

**Knowledge, Attitudes and Practices of Oral
Health Care Workers towards Infection Control
in Khartoum Dental Teaching Hospital, Sudan**

By

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Abstract

Background: Infection Control is a significant issue for health care systems and is a major public health concern. Dental practitioners are at high risk for cross infection. The present study aimed to assess the knowledge, attitude and practice of oral health care workers toward infection control measures in Khartoum Dental Teaching Hospital.

Methodology: A descriptive, cross-sectional, hospital-based study was conducted among all oral health care workers in the clinics at Khartoum Dental Teaching Hospital. Data was obtained using a structured self-administered questionnaire and SPSS V 28 software for analysis.

Results: The present study included 120 dental care health practitioners working at Khartoum Dental Teaching hospital. The majority were aware that infections can be transmitted before, during and after clinical procedures, however, less than a third (29.2%) were aware of the W.H.O five stages of hand hygiene, and less than half (40.9%) of the recommended 40-60 second duration of hand washing. The majority (80%) had a 'fair' knowledge regarding infection control, but only 5% correctly answered all the questions. The majority (87%) had a positive attitude towards infection control measures and nearly all had a hepatitis B vaccination. Just over half reported that they had a needle-stick injury (55%), but less than half (44%) administered any first aid and only 36.3% reported the injury. Follow-up blood tests were done by less than a third of the participants (31.8%) and 19.7% reported having taken post-exposure prophylaxis.

Conclusion: Sudanese oral health care workers showed fair knowledge about infection control with knowledge gaps in the recommended methods for hand washing. While participants had positive attitudes towards infection control practices, there were many gaps such as the need for an HBV booster vaccination, hand washing before dental procedures and between each patient encounters. The incidence of needle stick injury was high with poor management and low reporting rates of the incidents.

Declaration

I, the undersigned, hereby declare that the work contained in this dissertation is my original work and that it has not been previously in its entirety or in part submitted at any university for a degree.

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Dr. Duaa Kamal Elhassan

Dedication

Dedicated to

My beloved parents for their constant love, support and prayers

My husband Asim for his unfailing encouragement and support.

*Your love, care, help, and constant patience have taught me a
lot*

*My sons Mohamed Elfatih and Mutaman, thank you for all the
joy you brought to my life. You are truly blessing and the
greatest gift God could have given me.*

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List of Abbreviations

CDC	The American Center for Disease Control and Prevention
HBV	Hepatitis B Virus
HCV	Hepatitis C Virus
HIV	Human Immunodeficiency Virus
KAP	Knowledge, Attitude, and Practice Study
OHCW	Oral Health Care Workers
SPSS	Statistical Package of Social Sciences
WHO	World Health Organization

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Chapter One: Introduction

Infection Control is a significant issue for health care systems and is a major concern to the dental profession especially since the World Health Organisation reported in the early 1980s that six dentists were exposed to and contracted HIV infection (Moradi Khanghahi *et al.*, 2013). Dental practitioners are at high risk to cross infection because the oral cavity is a natural environment to many microorganisms, where its moist environment is suitable for bacterial growth (Yüzbaşıoğlu *et al.*, 2009; Moradi Khanghahi *et al.*, 2013). In addition, the direct contact with saliva and blood increases the risk to infection from pathogens that colonise the oral cavity. There is an increased risk for exposure from blood borne pathogen such as hepatitis B and C virus, human immunodeficiency virus, Mycobacterium tuberculosis, streptococci and other viruses and bacteria that colonise the oral cavity and upper airways tract (Moradi Khanghahi *et al.*, 2013; Halboub *et al.*, 2015).

Cross-infection may be identified as the spread of pathogens between patients and clinicians within the clinical environment (Halboub *et al.*, 2015). Transmission of infection occurs during dental procedures either by direct contact with body fluids or indirectly by contaminated instruments (Alharbi *et al.*, 2019). The majority of infectious diseases are not easily detected in the dental setting. Infection is bidirectional between the dentist and the patient, and it is important for all oral health care workers to be aware of the risk of transmission of infectious diseases and exposures during dental procedures. Efforts are required to strengthen behaviors, provide awareness and encourage students and professionals to take effective and regular steps to avoid infections (Al-Maweriet *et al.*, 2015; Mutters *et al.*, 2014; Nejatidanesh *et al.*, 2013).

The most successful way to prevent cross infection is implementation of standardised protocols for infection control in dental clinics. Dental institutions should ensure that there are programmes in place regarding transmission and infection control in the dental setting. Furthermore, the importance of vaccination as a requirement for all oral health care workers should be re-iterated (Rahman *et al.*, 2013; Halboub *et al.*, 2015). Studies have found that it is not of high concern among dental students and dental practitioners (Singh *et al.*, 2011).

Knowledge, attitude and practice are the three important key elements to ensure good infection control. Knowledge provides the information necessary to behave correctly, have the right attitude for excellent practice (Alharbi *et al.*, 2019). Research among oral health care workers has found low levels of knowledge about infection control and very low adherence to infection control recommendations (Al-Maweri *et al.*, 2015).

Rationale for the present study

Khartoum Dental Teaching Hospital is one of the specialized dental health care hospitals in Sudan, in both the public and private health sectors, aside from a few units in other general hospitals. It is the major health facility that provides all types of oral health care services in addition to surgical interventions in the field of maxillofacial surgery. Moreover, most of the dentists spend a considerable time during their housemanship year training at the institution.

Due to the paucity of published data regarding the status of infection control in Khartoum Dental Teaching Hospital, a knowledge attitude and practice study targeted at oral health care workers (OHCW) at the hospital was a major step towards identifying problems regarding the infection control protocols that are implemented in the hospital. It was anticipated that the findings will assist the development or refining of existing infection control policies in this large public sector dental health providing facility in Sudan.

Chapter Two: Literature review

In hospitals and healthcare settings, infection control policies and practices are used to manage and reduce the spread of illnesses with the primary goal of lowering infection rates (Habboush *et al.*, 2022). Infection control is important and necessary in dental settings (Al-Omari and Al-Dwairi, 2005). Fortunately, cross infection in dental settings are rare (Mutters *et al.*, 2014), but this could be due to poor recording, reporting and incomplete data (McCarthy *et al.*, 2002). The American Center for Disease Control and Prevention (CDC) has stated that regardless of the fact that reports of cases of cross infection in dental clinics from 2005 to 2015 were rare, it did not eliminate cross infection risk. There is a need to address and continually evaluate it, given the dire outcomes to the patients in unhygienic or infectious dental health establishments (CDC, 2016).

All oral health workers (OHCW) are at risk of infection in dental clinics. This is due to the fact that the oral cavity is an environment rich in different types of microbes (Mutters *et al.*, 2014). Some of these microbes are airborne such as *Mycobacterium tuberculosis*, *Micrococcus lylae*, *Staphylococcus epidermidis* and *Staphylococcus haemolyticus* (Kimmerle *et al.*, 2012). Other microbes include viruses like the human immunodeficiency virus and hepatitis B and C viruses (Yüzbaşıoğlu *et al.*, 2009). The transmission of these microbes represent a health risk not only to the oral health care workers' health, but also to patients' health either by direct infection by the HCW or through other indirect routes (Elkarim *et al.*, 2004).

Dental procedures present a route for microbial transmission, and the exposure of the OHCW to the microbes. There are various modes of transmission: either directly via blood, saliva or infected water from the unsterilized dental units, or indirectly by the contact or exposure to infected dental instruments like needles, burs, or contact with infected surfaces (Alharbi *et al.*, 2019). A significant contributor to healthcare-associated infections is healthcare workers' inconsistent observance of fundamental preventative practices including hand hygiene (Tarrac *et al.*, 2008).

Another factor that results in an increase in the microbial transmission are the various modes and vectors of transmission by different clinical instruments and their contents, for instance, direct contact, smear infections, droplets infections (aerosols from the handpieces and the scaler instruments), splash transmission etc. (Malhotra, Kaura and Sharma, 2017). Dental handpieces and scalers induce accumulation of aerosol which are infected with bacteria, fungi and viruses and sometimes blood, thereby increasing the risk of infection (Dutkiewicz, 2008; Al-Maweri *et al.*, 2015).

Blood borne pathogens risk is especially elevated in dental settings due to the utilization of sharp instrument in a small operating field (i.e. the oral cavity) which introduces an even greater occupational hazardous situation (Sofola *et al.*, 2007).

Accidental injuries by sharp objects are more likely to occur in dental clinics than any other health care facility (Younai, et al., 2001). This can also be due to the limited working space, the frequent movement of the patient and the various types of sharp instruments used in dental operations. Moreover, it has been reported that the frequency of injuries increase as a dental student or trainee advances through dental school training which might be attributed to the fact that students encounter longer and more variable clinical exposure (Al-Maweri *et al.*, 2015).

Needle stick injury represents a hazardous route for cross infection by a blood borne microbe between the patients and OHCW. Local anaesthesia administration was found to be the most frequent source of sharp object injury in dental practice (Al-Maweri *et al.*, 2015). In addition to this, the estimated risks of needle sticks injured dental HCWs acquiring HIV, HCV and HBV infections were found to be 0.3%, 3.0% and 30.0% respectively (Malhotra, Kaura and Sharma, 2017).

The implementation of infection prevention protocols is a practical way to counter cross infection risks in dental clinics since there is no applicable way to detect the infection carrying individual in a routine dental setting (Al-Maweri *et al.*, 2015). Such implementation must be carried out by the dental institutions in every dental clinical setting (Kohn *et al.*, 2004). The implementation of such protocols has proved to be the most effective method to control the incidences of cross infection (Al-Maweri *et al.*, 2015).

There are numerous published infection control policies and guidelines (Al-Maweri *et al.*, 2015). The CDC recommends in its guidelines that each unique dental setting must develop and maintain an infection control programme and protocol and provide supplies that aide in the adherence to the protocol, ranging from hygienic materials, post-exposure prophylaxis and written infection control policies and instructions for the OHCW and patients in the dental facility.

Moreover, establishing a system for early detection, surveillance and management of potentially infected personnel is recommended by the CDC. Occupational and task specific training for infection control protocols implementation at regular intervals can help maintain and keep OHCW updated with the protocols. The CDC also recommends the routine OHCW screening for infectious disease (CDC, 2016).

Hand hygiene is the most important measure to prevent the spread of infections among patients and OHCW (CDC, 2016). Maintaining good hand hygiene reduces the growth of microorganisms, which lowers not only the risk of infection, but also total healthcare expenditure, hospital stays, and eventually reimbursement (Toney *et al.*, 2022). It is recommended that hands must be washed before and after patients, before wearing gloves and immediately after their removal (Siegel *et al.*, 2007).

The WHO recommendations are known as the "Five Moments for Hand Hygiene" (WHO, 2009). Using an alcohol-based hand rub for hand hygiene is also recommended in a septic procedures (Widmer *et al.*, 2007). Handwashing with soap and water can eradicate virtually all transient gram-negative bacilli in about 10 seconds, while chlorhexidine may be preferable to soap and water for the elimination of transitory gram-positive bacteria (Allothman, 2005). Wearing gloves is recommended in cases of potential contact with blood, saliva, mucous membranes, non-intact skin or contaminated equipment (CDC, 2016). Since areas around the nose and the inner corners of the eyes were found to have a significant high risk of contamination in dental procedures, these are the most important areas to be covered during dental procedures (Nejatidanesh *et al.*, 2013). Covering these areas by wearing face masks, eyes protection prevents potential contact with blood, saliva and other potential infectious materials (CDC, 2016).

Researchers have found that infection control is not well managed in dental and hospital care environments. There is a divergence between knowledge and behaviors which may be due to an insufficient availability of personal safety devices, lack of awareness, lack of frequent training services and insufficient controlling of medical waste. In addition, there is a lack of awareness regarding the importance of vaccination (Halboub *et al.*, 2015; Rahman *et al.*, 2019). A study in Turkey concluded that OHCW in Turkish dental clinics need more compliance and education with the infection control standards since "...the knowledge of Turkish dentists is relatively weak about infection control procedures" (Yüzbaşıoğlu *et al.*, 2009). Another study conducted in a university clinic in Germany found that only a third of the participants adhered to the hand hygiene protocols (Mutters *et al.*, 2014). These findings led to the recommendations that more training and stricter application of infection control were required (Mutters *et al.*, 2014; Yüzbaşıoğlu *et al.*, 2009).

Many knowledge, attitude and practice (KAP) studies have been conducted on dental students in different countries, and a deficiency in at least one of the three KAP pillars was noted. For instance, a study conducted on students in a dental school in Patiala, India concluded that there were gaps in the students' knowledge and practices despite having the standard WHO and CDC infection control measures (Malhotra *et al.*, 2017). Another KAP study conducted on Saudi dental students reported that while students had good knowledge and positive attitudes, their practices were deficient (Al-Maweri *et al.*, 2015). The government in Malaysia drew attention to infection transmission from patient to practitioner and vice versa and from the clinical dental environment. It found that hand hygiene was the most important element in infection control and the infection control measure should be included in the curriculum and monitored by supervisors (Wan Noorin *et al.*, 2015). All these studies were consistent with the statement of Malhotra *et al.* (2017) that dental school is the first institute responsible to provide the dentist with adequate knowledge for better practice (Malhotra, Kaura and Sharma, 2017).

In Sudan, even though the studies related to the topic are scarce and limited, the findings of published theses were consistent with the findings of other countries. A 2004 study reported a positive attitude and practice with regard to the personal protective equipment

use; there was a need for improvement regarding the reuse of cartridges, HBV vaccination, waste disposal and sterilization techniques (Elkarim *et al.*, 2004). Another study regarding the knowledge and education about HIV and AIDS in a group of dental students concluded that the information regarding the topics were insufficient (Nasir *et al.*, 2008). A more recent study found that there was a high prevalence of needle-stick injuries, low reporting incidences, a lack of formal training on infection prevention and control and low rate of HBV immunization (Osman, 2014).

Chapter Three: Aim and Objectives

Aim: To determine the knowledge, attitude and practice of oral health care workers toward infection control measures in Khartoum Dental Teaching Hospital.

Objectives:

1. To determine the knowledge of OHCW in Khartoum Dental Teaching Hospital regarding infection control,
2. To determine OHCW attitudes towards infection control protocols and
3. To determine the practice of OHCW towards infection control protocols.

Chapter Four: Methodology

4.1. Study design: A descriptive cross-sectional hospital-based study was conducted.

4.2. Study population: Oral health care workers working at Khartoum Dental Teaching Hospital

4.2.1. Inclusion criteria: All OHCW working in the clinics at Khartoum Dental Teaching Hospital and who are willing to contribute to the study.

4.2.2. Exclusion criteria: Any OHCW who worked for less than 6 months at Khartoum Dental Teaching Hospital.

Any OHCW who is not working in the clinics at Khartoum Dental Teaching Hospital.

4.3. Sampling

4.3.1. Sampling technique: Non-probability Convenience sampling.

Sample size: will be calculated according to the formula: The sample size $(n) = \frac{N \cdot X}{(X + N - 1)}$

Where,

$$X = \frac{Z_{\alpha/2}^2 \cdot p \cdot (1-p)}{MOE^2}$$

Where $Z_{\alpha/2}$ (the critical value) is 1.96 The MOE (margin of error) is 5%

p is the sample proportion and n is the population size (120 dental practitioners and dental assistants)

$$\begin{aligned} \text{Then, } X &= \frac{3.84 \times .25}{.0025} = 384 \quad n = \frac{120 \times 384}{(384 + 120 - 1)} \\ &= \frac{46,080}{503} = 91.6 \end{aligned}$$

The sample size = 92

4.4. Data collection: Data was collected using a self-administered questionnaire (Appendix 1) formulated by the researcher, the questionnaire was distributed to the participants by the principal researcher.

4.5. Data analysis: Data was cleaned and entered into Microsoft Excel data sheet and was analyzed using SPSS version 28 software. Categorical data was represented in the form of frequencies and proportions. MS Excel and MS word were used to obtain various types of graphs such as bar diagram. Data was represented after analysis in form of uni-variable tables, cross tabulation (bi variable tables), figures and narrative illustration.

4.6. Ethical considerations: An Information Sheet was provided to all eligible participants (Appendix 2). Informed consent was obtained from each participant (Appendix 3). The study participants were anonymized, confidentiality was strictly maintained and the participant could withdraw from the study at any time without any reason. Permission was obtained from Medical Khartoum Dental Teaching Hospital, ethical committee review board, hospitals administrators and the Khartoum State Ministry of Health. Ethical Approval was obtained from the Biomedical Research Ethics Committee (BMREC) of the University of the Western Cape (Approval no. BM21/13/12) (Appendix 4)

Chapter Five: Results

The present study included 120 dental care health practitioners working at Khartoum Dental Teaching Hospital. The majority were between aged 20 to 30 years old (77.5%) and female (73.3%). Regarding their professional position, the majority were housemen (41.7%) and registrars (26.7%). Just over half (50.8%) had less than 2 years of experience and 11.6% had more than 5 years of experience (Table 1).

Table 1: Characteristics of the participating oral health workers in Khartoum Dental Teaching hospital.

	Category	Frequency	Percent
Age	20-30	93	77.5%
	30-40	18	15%
	>40	9	7.5%
Gender	Male	32	26.7%
	Female	88	73.3%
Position	Houseman	50	41.7%
	General dental practitioner	16	13.3%
	Dental registrar	32	26.7%
	Specialist	12	10%
	Dental assistant	10	8.3%
Experience	Less than 2 years	61	50.8
	2 to 5 years	45	37.5%
	More than 5 years	14	11.6%

The majority of the participants were aware that infections can be transmitted before, during or after the clinical procedure, however, only 35 (29.2%) were aware of the WHO five stages of hand hygiene, and 49 (40.9%) knew of the recommended 40-60 second duration of hand washing (Table 2).

Table 2: Knowledge of infection control

Questions (correct answer)	Correct	Incorrect
Can infectious diseases be transferred before the clinical procedure? (Yes)	101 (84.2%)	19 (15.8%)
Can infectious diseases be transferred during the clinical procedure? (Yes)	105 (87.5%)	15 (12.5%)
Can infectious diseases be transferred after the clinical procedure? (Yes)	104 (86.7%)	16 (13.3%)
In how many moments in hand hygiene is required according to the WHO? (5 stages)	35 (29.2%)	85 (70.8%)
What is the recommended hand washing duration according to the WHO? (40-60 seconds)	49 (40.8%)	71 (59.2%)

Figure 1 depicts the participant's overall knowledge of infection control and it can be seen that 80% had a 'fair' knowledge regarding infection control, but only 5% correctly answered all the questions.

Figure 2 shows that nearly two thirds (59%) of the participants had received information on the standard precautions of infection control.

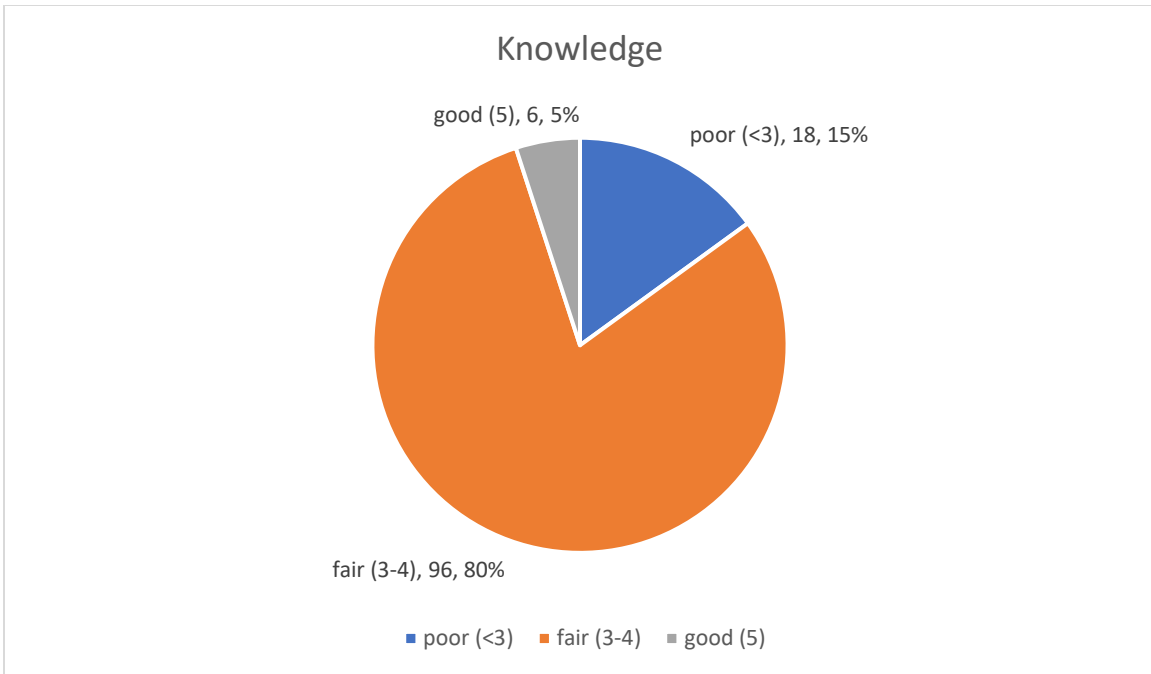


Figure 1: Knowledge of infection control

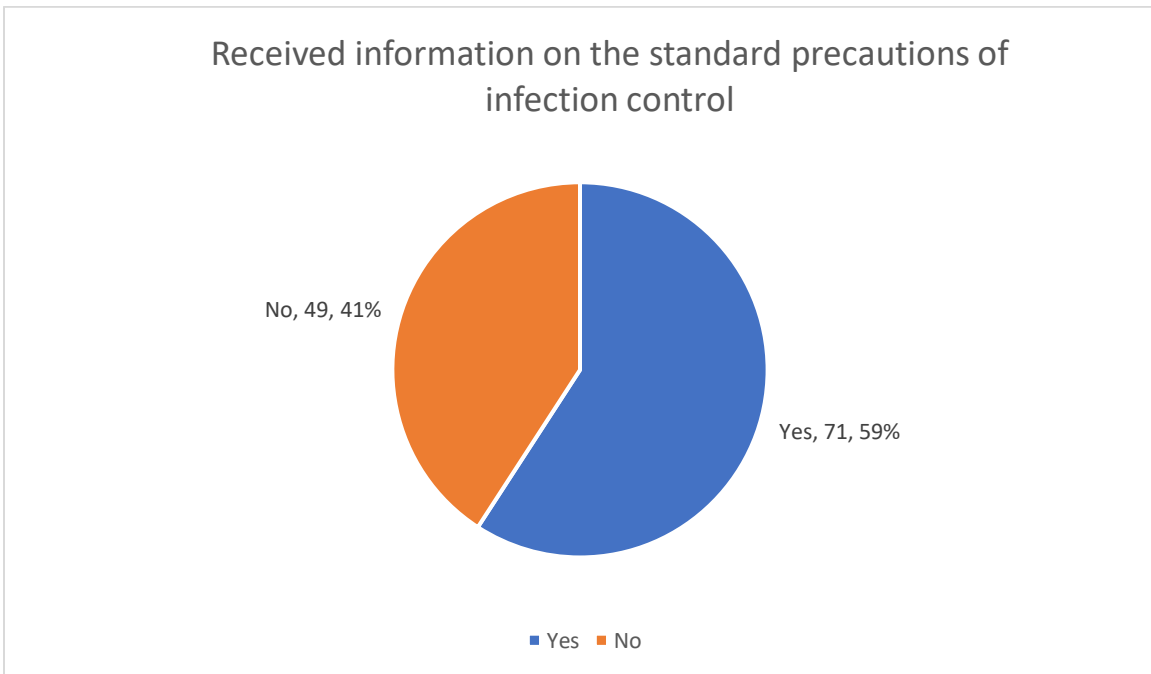


Figure 2: Information on the standard precautions of infection control

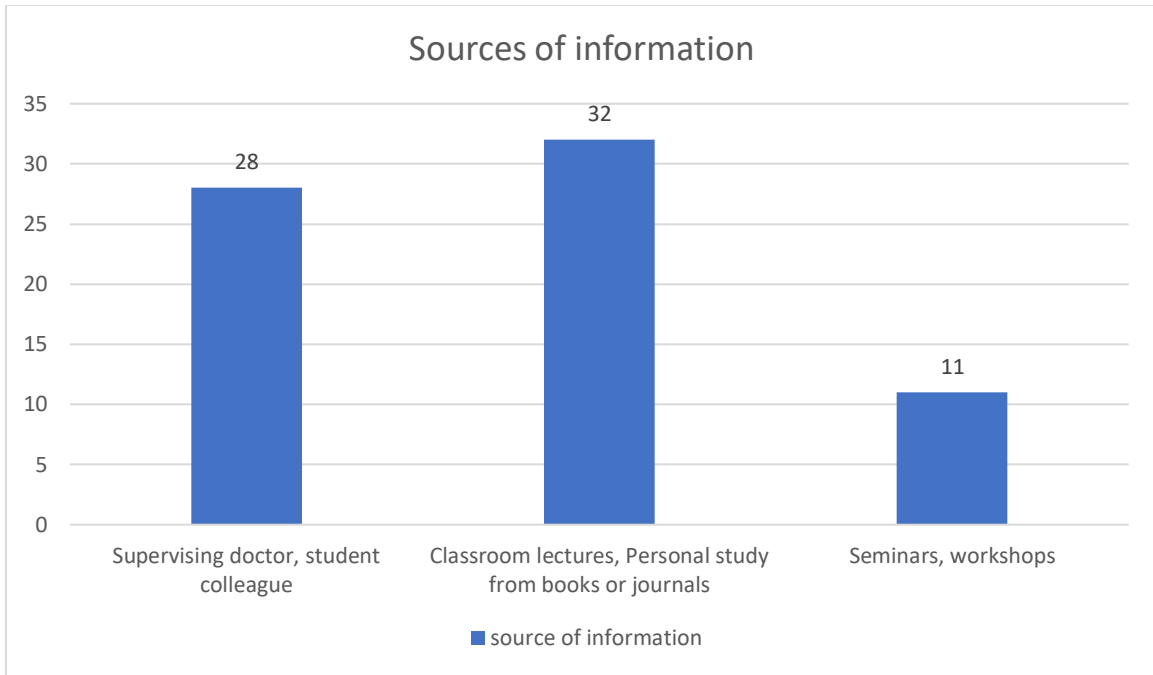


Figure 3: Sources of information on the standard precautions of infection control

Classroom lectures and personal study from books or journals were the main source of knowledge regarding infection control among study participants.

Participants showed positive attitude scores regarding the wearing of facemasks: changing facemask between patients (3.5 ± 0.6), treating every patient as a source of infection (3.3 ± 1), doubling masks; gloves: in known infectious cases (3.3 ± 1), wearing gloves in every examination procedure (3.4 ± 1), and with regard to the changing of probes between examinations (3.7 ± 0.7) (Table 3).

Table 3: Attitudes towards infection control among oral health workers

Statement	Scale	Meaning
Changing facemask between patients is a crucial infection control measure	3.5 ± 0.6	Positive
Dental health care practitioners should treat every patient as a possible source of infection	3.3 ± 1	Positive
When treating a patient with a known infectious condition, standard infection control protocol is not enough and I would resort to double gloving	3.3 ± 1	Positive
It is necessary to wear gloves for every clinical examination procedure	3.4 ± 1	Positive
It is necessary to change the explorer probes between examinations	3.7 ± 0.7	Positive

The majority (87%) of participants had a positive attitude towards infection control measures (Figure 4).

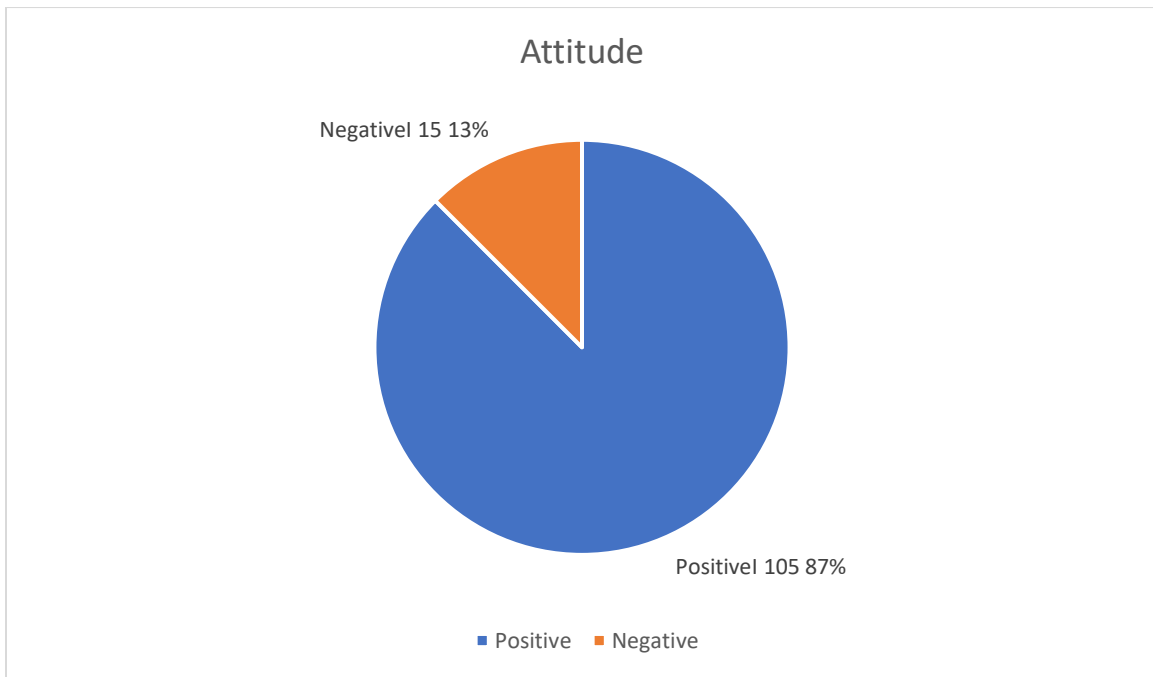


Figure 4: Overall attitude towards infection control

Nearly all (99.2%) had a hepatitis B vaccination, but less than half (46.2%) had a booster dose. Regarding infection control practices, the majority reported that they remove hand accessories (86.7%) before treatments, only half reported washing their hands before dental procedures (50.8%), 94.2% wore gloves during dental procedures, just over half (57.5%) washed their hands between each patient encounters. Over two thirds (78.3%) reported that they wear a facemask during every dental procedure, and 59.2% wore a face shield when aerosol exposure was expected. The majority of 98 (81.7%) reported that they changed their protective clothes when it was contaminated; just over half (52.5%) disinfected the dental chair between each patient and reported that they covered the dental chair before any procedures were carried out (Table 5).

Table 5: Infection control practices

	No	Sometimes	Always
Remove hand accessories before wearing gloves	5 (4.2%)	11 (9.2%)	104 (86.7%)
Hand washing before dental procedure	7 (5.8%)	52 (43.3%)	61 (50.8%)
Wear gloves during every dental procedure	0	7 (5.8%)	113 (94.2%)
Wash hands between each patient encounters	10 (8.3%)	14 (34.2%)	69 (57.5%)
Wear facemask during every dental procedure	8 (6.7%)	18 (15%)	94 (78.3%)
Wear face shield during dental procedure	48 (40%)	71 (59.2%)	1 (0.8%)
Protective head cap during dental procedure	52 (43.3%)	56 (47.7%)	12 (10%)
Change protective cloth if exposed to contamination	22 (18.3%)	0	98 (81.7%)
Disinfect dental chair between each patient	25 (20.8%)	32 (26.7%)	63 (52.5%)
Cover dental chair before any procedure	63 (52.5%)	28 (23.3%)	29 (24.2%)

Just over half reported that they had a needle-stick injury (55%), and 75.8% stopped the procedure they were carrying out at the time. However, less than half (44%) administered any first aid and only 36.3% reported the injury. Follow-up blood tests was done by less than a third of the participants (31.8%) and 19.7% had post exposure prophylaxis (Table 6).

Table 6: Needle-stick injuries

	No	Yes	n
Injury	54 (45%)	66 (55%)	120
Stopped the procedure	16 (24.2%)	50 (75.8%)	66
Administered first aid	37 (56%)	29 (44%)	66
Reported it	42 (63.7%)	14 (36.3%)	66
Nothing	64 (97%)	2 (3%)	66
Blood test	45 (68.2%)	21 (31.8%)	66
Post exposure prophylaxis	53 (80.3%)	13 (19.7%)	66

Overall, participants scored a mean of 3.2 ± 1 out of 5; with 58 (48%) considered as poor knowledge (below the average), and 62 (52%) as good knowledge (above the average). Regarding attitude, the mean score was 17 ± 3 out of 25; with 41 (35%) considered as Negative (below average) and 78 (65%) Positive (above average). Practice mean score was 6.4 ± 3 out of 20; hence, 72 (60%) had poor practice (below average), and 48 (40%) had good practice (above average) (Table 7).

Table 7: Overall knowledge, attitude and practice scores

Mean± SD/ Frequency (%)	
Knowledge	3.2± 1
Poor (below average)	58 (48%)
Good (above average)	62 (52%)
Attitude	17± 3
Negative (below average)	41 (35%)
Positive (above average)	78 (65%)
Practice	6.4± 3
Poor (below average)	72 (60%)
Good (above average)	48 (40%)

Comparison between groups regarding knowledge, attitude, and practice showed that specialist had the best knowledge, while housemen had poor knowledge. Attitude was negative in dental assistants and positive in the other groups, while practice was poor in all groups except in housemen (table 8).

Table 8: Comparison of knowledge attitude and practice according to professional position.

	Assistant	Houseman	GP	Registrar	Specialist	p-value
Knowledge						0.01
Poor	5 (50%)	28 (56%)	8 (50%)	15 (47%)	2 (17%)	
Good	5 (50%)	22 (44%)	8 (50%)	17 (53%)	10 (83%)	
Attitude						0.001
Negative	10 (100%)	16 (32%)	4 (25%)	8 (25%)	4 (33%)	
Positive	0	34 (68%)	12 (75%)	24 (75%)	8 (67%)	
Practice						0.001
Poor	10 (100%)	19 (38%)	14 (88%)	20 (63%)	9 (75%)	
Good	0	31 (62%)	2 (12%)	12 (37%)	3 (25%)	

Chapter Six: Discussion

Infection Control is a significant issue for health care systems and is a major concern to the dental profession (Moradi Khanghahi *et al.*, 2013). Dental practitioners are at high risk to cross infection because the oral cavity is a natural environment to many microorganisms, where it's moist environment is suitable for bacterial growth (Yüzbasioğlu *et al.*, 2009; Moradi Khanghahi *et al.*, 2013) with the increased risk for exposure from blood borne

pathogen such as hepatitis B and C virus and human immunodeficiency virus (Moradi Khanghahi *et al.*, 2013; Halboub *et al.*, 2015). The present study aimed to determine the knowledge, attitude and practice of oral health care workers toward infection control measures in Khartoum Dental Teaching Hospital.

It is known that hand hygiene is the most important measure to prevent the spread of infections among patients and OHCW (CDC, 2016). Hands must be washed before and after patients and before wearing gloves and immediately after their removal (Siegel *et al.*, 2007). In the present study, oral health care workers knowledge regarding infection control was assessed in three ways: infection transmission, WHO recommendations for hand hygiene and recommended duration of hand washing. The majority of the participants were aware that infections can be transmitted before, during or after the clinical procedure, however, only 29.2% were aware of the WHO five stages of hand hygiene, and 40.9% knew of the recommended 40-60 second duration of hand washing.

Despite the fact that the majority of the participants in the present study had a fair knowledge regarding infection control, it appears that their knowledge about the WHO recommendations for times to apply hand hygiene and the recommended duration were poor. In contrast, Shenoy *et al.* found that the majority of dentists had a good knowledge about hand hygiene methods (Shenoy *et al.*, 2021). In the present study, despite the fact that participants had classroom lectures and made personal study from books and journals as their main source of knowledge regarding infection control, they showed poor knowledge about the effective hand hygiene methods. This can be attributed either to limitations in the resources or lack of proper training, and both are recommended to fill the apparent knowledge gap.

Most participants showed that they had a positive attitude to infection control measures as they showed positive attitude scores regarding the wearing of facemasks, changing facemask between patients, treating every patient as a source of infection, doubling masks and gloves. In known infectious cases, they reported the wearing gloves for every examination procedure, and the changing of probes between examinations. This is consistent with most of the recent studies which have emphasised that dental practitioners

have positive attitude towards infection control procedures. Alharbi *et al.* (2019) studied dental faculty members, and reported that they had a positive attitude towards infection control procedures and guidelines. In Yemen, Halboub *et al.* (2015) investigated senior dental students' attitude towards infection control procedures and the survey revealed similar findings, as did Yüzbaşıoğlu *et al.* (2009) who found that the majority of the respondents stated that all patients have to be considered as infectious and universal precautions must apply to all of them.

In the present study, oral health care workers had good compliance with hepatitis B vaccination and nearly half of them had a booster dose. An earlier previous study in Sudan reported that HBV vaccination status was one of the defective practices that needed to be improved (Elkarim *et al.*, 2004). Moreover, Malhotra *et al.* reported poor implementation of standard infection control measures in dental students' practices regarding HBV prevention (Malhotra *et al.*, 2017).

Regarding hand hygiene practices, the majority of oral health care workers reported that they removed all hand accessories before treatment procedures and wore gloves during dental procedures, only half reported washing their hands before dental procedures and washed their hands between each patient encounters. Although compliance to hand hygiene practices among participants was good, some defective areas were detected. Similarly, Cheng *et al.* reported that handwashing compliance and accuracy rates were low in general dental practice (Cheng *et al.*, 2019).

Over two thirds reported that they wore a facemask during every dental procedure, and 59.2% wore a face shield when aerosol exposure was expected. The majority reported that they changed their protective clothes when it was contaminated and just over half disinfected the dental chair between each patient and that they covered the dental chair before any procedures were carried out. Such practices are considered better than what was reported by Elkarim *et al.* (2004) who reported that the use of personal protective equipment and sterilization techniques were inadequate among Sudanese dentists. Furthermore, Wan Noorin *et al.* (2015) reported that vast majority of dental students reported wearing facemask during dental procedures.

Just over half reported that they had a needle-stick injury, and majority of them stopped the procedure they were carrying out at the time. However, less than half reported having any first aid administered and only on-third reported the injury. Follow-up blood tests was done by less than a third of the participants and 19.7% reported having administered post-exposure prophylaxis. Participant's practices regarding needle stick injuries are considered poor with a high incidence of needle stick injuries which is higher than what was reported by Osman *et al.*, (2014) in Sudan and poor practice following needle stick injuries was also reported by Wan Noorin *et al.*, (2015) in Malaysia. Sofola *et al.*, (2007) reported that no needle stick injuries were reported in their study.

In summary, Sudanese oral health care workers were found to have a fair knowledge about infection control with knowledge gaps in the recommended methods for hand washings. Participants had positive attitude towards infection control practices, but deficiencies in their practice regarding infection control such as HBV booster, hand washing before dental procedures and between each patient encounters. The incidence of needle stick injury was found to be high among study participants, but there was poor management, follow-up and low reporting rates.

Chapter Seven: Recommendations

- More educational programmes are required with oversight to be implemented in dental teaching institutions and postgraduate practices.
- Regular auditing and reporting for infection control in dental practices are

mandatory to improve oral dental care practices and to ensure safe practice and patient safety.

- Hepatitis B vaccination and booster dose should be mandatory and scheduled for all dental care practitioners.
- Oral health care workers should be trained in infection control in general and in dealing with needle stick injuries in particular.

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Appendix 1: Information Sheet

Faculty of Dentistry & WHO Collaborating Centre for
Oral Health



UNIVERSITY OF THE WESTERN CAPE

Private Bag X1, Tygerberg, Cape Town REPUBLIC OF SOUTH AFRICA

Project Title: Knowledge, Attitudes and Practices of Oral Health Care Workers towards Infection

Control in a Khartoum Dental Teaching Hospital, Khartoum, Sudan What is this study about?

This is a research project conducted by Dr Duaa Elhassan under the supervision of Prof Sudeshni Naidoo at the University of the Western Cape in South Africa. We are inviting you to participate in this research project because you meet the set criterion for the population of interest and your participation will help other colleagues in your profession and the country as a whole. The study will investigate the knowledge, attitudes and practices of the dental practitioners and dental assistants towards infection control measures, and the precautions they take to prevent cross infection between the staff and the patients.

What will I be asked to do if I agree to participate?

You will be asked to sign a consent form agreeing to take part in the study. Your participation will involve having to complete a questionnaire and it that should take no longer than 10 minutes to do so. This questionnaire will be conducted at a time and location that is convenient to you. The questionnaire will be administered to elicit the knowledge, attitudes and practices regarding infection control measures. All oral health care workers including dental residents and dental assistants who work currently at Khartoum Dental Teaching Hospital will be asked to participate.

Would my participation in this study be kept confidential?

All the information, including any personal information you provide will be kept strictly confidential. Your real name will not be included on the data capture sheet and all information collected will be locked in secure password protected files on the computer. Additionally, access to any information will be restricted to me, the researcher and my research supervisor only. Summary questionnaire content or direct quotations that will be made available through my dissertation, academic publications or policy documents will be coded and anonymized. At the end of the study, all data will be kept for as long as legally required and thereafter will be properly disposed of, deleted or destroyed.

What are the risks of this research?

There are no risks associated with participation. As described above, all precautions (coding of data, restricted access, storage in locked cabinets and/or password protected computers) to protect anonymity and identity will be strictly applied. You also have the right to only answer questions you want to answer. **What are the benefits of this research?**

At the end of this study, we will be able to assess the knowledge, attitudes and practices of oral health care workers at the teaching hospital towards infection control measures and make constructive recommendations if need be to safeguard both you and the patients.

Do I have to be in this research and may I stop participating at any time?

Your participation in this research is completely voluntary. You may choose not to take part at all. If you decide to participate, you have the right to withdraw at any time or only answer selected questions. If you decide not to participate in this study or if you stop participating at any time, you will not be penalized in any way.

Is any assistance available if I am negatively affected by participating in this study?

If at any time of the study, you feel uncomfortable and need assistance, the researcher will refer you for counselling through social welfare office in your area.

What if I have questions?

Should you have any questions regarding this study and your rights as a research participant or if you wish to report any problems you have experienced related to the study, please do not hesitate to contact:

Researcher: Dr D.Elhassan

Faculty of Dentistry, University of Khartoum (Community Dentistry)

Tel: +249 914 08 7999

Email: duaakamal25@gmail.com

Supervisor: Prof Sudeshni Naidoo

Email: suenaidoo@uwc.ac.za

Head of Department: Prof D Smit

Faculty of Dentistry, University of the Western Cape dsmit@uwc.ac.za

Research Ethics Committee

Biomedical Research Ethics Committee (BMREC), University of the Western Cape
Private Bag x17, Bellville, 7535

Tel: +27 21 959 4111

Email: research-ethics@uwc.ac.za



Appendix II: Informed Consent Form

Faculty of Dentistry & WHO Collaborating Centre for Oral Health



UNIVERSITY OF THE WESTERN CAPE

Private Bag X1, Tygerberg, Cape Town REPUBLIC OF SOUTH AFRICA

Project Title: Knowledge, Attitudes and Practices of Oral Health Care Workers towards Infection Control in a Khartoum Dental Teaching Hospital, Khartoum, Sudan

Principal Investigator: Duaa Kamal Elhassan Supervisor: Prof Sudeshni Naidoo

Department: Community Oral Health

Telephone: +249 91 408 7999, +966 53 406 8736

Email: duaakamal25@gmail.com

Dear

You are being invited to participate in the above-mentioned research study. Please take time to read the information that is presented below.

The study entitled ‘Knowledge, Attitudes and Practices of Oral Health Care Workers towards Infection Control in a Khartoum Dental Teaching Hospital, Khartoum, Sudan’ will investigate the awareness of oral health care workers including dental residents and dental assistants towards infection control and the precautions used to prevent the cross infection between the staff and patients.

Your participation will involve a verbal administered questionnaire that should take no longer than 10 minutes to complete. Participation is voluntary and you have the right to withdraw at any time, to only answer selected questions or to refuse to participate entirely without the risk of penalty or prejudice. There are no risks associated with participation in the study. Please indicate your willingness to participate through completion of the attached declaration on the next page.

Thank you for taking time to read this information sheet. Should you have any queries relating to participation or the nature of the study, please do not hesitate to speak to the researcher. You will receive copies of the information sheet and consent form for your records.

Yours Sincerely

Duaa Elhassan

Project Title: Knowledge, Attitudes and Practices of Oral Health Care Workers towards Infection Control in a Khartoum Dental Teaching Hospital, Khartoum, Sudan

Declaration by the Participant

I (full name)

- Declare that the study has been described to me in language that I understand;
- Have read, understood and received a copy of the information sheet and consent form, written in a language with which I am fluent;
- Have had the opportunity to ask questions regarding the study and my questions have been answered to my satisfaction;
- understand that my identity will not be disclosed and that I have the right to withdraw from the study at any stage without giving a reason and without the risk of penalty; and that it will not negatively affect me in any way and that I
- Freely and voluntarily agree to participate in this study.

Signature of participant:.....Date:

Signature of Investigator:.....Date:

Signature of Witness:.....Date:

We thank you for your contribution to our research



Appendix III: Study



Questionnaire

Faculty of Dentistry & WHO Collaborating Centre for Oral Health

UNIVERSITY OF THE WESTERN CAPE

Private Bag X1, Tygerberg, Cape Town REPUBLIC OF SOUTH AFRICA

Project Title: Knowledge, Attitudes and Practices of Oral Health Care Workers towards Infection Control in a Khartoum Dental Teaching Hospital, Khartoum, Sudan

A. DEMOGRAPHY

1.
Name:
2. Gender:
 - a. Male
 - b. Female
3. Age Years
4. What is your position at the Khartoum Dental Teaching Hospital?
 - a. Houseman
 - b. General Dental Practitioner
 - c. Dental Registrar
 - d. Specialist
 - e. Dental Assistant
 - f. Other:
5. How long have you been in your current position?
 - a. 6 months
 - b. 1 year
 - c. 2-5 years
 - d. >5 years

B. KNOWLEDGE

6. Can infectious diseases be transferred before, during and after clinical procedures?
 - a. Before Yes No
 - b. During Yes No
 - c. After Yes No
7. According to the WHO, how many steps are involved in hand washing?
 - a. 4
 - b. 3
 - c. 5
 - d. 6
8. According to the WHO what is the duration of hand washing according to the WHO?
 - a. 20-40 seconds
 - b. 40-60 seconds
 - c. 60-90 seconds
 - d. 90-120 seconds

C. ATTITUDES

9. How do you view this statement "Changing face masks between patients is a crucial infection control measure"?
 - a. Strongly Agree
 - b. Agree
 - c. Neutral
 - d. Disagree
 - e. Strongly Disagree
10. How do you view this statement "A DHCP should treat every patient as a possible source of Infection"?
 - a. Strongly Agree
 - b. Agree
 - c. Neutral
 - d. Disagree
 - e. Strongly Disagree

11. How do you view this statement "When treating a patient with a known infectious condition, standard infection control protocol is not enough, and I would resort to doubling masks and gloves"?
- Strongly Agree
 - Agree
 - Neutral
 - Disagree
 - Strongly Disagree
12. How do you view this statement "It is necessary to wear gloves for every examination procedure"
- Strongly Agree
 - Agree
 - Neutral
 - Disagree
 - Strongly Disagree
13. How do you view this statement "It is necessary to change mirrors between examinations or use disposable mirrors for each patient examination"?
- Strongly Agree
 - Agree
 - Neutral
 - Disagree
 - Strongly Disagree
14. How do you view this statement "It is necessary to change explorer probes between examinations"?
- Strongly Agree
 - Agree
 - Neutral
 - Disagree
 - Strongly Disagree

D. PRACTICE

15. Have you received vaccination against hepatitis B virus?
- a. Yes
 - b. No
- 16a. if yes, have you had a booster dose or revaccination for hepatitis B vaccine?
- a) Yes
 - b) No
16. Do you remove hand accessories (e.g. watches, finger rings, jewelries etc.) before wearing gloves?
- a. Yes
 - b. No
 - c. Sometimes
17. Do you perform handwashing hygiene before dental treatment?
- a. Yes
 - b. No
 - c. Sometimes
18. Do you wear gloves during every dental procedure?
- a. Yes
 - b. No
 - c. Sometimes
19. Do you wash your hands between each patient encounters?
- a. Yes
 - b. No
 - c. Sometimes
20. Do you wear a facemask during every procedure?
- a. Yes
 - b. No
 - c. Sometimes

21. Do you wear face shield during procedures?

- a. Yes
- b. No
- c. Only for procedures that create aerosol droplets

22. Do you wear protective head caps during procedures?

- a. Yes
- b. No
- c. Sometimes

23. Do you change your protective clothing if exposed to visible contamination?

- a. Yes
- b. No

24. Do you disinfect the dental chair between each patient?

- a. Yes
- b. No
- c. Sometimes

25. Do you wrap/cover the chair before any procedure?

- a. Yes
- b. No
- c. Sometimes

26a. if Yes, do you change the dental wrap/cover after each patient?

- a) Yes
- b) No
- c) Disinfect it only

26. How do you recap needles after use?
- I do not recap needles
 - One-handed technique
 - Two-handed technique
27. What do you do with the needles after you have used them?
- Nothing
 - Dental assistant takes care of it
 - Bend it
 - Discard in sharps bin
28. Do you know what the probability of a DHCW being infected by HIV, HBV and HCV following a needle stick injury?
- Yes
 - No
- 29a. If Yes, what is it
- HIV
 - HBV
 - HCV
29. How well do you know the protocol of management of needle stick injuries?
- Not at all
 - Only heard about them but don't know the details
 - Know some details about them
 - Know all the details and protocols
30. What do you do if you are injured by needles or any other sharp objects during a clinical procedure?
- Nothing
 - Stop the procedure immediately
 - Stop the procedure immediately but only if the injury is severe

31. How many times have you been injured with a sharp instrument in a dental clinic in the past 6 months?
- a. Never
 - b. Once or twice
 - c. More than two times
 - d. Cannot remember

ONLY IF YOU HAVE ANSWERED 32b OR 32c (HAD A NEEDLE-STICK INJURY PREVIOUSLY), please answer the following questions 33-36

32. What did you do after the injury? You can tick more than one response

- a. Stopped the procedure
- b. Administered first aid
- c. Reported it
- d. Nothing

33. If you did not report the injury, why not?

- a. I do not know how or to whom to report injury
- b. I use self-care
- c. Injury was minor
- d. Item was unused
- e. Too busy

34. Did you do a blood test after you were injured by a sharp object/instrument?

- a. Yes
- b. No

35. Did you take post-exposure prophylaxis after being injured by a sharp object/instrument?

- a. Yes
- b. No

36. Have you ever received information on the standard precautions for infection control?
- a. Yes
 - b. No
 - c. If Yes, where did you get the information from?
 - a) Supervising doctor, student colleague,
 - b) Nurse or dental assistant
 - c) Classroom lectures, Personal study from books or journals
 - d) Seminars, workshops

Thank you for your time – it is much appreciated!

Appendix IV: UWC BMREC Approval

20 May 2021

Dr D Elhassan
Community Oral Health
Faculty of Dentistry

Ethics Reference Number: BM21/03/12

Project Title: Knowledge, Attitudes and Practices of Oral Health Care Workers towards Infection Control in a Dental Teaching Hospital, Khartoum, Sudan

Approval Period: 09 May 2021 – 09 May 2024

I hereby certify that the Biomedical Science Research Ethics Committee of the University of the Western Cape approved the scientific methodology and ethics of the above mentioned research project.

Any amendments, extension or other modifications to the protocol must be submitted to the Ethics Committee for approval.

Please remember to submit a progress report annually by 30 November for the duration of the project.

Permission to conduct the study must be submitted to BMREC for record-keeping.
The Committee must be informed of any serious adverse event and/or termination of the study.

Ms Patricia Josias
Research Ethics Committee Officer
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