Deanship of Graduate Studies

Al-Quds University (AQU)

Knowledge, Attitude, and Practices of Infection Control Protocols Among Dental Students and Interns at Al-Quds University

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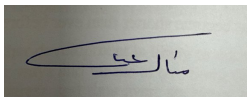
Jerusalem-Palestine

1447/2025

Declaration

I declare that this thesis submitted for the master's degree in public health is the result of my research, except where otherwise acknowledged, and this thesis has not been submitted for a higher degree to any other universities or institutions.

Signed: 

Manal Ali Deif-Allah Ayyad

Date: 20/12/2025

Dedication

I dedicate this thesis to the soul of Dr. Mousa Al-Bajali, our beloved former Dean. A strong and wise man, passionate about knowledge and teaching, he inspired everyone around him. His guidance and love for learning will always remain with us.

May his soul rest in peace.

Manal Ali Deif Allah Ayyad

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Manal Ali Deif Allah Ayyad

Abstract

Background

Infection control is an essential topic in dental education, as there is an elevated risk of infection in dental clinics. Dental students and interns are among the primary dental care providers during their clinical training stage. Therefore, it is believed that their knowledge, attitudes, and practices (KAP) significantly influence patient and community health safety from cross-infection.

Objectives:

This study attempted to evaluate the knowledge, attitudes, and practices (KAP) regarding infection control among fourth- and fifth-year dental students and interns participating in specialty programs at Al-Quds University (AQU). The study also assessed the impact of certain demographic characteristics on knowledge, attitudes, and practices (KAP), including year of study, gender, marital status, age, and hepatitis B virus (HBV) vaccination status. The study examined the discrepancies between participants' knowledge and attitudes and their actual clinical infection control procedures.

Methods:

This cross-sectional study was conducted using a valid and reliable self-administered questionnaire that was adapted from previous literature and international infection control standards for infection control in dental settings. The questionnaire was validated by internal and external experts to ensure the reliability of Cronbach's alpha >0.8. The questionnaire was distributed online as a Google form to 400 eligible students. The total replies were 379 (response rate = 94.8%). The gathered data was analyzed using SPSS version 26. The applied data analysis tests were descriptive statistics, such as mean and

standard deviation, and inferential statistics including chi-square tests, independent sample *t*-tests, ANOVA, and Pearson correlation coefficient (*r*).

Results:

The results showed that students had moderate knowledge levels (mean= 3.45/7), a positive attitude (mean = 3.65/5), and generally favorable practices (mean = 4.08/5). Statistically significant associations were found between gender and both attitudes and practices, as well as between age and practices at ($P \leq 0.05$). Knowledge didn't vary significantly across demographic variables. However, there was a significant correlation between participants' knowledge, Attitude, and practices of infection controls at ($P< 0.001$).

Conclusion:

In general, results showed encouraging levels of knowledge and practices with infection control standards. The majority of Al-Quds University (AQU) dental students and interns demonstrated good knowledge of key sterilization principles, particularly autoclave operation. The students also reflected on strong compliance with the essential protective tools (PPE), such as gloves and masks. Although students showed moderate knowledge and a positive attitude there were few gaps observed. The study recommends implementation of mandatory vaccination follow-up through a committee to verify protective immunity levels (anti-HBs Ab). Future infection control education should include simulation-based training modules to effectively connect theoretical knowledge with practical clinical application.

Keywords: Infection control, dental students, knowledge, attitude, practice, cross-infection, cross-sectional study, dental education, public health.

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Abbreviations

KAP	Knowledge, Attitude and Practice
AQU	Al-Quds University
BDS	Bachelor of Dental Surgery
PEP	Post-Exposure Prophylactic
CDC	Centers for Disease Control and Prevention
WHO	World Health Organization
OSHA	Occupational Safety and Health Administration
PPE	Personal Protective Equipment

SPSS	Statistical Package for the Social Sciences
ANOVA	Analysis of Variance
HIV	Human Immunodeficiency Virus
HBV	Hepatitis B Virus
HCV	Hepatitis C Virus
SOP	Standard Operating Procedure
AI	Artificial Intelligence

Chapter One

1.1 Introduction

Infection is a worldwide challenge in healthcare systems, it is a primary contributor to morbidity, diagnostic, and treatment interventions (Lacerda & Egry, 1997).

Infection control refers to a set of measures established within the dental setting to avoid or minimize the transmission of pathogenic agents between patients and dental healthcare workers, as well as to limit the spread of infection outside the dental facility. These measures include standard and transmission-based precautions, such as proper hand hygiene, appropriate utilization of personal protective equipment, safe work practices, complete environmental cleaning and disinfection (Bromberg and Brizuela, 2024).

Knowledge, attitude, and practice (KAP) are the three essential elements of the dynamic system of life. Knowledge is identified as information acquired through various aspects, including reading, experience, and comprehension. Attitude refers to the manner, feeling, or position toward something; it includes mind perceptions and self-orientation. Practice reflects compliance with rules and knowledge that leads to action. Subsequently, having the right knowledge, positive attitude, and good practice is essential for healthcare providers while serving their patients (Jain et al., 2010).

To guarantee effective infection control, three essential components must be present: knowledge, attitude, and practice (KAP). Knowledge gives one the information needed to perform appropriately and adopt the right attitude for

outstanding practice (Jain et al., 2010). This study will evaluate the knowledge, attitudes, and practices of infection control among Al-Quds University (AQU) dental students and interns. To our knowledge, the current study is the first study that will be conducted in a Palestinian university and assess (KAP) domains for cross-infection control protocols among dental students.

1.1 Infection in Dental Clinics

Dentists are particularly vulnerable to cross-infection because numerous pathogens naturally thrive in the mouth cavity, where the wet conditions encourage the growth of pathogens (Yüzbasioglu et al., 2009). Furthermore, the risk of infection from oral cavity-colonizing microorganisms is increased by direct contact with blood and saliva. Blood-borne infections such as the Hepatitis B (HBV) and C virus (HCV), the Human Immunodeficiency Virus (HIV), *Mycobacterium tuberculosis* (TB), streptococci, and other bacteria and viruses that colonize the upper respiratory tract and oral cavity (Halboub et al., 2015).

In 2012, Laheij et al. a study reviewed the literature to ascertain the probability for infection and cross-transmission of bacteria and viruses particularly pertinent to the dental practice environment, including HBV, HCV and HIV. The study determined that the transmission and infection of HBV present the most danger for both dentists and patients (Laheij et al., 2012).

A study conducted in the late 1970s (Scully and Greenspan, 2006), showed that dentists were likely exposed to HBV infection three times more than the general population. In 1991, the Occupational Safety and Health Administration (OSHA) of the United States Department of Labor established the Blood-borne Pathogens Standard to protect workers from exposure to blood-borne pathogens, including HBV, HCV, and HIV.

1.2 Infection Transmission in Dental Clinics

The transmission of infection between patients and clinicians in a clinical setting is known as cross-infection. During dental operations, infections can spread through direct contact with body fluids or indirectly through infected tools (Alharbi et al., 2019). In dental procedures, infection transmission may occur via direct contact with blood, saliva, injury from an anesthetic needle, splash exposure to mucous membranes, droplets, aerosols, or indirect contact via contaminated tools and surfaces (Figure1.1). Accidental exposure to pathogens in dental facilities can be

prevented by adhering to safety procedures and applying infection control protocols (Rahman et al., 2013; Singh et al., 2011).

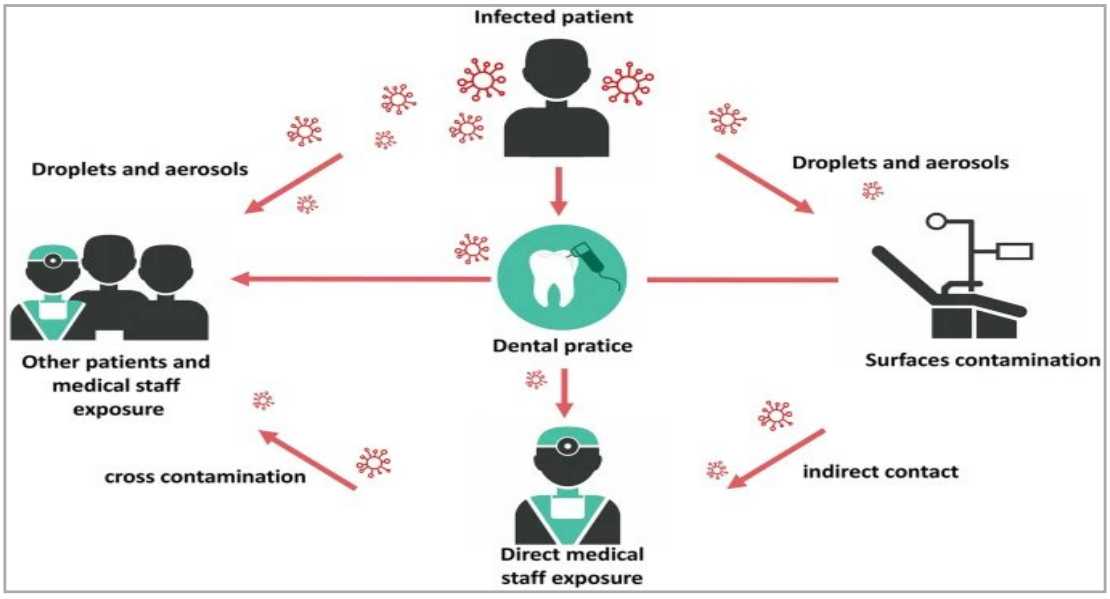


Figure (1.1): Cross-infection cycle in dental clinics (Gasmi Benahmed et al., 2022).

1.3 Infection control protocols in dental clinics

Infection control strategies comprise contact, droplet, and airborne precautions, determined by the transmission method of the infectious agent (Shetty et al., 2010). Health care personnel who fail to implement appropriate infection control measures during patient care are at an increased risk of contracting infectious illnesses (de Souza et al., 2006).

CDC adopted the term "standard precautions" in 1996 to represent a more inclusive strategy for preventing virus transmission (Kohn et al., 2003). Standard precautions involve augmenting general preventative actions to protect healthcare workers and patients from pathogens in healthcare facilities (Kohn et al., 2003).

Strategies to protect health workers include implementation of standard precautions; vaccination against relevant infectious diseases; provision of personal protective equipment (PPE); effective disinfection and cleaning of

surfaces and equipment to eradicate pathogens; sterilization of instruments; and appropriate handling of sharp instruments and management of exposure, as advised by the World Health Organization (WHO) (Malhotra et al., 2017). Dental education is essential for teaching dental students, enabling the development of required knowledge and attitudes related to infection control (MHNJd et al., 2009).

Standardized infection control protocols are the most effective strategy for reducing cross-infection in dental facilities. Dental institutions must ensure the enforcement of protocols associated with prevention and transmission within the dental setting. Also, it is essential to emphasize the importance of vaccination for all those delivering oral health care (Rahman et al., 2013; Halboub et al., 2015).

1.4 Knowledge, Attitude, and Practice (KAP) Definition:

1.4.1 Knowledge

It is the ability to obtain, retain, and utilize information, including understanding, experience, awareness, and skills (Emhj, 1995). The essence of knowledge derives from the various methods through which concepts are obtained, such as perception, imagination, memory, judgment, abstraction, and reasoning. It includes the capacity that allows us to distinguish between good and incorrect (Badran, 1995).

1.4.2 Attitude

Attitudes are defined as preferences to respond in a particular way to specific circumstances; to see and interpret activities according to certain characteristics; or to arrange opinions into logical and connected frameworks (Badran, 1995).

1.4.3 Practices

Practices are the applications of rules and knowledge that lead to action. Good practice is an art that is linked to the progress of knowledge and technology and is executed in an ethical manner (Badran, 1995).

1.5 Statement of the problem

In terms of morbidity, oral diseases were classified in addition to upper respiratory infections and COVID-19 as the most common diseases in Palestine in 2021 (Murray, 2022). The situation in Palestine aligns with general trends noticed in

middle-class and lower-class countries, where the prevalence of oral disease is higher than in wealthy countries (Ashour et al., 2024). This highlights the need to establish a firm cross-infection prevention policy based on dental workers' sufficient knowledge, attitudes, and practices to minimize the distribution of oral diseases. This study assesses the knowledge, attitudes, and practices (KAP) of dental students and interns participating in specialty programs at Al-Quds University (AQU).

1.6 Research Justification/Rationale

Dental faculty at Al-Quds University (AQU) was established in 2000 to provide dental medicine education in Palestine, and since then, more than2,000 students have earned Bachelor of Dental Surgery (BDS) degrees (Al-Quds University, 2025). This information was obtained from the official Al-Quds University website and was used to describe the institutional background, establishment year, and educational mission of the Faculty of Dentistry. The vision of the dental faculty is to establish a set of standards for the advancement of the dental education future. The faculty mission is to prepare dental 2education leaders to provide the community with skilled and highly qualified dentists throughout the continuous development of the dental college to meet global developments in dentistry (AQU, 2025).

The dental faculty at AQU provide dental services for the local community and the other Palestinian governorates. Generating dentists capable of fulfilling the core duties of dentistry is the aim of dental education. Furthermore, dentists need to have the qualities required to fulfill their individual and group obligations to society. This belief contributes to the fundamental goal of AQU dental faculty, which is to produce highly skilled, qualified, loyal, and most importantly, compassionate dentists (AQU, 2025).

1.7 Study importance

Dentists play an important role in maintaining the Palestinian population healthy by treating dental diseases. Thus, by enhancing dentists' knowledge, attitudes, and oral infection management practices, they can also contribute to preventing the spread of oral illness.

Considering the statement of the problem, it is crucial for AQU to estimate the level of KAP of dental students and interns registered in its dental college. As it matters for AQU to prevent infection. The literature lacks studies that investigated the KAP

domains for infection-control protocols among dental students and interns in Palestinian universities. To our knowledge, this study is considered the first of its kind in this country

Al-Quds University (AQU), as a leading academic institution in Palestine, is vital for the Palestinian community through developing the skills of future dental healthcare professionals. This study was dedicated to assist AQU and its dental faculty to identify the gaps in dental students KAP of infection control. The study serves as evidence to enhance the university's academics, update the infection control training program, and as an outcome guarantee to prepare dentists who can be reliable to provide safe and responsible duties in both public and private Palestinian healthcare sectors.

1.8 Research Objectives

The general objective of this study is to assess Al-Quds University's dental students and interns' knowledge, attitudes, and practices (KAP) for preventing cross-infections and defending both themselves and their patients. The data acquired will be utilized to evaluate how aware dental students and interns are of cross-infection. The intended outcomes are to identify mistakes in behaviors and mindsets and establish procedures for correcting them to protect both dental professionals and patients.

The specific objectives are to:

1. To assess knowledge, attitudes, and practices (KAP) regarding infection control among dental students and interns at Al-Quds University (AQU).
2. Find out if there are any differences in knowledge, attitudes, and practices (KAP) between fourth, fifth year and interns.
3. Identify if there are differences in knowledge, attitudes, and practices (KAP) of the participants according to their gender.

1.9 Limitations of study

The primary limitation of this study was the lack of commitment of some students and interns in completing this questionnaire. In addition to the scarcity of published literature about infection control in Palestine which posed a challenge that limited the ability to compare findings with local data.

Chapter Two

Literature Review

2.1 Introduction

The primary aim of infection control policies and procedures, implemented in hospitals and other healthcare environments, is to reduce infection rates and prevent the transmission of infections (AlAnazy and Mwandenga, 2024). In dental environments, infection management is imperative and vital (Al-Omari and Al-Dwairi, 2005). Cross-infections in dental environments are uncommon (Mutters et al., 2014); nevertheless, this may be attributed to inadequate recording, lack of information, and reporting (McCarthy et al., 2002). The American Center for Disease Control and Prevention (CDC) asserts that the risk of cross-infection persists despite the limited reporting of such instances in dental care clinics from 2005 to 2015. Due to the significant consequences for patients in contaminated or infectious oral health facilities, it is essential that these conditions be explored and regularly evaluated (Arti, 2023). This chapter focuses on the studies that investigated Knowledge, attitude, and practice (KAP)of dental students at local, regional, and global.

2.2 Local Studies

A study was conducted at Al-Quds University (AQU) assessed the infection control protocols at dental clinics within the Hebron district of Palestine, focusing on adherence to guidelines for infection control (Al-Quds University [AQU]2017). Merely 5.5% of dentists attended infection control training courses in the past two years, and only 19.3% were given access to the protocol when required. Most dentists showed a positive attitude towards handwashing protocols and commitment to hand hygiene practices. Also, variations were spotted among males and females in hands washing, dental clinic surroundings disinfection, and sterilization of dental instruments. Dentists' attitude score towards infection control was estimated at 65.82%, while compliance was 44.1%. The study outlined that there was insufficient implementation of infection control protocols in Palestinian dentists' clinics (Hroub, (2017). Assessment of the Infection Control System in Dental Clinics in Hebron District (master's Thesis, Al-Quds University).

Menawi et al. (2021) aimed to investigate the knowledge and compliance degree with infection control procedures in dentist clinics in the Palestinian areas of Nablus and Tulkarm. The results outlined that there was medium compliance (70%) with infection control protocols in Nablus and Tulkarm dentists' facilities.

Al-Sharif and Husseini (2023) attempted to evaluate the knowledge and compliance of infection control standards across dentists in the West Bank and Jerusalem. The research included a self-administered questionnaire provided to dentists in the West Bank and Jerusalem. The study sample involved 395 dentists. The findings indicated that overall dentists' adherence to infection control standards was poor as only 18.5% of dentists expressed good compliance. This study also highlighted that compliance is correlated with age, work experience, and year of graduation.

2.3 Regional Studies

Alharbi et al. (2019) conducted a cross-sectional study to evaluate KAP regarding infection control protocols among dental college staff and students at King Saud University (KSU) in Riyadh, Saudi Arabia. The sample comprised 317 dental staff members, third, fourth, and fifth-year students. A questionnaire comprising three KAP sections was distributed to the participants. Statistical analysis was

conducted utilizing SPSS® software for Windows® version 21, Analysis of Variance (ANOVA) was used to compare the means of KAP scores, and an independent *t*-test to assess the attitudes of the two sample groups. The significance level was established at $p< 0.05$ for all statistical analyses. The findings showed that dental staff and students at KSU had strong infection control compliance. On the other hand, the study identified a gap in knowledge of fundamental infection control principles. Unexpectedly, the Third-year students expressed higher knowledge and compliance level. Furthermore, students had better compliance than their teachers. The study investigation of HBV vaccination revealed a high percentage of participants who received the HBV vaccine (93.1%).

El-Saaidi et al. (2021) conducted a cross-sectional study in four public dental schools in Egypt to verify dental students' KAP of infection control. A self-administered questionnaire was used to collect responses. The overall response rate was only 60.1%. The study revealed that students' knowledge was low in spite of their positive attitude and practice. The Female students showed higher knowledge of sterilization techniques and better practices in the use of personal protective equipment (PPE). The fourth-year students had better scores than in the fifth students in infection control practices. This study also found that 30% of students were unvaccinated; this is a high percentage when combined with findings that 60% and 38% experienced needles and sharp injury.

Salih (2021) reported dental students' KAP of infection control. This research was applied in the Pedodontics Clinics, Faculty of Dentistry of the University of Baghdad, Iraq. The findings showed a high compliance amongst students with glove usage at 98.2% and consistent PPE use (100%). 84.04% of students were vaccinated against HBV. Occupational injuries were mainly due to needle sticks; this incident was the highest among the postgraduate students' group.

Asif et al. (2018) conducted a study at the College of Dental Medicine in King Khalid University in Saudi Arabia (KSU) to evaluate students' KAP toward infection control using a self-administered questionnaire. Most participant students were males (82%). The study revealed poor compliance with protective eyewear which was used by only 22% of students. About 90% of students had received HBV vaccination and their practices were positive as, 98.7% reported wearing gloves during dental procedure. Besides, only 40.5%of all students expressed willingness to treat patients with infectious diseases.

Halboub et al. (2015) conducted a study at Sana'a University in Yemen. The study assessed the fourth and fifth-year dental students' KAP towards infection control. This cross-sectional study involved a self-administered questionnaire. The students' response rate was 72% and 71.7% were vaccinated against the HBV.

Only a small portion of students tested their immunity level after vaccination (9.5%). The students showed a high compliance towards wearing gloves during dental procedures (96.6%). This study had also identified a gap in using face masks and eyewear as only 53.8% and 14% of students used them respectively.

Saleem et al. (2023) went further than evaluating infection control KAP. Their study was dedicated to reviewing practices of post-exposure prophylaxis (PEP). The study conducted a self-administered questionnaire among fifth-year students in private institutions in Egypt. The study found a knowledge gap in the students understanding of PEP administration in case of needle or sharp injury. Surprisingly, 47.5% of students reported that PEP should be administered following any needle stick injury.

Dagher et al. (2017) conducted a study in private dentistry clinics in Lebanon to assess dentists' knowledge of infection control protocols. The findings of this study revealed a high percentage (90.6%) of vaccination against HBV. The study also found a low eyewear usage similar to others reviewed in the literature, only 43% of dentists reported they used it.

In Morocco, Kadri et al. (2022) evaluated dentists' KAP in both the public and private sectors. The study was based on a self-administered questionnaire. Out of the 209 collected replies58% were from the corporate sector and 32.7% were academics. Unlike previous studies, this study compared the differences between the groups based on the median. The dentist's knowledge in this study showed a high median score (21 out of a possible 24). The median attitude score was 3 out of 6 (relatively low). The dentists also showed a very poor median practice score (1 out of 8).

2.4 Global Studies

In Bhopal in Central India Singh et al. (2011) performed a study involving245 students in college stage. The study assessed dental KAP towards infection control utilizing a self-administered questionnaire. The study showed moderate levels of knowledge (3.75), attitude (3.4) and practice (3.35). The study revealed a significant linear correlation between attitude and practice (r=0.2, p<0.01). Surprisingly, a high percentage of students were unvaccinated against HBV, about 61.2%. The study recommended training on infection control protocols before graduation and obligatory HBV vaccination before entering clinical training stage.

A cross-sectional study was conducted at the dental college of the Foundation University Dental Collegian Rawalpindi in Pakistan. This study also assessed

senior dental students' knowledge of infection control protocols. The study relied on a self-administered questionnaire to collect required data. It was revealed that over 50% of students didn't use antiseptics to sanitize their hands. Students had low knowledge regarding the standard autoclave temperature and only one-third of them used PPE during dental procedures operation. The study highlighted poor students' knowledge and practice despite their positive attitude (Qamar et al., 2020).

Another Indian cross-sectional study from India by Mohan et al. (2024), evaluated the KAP of 222 dental students at the Rajendra Institute of Medical Sciences. Although 98.8% of students demonstrated knowledge about immunization, only 3.8% of students had received HBV vaccine. This highlights the gap between theoretical knowledge and real practice.

Azhar et al. (2022) a cross-sectional study in public dental college in Karachi compared KAP toward infection control. A self-administered questionnaire was used to collect data. The study found a high compliance to PPE and about 88.4% of students received HBV vaccine.

In the Northwestern Ethiopia, Anteneh et al. (2019) a study was performed in the University of Gonder Comprehensive Specialized Hospital. The study involved health science students including dentists. The study is important as it highlights the gap in knowledge of PEP of HIV. Unfortunately, hardly 30% of medical students had sufficient knowledge of anti-HIV drugs and PEP.

A similar cross-sectional study was conducted in Romania. Dincă et al. (2024) formulated a questionnaire to evaluate dental students' KAP of infection control. The study showed a good student's knowledge of PPE but poor understanding of the viral transmission risk. The student's willingness to treat patients with infectious diseases was excellent.

A cross-sectional study was conducted in Peru assessed dental students' KAP. Using a validated questionnaire developed by Silva-Robles et al. (2025) data was collected from 503 dental students. The findings showed poor students' knowledge, but their attitude was positive.

In Athens, a study was conducted at the National and Kapdoistian University to assess fifth year dental students' KAP. Antoniadou et al. (2025) found that vaccinated dental students had greater knowledge compared to their unvaccinated peers.

Another important aspect in dental clinics is the dental impressions disinfection. Binassfour et al. (2024) investigated KAP of dental health workers regarding dental impressions. This study gathered data by a questionnaire distributed via google

form. This study found an average knowledge of dental impressions disinfection (54.6%). The dentist's attitude was neutral and only 25.1% were positive about disinfection of impressions.

2.5 Artificial Intelligence (AI) and Digital Dentistry Application

Infection control is obviously fundamental to maintaining safe dental settings. The growing fast smart world has recently led to emerging Artificial intelligence (AI) in various aspects of life. The idea of integrating sterilizing techniques with AI has become popular in the last few years (Alamri et al., 2024).

Yet, the classical AI application in dental medicine is primary diagnosis.AI is being recently operated in cavities, vertical root cracks, and lesions identification. Several recent studies indicated remarkable efficiency and accuracy in dental diagnosis (Ding et al., 2023).

A systematic review was done by Ahmed et al. (2021); this review examined AI techniques and impacts on dental medicine. The study emphasized that AI facilitates precise patient care and diagnosis. This review underscored that AI contributes to more precise patient care by improving diagnostic accuracy, supporting individuals' treatment plans and facilitating precise clinical interventions.

In terms related to infection control, AI showed high capacity of infection prediction. Arab et al. 2025 found that AI assisted with surveillance systems toped conventional systems with its capacity to precisely identify infections and improve compliance to hand hygiene protocols. This study highlighted AI capacity to enhance early detection of outbreaks, optimize surveillance systems and support decision making through predictive analytes.

An Interesting recent study by Aldahlawi et al. (2025) evaluated the efficiency of an AI model in assessing proper hand sanitization in dental clinics. The AI model demonstrated 90.91% agreement with infection control standards with sensitivity of 85.7% specificity 100%. The study concluded that AI models for hand hygiene assessment were reliable.

The AI perception is not yet fully favored in many different occupations including dentistry. Amiri et al. (2024) found that students hesitate to utilize AI despite its benefits as they have concerns about their future work opportunities being dominated by AI technology.

Chapter Three

Methodology

3.1 Introduction

This chapter encompasses study design, study population, inclusion criteria, sampling method, sample size, data collection, data analysis, ethical considerations, and conceptual framework.

3.2 Study design

This cross-sectional study was conducted using a self-administered questionnaire that was distributed via Google Forms to fourth-and fifth-year dental students and dental interns enrolled in the specialty program at Al-Quds University (AQU) (refer to the annex for the questionnaire). This study design was chosen because it is simple, quick, inexpensive, and has been used in previous similar studies. The questionnaire items were derived from prior peer-reviewed research by Singh et al. (2011), Alharbi et al. (2019), Qamar et al. (2020), Mohan et al. (2024), and Elsaaidi et al. (2021), and were verified by both internal and external experts to confirm content validity and reliability. The questionnaire was also verified and tested via a pilot study.

3.3 Study population

The study included fourth- and fifth-year dental students and dental interns of the specialty program of AQU.

3.4 Inclusion criteria

The current study was conducted among fourth- and fifth-year dental students and dental interns of the specialty programs at AQU, Abu-Dis in Palestine in the duration between December 2024 and June 2025. Informed consent was included in the Google online form. Students who were not willing to participate in the study were not included in the study population.

3.5 Sample size

At Al-Quds University (AQU), at the time of this study, there were 30 interns, 140 fifth-year students, and 230 fourth-year students. The sample size was 400.

3.6 Questionnaire construction

The online distributed questionnaire used in the current study was previously framed by Singh et al. (2011), Alharbi et al. (2019), Qamar et al. (2020), Mohan et al. (2024) and Elsaaidi et al. (2021). It was also modified by the researcher based on the literature review describing infection prevention and control practices in dental settings (Alqadi et al., 2024; Clayton & Miller, 2017; Harte, 2010).

3.7 Questionnaire validation

The questionnaire was reviewed and evaluated by internal and external experts to verify its validity. The reliability was also measured using Cronbach's alpha scale and showed good reliability (0.839).

3.8Data Analysis

The data collected was analyzed using MS Excel and the Statistical Package for Social Sciences (SPSS) version 26.

3.9 Ethical Consideration

Google Forms was used to create a study survey, which was distributed to the target students via email and other available contact methods. An information sheet was provided to all eligible students, who were required to submit an agreement to participate. Participant students were able to withdraw from the study at any time without explanation, and they remained anonymous. They were also not required to add their names to the complete questionnaire, and they were informed that the study will not influence their academic evaluation whatever they answered.

The study was carried out after obtaining approval from the ethical research committee/ the faculty of public health at AQU. The approval form registration number is REF.10/25.

3.10Theoretical Model and Conceptual Framework

3.10.1 Theoretical Model

The current study adopted the knowledge, attitude, and practice (KAP) model as its research framework. We believe that AQU dental students and interns' level of knowledge about cross-infection directly influences both their attitudes and practices (Figure 2.3). In other words, the more knowledgeable the students are, the better their attitudes will be, which subsequently leads to better practices. Also, the gained students' occupational experience with advancement of their academic level and age is believed to improve their KAP levels. For this reason, students and interns age was another included independent variable besides to their gender and academic level.

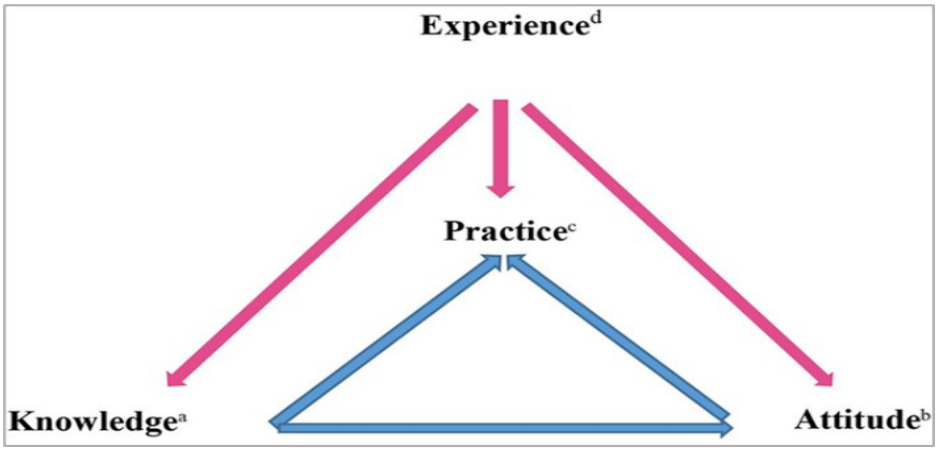
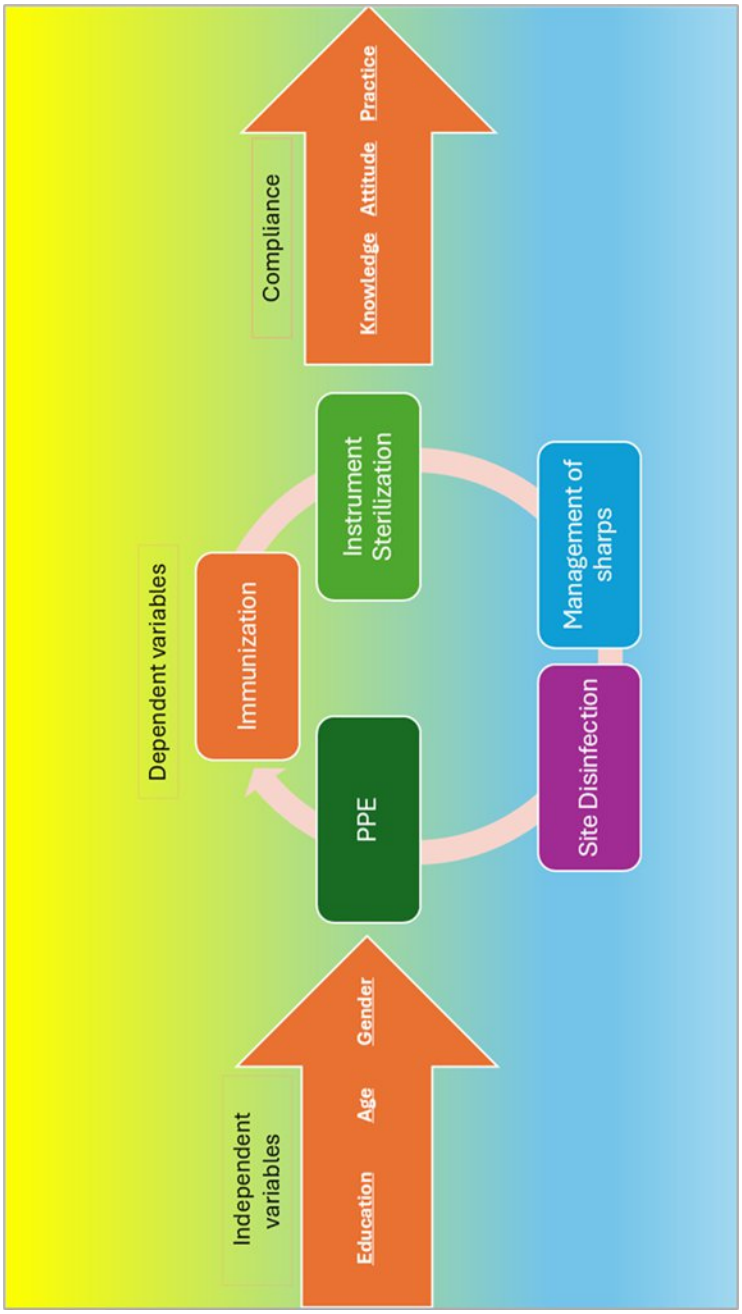


Figure (2.3): Theoretical model of KAP to minimize cross-infection (Tsui et al., 2023)

3.10.2 Conceptual Framework

The KAP of dental students and interns about infection control at AQU dental clinics were investigated through this research framework (Figure 3.3). Several essential variables were specified in the WHO's international infection control guidelines to ensure cross-infection control. These variables were evaluated in this study to determine compliance of AQU dental students and interns to infection

control guidelines. To our most knowledge, no previous studies were found similar to our study in Palestine.



3.11 Variable measurements

The compliance of dental students and interns to infection control protocols was measured through a valid and reliable self-administered questionnaire. The following section describes the variables measured in this study.

3.11.1Vaccination against the hepatitis B virus (HBV) and needle-stick injury

Dental healthcare practitioners are vulnerable to prevalent diseases that might be mitigated by

Figure(3.3): Conceptual framework model of the study

vaccination. The objective of vaccination is to limit the possibility of diseases occurrence (Bromberg and Brizuela, 2024). All clinical staff members must be vaccinated against HBV within ten days of patient interaction. They are authorized to consult with patients

for the duration required to complete the immunization schedule, which often spans two to six months. Immunization is considered successful when the HBV surface antibody (HbsAb) level exceeds 100 mIU/ml. Antibody levels ranging from 10 to 100 mIU/ml signify a poor immunity, while levels below 10 mIU/ml denote a non-immunized (Bromberg and Brizuela, 2024). The vaccination related questions in the questionnaire were questions 5 and 6.

Needle stick injury from a used or potentially contaminated object: This variable aims to identify the incidence of needle injury among student groups. The incidence rate among dental students was measured by question 7 in the questionnaire.

3.11.2Knowledge variables

In this section the following variables were applied to evaluate the students and interns' knowledge of infection control protocols:

1. Instrument sterilization procedures: This involves many processes utilizing specialized equipment. Every dental practice must establish policies and procedures for the containment, transportation, and handling of tools and equipment potentially contaminated with blood or body fluids (Siegel et al., 2007). The predominant sterilization method employed in dentistry is autoclaving, which utilizes pressurized steam. It is efficient and user-friendly, and the efficacy of sterilization can be verified. Autoclave sterilization system operates at a temperature of 121°C for a duration of 20 minutes. However, other validated autoclave cycles (e.g., higher temperatures for shorter durations) may also be used depending on the sterilizer type and load (Bromberg and Brizuela, 2024). Knowledge of instruments autoclaving was measured by questions 8 through 10 in the questionnaire.
2. Transmission rate of viruses: HBV is the most prevalent, presenting an average risk of 6-30%following percutaneous exposure to HBS-Ag-positive blood. Exposure to HCV-positive blood carries a risk of 1.8%, but needlestick exposure to HIV-contaminated blood presents an estimated risk of 0.3% (Bromberg and Brizuela, 2024). The knowledge of HBV transmission was measured by question 11 in the questionnaire.
3. Transmission rates of HIV and HCV: Immunization against HIV or HCV is not available, but fortunately the risk of transmission of HIV or HCV by hollow needlestick injuries is low, 0.3% and 1.8% respectively (Frijstein et al., 2011). The knowledge of HIV transmission was measured by question 12 in the questionnaire.
4. Actions to follow in the event of direct blood exposure to an HIV or HBV patient as per the CDC (Kuhar et al., 2013):

a. Cleans the site of punctures or injury with water and soap for at least 15 minutes.
b. Obtain medical care to assess the risk related to exposure.
c. Administer PEP: For HBV, provide PEP promptly, ideally within 24 hours. HBVPEP may be administered to pregnant women. For HIV, start PEP immediately, ideally within hours of exposure. Administer HIV PEP for four weeks if well-tolerated.
d. Conduct follow-up testing: Assess for anti-HBV 1 to 2 months post-administration of the final vaccine dose if vaccination is the sole intervention. Follow-up is unnecessary if the exposed individual is immune to HBV or has received HBVPEP. Assess individuals who have undergone PEP within 72 hours upon exposure and observe them for medication toxicity for a minimum of 2 weeks. Conduct HIV antibody testing at intervals of 6 weeks, 3 months, and 6 months following exposure. Conduct HIV antibody testing for conditions consistent with acute retroviral syndrome. Instruct exposed individuals to implement procedures to avert secondary transmission throughout the follow-up period.

The knowledge of actions following exposure to an infectious disease was measured in questions 13 and 14 of the questionnaire.

5. Artificial intelligence (AI) and application in dentistry: The primary application is diagnosis, as AI can deliver more accurate and efficient evaluations, hence reducing the workload on dentists (Ahmed et al., 2023). AI as well contribute to cross-infection prevention by enhancing proper hand sanitization (Aldahlawi et al., 2025) and early detection of out breaks (El Arab et al., 2025). Knowledge of AI role in dental clinics was measured by question 15 in the questionnaire. This item was included to assess students' attitudes toward the integration of digital and AI-based tools in infection control practices.

3.11.3Attitude variables

This section evaluated the students and interns' attitude toward infection control protocols. The following variables were used for evaluation.

1. Disinfection of work environment and cross infection: In dental locations, doorknobs, chairs, workstations, elevators, and restrooms must be sanitized with disinfectants such 0.1-0.5% sodium hypochlorite, 62-71% ethanol, or 2% glutaraldehyde (Bromberg and Brizuela, 2024). Students' attitude toward this item was measured by questions 16, 18,19 and 21 in the questionnaire.
2. Oral hygiene and rinsing before a dental procedure: Given that dental procedures necessitate proximity between the patient and the dentist, the generation of aerosols poses a risk of cross-infection; hence, reducing the production of contaminated aerosols is essential for infection control. It is thus logical to presume that any method employed to lower the viable microbial load of aerosols could reduce the potential of cross-contamination in the dental environment. Therefore, pre-procedural mouth rinses would enhance this effort (Nagraj et al., 2020). Question 17 in the questionnaire is related to this item.
3. Providing dental treatment to patients infected with HBV, HCV or HIV: Individuals suffering of chronic HCV can get elimination of the virus with effective treatment utilizing a combination of two or three antiviral agents. Chronic HBV can be treated with antiviral medications to mitigate liver damage. Nevertheless, therapy may not completely eradicate the virus, and certain individuals may require ongoing treatment for life. Antiretroviral therapy in individuals with HIV may achieve viral suppression, meaning their viral load can be reduced to an undetectable level (Lala et al., 2018). The attitude of students toward infected patients' treatment was measured by question 20.
4. Disinfection of Impressions: Impressions obtained from the patient's oral cavity are contaminated. Prior to dispatch to the dental laboratories, they must be carefully cleaned with the appropriate disinfectant and duration to ensure dimensional stability. Ensuring efficient communication with dental laboratories is crucial to avoid missing or unnecessary repetition of disinfection procedures (Bromberg and Brizuela, 2024). Students attitude toward dental impression disinfection was measured by question 21 in the questionnaire.

3.11.4 Practice evaluation variables

1. Wearing personal protective equipment (PPE): Standard precautions must incorporate protective barriers or PPE.PPE provides a barrier against sprays and spatters carrying potentially contagious agents. Among these are masks, gloves, protective clothing, and safety eyewear (Bromberg and Brizuela, 2024). The PPE utilization by dental students was evaluated by questions 24, 25 and 26 in the questionnaire.

2. Hand Hygiene: Hand washing involves cleansing hands using conventional soap and water. Antiseptic hand washing involves cleansing hands with soap that contains antiseptic agents, such as triclosan or chlorhexidine. Alcohol hand rub stands for the application of a waterless formulation comprising 60% to 95% ethanol or isopropanol. This should not replace regular handwashing (Bromberg and Brizuela,2024). Hand sanitization among dental students was evaluated in questions 22 and 23 of the questionnaire.

3.12 Statistical analysis

1. Descriptive Statistics: were applied to summarize students' demographics and KAP components frequencies, percentages, averages, and standard deviations (Pallant, 2020).
2. Reliability Assessment: Cronbach's Alpha evaluated the internal consistency of the questionnaire. Itis considered moderately acceptable in the range of 0.7 – 0.79, good for research purposes when falling between 0.8 – 0.89 and excellent if it is greater than 0.9(Edel Brunner et al., 2025). The reliability of the current study's questionnaire was 0.839 which indicates good reliability.
3. Inferential Statistics: The following section summarizes the used inferential statistics in this study.
   A. Chi-square test (χ^2): Utilized to ascertain relationships between categorical variables, including gender, academic year, and infection control procedures. A *p*-value <0.05 was considered significant (Pallant, 2020).
   B. Independent-samples *t*-test was used to compare the mean score of students' KAP of groups (e.g., gender and marital status). A *p*-value<0.05 was considered significant (Pallant, 2020).
   C. Analysis of Variance (ANOVA): This test Assessed the mean differences among multiple groups (e.g., year of study). When ANOVA was significant it was further analyzed with Post Hoc tests to determine specific group variations. A *p*-value<0.05 was considered significant (Pallant, 2020).
   D. The Pearson Correlation Coefficient (*r*): It was applied to identify linear relationship between variables especially the KAP scores. Utilized to assess the linear association between KAP scores. A *p*-value<0.01 was considered significant (Pallant, 2020).
   E. Normal distribution tests: This criterion included data frequency distribution, Shapiro-Wilk and Kolmogorov-Smirnov and Q-Q plots.

Following data for a specific variable distribution, Shapiro-Wilk and Kolmogorov-Smirnov tests are applied. These tests are helpful to determine whether a variable observed distribution is following normal distribution or not. In case of normality, the *p*-value will be found to be higher than 0.05. To support the interpretation of Shapiro-Wilk and Kolmogorov-Smirnov, normal Q-Q plots should be visually examined in order to determine that data is normally distributed and as a result parametric tests are then applied (Field, 2024; Pallant, 2020).

3.13 Pilot study

The initial pilot study included 37 students from Al-Quds University. Students' groups were classified as follows: 14 students (37.8%) from the fourth-year, 21 students (56.8%) from the fifth year, and two interns (5.4%) at the AQU specialty program. The questionnaire was distributed via Google Form and was evaluated for internal consistency using Cronbach's Alpha. The initial questionnaire's Cronbach's Alpha was significantly low (0.47). The questionnaire was then revised and modified using 5 Likert scale to evaluate attitude and practice while knowledge questions were kept as multiple choice with one correct answer.

Chapter Four

Results

In this chapter results of data analysis for knowledge, attitudes, and practices (KAP) cross sectional study are illustrated.

4.1 Introduction

This chapter presents the main findings of knowledge, attitude, and practice (KAP) on infection control among dental students and interns of the specialty program at Al-Quds University AQU. Descriptive and inferential statistics are summarized using tables and figures to highlight the key results and relationships relevant to the objectives.

4.2 Response rate

Table 1.4 presents the response rates of dental students and the interns of the specialty program at AQU according to their academic level.

Table (1.4): Response rate according to the academic level

Category	(*n*) students	(*n*) Responses	(%) Response rate	Interpretation
4th Year	230	219	95.7	Excellent
5th Year	140	131	92.9	Excellent
Interns & Specialty Program	30	29	96.7	Excellent
Total	400	379	94.8	Excellent

4.3 Respondents' demographics

In Table (2.4) the participated student's demographics are shown. The table is also represented in Figure 5. The table and figure summarize the demographic distribution of participant students and interns at AQU by gender, year of study, marital status, and age group.

Table (2.4): Respondents' demographics

		(*n*)	Percent (%)
Gender	Female	265	69.9
	Male	114	30.1
Year of study	4th year	219	58.0
	5th year	130	34.3
	Intern at a Specialty Program	29	7.7
Marital status	Married	39	10.3
	Unmarried	340	89.7
Age (Year)	19-23	327	86.3
	24-30	32	8.4
	31-45	20	5.3
	Total (*n*)	379	100.0

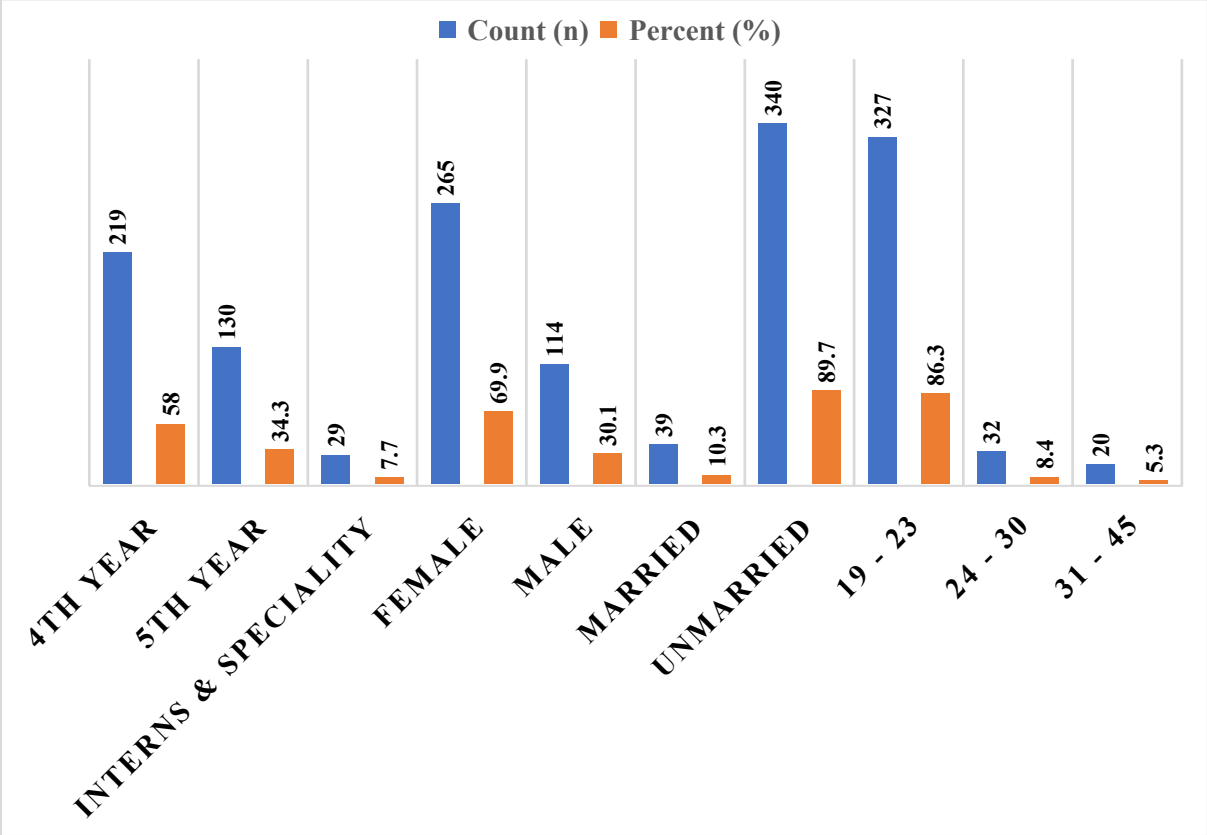


Figure (4.4): Respondents demographics

4.4 Hepatitis B virus (HBV) vaccination

Table(3.4) summarizes the responses distribution related to HBV serological testing, HBV Ab titer level, vaccination status, number of received doses, and willingness of students to receive vaccination.

Table (3.4): Vaccination summary

			Percent
		(*n*)	(%)
5. Have you ever performed a serological test for HBV Abs before your clinical stage?	No	189	49.9
	Yes	190	50.1
6. If yes, what was your HBV titer level (IU)?	Above 10 IU	82	21.6
	Didn't perform titer level	72	19.0
	Don't know	225	59.4
7. Have you received Hepatitis B Virus (HBV) vaccination?	No	132	34.8
	Yes	247	65.2
8. If yes, how many doses have you received?	Complete HBV vaccination (initial & booster doze)	105	27.7
	Didn't receive any doze	139	36.7
	Initial HBV doze only	135	35.6
9. Would you go for HBV vaccination if it was not obligatory?	No	122	32.2
	Yes	257	67.8
	Total (*n*)	379	100.0

4.5 Sharp Injury and Nail Hygiene

Table 4 summarizes the incidence rate of sharp injury among participating students and interns at AQU. The table shows incidence of needle-stick injury, source of injuries, and nail hygiene practices.

Table (4.4): Sharp Injury Questions Summary

			Percent
		(*n*)	(*%*)
10. Have you ever experienced a needle stick injury?	No	232	61.2
	Yes	147	38.8
11. If yes, the source of injury?	Burs	35	9.2
	Needle	125	33.0
	Never injured	198	52.2
	Scaler tips	13	3.4
	Scalpel blade	8	2.1
12. Do you keep short nails?	No	78	20.6
	Yes	301	79.4
	Total (n)	379	100.0

4.6 Infection control

Table (5.4) presents AQU students and interns' responses regarding the responsibility of dental schools for implementing infection control protocols, willingness to implement infection control protocols, and interest in infection control workshops.

Table (5.4): Infection control Questions Summary

			Percent
		(*n*)	(%)
13. Are dental schools responsible for implementation of infection control protocols?	No	35	9.2
	Yes	344	90.8
14. Will you follow infection control in your future dental clinic?	No	16	4.2
	Yes	363	95.8
15. Have you attended/ wish to attend hands-on workshop on infection control?	No and don't wish to attend	26	6.9
	No but would like to attend	93	24.5

	more		
	Yes, and would like to attend more	229	60.4
	Yes, but don't wish to attend more	31	8.2
	Total (n)	379	100.0

4.7 Knowledge of Sterilization, risk of transmission and post-exposure actions

Table (6.4) shows the distribution of students and interns' responses regarding knowledge of sterilization procedures, autoclave operation, transmission risks of infectious diseases, and appropriate post-exposure actions. related to sterilization, risk of infection transmission and post exposure actions.

Table (6.4): Knowledge of Sterilization, risk of transmission, and post-exposure actions

		Percent
	(*n*)	**(%)**

16. What is the most effective method for sterilizing dental instruments?	Autoclave *	342	90.2
	Don't know	7	1.8
	Dry heat oven	18	4.7
	Washing with disinfectant	12	3.2
17. What is the minimum time required for sterilization in an autoclave?	10 minutes	67	17.7
	15 minutes *	222	58.6
	5 minutes	38	10.0
	Don't know	52	13.7
18. At what temperature does autoclave sterilization occur?	100°C	32	8.4
	120°C *	246	64.9
	150°C	56	14.8
	Don't know	45	11.9
19. Which of the following diseases has the highest transmission risk via saliva?	Don't know	46	12.1
	Hepatitis B Virus (HBV)*	217	57.3
	Human Immunodeficiency Virus (HIV)	74	19.5
	Tuberculosis	42	11.1
20. What is the risk of HIV transmission after a single contaminated needlestick injury?	0.1% – 0.4% *	103	27.2
	1% – 4%	55	14.5
	10% – 40%	54	14.2
	Don't know	167	44.1
21. What immediate action should be taken in case of direct blood contact with an HIV patient?	Administration of anti-HIV drugs *	86	22.7
	Administration of anti-HIV immunoglobulins	116	30.6
	Conducting blood tests	80	21.1
	Don't know	97	25.6
22. What immediate action should be taken in case of direct blood contact with an HBV patient?	Administration of anti-HBV drugs	57	15.0
	Administration of anti-HBV immunoglobulins	143	37.7
	Don't know	89	23.5
	Measure your HBV immunity level *	90	23.7
	Total	379	100.0

Note: * indicates the correct answer

4.8 Attitude Questions Responses

Table (7.4) presents the distribution of students and interns' attitude toward various infection control practices. The table includes sterilization, disinfection, patient management, and the role of artificial intelligence in promoting infection control.

Table (7.4): Attitude toward infection control practices and preventive measures

			Percent
		(*n*)	(*%*)
23. Artificial Intelligence (AI) and digital dentistry workflow have a positive impact on infection control.	Strongly Agree	56	14.8
	Agree	151	39.8
	Neutral	24	6.3
	Disagree	121	31.9
	Strongly Disagree	27	7.1
24. Dental clinics pose a higher risk for infection transmission compared to other medical settings.	Strongly Agree	22	5.8
	Agree	145	38.3
	Neutral	81	21.4
	Disagree	43	11.3
	Strongly Disagree	88	23.2
25. Oral mouth rinse before commencement of any treatment procedure can reduce transmission of oral infection.	Strongly Agree	39	10.3
	Agree	133	35.1
	Neutral	142	37.5
	Disagree	42	11.1
	Strongly Disagree	23	6.1
26. Ineffective dental instruments sterilization during clinical practice can transmit infection from one patient to another?	Strongly Agree	164	43.3
	Agree	106	28.0
	Neutral	58	15.3
	Disagree	29	7.7
	Strongly Disagree	22	5.8
27. Disinfection of dental chairs, units, and environmental surfaces is essential for infection control.	Strongly Agree	195	51.5
	Agree	95	25.1
	Neutral	19	5.0
	Disagree	54	14.2
	Strongly Disagree	16	4.2
28. I am willing to treat patients with HBV, HCV, or HIV under standard infection control precautions.	Strongly Agree	57	15.0
	Agree	123	32.5
	Neutral	116	30.6
	Disagree	52	13.7
	Strongly Disagree	31	8.2
29. Disinfection of dental impressions before sending them to the lab can reduce infection transmission.	Strongly Agree	104	27.4
	Agree	178	47.0
	Neutral	68	17.9
	Disagree	12	3.2
	Strongly Disagree	17	4.5
	Total	379	100.0

4.9 Practice Questions Responses

The following Table (8.4) shows students responses regarding the frequency of hand hygiene performance, use of antiseptic solutions, and compliance with PPE measures such as gloves, masks, eye protection, rubber dam use, and changing gloves between patients.

Table (9.4) presents the distribution of HBV vaccination status, number of vaccination doses received, and the incidence of needle-stick injuries among students and interns' categorized by the year of study and gender. The comparison was done using Chi-square and the significant *p*-value was set to < 0.05.

Tables 10 and 11 present the distribution of students and interns according to both marital status and year of study in relationship to their experience with needle-stick injuries. The table includes the percentages and the *p*-value of Chi-square test.

Table (8.4): Frequency of hand hygiene performance, use of antiseptic solutions, and compliance with PPE

		(*n*)	Percent (%)
30. How often Do you wash hands after contact with patient?	Always	254	67.0
	Often	54	14.2
	Sometimes	39	10.3
	Rarely	15	4.0
	Never	17	4.5
31. How often do you use plain soap or antiseptic solution for hand washing?	Always	215	56.7
	Often	72	19.0
	Sometimes	62	16.4
	Rarely	14	3.7
	Never	16	4.2
32. How often do you wear gloves while working in the dental clinic?	Always	316	83.4
	Often	17	4.5
	Sometimes	22	5.8
	Rarely	12	3.2
	Never	12	3.2
33. How often do you wear face masks while working in the dental clinic?	Always	258	68.1
	Often	41	10.8
	Sometimes	36	9.5
	Rarely	21	5.5
	Never	23	6.1
34. How often do you wear eye covers while working in the dental clinic?	Always	56	14.8
	Often	44	11.6
	Never	89	23.5
	Sometimes	102	26.9
	Rarely	88	23.2
35. How often do you use rubber dam during dental procedures?	Always	122	32.2
	Often	133	35.1
	Sometimes	100	26.4
	Rarely	15	4.0
	Never	9	2.4
36. How often do you change gloves between patients?	Always	325	85.8
	Often	14	3.7
	Sometimes	22	5.8
	Rarely	7	1.8
	Never	11	2.9
	Total	379	100.0

Table (9.4): HBV vaccination, vaccination doses and needle-stick injury among males and females' dental students

		4th year *n*= 219 %58			**5th year *n*=131 %34.3**			**Interns & specialty program *n*=29 %7.7**		
		Male *n*= 68 % 31.1	Female *n*= 151 % 68.9	*p*-value	Male *n*= 32 %24.4	Female *n*=99 %75.6	*p*-value	Male *n*=13 %44.8	Female *n*= 16 %55.2	*p*-value
HBV Vaccination	Yes	40 (58.8)	99 (65.5)	0.338	22 (68.8)	63 (63.6)	0.598	10 (76.9)	14 (87.5)	0.453
	No	28 (41.2)	52 (34.5)		10 (31.2)	36 (36.4)		3 (23.1)	2 (12.5)	
Number of Vaccination Dozes received	Didn't receive any dose	25 (36.8)	57 (37.7)	0.905	16 (50)	35 (35.4)	0.328	2 (15.4)	5 (31.3)	0.422
	Initial HBV doze only	25 (36.8)	51 (33.8)		10 (31.3)	38 (38.4)		4 (30.8)	6 (37.5)	
	Complete HBV vaccination	18 (26.4)	43 (28.5)		6 (18.7)	26 (26.2)		7 (53.8)	5 (31.2)	
Experienced Needle stick injury	Yes	16 (23.5)	46 (30.5)	0.292	16 (50)	47(47.5)	0.804	11 (84.6)	11 (68.8)	0.321
	No	52 (76.5)	105 (69.5)		16 (50)	52 (52.5)		2 (15.4)	5 (31.2)	

Table (10.4): Association between marital status and needle-stick injuries

			No	Yes	Total	*p*-value
Marital status	Married	Count	14	25	39	0.001
		% within 10. Have you ever experienced a needle stick injury?	35.8%	64.1%		
	Unmarried	Count	218	122	340	
		% within 10. Have you ever experienced a needle stick injury?	64.1%	35.8%		

Table (11.4): Incidence of needle stick injury based on year of study

			No	Yes	Total	*p*-value
Year of Study	4th year	Count	157	62	219	<0.001
		% within Year of Study	71.7%	28.3%		
	5th year	Count	68	63	131	
		% within Year of Study	51.9%	48.1%		
	Intern at a Specialty Program	Count	7	22	29	
		% within Year of Study	24.1%	75.9%		

4.10 Questionnaire's Reliability

The internal consistency of the questionnaire was evaluated using Cronbach's alpha. Table (12.4) shows full-scale reliability of 0.839. The internal consistency of each KAP domain is shown as well.

Table (12.*4)*: Reliability of the questionnaire domains

Construct	Number of items	Cronbach's Alpha
Knowledge	7	0.382
Attitude	7	0.806
Practice	7	0.800
Full Scale (Total)	21	0.839

4.11 Tests of Normal Distribution for KAP scores

The following Table (.4)13 summarizes the students and interns KAP scores including the range, minimum, maximum, mean, standard deviation, and variance.

Table (13.4): Descriptive statistics of knowledge, attitude and practice (KAP) scores

	N	Range	Minimum	Maximum	Mean	Std. Deviation	Variance
Knowledge score	379	7.00	0.00	7.00	3.45	1.42	2.02
Attitude score	379	4.00	1.00	5.00	3.65	0.74	0.55

Practice score	379	4.00	1.00	5.00	4.08	0.78	0.61

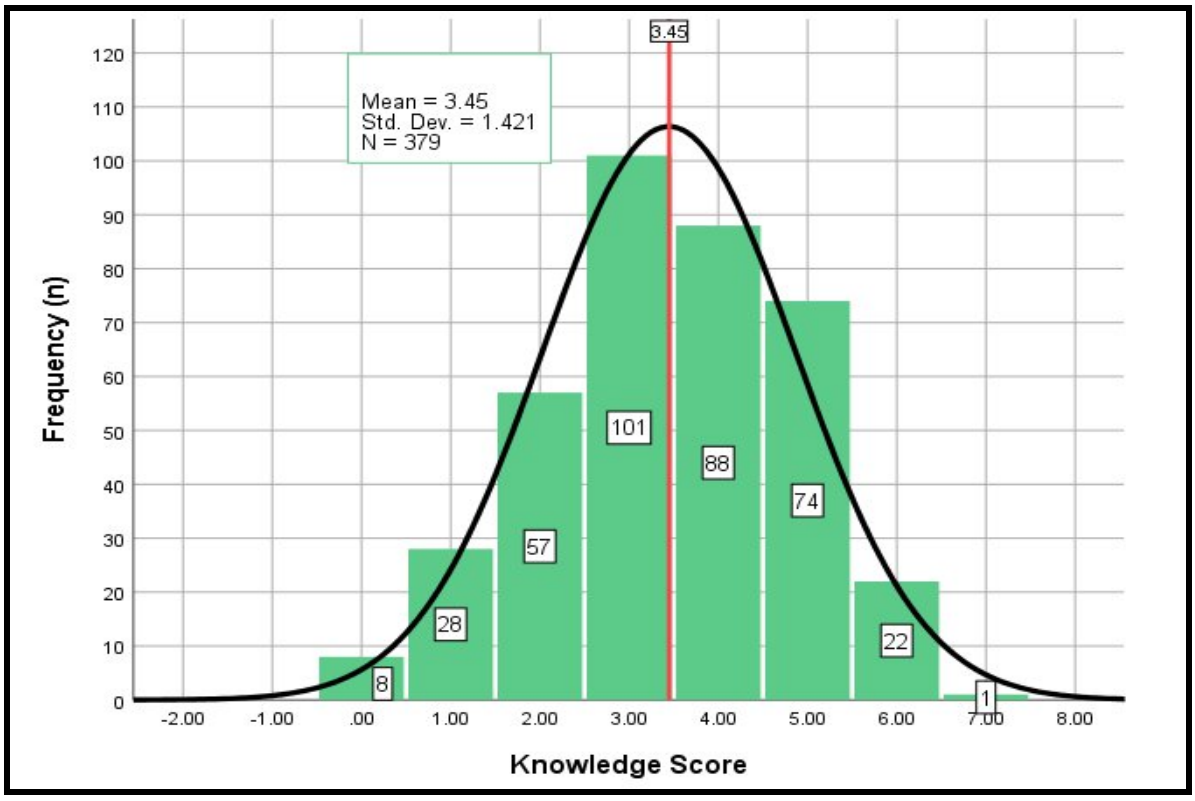


Figure (5.4): Distribution of knowledge score among AQU students and interns

The following Figures (5.4, 6.4, and7.4) present the frequency distribution of knowledge, attitude and practice scores among dental students and interns. The figures also show the mean, standard deviation, and the fitted normal curve.

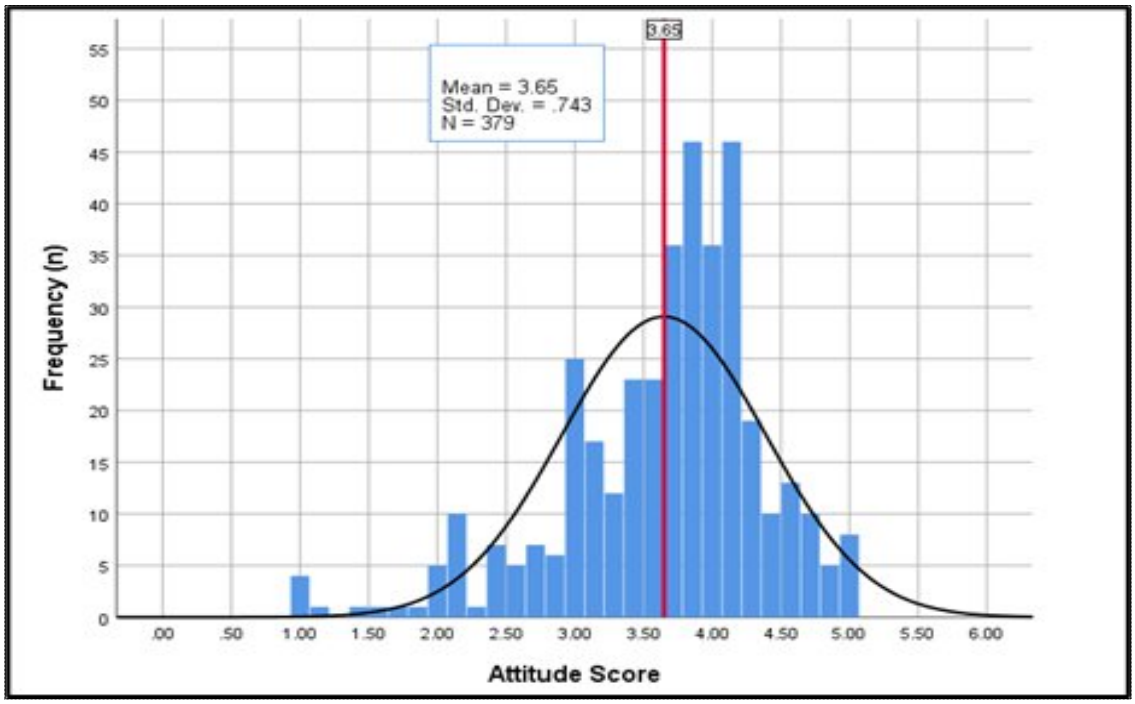


Figure (6.4): Distribution of attitude score among AQU students and interns

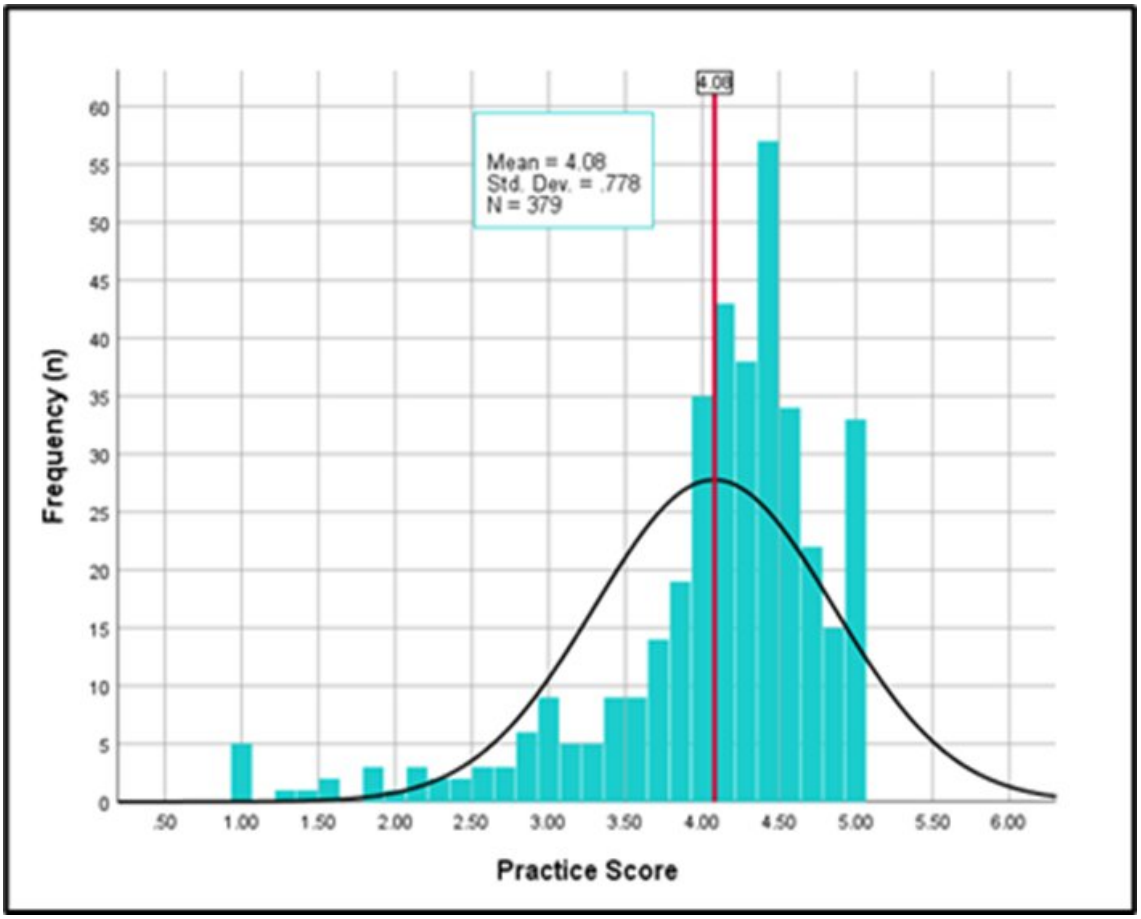


Figure (7.4): Distribution of Practice score among AQU students and interns

Table (14.4) presents the Kolmogorov-Samirov and Shapiro-Wilk tests that assess distribution normality of KAP scores.

Table (14.4): Tests of normality for KAP scores

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	***df***	***p*-value**	**Statistic**	***Df***	***p*-value**
Knowledge score	0.14	379	<0.001	0.95	379	<0.001
Attitude score	0.14	379	<0.001	0.94	379	<0.001
Practice score	0.19	379	<0.001	0.84	379	<0.001

Figures 8 to 10 show the Q-Q plots of knowledge, attitude, and practice scores. The normal Q_Q plot shows the relationship between the observed and expected normal values used to assess normal patterns. When approximately most data points align closely with the diagonal reference line, this indicates approximate normal distribution.

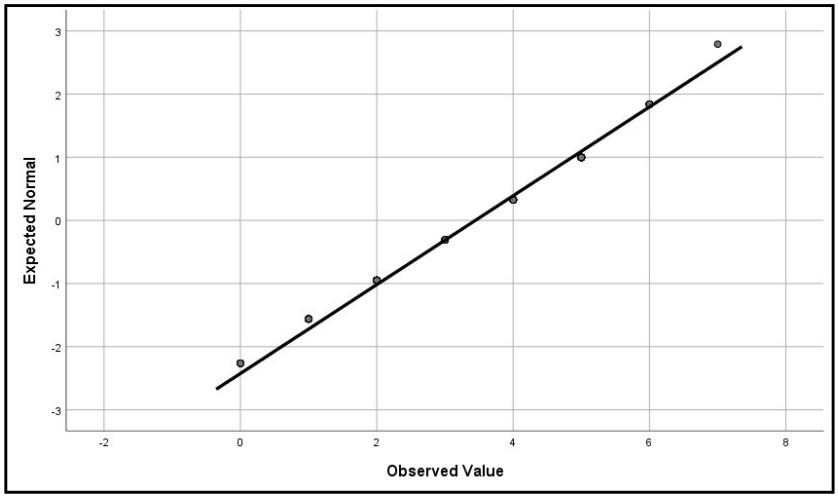


Figure (8.4): Normal Q-Q plot of knowledge score

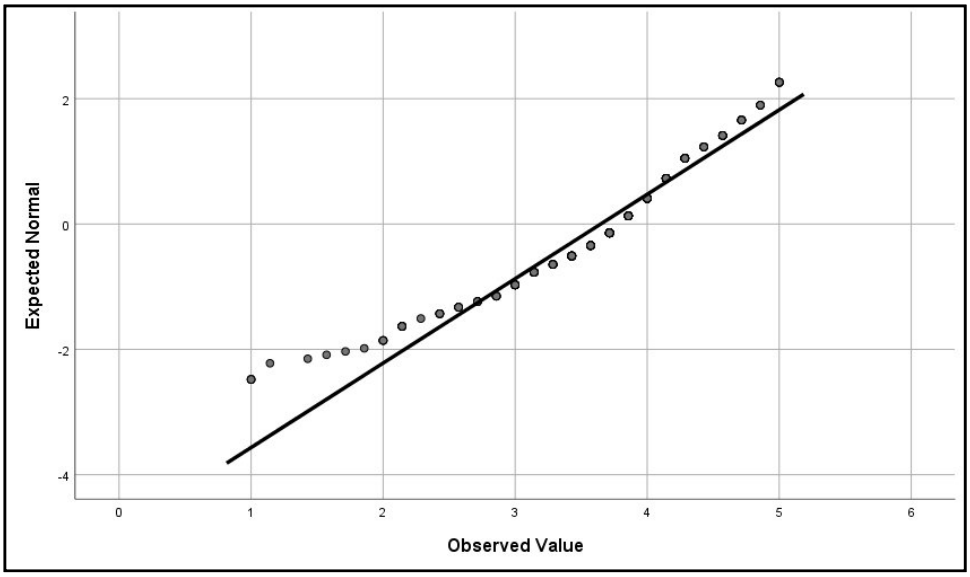


Figure (9.4): Normal Q-Q plot of attitude score

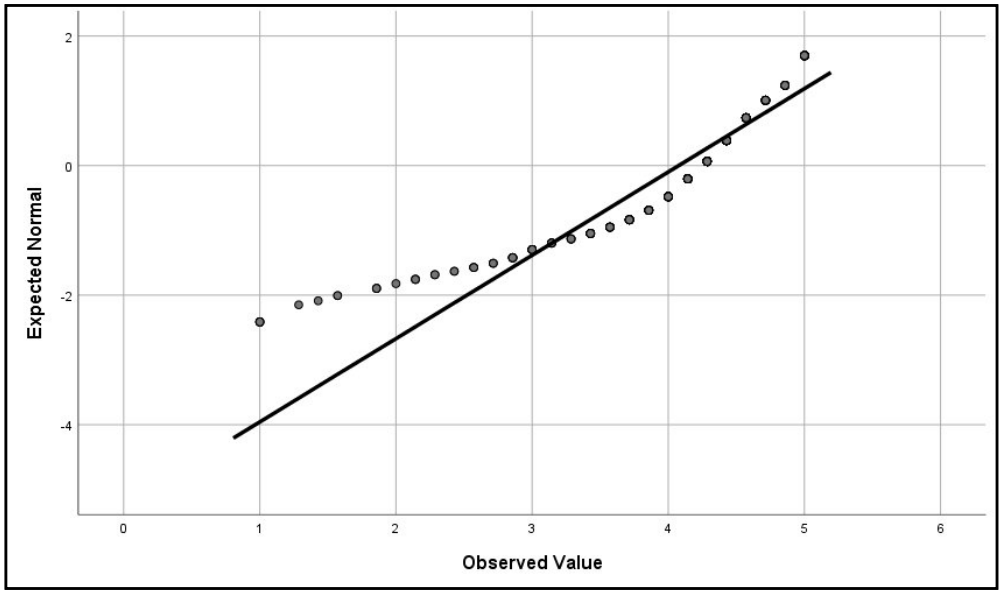


Figure (10.4): Normal Q-Q plot of practice score

4.12 Management of outliers in KAP scores

The boxplots for each of the KAP domains are shown below in Figures (11.4 to 13.4). In the box-and- whisker plot, the box represents the interquartile range (IQR), the line in the box center indicates the median score and the whiskers display the minimum and the maximum scores. Points that are appearing outside the whiskers are potential outliers.

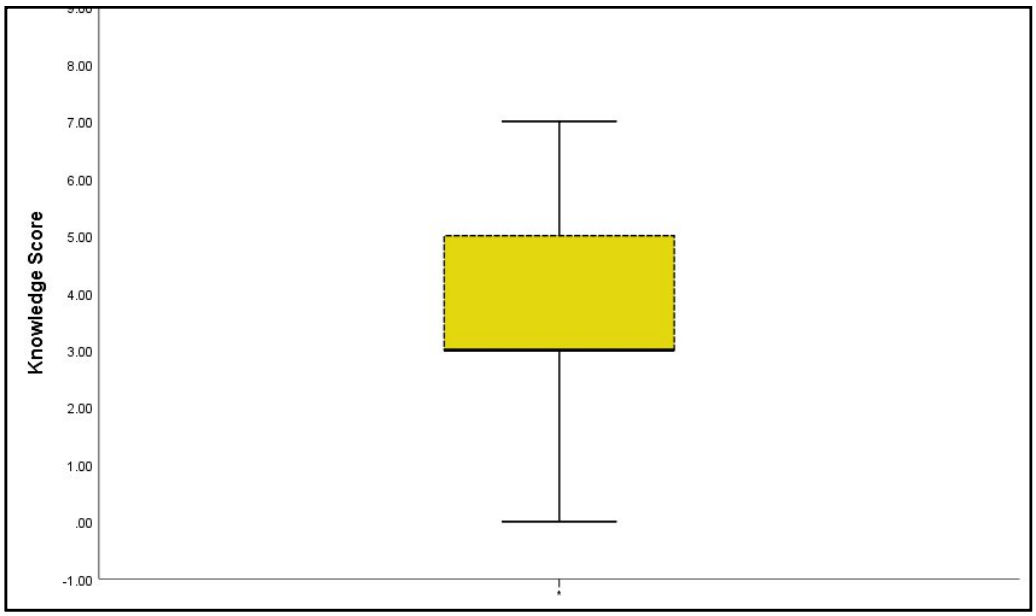


Figure (11.4): Boxplot of knowledge score among AQU students and interns

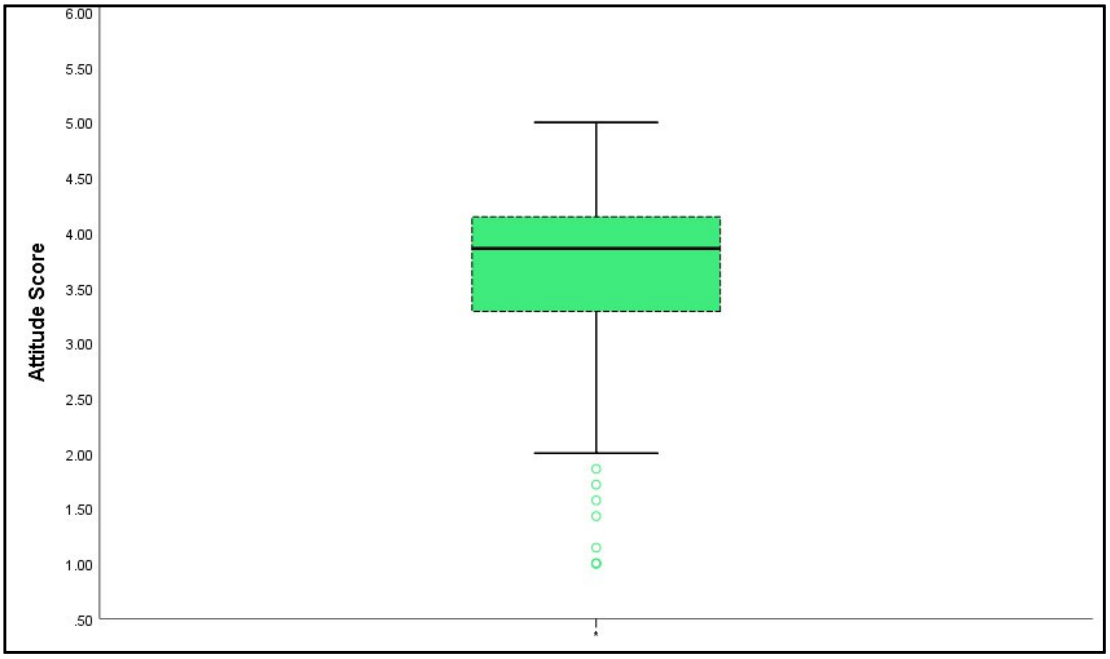


Figure (12.4): Boxplot of attitude score among AQU students and interns

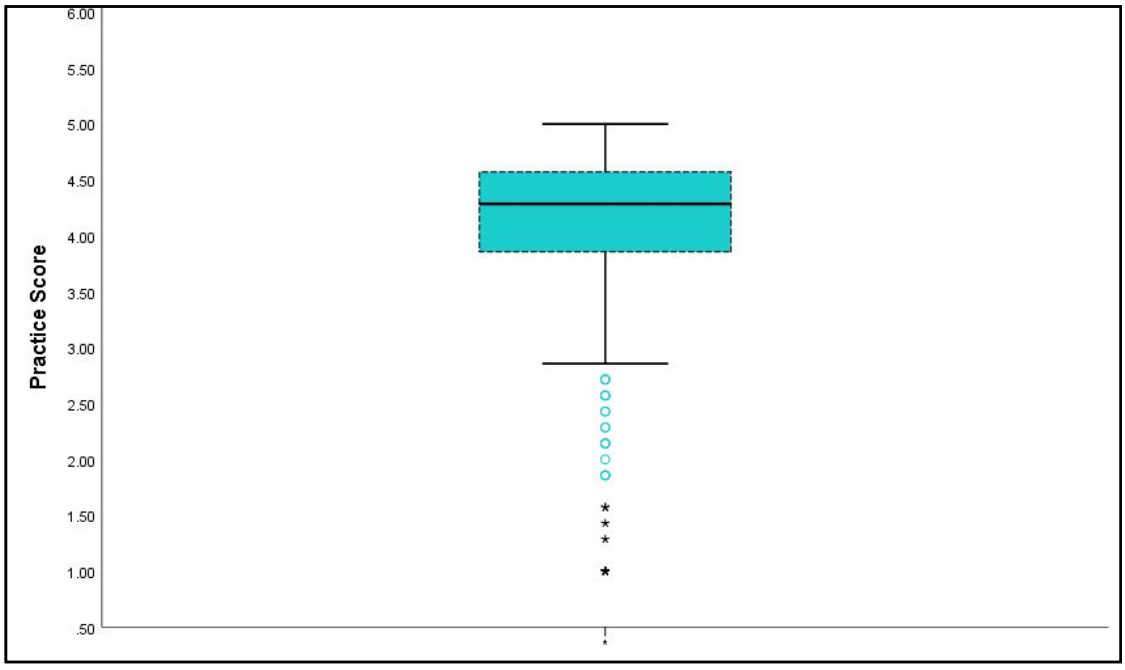


Figure (13.4): Boxplot of practice score among AQU students and interns

4.13 Distribution of KAP scores among students and interns

Figures (14.4 to 16.4) presents the distribution of all students and interns according to their level of knowledge, attitude, and practice (KAP) regarding infection control. Knowledge scores were based on the number of questions correctly answered (range 0 – 7). While attitude and practice scores were derived from 5 Likert-scale items (range 1-5). The cut-offs were determined by dividing score ranges into logical intervals, consistent with previous KAP research (Juttla et al., 2024). The knowledge scores were categorized based on the correct answers as poor (0-2), moderate (3-5), and good (6-7). Attitude scores were categorized as negative (1-2.33), neutral (2.34-3.66), and positive (3.67-5). Finally, practice scores were categorized as poor (1-2.33), moderate (2.34-3.66), and good (3.67-5).

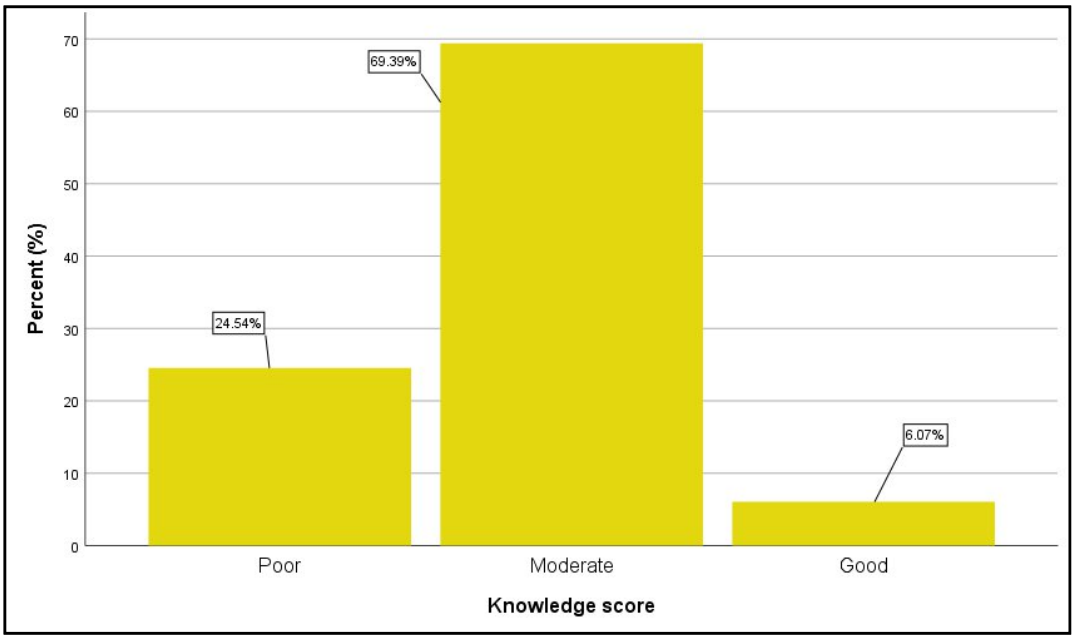


Figure (14.4): Knowledge scale among AQU students and interns

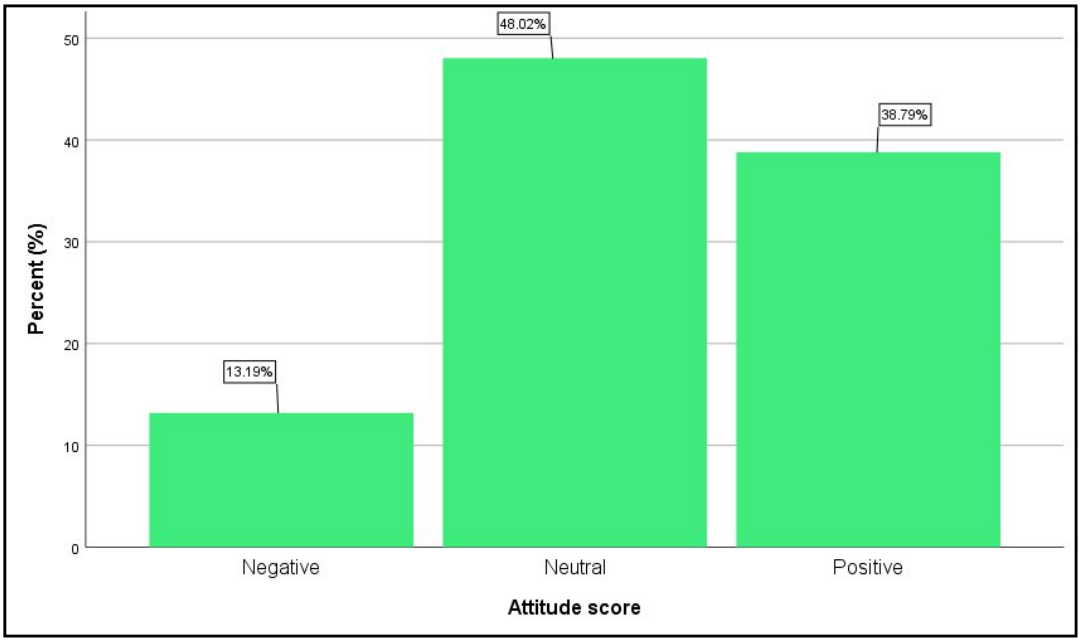


Figure (15.4): Attitude scale among AQU students and interns

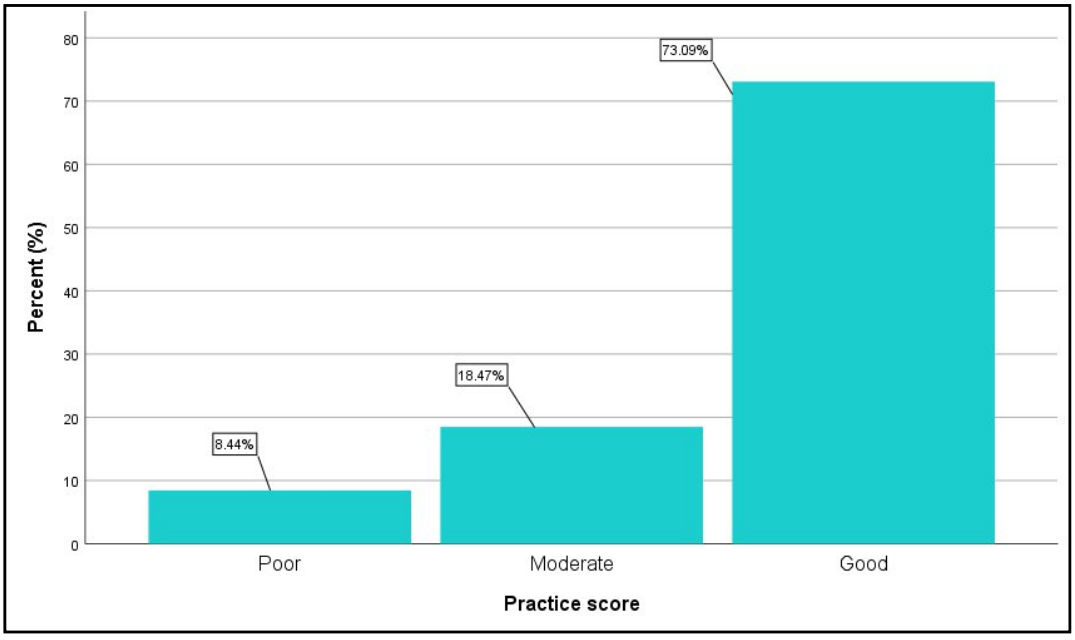


Figure (16.4): Practice scale among AQU students and interns

4.14 Comparison of KAP scores based on the year of study

Tables (**15 .4** to 17.4) show the comparison of KAP among students based on the year of study. Each table includes the year of study, percent (%), mean, standard deviation and *p*-value derived from ANOVA statistical test.

Table (15.4): Comparison of knowledge scores between students according to students' year of study

	N	**% of Total *N***	**Mean**	**Std. Deviation**	***p*-Value**
4th year	219	57.78	3.37	1.48	0.43
5th year	131	34.56	3.53	1.34	
Intern at a Specialty Program	29	7.65	3.66	1.29	

Table (16.4): Comparison of attitude scores between students according to students' year of study

	N	**% of Total *N***	**Mean**	**Std. Deviation**	***p*-value**
4th year	219	57.78	3.66	0.75	0.203
5th year	131	34.56	3.59	0.76	
Intern at a Specialty Program	29	7.65	3.86	0.52	

Table (17.4): Comparison of practice scores between students according to students' year of study

	N	% of Total *N*	Mean	Std. Deviation	*p*-value
4th year	219	57.78	4.08	0.85	0.394
5th year	131	34.56	4.04	0.70	
Intern at a Specialty Program	29	7.65	4.26	0.52	

4.15 Comparison of KAP scores based on gender

Tables (18.4 to 20.4) show the comparison of KAP among students based on gender. Each table includes the percentage (%), mean, standard deviation and *p*-value derived from independent-sample *t*-test.

Table (18.4): Comparison of Knowledge score based on students' gender

Gender	*N*	% of Total *N*	Mean	Std. Deviation	*p*-Value
Male	113	29.82	3.36	1.56	0.459
Female	266	70.18	3.48	1.36	
Total	379.	100.00	3.45	1.42	

Table (19.4): Comparison of attitude score based on students' gender

Gender	*N*	% of Total *N*	Mean	Std. Deviation	*p*-Value
Male	113	29.82	3.53	0.67	0.045
Female	266	70.18	3.70	0.77	
Total	379	100	3.65	0.74	

Table (20.4): Comparison of practice scores based on students' gender

Gender	*N*	% of Total *N*	Mean	Std. Deviation	*p*-value
Male	113	29.8%	3.90	0.86	0.006
Female	266	70.2%	4.15	0.73	
Total	379	100.0%	4.08	0.78	

4.16 Comparison of KAP scores based on marital status

In Tables (21.4 to 23.4), the comparison of KAP among students based on marital status is presented. Each table includes the percentage (%), mean, standard deviation, and *p*-value derived from independent-sample *t*-test.

Table (21.4): Comparison of knowledge scores based on students' marital status

Marital status	*N*	% of Total *N*	Mean	Std. Deviation	*p*-value
Married	39	10.3%	3.28	1.56	0.448
Unmarried	340	89.7%	3.46	1.41	
Total	379	100.0%	3.45	1.42	

Table (22.4): Comparison of attitude scores based on students' marital status

Marital status	*N*	% of Total *N*	Mean	Std. Deviation	*p*-value
Married	39	10.3%	3.96	0.48	< 0.001
Unmarried	340	89.7%	3.61	0.76	
Total	379	100.0%	3.65	0.74	

Table (23.4): Comparison of practice scores based on students' marital status

Marital status	*N*	% of Total *N*	Mean	Std. Deviation	*p*-value
Married	39	10.3%	4.29	0.69	0.077
Unmarried	340	89.7%	4.05	0.78	
Total	379	100.0%	4.08	0.78	

4.17 Comparison of KAP scores based on age

Tables (24.4 to 26.4) show the comparison of KAP among students based on their age. Each table includes the percentage (%), mean, standard deviation and *p*-value derived from ANOVA statistical test.

Table (24.4): Comparison of knowledge based on student's age

Age (Years)	*N*	% of Total *N*	Mean	Std. Deviation	*p*-value
19-23	327	86.3%	3.46	1.42	0.466
24-30	32	8.4%	3.16	1.42	
31-45	20	5.3%	3.60	1.47	
Total	379	100.0%	3.45	1.42	

Table (25.4): Comparison of attitude based on student's age

Age (Years)	*N*	% of Total *N*	Mean	Std. Deviation	*p*-value
19-23	327	86.3%	3.63	0.76	0.119
24-30	32	8.4%	3.60	0.71	
31-45	20	5.3%	3.98	0.45	
Total	379	100.0%	3.65	0.74	

Table (26.4): Comparison of practice based on student's age

Age (Years)	*N*	% of Total *N*	Mean	Std. Deviation	*p*-value
19-23	327	86.3%	4.06	0.78	0.047
24-30	32	8.4%	3.96	0.87	
31-45	20	5.3%	4.48	0.45	
Total	379	100.0%	4.08	.78	

4.18 Comparison of KAP scores based on vaccination status

The comparison of knowledge, attitude and practice among students based on their vaccination status is shown in Table (27.4). The table shows the number of vaccinated and unvaccinated students per KAP, the mean, standard deviation, and corresponding p-value derived from the independent-sample *t*-test.

Table (27.4): Comparing KAP scores for vaccinated and unvaccinated students

7. Have you received Hepatitis B Virus (HBV) vaccination?		*N*	Mean	Std. Deviation	*p*-value
Knowledge Score	No	131	3.18	1.58	0.009
	Yes	248	3.58	1.31	
Attitude Score	No	131	3.51	.79	0.010
	Yes	248	3.72	.71	
Practice Score	No	131	3.96	.87	0.031
	Yes	248	4.14	.72	

4.19 Summary of variables impacts on KAP scores

Table (28.4) summarizes the statistical significance (p-value) of the demographic and the experimental factors on KAP domains. The factors are displayed in the left column and the KAP domains in the first row. A *p*-value < 0.05 indicates that the factor had impact on the domain.

Table (28.4): Summary of factors impact on KAP scores

Variable	Impact on knowledge (*p*-value)	Impact on attitude (*p*-value)	Impact on practice (*p*-value)
Gender	Not significant (0.459)	**Significant (0.045)**	**Significant (0.006)**
Marita Status	Not significant (0.448)	**Significant (< 0.001)**	Not significant (0.077)
Age	Not significant (0.466)	Not significant (0.119)	**Significant (0.047)**
Year of study	Not significant (0.43)	Not significant (0.203)	Not significant (0.394)
HBV vaccination	**Significant (0.009)**	**Significant (0.010)**	**Significant (0.031)**
Needle stick injury	Not significant	Not significant	Not significant

4.20 Correlation between knowledge, attitude and practice (KAP)

The correlation between knowledge, attitude and practice (KAP) is shown in Table (29.4). The table shows the Pearson correlation coefficient (*r*) and the corresponding *p*-value. Correlation strength was interpreted based on the *r* value, while the correlation was considered significant at *p*-value < 0.01.

Table (29.4): Correlation between knowledge, attitude and practice scores

Variable pairs	N	Pearson Correlation (*r*)	*P*-value
Knowledge & Attitude	379	0.21** (weak)	<0.001 (significant)
Knowledge & Practice	379	0.21** (weak)	<0.001 (significant)
Attitude and Practice	379	0.53 ** (strong)	<0.001 (significant)

**. Correlation is significant at p-value <0.01

Figure (17.4)shows the KAP relationships. The color scale represents the strength of the correlation based on the Pearson correlation coefficient (*r*). Darker color tones signify a stronger positive correlation among the KAP domains.

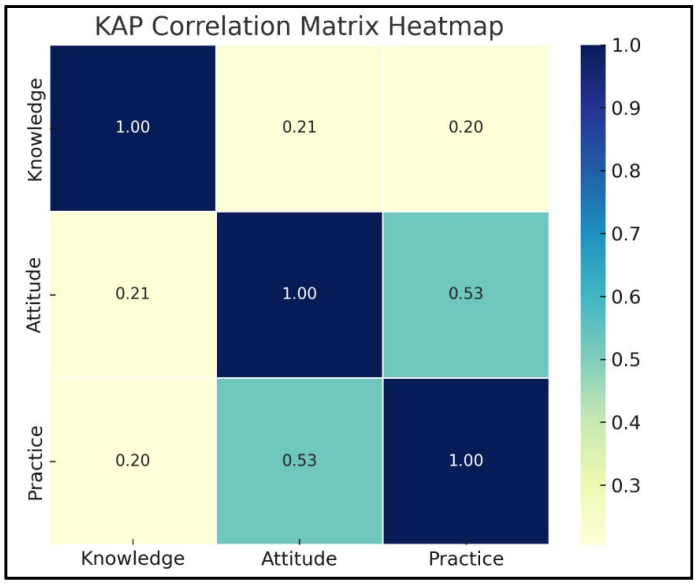


Figure (17.4): KAP correlation matrix heat map

Chapter Five

Discussion

In this chapter, the results of the study are discussed in accordance with the order of results presentation in the previous chapter four.

5.1 Response Rate

Table (1.4) illustrates the distribution of students and interns according to their academic level. The predominant group consisted of fourth-year students, representing 58.0% (*n* = 219) of the sample, while fifth-year students accounted for 34.3% (*n* = 130). Although interns of the AQU specialty program were a minority, 7.7% (*n* = 29), almost all of them participated in the survey.

This study's response rate was markedly higher than the response rate reported among dental students by El-Saaidi et al. (2021) in Egypt (60.1%).

5.2Respondents' demographics

In Table (2.4) and Figure (4.4), a total of 379 dental students and interns were engaged in this study. The predominant demographic of participants was females, comprising 69.9% (*n* = 265), and males constituted 30.1% (*n* = 114). This finding was in contrary to Asif et al. (2018) in Saudi Arabia where the predominant demography were males (82%), perhaps due to the limited opportunities for females to join dental clinics there.

Concerning level of education, most students were in their fourth year (58.0%, n = 219), followed by fifth-year students (34.3%, *n* = 130), and a minor group of interns in the specialty program (7.7%, *n* = 29).

A significant majority of the students were unmarried (89.7%, *n* = 340), whereas only 10.3% (*n* = 39) were married. The age distribution indicated that most respondents were aged 19 to 23 years (86.3%, *n* = 327), followed by those aged 24 to 30 (8.4%, *n* = 32), and a minor group aged 31 to 45 (5.3%, n = 20).

5.3 Hepatitis B virus (HBV) Vaccination

In Table (3.4), of the 379 individuals, the replies about HBV-related practices were as follows. Approximately 50.1% of participants (n = 190) indicated that they had tested their HBV antibody level prior to starting clinical training, while 49.9% (n = 189) stated that they had not. This finding was relatively higher than reviewed studies such as Halboub et al. (2015) in Yemen, where only a small portion (9.5%) of students tested their immunity level. Another study in Pakistan reported similar findings, where only 3.8% out of 130 students checked their immunity levels following complete vaccination (Khattak et al., 2022). It is important to note that serological testing reflects awareness of immunity status rather than vaccination coverage itself.

At Al-Quds University (AQU), the Faculty of Dentistry adheres to a strict infection control protocol that requires all dental students and interns to undergo anti-HBs Ab titer testing before starting clinical training, regardless of their vaccination status. This policy was established to verify that students have sufficient protective immunity prior to engaging in clinical training.

Of the students who participated in the study, only 82 participants (21.6%) reported a protective antibody titer level above 10 IU. Notably, 225 participants (59.4%) were unaware of their HBV antibody titer levels, and 72 participants (19.0%) stated that they had not performed titer testing before receiving HBV vaccination. As these responses were self-reported, they may reflect misunderstanding of the questionnaire rather than actual deviation from institutional policy. A significant proportion of students (n = 247, 65.2%) reported that they had received the HBV vaccine, whereas 132 students (34.8%) indicated that they had not. This vaccination rate was similar to that reported by El-Saaidi et al. (2021) in Egypt but lower than findings from Saudi Arabia reported by Alharbi et al. (2019), where vaccination coverage reached 93.1%.

Given that hepatitis B vaccination has been routinely provided at birth in Palestine since 1992, most dental students are expected to have received primary vaccination during early infancy. At the age of one year, 92.2% of Palestinian children were found immune to HBV, with anti-HBs Ab titers exceeding 100 mIU/ml (Qawasmi et al., 2015). Therefore, self-reported non-vaccination should be interpreted with caution. Qawasmi et al. (2015) demonstrated that although vaccine-induced protective antibody titers decrease progressively with age, immunological memory remains preserved and can be efficiently restored with a single booster dose. In addition, several studies have shown that WHO universal hepatitis B vaccination programs for infants result in long-term vaccination coverage and a marked reduction in HBV transmission, supporting the assumption that most students in the present study were immunized early in life (Chen et al., 1987).

Accordingly, in this study, the proportion of students who reported that they had not received HBV vaccination most likely reflected misunderstanding of vaccination and immunity-related questions rather than true non-vaccination. These students likely meant that they had not received a booster dose, rather than lacking primary vaccination, as their immunity from early childhood vaccination was sufficient and did not require booster administration. This interpretation is consistent with the Palestinian national childhood immunization program and the findings of Qawasmi et al. (2015), which confirmed the persistence of immune memory among individuals vaccinated during early childhood. Conversely, students who reported receiving the HBV vaccine most likely referred to having received a booster dose, and the proportion of these students was relatively similar to the percentage of individuals who were expected to require booster administration, as reported by Qawasmi et al. (2015).

Only 105 participants (27.7%) reported completing the entire HBV vaccination schedule, including the booster dose. In contrast, 139 participants (36.7%) reported having received no vaccination dose, while 135 participants (35.6%) stated that they had received only the initial dose. This pattern further suggests misinterpretation of vaccination terminology, given that HBV vaccination at birth has been obligatory in Palestine since 1992 and that most students in this cohort were born after that year. Consequently, most students would be expected to have completed primary vaccination during infancy, and booster doses would only be required for a limited subgroup. These findings indicate a misconception among students regarding their vaccination history and highlight a gap in knowledge related to immunization and post-vaccination follow-up.

Of the students surveyed, 257 (67.8%) indicated a willingness to receive the HBV vaccine if it were not mandatory, whereas 122 (32.2%) expressed refusal to

receive it. This willingness suggests generally positive attitudes toward vaccination despite gaps in knowledge and documentation.

In past section the findings showed a clear gap in the students' perception regarding vaccination and infection control. Similar findings were reported in Romania by Dinca et al. (2024) and in Greece by Antoniadou et al. (2025).

5.4 Sharp Injury and Nail Hygiene

In Table (4.4), among the 379 students, 38.8% (n = 147) reported experiencing a needle stick injury during their clinical training, while 61.2% (n = 232) indicated they had not encountered this incidence. This was lower than previously reported by El-Saaidi et al. (2021) where about 60% experienced needle injury. Among the injured, needles were the major source, representing 33.0% (n = 125) of cases. Burs accounted for 9.2% (n = 35), scaler tips for 3.4% (n = 13), and scalpel blades for 2.1% (n = 8). Although the proportion of scalpel blade injuries was relatively low, such injuries remain clinically significant due to the elevated risk of bloodborne pathogen transmission and often occur during instrument handling or disposal. 198 participants (52.2%) ensured that they had never experienced any injuries from sharp tools.

Needles in this study represented the major source of students and interns' injuries. This finding was previously highlighted by Pinelli et al. (2016). It is believed that needles are frequently used during dental procedures and that manual recapping, along with limited clinical experience among students, are contributing factors to this finding (Huang et al., 2023). These observations emphasize the importance of reinforcing safe needle-handling practices during clinical training**.**

The majority of students (79.4%, n = 301) reported maintaining short nails, an advisable infection prevention approach, while 20.6% (n = 78) of participants claimed they did not keep their nails short. However, the persistence of sharp injuries despite good nail hygiene suggests that personal protective behavior alone are insufficient to prevent occupational exposure. This finding highlights the need for structured practical training, closer clinical supervision, and clear sharps injury reporting and post-exposure management protocols.

5.5 Infection Control

In Table (5.4) a predominant 90.8% of students (*n* = 344) believed that universities are responsible for implementing infection control protocols, while only 9.2% (*n* = 35) of the participants opposed this view. When questioned regarding their future intentions, 95.8% (*n* = 363) of students confirmed they would adhere to infection control protocols in their future dental practices, whereas only 4.2% (*n* = 16) stated they would not. Concerning training, 60.4% (*n* = 229) of participants reported prior attendance at a hands-on workshop on infection prevention and indicated a desire to participate in more sessions. An additional 24.5% (*n* = 93) of participants had not yet participated in such a workshop but expressed a desire to do so.

A minority of participants (8.2%, *n* = 31) attended a workshop but showed interest in future training workshops. In contrast, 6.9% of participants (n = 26) indicated that they had neither attended a workshop nor shown interest in participating in one. These data indicate robust support for infection control education and compliance among dentistry students and interns of the specialty program at Al-Quds University (AQU).

5.6 Knowledge

In Table (6.4); most students (90.2%, *n* = 342) accurately recognized the autoclave as the most efficient method for sterilizing dental instruments. This high percentage was observed by Sign et al. (2011) and Menawi et al. (2021) who both found about 94% autoclave use in their studies. A minor percentage chose inappropriate methods, including dry heat ovens (4.7%, *n* = 18), washing with disinfectants (3.2%, *n* = 12), or exhibited uncertainty (1.8%, *n* = 7).

Concerning the minimum required duration for autoclave sterilization, 58.6% (*n* = 222) of participants accurately identified 15 minutes, whereas others selected for 10 minutes (17.7%, *n* = 67), 5 minutes (10.0%, *n* = 38), or were uncertain (13.7%, *n* = 52). Assessment of the minimum required sterilization time was included to evaluate students' knowledge of the lowest acceptable exposure necessary to ensure effective sterilization, as the time lower than the assigned duration limits in this study is a common cause of sterilization failure in clinical environment. In the same manner, 64.9% (*n* = 246) of participants accurately recognized 120°C as the usual sterilizing temperature, while others provided inaccurate numbers such as 100°C (8.4%) or 150°C (14.8%), and 11.9%of the participants indicated

uncertainty. Comparable results were reported by Signh et al. (2011) in India as 87.4% of students identified 15 minutes and 96.4% 120°C as the correct answer.

The majority of students (57.3%, *n* = 217) accurately recognized Hepatitis B Virus (HBV) as the most prevalent risk for disease transmission via saliva. This finding aligns with Halboub et al. (2015) and Signh et al. (2011). Regarding the chance of HIV transmission following one needlestick injury, only 27.2% (*n* = 103) provided the right response (0.1%–0.4%), but a significant percentage (44.1%, *n* = 167) indicated "don't know." Comparable knowledge deficiencies regarding HIV transmission were noted by Asif et al. (2018) and Alharbi et al. (2019) who reported that less than one-third of dental students identified the true HIV risk of transmission.

Regarding the questions about the appropriate response to direct blood exposure to an HIV patient, only 22.7% (*n* = 86) of participants accurately identified the administration of anti-HIV drugs, which constitute post-exposure prophylaxis (PEP) and should be initiated promptly following occupational exposure, while others selected wrong responses such as anti-HIV immunoglobulins (30.6%), blood tests (21.1%), or expressed uncertainty (25.6%). In relation to exposure to HBV-positive blood, 23.7%of the participants accurately identified that the initial action should involve measuring HBV immunity levels. However, 37.7% (*n* = 143) of the participants said that immunoglobulin administration was essential, 15.0% (*n* = 57) selected antiviral medicine administration, and 23.5% (*n* = 89) indicated "don't know." Similar knowledge gaps were reported in Egypt and Saudi Arabia were less than one-third of students accurately identified the correct use of PEP following exposure to HIV or HBV.

These findings highlight a gap in knowledge regarding infection prevention methods and post-exposure management among dental students at AQU.A similar gap was identified in Romania by Dincă et al. (2024) who reported that students showed poor knowledge of viral transmission risk. In addition, Anteneh et al. (2019) in Ethiopia had also found that merely 30% of the dental students had knowledge for anti-HIV drugs and post-exposure prophylaxis (PEP).

5.7 Attitude

Table (7.4) shows attitude questions. Students revealed variation in their attitude regarding infection control protocols. Concerning the influence of AI technology, 39.8% (*n* = 151) agreed and 14.8% (*n* = 56) strongly agreed that artificial intelligence (AI) and digital incorporation will positively influence infection control, while 31.9% (*n* = 121) maintained a neutral position. A minority expressed

disagreement (6.3%, *n* = 24) or extreme disagreement (7.1%, *n* = 27). This finding was better than Amiri et al.'s (2024) findings in Iran where students hesitated to use AI despite its benefits.

Regarding the risk of infection transmission in dental clinics compared to other clinical settings, 38.3% (n = 145) of students agreed and 5.8% (n = 22) strongly agreed, while 21.4% (n = 81) were neutral, and 34.5% showed varying degrees of disagreement. This variation proposes differences in students' understanding of risks rather than denial of infection risk, as dental environments involve aerosol generation and short distance of patient contact.

Perspectives on preventive actions also differed among students. For example, 35.1% (*n* = 133) agreed and 10.3% (*n* = 39) agreed that oral mouth rinse prior to treatment reduces infection transmission, however 37.5% (*n* = 142) maintained a neutral attitude. Additionally, 43.3% (*n* = 164) strongly agreed and 28.0% (*n* = 106) agreed that inadequate instrument sterilization may lead to cross-infection among patients. Disinfection of dental chairs and surrounding surfaces showed robust approval, with 51.5% (*n* = 195) strongly agreeing and 25.1% (*n* = 95) agreeing on its significance for infection control.

Concerning ethical and clinical perspectives, 15.0% (*n* = 57) strongly agreed and 32.5% (*n* = 123) agreed that they were prepared to treat patients with HBV, HCV, or HIV amid standard precautions, while 30.6% (*n* = 116) remained neutral and 21.9% expressed a degree of disagreement. This was similar to the findings of Asif et al. (2018) in Saudi Arabia, where students showed fear of infected patients, as only 40.2% agreed compared to 47.5% in our study. These results indicate an attitude concern rather than a clear refusal to provide care for infected patients. This highlights the need for encouraging students' ethical principles and confidence in standards of infection control protocols. This finding shows a gap in students' attitude towards infected patients' treatment, which highlights the need to improve their knowledge of infection control standards. Similar points were noted among students in Yemen where Halboub et al. (2015) reported that less than half of students were willing to treat infectious patients.

Ultimately, most students recognized the significance of disinfection in laboratory impressions, with 47.0% (*n* = 178) agreeing and 27.4% (*n* = 104) strongly agreeing that cleaning dental impressions prior to laboratory submission can mitigate infection transmission. This insight was reported by Binassfour et al. (2024) in Saudi Arabia where 79% of dental students emphasized the need to disinfect dental impressions. Similarly, Al-Sharif and Husseini (2023) reported comparable awareness of impressions disinfection among Palestinian dentists.

5.8 Practice

Table (8.4) shows the practice questions responses. Students indicated different levels of compliance with standard infection control protocols in healthcare environments. A majority of 67.0% (*n* = 254) of the participants said that they consistently wash their hands following patient interaction, while 14.2% (*n* = 54) of the participants indicated that they do it often. A minority acknowledged washing their hands sometimes (10.3%, *n* = 39), rarely (4.0%, *n* = 15), or never (4.5%, *n* = 17).

In response to questions on handwashing with regular soap or antiseptic solutions, 56.7% (*n* = 215) of students indicated "always," and the remaining students varied from "often" (19.0%) to "never" (4.2%). This finding was better compared to the findings of Qamar et al. (2020) in Pakistan where around 50% of students consistently washed their hands.

The use of gloves was notably high, with 83.4% (*n* = 316) indicating they always wear gloves, and 85.8% (*n* = 325) confirming that they consistently change gloves between patients. A minority reported poor practices, with 2.9% (*n* = 11) never changing gloves between patients and 3.2% (*n* = 12) never using gloves during procedures. These finding highlights excellent students' practice regarding gloves use, which was similar to findings among Iraqi students (98.2%) in Salih, (2021). It is important to point out that the Faculty of Dentistry at Al-Quds University applies a strict infection control protocol on students and staff, this protocol demands the use of gloves and their replacement between each patient without exception. This policy is implemented throughout clinical training and prohibits any deviations under all circumstances. Therefore, the minimal percentage of "never" responses reported in this study is unlikely to be related to true clinical practice. Instead, these responses were due to students misunderstanding of the question, a misinterpretation of the answer options, or completing the questionnaire without sufficient concentration.

Concerning face mask usage, 68.1% (*n* = 258) of students consistently wore masks in the dental clinic, while an additional 10.8% (*n* = 41) often did so. Nonetheless, 6.1% (*n* = 23) of students acknowledged that they never wore face masks. This finding was higher than for students in Yemen (53.8%) according to Halboub et al. (2015) but lower than for Asif et al. (2018) who found higher compliance to face masks (93%).

Eye protection was inconsistently used, with only 14.8% (*n* = 56) of students constantly using eye covers, 23.5% (*n* = 89) of students never using them, and 26.9% (n = 102) indicating occasional use. This finding was similar to Halboub et

al. (2015), Dagher et al. (2017), and Asif et al. (2018) who reported reduced eye cover usage as 14%,43% and 22% respectively. This pattern suggests that eye protection may be perceived as less critical compared to gloves and masks, despite its importance in preventing exposure to splashes and aerosols.

Regarding the utilization of rubber dams in dental treatments, 32.2% (*n* = 122) of students constantly used them, while 35.1% (*n* = 133) indicated regular usage. Nonetheless, 26.4% (*n* = 100) of students utilized it occasionally, and 2.4% (*n* = 9) indicated that they never used it. Mohan et al. (2024) found that the student's actual usage of rubber dams was limited due to time constraints and that students perceived them inconvenient.

Overall, the practice responses among AQU students reflected a high students' compliance to infection control protocols particularly with glove and mask usage. On the other hand, students' responses revealed gaps in few practices like constant eye protection and rubber dam use. Similarly, this was reported by Mohan et al. (2024) and Halboub et al. (2015), among Indian and Yemini students where adherence to basic PPE was high but lower for advanced protective tools such as eye protection and rubber dams. These findings highlight the need for focused clinical supervision and practical reinforcement of advanced PPE use and basic protective equipment.

5.9 HBV vaccination, vaccination doses and needle-stick injury among male and female dental students

In Table (9.4), a comparative analysis was conducted to assess the pattern of HBV vaccination status among students, the number of doses administered, and the incidence of needle stick injuries among students across various academic years and between genders. In this group of fourth-year students, 58.8% of males and 65.5% of females reported being vaccinated against HBV, with no statistically significant difference seen ($p = 0.338$). Similar trends were noted among fifth-year students (68.8% of males against 63.6% of females, $p = 0.598$) and interns (76.9% of males versus 87.5% of females, $p = 0.453$). These findings indicated relatively high and similar vaccination rates regardless of students'gender. Given that hepatitis B vaccination has been part of the national Palestinian immunization program since 1992, these results are an indicator of students' lack of awareness

of their vaccination history rather than true absence of immunization. The reviewed studies in the literature had not reported differences in this manner as well (Signh et al., 2011; Halboub et al., 2015).

According to students' gender, no significant differences in the number of HBV vaccination doses received were seen across academic years. In the fourth year, 36.8% of males and 37.7% of females did not receive any dose (p = 0.905), and the proportions of individuals who had received only the initial dose or completed the full series were similarly aligned. This pattern is another indicator of students misunderstanding of their vaccination history and dose classification, particularly that most students have received infant immunization. Among fifth-year students and interns, comparable non-significant differences were noted (all Chi-square p-value> 0.3), indicating a general consistency in vaccination behaviors across the three-year groups. This finding is in line with previous reports from Yemen, Saudi Arabia and Iraq (Halboub et al., 2015; Asif et al., 2018; Salih, 2021).

Regarding incidents of needle stick injuries, 23.5% of male and 30.5% of female fourth-year students reported such incidents (p = 0.292). In fifth-year students, the injury rate was 50% for males and 47.5% for females (p = 0.804). In interns, the injury rates were higher for males at 84.6% compared to 68.8% for females, however; this difference was not statistically significant (Chi-square p value = 0.321). The data indicate no statistically significant variations in HBV vaccination status, doses completion rates, or incidence of needle stick injuries throughout genders and academic year's level. It is important to note that the student's vaccination status did not appear to influence their injuries occurrence, this highlights the need for strict compliance to standard precautions regardless of immunization history. These findings are in line with prior reports investigated the occupational needle-stick injuries in dental clinics (Halboub et al., 2015; Asif et al., 2018; Salih, 2021). In addition, the evaluation of participants' awareness of post-exposure management revealed that not all students were sufficiently aware of the correct immediate procedures to take following a needle-stick injury, especially in case of HBV or HIV exposure.

In Table (10.4) an examination of the association between marital status and the incidence of needle stick injuries revealed a statistically significant relationship (Chi-square p-value =0.001). Of the three hundred seventy-nine students, 17.0% (n = 25) of those who reported a needle stick injury were married, whereas only 6.0% (n = 14) of those who did not have such an injury were married. On the other hand, 94.0% (n = 218) of students with no injuries were unmarried, and 83.0% (n = 122) of those who suffered injuries were unmarried. This finding indicates that

married individuals were more likely to report needle stick injuries compared to their unmarried academic peers; however, additional research is required to examine possible contributing variables.

In Table (11.4), the association between academic year and the incidence of needle stick injury was statistically significant ($p< 0.001$), suggesting that the probability of injury increased with clinical practice progression. Among fourth-year students, 28.3% ($n = 62$) reported experiencing a needle stick injury, whereas 48.1% ($n = 63$) of fifth-year students and 75.9% ($n = 22$) of students in internship of specialization programs reported the same. In contrast, 71.7% of fourth-year students, 51.9% of fifth-year students, and only 24.1% of interns didn't have a similar injury. The findings indicate a unique phenomenon: as students advance in clinical training, their exposure to possible occupational risks such as needle stick injuries markedly increases. This phenomenon was strongly supported by previous studies of Salih (2021), El-Saaidi et al. (2021), and Saleem et al. (2023).

5.10 Questionnaire's Reliability

Because Cronbach's alpha applies to continuous and numerical data, it was used in this study exclusively for questions that assessed knowledge, attitude, and practice. For 21 elements, the Cronbach's Alpha value is 0.839, indicating good internal consistency (Table 12.4). The reliability of this study questionnaire was stronger than that reported in Singh et al. (2011), and El-Saaidi et al. (2021).

Cronbach's Alpha is frequently used to evaluate the internal consistency of scale-based items, but its applicability to knowledge questions with binary scores (correct/incorrect) is frequently disputed. In contrast to attitude or perception scales, which are often designed to measure a single underlying latent construct, knowledge varies in substance and difficulty, internal consistency may not be a relevant statistic for knowledge questions. In many situations, a low Cronbach's Alpha indicates the diverse nature of knowledge assessment rather than indicating bad test quality. As a result, many statisticians believe that item difficulty and discrimination indices may be more suitable metrics for assessing the quality of knowledge tests and that reliability analysis using Cronbach's Alpha is not necessary (Tavakol & Dennik, 2011).

The difficulty index gives respondents an idea of how difficult each knowledge question is by calculating the percentage of respondents who properly answered each item. Items should ideally be moderately challenging, with 30% to 80% of correct answers, as this range optimizes the item's capacity to distinguish between people with high and low knowledge levels (Tarrant et al., 2009). Four of the seven knowledge items in the current study (Annexed Questions 17-20) came within or

close to this optimal range, suggesting a balanced degree of difficulty. However, 90.2% of participants correctly answered Question 16, indicating that it might be too simple and not have much of an impact on response performance differentiation. On the other hand, less than 30% of respondents correctly answered three things (Annexed Questions 20-22), indicating that they were extremely difficult. Although these difficult questions might cover important but less familiar material, their high difficulty index have caused inconsistent response pattern which led to the weakness of the knowledge Cronbach's Alpha (α = 0.30).

5.11 Tests of normal distribution for KAP scores

Table (13.4) shows the descriptive statistics of knowledge, attitude, and practice (KAP) scores across 379 participating AQU dentistry students indicating diverse levels of awareness and compliance with infection control procedures. The knowledge scores varied from 0 to 7, with a mean of 3.45 (±1.42), signifying intermediate knowledge overall. The attitude scores varied from 1 to 5, with a mean of 3.65 (±0.74), indicating predominantly favorable views toward infection management. Practice scores exhibited the highest average, with a mean of 4.08 (±0.78), indicating a significant level of self-reported compliance with infection control procedures. The relatively small standard deviations among all three domains indicate a moderate heterogeneity of responses in the sample. These findings are in line with KAP results of similar studies conducted in the region. Mohan et al. (2024) reported that Indian dental students had moderate knowledge but positive attitudes and good practices. The studies in Saudi Arabia (Alharbi et al., 2019; Asif et al., 2018) reported moderate dental students' knowledge, positive attitudes and good practices.

Figures (5.4 to7.4) show the distribution of knowledge, attitude and practice. There were clear trends in the participants' knowledge, attitude, and practice score distribution. A broad range within the sample was reflected in the knowledge scores, which were roughly normally distributed (M = 3.45, SD = 1.42). Practice scores (M = 4.08, SD = 0.78) and attitude scores (M = 3.65, SD = 0.74) were skewed toward the higher end, suggesting regular adherence to advised practices and primarily positive attitudes.

The Shapiro-Wilk and Kolmogorov-Smirnov tests were run to evaluate the data distributions' normality (Table 14.4). These tests determine whether a variable's observed distribution differs noticeably from a normal distribution. When the p-value is higher than 0.05, it suggests that the data are normal and not significantly different from it. To support the interpretation, normal Q-Q plots were also visually

examined (Figures 8-10). The appropriateness of using parametric statistical analysis for this study was assessed using both statistical and graphical plots.

Utilizing the Shapiro-Wilk and Kolmogorov-Smirnov tests, the data's normality was evaluated. The findings of both tests were statistically significant ($p< 0.05$) for each of the three variables (Knowledge, Attitude, and Practice), suggesting that the data distributions differ considerably from normality. At the same time, the visual deviations in the attitude and practice scores were not significant, and their Q–Q plots displayed near-linear patterns. As a result, parametric statistical tests were considered suitable for further examination. The application of parametric tests is supported by the large sample size (N = 379). The Central Limit Theorem states that even with slight skewness, parametric approaches are sufficiently stable since the sampling distribution of the mean tends toward normality as sample size grows (Field, 2024; Pallant, 2020).

5.12 Management of outliers in KAP scores

Boxplots, sometimes referred to as box-and-whisker charts, offer a brief overview of continuous data distribution. They display important statistics such as the interquartile range (IQR), which shows the middle 50% of the data, the median, which shows the midpoint of the data, whiskers, which illustrate the typical distribution of scores, and outliers, which are values that significantly differ from the rest of the data.

Figure (11.4) shows a knowledge score boxplot; the median score, which is between 3.0 and 3.5, indicates that half of the individuals received scores higher than this and half lower than it. There is moderate variation in knowledge levels, as indicated by the interquartile range (IQR), which roughly ranges from 3.0 to 5.0. Most values lie within the range indicated by the whiskers, which stretch from roughly 0 to 7.A tiny triangle (▲) indicates the presence of a single moderate outlier that is situated at zero. An outlier is a result that is either above the 75th percentile (Q3) or more than 1.5 times the IQR below the 25th percentile (Q1). Despite its mildness, this outlier refers to response number 8, although this student has 0 knowledge, he has an optimal practice score (5.0) and neutral attitude (3.29).

In Figure (12.4), the attitude boxplot; the respondents' generally optimistic views are reflected in the median attitude score, which is between 3.9 and 4.0. The core 50% of responses appear to be closely grouped, as indicated by the IQR, which broadly runs from 3.3 to 4.3. The whiskers show a reasonably wide range of attitudes, extending from about 2.0 to 5.0. Below 2.0, a few mild outliers can be seen (e.g., values like 1.5 or 1.0). These are those who have substantially less

favorable opinions about the topic under study. Although most students express positive attitudes, the existence of few low outliers suggests that the distribution is right-skewed, with a minority having more negative opinions. This could draw attention to regions that require focused attitude-change efforts.

The boxplot practice score in Figure (13.4); most students express frequent or strong adherence to recommended procedures, as indicated by the median practice score of about 4.2. Most scores are closely clustered at the upper end of the IQR, which ranges from roughly 4.0 to 4.5. Most of the lower scores are captured by the whiskers, which drop to about 3.0. The distribution of practice scores skews to the right, with a major portion of students falling far below the norm and a large concentration of respondents demonstrating good self-reported practice. These outliers might be people who don't comprehend excellent practices or who encounter structural obstacles when trying to apply them.
In summary, several mild and extreme outliers were found during the initial data screening process, which involved looking at boxplots for the Knowledge, Attitude, and Practice (KAP) scores, especially in the Practice domain. After examining each of these outliers separately in the dataset, no anomalies or data entry mistakes were found. It was decided to keep these results in the final analysis because of the relatively high sample size (N = 379), as well as the fact that parametric tests are typically resistant to the impact of outliers in large samples. By including these data points, the sample's heterogeneity and integrity are maintained, and significant variations in participant responses are not carelessly dropped out. Also, since the removal of the outliers from the boxplot of knowledge, attitude, and practice had no significant impact on the actual results, and as all outliers were reviewed and no data entry errors were discovered, it was decided to retain them in the analysis as a naturally occurring variation.

5.13 Distribution of KAP scores among students

In Figure (14.4), a few participants showed an advanced level of true knowledge, with the great majority falling into the category of moderate knowledge. The low percentage in the "Good" category suggests that additional focused training or educational initiatives may be required. This situation was also observed for students of Egypt (El-Saaidi et al., 2021), Saudi Arabia (Alharbi et al., 2019), India (Singh et al., 2011), Peru (Silva-Robles et al., 2025) and Romania (Dincă et al., 2024)).

In Figure (15.4), only 38.79 % of students had distinctly positive attitudes, compared to nearly half who had neutral attitudes. Although less significant, the

13% with Negative views could indicate a subgroup that lacks motivation or is unwilling to change their attitude. This pattern points to a possibility to use engagement and awareness strategies to shift negative and neutral attitudes toward more positive orientations. Compared to previous studies, Al-Quds student's neutral attitude was lower than attitude observed in El-Saaidi et al. (2021), Alharbi et al. (2019) and Singh et al. (2011).

About figure (16.4), although students showed moderate knowledge and neutral attitude; around 73% of students are good practitioners. Nearly three-quarters of students reported having good practical habits in the Practice area, which exhibits the most optimistic trend. This is an important result that might be an outcome of Al-Quds University institutional procedures. Nonetheless, a significant minority is still represented by the remaining 26.91% with poor or moderate practice. To guarantee that everyone in the population behaves consistently, intervention strategies may be required. These findings of good practice align with findings in previous studies in El-Saaidi et al. (2021) in Egypt, Singh et al. (2011) in India, Salih (2021) in Iraq, Asif et al. (2018) in Saud Arabia and Azhar et al. (2022) in Pakistan.

5.14 Comparison of KAP scores based on the year of study

In Table (15.4), although the mean of knowledge is higher for interns than in the fifth year than fourth year, the Analysis of Variance (ANOVA) shows no significant variation between groups according to the year of study with a *p*-value 0.43. This finding contradicts the findings of El-Saaidi et al. (2021) and Alharbi et al. (2019) who reported higher knowledge in earlier academic years, fourth and third year respectively.

In Table 16, although the mean of attitude is higher for interns than for fifth year and fourth year; the Analysis of Variance (ANOVA) shows no significant variation between groups according to the year of study with a *p*-value 0.203. This finding aligns with Singh et al. (2011) but again contradicts the findings of El-Saaidi et al. (2021) and Alharbi et al. (2019) who reported higher attitude in earlier academic years, fourth year and third years respectively.

In Table (14.7), although the mean of practice is higher for interns than fifth year and fourth year; the Analysis of Variance (ANOVA) shows no significant variation between groups according to the year of study with a *p*-value 0.394. this finding also contradicts the same studies of El-Saaidi et al. (2021) and Alharbi et al. (2019) who reported higher practice in earlier academic years, fourth- and third year respectively.

5.15 Comparison of KAP scores based on gender

In Table (18.4), both males and females have almost the same knowledge; the independent-sample *t*-test indicated no significant variation with a *p*-value 0f 0.459. This finding was consistent with the findings of previous studies (Halboub et al., 2015; Mohan et al.,2024; Asif et al.,2018).
In Table (19.4), females have higher attitude than males; the independent-sample t test indicated a significant variation with a *p*-value of 0.045. This finding was similar to Mohan et al. (2024) and Asif et al. (2018).
In Table (20.4), females are better practitioners than males, their mean is higher. The independent-sample *t*-test showed a significant variation with a *p*-value of 0.006. This observation aligns to the findings of El-Saaidi et al. (2021) and Al-Quds University (2017).

5.16 Comparison of KAP scores based on marital status

Table (21.4) shows no significant knowledge variation among students based on marital status; independent-sample *t*-test showed *p*-value of 0.448. On the other hand, in Table 22, married students showed a higher attitude compared to unmarried people. The Independent-sample*t*-test showed a significant *p*-value of 0.012. In Table 23 there was no significant practice variation among married and unmarried students. The independent-sample *t*-test showed a *p*-value of 0.077. The majority of students and interns in the sample were unmarried, which limited the comparison of knowledge, attitudes, and practices about cross-infection between married and unmarried participants.

5.17 Comparison of KAP scores based on student's age

In Table (24.4) there was no significant knowledge variation among age groups. The ANOVA test showed a *p*-value of 0.466. In Table 25 there was no significant attitude variation among age groups, the ANOVA test showed a *p*-value of 0.119. Eventually, Table 26 shows a significant practice variation among age groups as the oldest group has the highest practice score. The ANOVA test showed a *p*-value of 0.047. This finding was also reported by the Al-Sharif and Husseini (2023) Palestinian study. The predominant age group of students and interns in the sample was 18-23 years, which limited a precise comparison of their knowledge, attitudes, and practices regarding infection control.

5.18 Comparison of KAP scores based on vaccination status

In Table (27.4), there was a significant KAP score variation between vaccinated and unvaccinated students. Vaccinated students had significant higher knowledge,

practice, and attitude. The independent-sample *t*-test showed *p*-value <0.05 for the three KAP domains. This finding is directly supported by Antoniadou et al. (2025) in Greece.

5.19 Summary of variables' impacts on KAP scores

In Table (28.4), analysis of variables indicated that gender significantly influenced attitude (p = 0.045) and practice (p = 0.006) scores, but not knowledge. Marital status influenced attitude score (p< 0.001), but it did not significantly impact knowledge or practice. Age shown a notable association with practice (p = 0.047) but not with knowledge or attitude. HBV vaccination status was highly associated with all KAP constructs: knowledge (p = 0.009), attitude (p = 0.010), and practice (p = 0.031), suggesting its significant effect on infection control. Meanwhile, the year of study and experience with needle stick injuries did not show any statistically important impact on any of the KAP constructs. These findings were in line with previous studies which identified that gender and vaccination status are valid predictors of infection control attitudes and practice (Asif et al., 2018; Alharbi et al., 2019; Mohan et al., 2024).

5.20 Correlation between Knowledge, Attitudes, and Practice (KAP)

In Table (29.4), there was a significant correlation between knowledge, attitude and practice with a *p*-value<0.001. The strongest correlation is between attitude and practice with a Pearson Correlation (r) 0.53. These findings were supported by Singh et al. (2011) who observed significant attitude and practice correlation (r=0.2). The correlation in our study was stronger.

In Figure (17.4), The heatmap shows the correlations among knowledge, attitude, and practice scores. A moderate positive association was identified for attitude and practice scores (r = 0.53), suggesting that students with more positive attitudes toward infection control are likely to demonstrate improved practices. On the contrary, knowledge had only weak relationships with both attitude (r = 0.21) and practice (r = 0.20). These findings indicate that although knowledge may not significantly affect behavior, attitude is more essential to ensure successful infection control practices. Similar KAP correlations were observed in previous studies where attitude appeared as the most determinant of infection control practices.

(Asif et al., 2015; Mohan et al. 2024; Halboub et al., 2015).

Chapter Six

Conclusions

This study enhances the understanding of knowledge, attitudes, and practices regarding infection control among fourth and fifth-year dental students and interns at Al-Quds University. Overall, participants exhibited moderate knowledge, a good attitude, and favorable practices with infection control standards. The findings indicate a promising basis for infection prevention teaching at the AQU dental faculty.

Knowledge did not vary considerably among demographic groups. The moderate students and interns' knowledge level (mean = 3.45/7) which indicates that although students mastered the fundamental principles of sterilization and cross-infection control, their knowledge of post-exposure prophylaxis and the transmission risk associated with HBV and HIV was inadequate.

Students and interns demonstrated a positive attitude (mean = 3.65/5), indicating an understanding of their professional responsibilities and infection prevention.

The mean score of 4.08/5 in practice suggests favorable compliance, particularly in hand hygiene, glove usage, and sterilization via autoclave systems. However, the study identified unsatisfactory adherence to eye protection and rubber dams' utilization. The interns' and female participants demonstrated greater compliance to cross-infection protocols.

Vaccinated students' and interns showed better KAP scores compared to their unvaccinated peers. Although most students and interns' hold a documentation of hepatitis B vaccination, the study revealed that 59.4% of students and interns were unaware of their immune status, specifically about anti-HBs antibody levels. The reported prevalence of sharp and needlestick injuries (38.8%) emphasizes the necessity for an organized immunization follow-up and sharps injuries and management system as well.

The analysis of data across categories revealed a significant relationship between knowledge, attitude and practice, suggesting that augmenting students' motivation and perceived responsibility may result in favorable behavioral enhancement.

Concerning the influence of AI technology, a total of 54.6% of students agreed and strongly agreed that artificial intelligence (AI) and digital dentistry incorporation will positively influence infection control.

In summary, students and interns at Al-Quds University (AQU) dental faculty have shown great understanding and compliance with infection control protocols; however, their adherence to advanced PPE such as eye covers and rubber dams remains unsatisfactory.

Chapter Seven

Recommendations

The findings of this study can be utilized in clinical dental practice to support quality assurance procedures that ensure the constant application of infection control guidelines. Employing these findings to inform staff training, supervise students, and monitor compliance with infection control policies might mitigate occupational exposure risks and improve patient safety in dental clinics.

Based on the current study findings and comparative evidence from regional and international research, the following recommendations are proposed. Adopting these recommendations can enhance national standards to align with international accreditation systems and elevate the preparedness of Palestinian dental professionals for global practice.

1. Workshops and stimulations should be integrated among dental students and interns to increase students' knowledge of HBV, HCV and HIV, PEP management.

2. Protocols for post-exposure management should be available and onsite especially for prophylaxis in accordance with WHO and CDC recommendations. A detailed management system must be established to guarantee that students have immediate guidance, supervision, and follow-up after needle-stick injuries, with emphasis on reinforcing their understanding of suitable post-exposure protocols during clinical training.

3. Cross-disciplinary collaboration, integration of medical, nursing, and laboratory science faculties, and cooperative infection control initiatives to create a culture of collective responsibility.

4. AI tools and digital dentistry applications are preferably utilized and integrated in infection control applications and training.

5. The current questionnaire used in this study can be used as a tool for further studies concerning infection control protocols in higher educational institutions.

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Appendices

Appendix(A). Survey Questionnaire

Dear Students/Interns

This questionnaire is a tool to assist in conducting a study on knowledge, attitude, and practices to combat cross infection among dental students and specialty interns at Al-Quds University. This study is one of the requirements for obtaining a master's degree being supervised by the College of Public Health at Al-Quds University- Palestine.

Thank you for participating in the survey. There is no need to include participant's details such as names, and we assure you that no personal information will be accessed or disclosed in any materials or research for future publications.

By completing this questionnaire, you implicitly agree that the questionnaire has been explained in an understandable and clear language and that you voluntarily participated in this study. All your inquiries will be answered, assuring you that your identity will remain anonymous.

Purpose of the study

This descriptive cross-sectional study will evaluate the knowledge, attitudes, and practices of infection control protocols among dental students and interns at Al-Quds University in Palestine. The survey is comprised of thirty-six questions. For any inquiries, please contact us via the following email:

Student: Manal Ayyad

Email: manal.ayyad@students.alquds.edu

Advisor: Prof. Ra'ed Abu Hantash

Head Department of Conservative Dentistry and Periodontics/ Faculty of Dentistry

Al- Quds University- Palestine

Email: rhantash@staff.alquds.edu

Please attempt to answer all the following questions with a single answer.

SECTION A: DEMOGRAPHY

1. Year of Study
    - ☐ 4th year
    - ☐ 5th year
    - ☐ Intern at a Specialty Program

2. Gender
    - ☐ Male
    - ☐ Female

3. Marital status:
    - ☐ Married
    - ☐ Unmarried

4. Age (Years):
    - ☐ 19-23
    - ☐ 24-30
    - ☐ 31-45

Section B: Vaccination

5. Have you ever performed a serological test for HBV antibodies before your clinical stage?

    - ☐ Yes
    - ☐ No

1. If yes, what was your HBV titer level (IU)?
    - ☐ Below 10 IU
    - ☐ Above 10 IU
    - ☐ Didn't perform titer level
    - ☐ Don't know

7. Have you received Hepatitis B Virus (HBV) vaccination?

    - ☐ Yes
    - ☐ No

8. If yes, how many doses have you received?

    - ☐ Didn't receive any dose
    - ☐ Initial HBV dose only
    - ☐ Complete HBV vaccination (initial &booster dose)

9. Would you go for HBV vaccination if it was not obligatory?

☐ Yes
☐ No

10. Have you ever experienced a needlestick injury with a contaminated instrument?

☐ Yes
☐ No

11. If yes, the source of injury?

☐Needle
☐Scalpel blade
☐Burs
☐Scaler tips
☐Never injured

12. Do you keep short nails?

☐ Yes

For the following questions, please select the option that best reflects the current guidelines or your understanding of infection control in dental clinics.

13. Are dental schools responsible for implementation of infection control protocols?

☐ Yes
☐ No

14. Will you follow infection control in your future dental clinic?

☐Yes
☐ No

15. Have you attended/ wish to attend hands-on workshop on infection control?

☐Yes and would like to attend more
☐Yes but don't wish to attend more
☐No but would like to attend more

☐No and don't wish to attend

Section C: Knowledge

16. What is the most effective method for sterilizing dental instruments?

☐ Autoclave

☐ Dry heat oven

☐ Washing with disinfectant

☐ Don’t know

17. What is the minimum time required for sterilization in an autoclaveat 121 °C?

☐ 5 minutes

☐ 10 minutes

☐ 15 minutes

☐ Don’t know

18. At what temperature does steam autoclave sterilization occur?

☐ 100°C

☐121°C

☐ 150°C

☐ Don’t know

19. Which of the following diseases has the highest transmission risk via saliva?

☐ Hepatitis B Virus (HBV)

☐ Human Immunodeficiency Virus (HIV)

☐ Tuberculosis

☐ Don't know

20. What is the risk of HIV transmission after a single contaminated needlestick injury?

☐ 0.1% – 0.4%

☐ 1% – 4%

☐ 10% – 40%

☐ Don't know

21. What immediate action should be taken in case of direct blood contact with an HIV patient?

☐ Administration of anti-HIV immunoglobulins

☐ Administration of anti-HIV drugs

☐ Conducting blood tests

☐ Don't know

22. What immediate action should be taken in case of direct blood contact with an HBV patient?

☐ Administration of anti-HBV immunoglobulins

☐ Administration of anti-HBV drugs

☐ Measure your HBV immunity level

☐ Don't know

Section D: Attitudes

Please indicate your level of agreement with each statement using the following 5-point Likert scale:

☐ Strongly Disagree ☐ Disagree ☐ Neutral ☐ Agree ☐ Strongly Agree

23. Artificial Intelligence (AI) and digital dentistry workflow have a positive impact on infection control.?

☐ Strongly Disagree

☐ Disagree

☐ Neutral

☐ Agree

☐ Strongly Agree

24. Dental clinics pose a higher risk for infection transmission compared to other medical settings.

☐ Strongly Disagree

☐ Disagree

☐ Neutral

☐ Agree

☐ Strongly Agree

25. Oral mouth rinse before commencement of any treatment procedure can reduce transmission of oral infection.

☐ Strongly Disagree

☐ Disagree

☐ Neutral

☐ Agree

☐ Strongly Agree

26. Ineffective dental instruments sterilization during clinical practice can transmit infection from one patient to another?

☐ Strongly Disagree

☐ Disagree

☐ Neutral

☐ Agree

☐ Strongly Agree

27. Disinfection of dental chairs, units, and environmental surfaces is essential for infection control.

☐ Strongly Disagree

☐ Disagree

☐ Neutral

☐ Agree

☐ Strongly Agree

28. I am willing to treat patients with HBV, HCV, or HIV under standard infection control precautions.

☐ Strongly Disagree

☐ Disagree

☐ Neutral

☐ Agree

☐ Strongly Agree

29. Disinfection of dental impressions before sending them to the lab can reduce infection transmission.

☐ Strongly Disagree

☐ Disagree

☐ Neutral

☐ Agree

☐ Strongly Agree

Section E: Practices

For the following questions, please indicate the frequency of your actions using this 5-point Likert frequency scale:

☐ Never ☐ Rarely ☐ Sometimes ☐ Often ☐ Always

30. How often Do you wash hands after contact with patient?

☐ Never

☐ Rarely

☐ Sometimes

☐ Often

☐ Always

31. How often do you use plain soap or antiseptic solution for hand washing?

☐ Never

☐ Rarely

☐ Sometimes

☐ Often

☐ Always

32. How often do you wear gloves while working in the dental clinic?

☐ Never

☐ Rarely

☐ Sometimes

☐ Often

☐ Always

33. How often do you wear face masks while working in the dental clinic?

☐ Never

☐ Rarely

☐ Sometimes

☐ Often

☐ Always

34. How often do you wear eye covers while working in the dental clinic?

☐ Never

☐ Rarely

☐ Sometimes

☐ Often

☐ Always

35. How often do you use rubber dam during dental procedures

☐ Never

☐ Rarely

☐ Sometimes

☐ Often

☐ Always

36. How often do you change gloves between patients?

☐ Never

☐ Rarely

☐ Sometimes

☐ Often

☐ Always

Appendix (B): Ethical Approval

Al-Quds University
Jerusalem
School of Public Health

جامعة القدس
القدس
كلية الصحة العامة

التاريخ: 18/2/2025
الرقم: REF.10/25

عزيزتي الطالبة منال عياد المحترمة
برنامج ماجستير السياسات والادارة الصحية

الموضوع: موافقة لجنة اخلاقيات البحث العلمي

قامت اللجنة الفرعية لأخلاقيات البحث التابعة لكلية الصحة العامة بمراجعة مشروع الرسالة بعنوان:
"Knowledge, Attitude and Practices of Infection Control Protocols Among Dental Students and Interns at Al-Quds University"

المقدم من (مشرف البحث/د. رائد هنطش).
يعتبر مشروعك مستوفيًا لمتطلبات أخلاقيات البحث في جامعة القدس.
نتمنى لكم كل التوفيق في مسير المشروع.
ملاحظة: في حالة الحاجة الى موافقة من اللجنة المركزية في الجامعة، نصطبع التقدم باستخدام هذه الموافقة على الرابط https://research.alquds.edu/en/ethics/48-how-to-apply.html

رئيسة اللجنة الفرعية لاخلاقيات البحث
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Appendix (C): Questionnaire Validation Reviewers

Names of experts who reviewed the questionnaire for content validity:

Name	University	Email address
Dr. Rana Darwish	Faculty of Dentistry at Al-Quds University	rdarwish@staff.alquds.edu
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Prof. Ra'ed Abu Hantash	Al- Quds University	rhantash@staff.alquds.edu

المعرفة والمواقف والممارسات المتعلقة ببروتوكولات مكافحة العدوى بين طلاب طب الأسنان والمتدربين في جامعة القدس

إعداد: منال علي ضيف الله عياد

اشراف: البروفسور رائد ابوهنطش

الملخص

الخلفية:

تُعدّ مكافحة العدوى موضوعًا أساسيًا في تعليم طب الأسنان، نظرًا لارتفاع خطر الإصابة بالعدوى في البيئات السريرية. يُعدّ طلاب طب الأسنان والمتدربون من بين مُقدّمي رعاية الأسنان الأولية خلال مرحلة تدريبهم السريري، ونتيجةً لذلك، يُعتقد أن معارفهم ومواقفهم وممارساتهم (KAP) تؤثر بشكل كبير على سلامة صحة المريض والمجتمع من العدوى المتبادلة.

الهدف:

هدفت هذه الدراسة إلى تقييم معارف ومواقف وممارسات مكافحة العدوى بين طلاب طب الأسنان في السنة الرابعة والخامسة والمتدربين في برنامج التخصص في جامعة القدس. قيّمت الدراسة تأثير المتغيرات الديموغرافية، مثل سنة الدراسة، الجنس، الحالة الاجتماعية، العمر، والتطعيم ضد فيروس التهاب الكبد الوبائي ب (HBV)، على معارف ومواقف وممارسات مكافحة العدوى (KAP) وبحثت الدراسة الفجوات بين هذه المعارف والممارسات السريرية الفعلية.

المنهجية:

أُجريت دراسة وصفية مقطعية باستخدام استبيان ذاتي مُعتمد من الأدبيات السابقة ومعايير منظمة الصحة العالمية/مراكز السيطرة على الأمراض والوقاية منها (WHO/CDC) لمكافحة العدوى في بيئات طب الأسنان. تم التحقق من صحة الاستبيان من قِبل خبراء داخليين وخارجيين في جامعة القدس. ووُزِّع الاستبيان عبر الإنترنت كنموذج جوجل على 400 طالب مؤهل. وبلغ إجمالي الردود 379 ردًا (معدل الاستجابة = 94.8%). حُلِّلت البيانات المُجمَّعة باستخدام برنامج SPSS الإصدار 26. وشملت اختبارات تحليل البيانات المطبقة إحصاءات وصفية، مثل المتوسط والانحراف المعياري، وإحصاءات استدلالية شملت اختبارات مربع كاي، واختبارات t للعينات المستقلة، وتحليل التباين، ومعامل ارتباط بيرسون.

النتائج:

أظهرت النتائج مستويات معرفة متوسطة لدى الطلاب (متوسط الدرجات = 3.45/7)، وموقفًا إيجابيًا (متوسط = 3.65/5)، وممارسات جيدة بشكل عام (متوسط = 4.08/5). وُجِدت علاقات ذات دلالة إحصائية بين الجنس والمواقف ($p = 0.045$) والممارسات ($p = 0.006$)، وكذلك بين العمر والممارسات ($p = 0.047$). وكان التباين في المعرفة ضئيلًا عند مقارنته بالمتغيرات الديموغرافية. وُجدت فجوة بين معرفة الطلاب وممارساتهم الفعلية، لا سيما فيما يتعلق بإجراءات تعقيم أدوات طب الأسنان وبروتوكولات ما بعد التعرض بعد ملامسة مريض مصاب. كما لوحظ استخدام غير منتظم لبعض معدات الوقاية الشخصية، مثل أقنعة الوجه، وواقيات العين، والسدود المطاطية.

الخلاصة:

بشكل عام، أظهرت النتائج مستويات مشجعة من المعرفة والممارسات المتعلقة بمعايير مكافحة العدوى لدى طلاب البكالوريوس والاختصاص في جامعة القدس. أظهر غالبية الطلاب معرفة جيدة بمبادئ التعقيم الرئيسية، وخاصةً تشغيل أجهزة التعقيم بالبخار. كما أظهر الطلاب التزامًا قويًا باستخدام أدوات الوقاية الأساسية، مثل القفازات والأقنعة. على الرغم من أن الطلاب أظهروا معرفة متوسطة وموقفًا إيجابيًا، إلا أن هناك فجوات قليلة. توصي الدراسة بتنفيذ متابعة إلزامية للتطعيم من خلال لجنة للتحقق من مستويات المناعة الوقائية (أجسام مضادة لـ HBs). كما ينبغي أن يتضمن التعليم المستقبلي حول مكافحة العدوى وحدات قائمة على المحاكاة لسد الفجوة بين المعرفة النظرية والممارسة العملية.

الكلمات المفتاحية: مكافحة العدوى، طب الأسنان، المعرفة، الموقف، الممارسة، انتشار العدوى، دراسة مقطعية، الصحة العامة.