitudes toward infection control are strong, certain protective practices may require reinforcement.

3. Practice Tables

The practice variables include: Immediate reporting of exposure, washing the area of exposure well., Following proper hand hygiene procedures., Proper handling of sharp instruments., Adherence to using barrier precautions and careful handling of sharp tools., Sterilization of equipment, Use of appropriate dental disinfectants., In accordance with national and local guidelines. (Post-exposure Management Procedures is analysed separately below due to its multi-category responses.

Frequencies and percentages (within each demographic subgroup) for responses coded as 1 (positive practice) are shown below.

Table 7: Distribution of nurses' self-reported infection control practices across Gender.

Variable	Female (n=40)
Immediate reporting of exposure	27 (67.5%)
Washing the area of exposure well.	4 (10.0%)
Following proper hand hygiene procedures.	40 (100.0%)
Proper handling of sharp instruments.	40 (100.0%)
Adherence to using barrier precautions and careful handling of sharp tools.	40 (100.0%)
Sterilization of equipment.	40 (100.0%)
Use of appropriate dental disinfectants.	40 (100.0%)
In accordance with national and local guidelines.	40 (100.0%)

Table 8: Distribution of nurses' self-reported infection control practices across Age Groups.

Variable	20–25 years (n=6)	26–30 years (n=5)	31–35 years (n=17)	36–40 years (n=12)
Immediate reporting of exposure	4 (66.7%)	5 (100.0%)	11 (64.7%)	7 (58.3%)
Washing the area of exposure well.	1 (16.7%)	1 (20.0%)	1 (5.9%)	1 (8.3%)
Following proper hand hygiene procedures.	6 (100.0%)	5 (100.0%)	17 (100.0%)	12 (100.0%)
Proper handling of sharp instruments.	6 (100.0%)	5 (100.0%)	17 (100.0%)	12 (100.0%)
Adherence to using barrier precautions and careful handling of sharp tools.	6 (100.0%)	5 (100.0%)	17 (100.0%)	12 (100.0%)
Sterilization of equipment.	6 (100.0%)	5 (100.0%)	17 (100.0%)	12 (100.0%)
Use of appropriate dental disinfectants.	6 (100.0%)	5 (100.0%)	17 (100.0%)	12 (100.0%)
In accordance with national and local guidelines.	6 (100.0%)	5 (100.0%)	17 (100.0%)	12 (100.0%)

Table 9: Distribution of nurses' self-reported infection control practices across Educational Levels.

Variable	Diploma (n=16)	BSN (n=4)	Middle school (n=15)	Dental nursing (n=5)
Immediate reporting of exposure	7 (43.8%)	4 (100.0%)	11 (73.3%)	5 (100.0%)
Washing the area of exposure well.	0 (0.0%)	3 (75.0%)	1 (6.7%)	0 (0.0%)
Following proper hand hygiene procedures.	16 (100.0%)	4 (100.0%)	15 (100.0%)	5 (100.0%)
Proper handling of sharp instruments.	16 (100.0%)	4 (100.0%)	15 (100.0%)	5 (100.0%)
Adherence to using barrier precautions and careful handling of sharp tools.	16 (100.0%)	4 (100.0%)	15 (100.0%)	5 (100.0%)
Sterilization of equipment.	16 (100.0%)	4 (100.0%)	15 (100.0%)	5 (100.0%)
Use of appropriate dental disinfectants.	16 (100.0%)	4 (100.0%)	15 (100.0%)	5 (100.0%)
In accordance with national and local guidelines.	16 (100.0%)	4 (100.0%)	15 (100.0%)	5 (100.0%)

Practices such as hand hygiene, sterilization, and use of disinfectants were universally reported (100%). However, "washing the area of exposure well" following incidents showed very low adherence, especially among diploma and dental nursing groups. Reporting of exposures was also incomplete, with only about two-thirds of nurses indicating immediate reporting. This highlights a discrepancy between strong knowledge/attitudes and inconsistent real-world practices.

Post-exposure Management Procedures (Separate Due to Multi-Category Responses)

Table 10: Post-Exposure Management Procedures (Levels 1–8) stratified by gender group.

Gender	Level 1	Level 2	Level 3	Level 4	Level 5	Level 6	Level 7	Level 8	n	Mean
Female	19	8	2	2	6	1	1	1	40	2.50

Table 11: Distribution of nurses' responses (Levels 1–8) for post-exposure management procedures, stratified by age groups.

Age Group	Level 1	Level 2	Level 3	Level 4	Level 5	Level 6	Level 7	Level 8	n	Mean
20–25 years	3	1	0	0	1	0	1	0	6	2.83
26–30 years	2	1	0	0	2	0	0	0	5	2.80
31–35 years	7	3	2	0	2	1	0	1	16	2.69
36–40 years	7	3	0	2	1	0	0	0	13	2.00

Table 12: Distribution of nurses' responses (Levels 1–8) for post-exposure management procedures, stratified by educational level groups.

Educational Level	Level 1	Level 2	Level 3	Level 4	Level 5	Level 6	Level 7	Level 8	n	Mean
Diploma	8	2	2	2	2	0	1	0	17	2.53
BSN	4	0	0	0	0	0	0	0	4	1.00

Middle school	5	4	0	0	4	0	0	1	14	2.93
Dental nursing	2	2	0	0	0	1	0	0	5	2.40

The multi-category responses show variability in how nurses manage exposure incidents. Younger groups (20–25, 26–30) and those with BSN degrees had lower mean scores, suggesting less comprehensive response patterns. Middle school-educated nurses reported the highest average scores, indicating more thorough management procedures. This variation points to potential gaps in standardized training for handling exposure incidents.

4. P-value Table

Knowledge, attitude, and practice scores were calculated as the sum of positive responses (coded as 1) across variables in each category (knowledge: max=6; attitude: max=12; practice: max=8, excluding Post-exposure Management Procedures).

Kruskal-Wallis tests (non-parametric ANOVA) were used to compare scores across age groups and education levels. Gender analysis is not applicable (as all participants are female). Significance is at $p<0.05$.

Table 13: Comparison of knowledge, attitude, and practice scores across age and education groups using the Kruskal-Wallis test (N=40).

Score	vs. Gender	vs. Age	vs. Education
Knowledge Score (mean=4.75, SD=0.71)	N/A	p=0.8123 (not significant)	p=0.2816 (not significant)
Attitude Score (mean=11.28, SD=0.72)	N/A	p=0.4429 (not significant)	p=0.9605 (not significant)
Practice Score (mean=6.78, SD=0.62)	N/A	p=0.3829 (not significant)	p=0.0031 (significant)

No significant differences were observed in knowledge or attitude scores across age and education groups. However, practice scores showed a significant difference by education level (p=0.0031), indicating that training background has a measurable effect on the consistency of infection control practices. This emphasizes the need for targeted educational interventions to standardize practices across different nursing qualifications.

IV. Discussion

The current study confirms a strong overall level of knowledge and positive attitudes toward infection control among nurses, consistent with earlier work in Egypt. For example, El-Saaidi et al. found that dental students in Egyptian schools had good attitudes and practices despite somewhat lower knowledge scores. Similarly, El-Kazzaz et al (17). reported substantial awareness among healthcare workers in Mansoura University Hospitals, though with gaps, particularly in translating knowledge into practice.

One of the more concerning results, namely, low vaccination rates against hepatitis B and incomplete post-exposure management, mirrors results in other low- and middle-income settings(18). For instance, Issa et al. in Nigeria reported high awareness but suboptimal HBV vaccine uptake among healthcare workers. Also, the study "Low uptake of hepatitis B vaccination among healthcare workers despite the existence of risky exposures" highlights similar discrepancies between risk exposure and preventive action (19). The protective effect of full vaccination is well established (e.g., Batra et al.) both for individual health and for reducing nosocomial transmission risk(20).

Infection control practice in this study results show strong results for hand hygiene, use of gloves, sterilization, and disinfectants, which align with other studies showing better practices where training and resources are available. For example, Desta et al. in Ethiopia noted that while most healthcare workers were knowledgeable, fewer (around 57%) demonstrated good practice. Key associated factors were educational level, work experience, and in-service training. Similarly, Saati et al. showed significant improvement in knowledge and practice among medical students after practical training interventions(21)(22).

The findings of this study of variability in practice, especially related to protective equipment like face shields and post-exposure protocols, point to gaps similar to those in other settings. For example, in the El-Saaidi et al. study, many students had not completed full hepatitis B immunization, and many had experienced needle/sharp injuries with insufficient or irregular reporting. The barriers to optimal practice often include a lack of training refreshers, inconsistent supplies of personal protective equipment (PPE), heavy workloads, and sometimes a lack of institutional enforcement. These barriers are also articulated in the Egyptian literature (23)(24).

These parallels suggest that results are not isolated. They fit into a wider pattern: high knowledge and positive attitude among healthcare workers, but lapses in consistent practice, especially in vaccination, post-exposure management, and full adherence to PPE use. Educational level, work experience, continuous training, institutional support, and availability of supplies seem to be strong moderating factors.

V. Conclusion

In conclusion, this study highlights that while nurses demonstrate a solid foundation of knowledge and favorable attitudes toward infection control, critical gaps remain most notably in the areas of complete hepatitis B vaccination, post-exposure management, and the consistent use of certain protective equipment. These gaps undermine the full protection of both healthcare workers and patients.

Acknowledgment

The authors would like to acknowledge the Dean and students of the College of Dentistry for their participation and constant support.

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