

Infection Control Knowledge and Practices of Dental Clinic Nurses at Rural Health Units

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Abstract: Provision of dental care is not without risk of exposure to blood borne pathogens for both dental workers and patients. Most exposures to infectious agents in the dental clinics are accidental and can be avoided by using safe work practices and following infection control guidelines. **Aim:** To assess dental clinics nurses' knowledge and practice at rural health units. **Design:** A descriptive cross sectional design was used. **Setting:** It was conducted at 120 out of 175 dental clinics at rural health units of Ministry of health and population in six districts in Menoufia Governorate. **Sample:** Multistage random sample composed of 120 nurses, who are working in dental clinics' at rural health units of Ministry of health and population from selected six districts in Menoufia Governorate. **Tools:** Self-administered structured questionnaire included socio demographic data, knowledge of dental nurses as regard to infection control measures, observational checklist of practice of dental nurses and observational checklist of dental clinic. **Results:** There was 87.5% of studied nurses had good level of knowledge about infection control measures and 12.5% had poor knowledge level. Additionally, there was 82.5% of studied nurses had safe practice about infection control measures and 17.5% had a risky practice. **Conclusion:** The majority of participating nurses had good knowledge responses of different infection control measures with exception of report injury incident to infection control committee and no extra precautions should be followed when dealing with patient infected with blood borne pathogen. The majority of participating nurses displayed good practices of different infection control procedures, with the exception of hand hygiene practice and using personal equipment. **Recommendation:** The oral health directorate and infection control directorate should undertake periodic surveys to ensure that the knowledge and skills of oral health care workers are maintained and to identify any weaknesses and modify the training accordingly.

Keywords: dental nurses, oral health care, dental workers, training accordingly.

1. INTRODUCTION

In carrying out their professional work, dental nurses and dentists are exposed to a number of work related health risk factors. These factors cause the appearance of various ailments specific to the profession, which develop and intensify with years. In many cases they result in diseases and disease complexes, some of which are regarded as work related illnesses. These health risk factors categorized as physical, mechanical, chemical, biological and psychological (1). Physical health risk factors include eye injuries occurring from cuts from sharp instruments, or puncture wounds from needles or other sharps instruments. Such injuries can result in the transmission of serious infectious diseases to the dental nurses and dentists. Noise and vibration from the hand piece can lead to hearing problems. Mechanical risk factors like wrist ache, lower backache, and neck ache can occur due to the need to work in specific working positions using a continuous repetitive motion. Chemical risk factors can be inorganic (mercury toxicity), organic (solvents and gases), toxicity from anesthetic gases (Nitrous oxide) and latex glove allergy (contact dermatitis) (2). Dental nurses and dentists are exposed to biological risk factors as a result of direct or indirect contact with traumatized tissues, saliva and blood on a daily basis. So, dental nurses and dentists are at risk of exposure to hepatitis B, C, human immune deficiency virus (HIV), and other types of communicable infection (3).

Infection is the invasion and multiplication of micro-organisms within the tissue, which then results in their destruction. This is often seen as a chain of events. Each link in the chain must be present, and in the sequential order for an infection to occur. Understanding the different links in the chain provides healthcare professionals with methods to protect vulnerable people and thereby prevent the spread of infection. If any one of the links in the chain is broken or eliminated, then the infection can be prevented or the spread of infection reduced (4).

In Egypt, a study conducted in Beni-Suef university hospital, revealed that occupational cut injury occurred in 75% of nurses. This is higher than similar studies in the University Hospital of the West Indies and Georgia (occupational cut injury prevalence's of 43.5% and 38% respectively), and is higher than that reported from eight major health facilities in Kampala and Uganda (5). Furthermore, a study aims to assess the occupational exposure to blood and body fluids among undergraduate nursing and dental students at internship year in Assiut city, 88.6%, and 51.3% respectively of nursing and dental students were exposed to needle stick injuries and blood and body fluids.

The risk of infection as a result of dental procedures represents an important patient safety consideration. By understanding how diseases are transmitted, and applying infection prevention and control principles, oral health care workers can develop strategies to interrupt the transmission of micro-organisms among patients and oral health care workers, and from dental instruments, hand pieces, devices and equipment (6).

1.1. SIGNIFICANCE OF THE STUDY:

Because of their frequent direct or indirect contact with blood or blood-contaminated saliva, transmission of blood borne pathogens is of great concern to dental health care workers. It has been documented that HBV infection is the most important infectious occupational hazard in the dental profession, the risk of HBV transmission to a health care workers after the percutaneous exposure is approximately 30%, and a number of reports suggest a significantly higher incidence of HBV infection among dental staff (7).

In Egypt, infection rates of HCV among dental nurses is 25% while risk of transmission of HBV for non-immune dental nurse is 2-40%, several studies suggested dental practices and poor adherence to standard infection control are main causes. Vaccination of healthcare workers for HBV has greatly reduced the risk of transmission. Moreover, patient-to-patient transmission of HBV has recently been proven. The risk of transmission of HBV through the dental practice remains an issue (8).

Nursing science contributed to identifying specific infection prevention practices for health care workers. Having an infection control conscience helps the nurse to apply good aseptic practices at the right time and right clinical situation. Nurse's lack of knowledge may be a barrier in prevention of infections (9). Hence, this study was carried out to assess infection control knowledge and practices of dental at rural health units.

1. 2. AIM OF STUDY:

The aim of the study was to assess infection control knowledge and practices of dental clinics nurses at rural health units

1. 3. RESEARCH QUESTIONS:

The following research questions were formulated in an attempt to achieve the aim of current study:

- What is the knowledge of dental clinic nurses about infection control measures?
- What is the level of knowledge of dental clinic nurses about infection control measures?
- What is the level of practice of dental clinic nurses about infection control measures?
- What are the resources and logistics of dental clinics at rural health unit?

II. SUBJECTS AND METHODS

2.1. Research design:

A descriptive cross sectional design was used to achieve the aim of study

2.2. Research setting:

This study was conducted at 120 out of 175 dental clinics at rural health units of Ministry of health and population in six districts in Menoufia Governorate, setting was selected by using multistage random sample technique.

2.3. Research sample:

Multistage random sample composed of 120 nurses who are working in dental clinics' at rural health units of Ministry of health and population from selected six districts in Menoufia Governorate, according to the following stages:

- First stage: Random selection of six districts out of ten districts in Menoufia Governorate, Egypt, the selected districts were Shebin El kom, Menouf, Tala, Berket Elsab, Elbaghour and Qesna district.
- Second stage: Random selection of 120 out of 175 dental clinics at rural health units of Ministry of Health and Population at selected six districts in Menoufia Governorate using a simple random technique from the list of dental clinics at rural health units obtained through the Directorate of Health Affairs in Shebin El kom.
- Third stage: In each dental clinic of rural health units there was one responsible nurse and a substitute one, in which dental clinic nurse who agreed to participate in the study and attending infection control program provided written informed consent was included in the study.

2.4. Sample size:

It was calculated using the online Epi-info software for sample size calculation according to the following equation:

$$n = [DEFF * Np(1-p)] / [(d^2 / Z^2_{1-\alpha/2} * (N-1) + p * (1-p)]. \text{Our assumptions were:}$$

1. Population size $N=175$ dental nurses
2. Hypothesized % frequency of Infection control knowledge among the population (p): 8% +/-5
3. Confidence limits as % of 100(absolute +/- %)(d): 5%
4. Design effect (for cluster surveys- $DEFF$): 1

Results from Open Epi, Version 3, open source calculator—SSPropor. Sample sizes were provided for confidence levels from 90% to 99.99%. We used 95% confidence level with approximation of sample size of 114 to 120 dental nurses as our required sample size.

2.5. Tools of the study:

Data was collected using the following tools:

2.5.1. Self-administered structured questionnaire:

It was designed by the researchers based on review of relevant literatures to elicit the needed information (El Nimr, 2007; Australian Dental Association, 2015; CDC 2016). It consists of two main parts:

A. Personal characteristics: Included nurses' age, marital status, level of education, years of experience.

B. Knowledge of dental nurses related to infection control measures

It was developed by Australian Dental Association (2015) & CDC (2016) and modified by the researchers to be suitable with the Egyptian culture, included 25 items to assess knowledge of dental nurses about infection transmission during dental practice (7 items), infection control measures that should be performed routinely (10 items), sharp and non sharp waste disposal (2 items), disinfection and sterilization measures of dental instruments as burs and hand piece (6 items). Each correct response was given two score, incorrect response was given one.

The questionnaire was evaluated giving a score of 1 -50 The total score of each nurse was categorized arbitrary into "good knowledge" when the nurse achieved $\geq 75\%$ of the total score, and "poor knowledge" was considered when the nurse achieved 50 to $< 75\%$ of the total score. Reliability of tool one was applied by the researcher for testing the internal consistency of the instrument, among 10 participants by using test retest method with two weeks apart between them. Then correlation coefficient (Cronbach's alpha) was calculated between the two scores. Correlation coefficient was 0.85 which indicates that tool one is reliable.

2.5.2. Infection control practices (observational checklist sheet):

It was adopted from CDC (2016), included 40 items, it was observed by the researchers and used to assess hand hygiene practices before wearing and after removing gloves (17 items), practices of using personal protective equipment (6 items), using of aseptic technique practices (6 items), dealing with environmental surfaces (2 items), sharps and non-sharp waste management (5 items), disinfection and sterilization (3 items). Nurses' practices were studied in a list of 40 items, the responses of each item in the form of two points Likert scale (0 – 1) as one for “Safe practice”, and zero for “Risky practice”. The checklist was evaluated giving a score of 0-40. The total score of each nurse was categorized arbitrary into “safe practice” when the nurse achieved $\geq 75\%$ of the total score, and “risky practice” was considered when the nurse achieved from 50 to $<75\%$ of the total score. Test-retest reliability was applied by the researchers for testing the internal consistency of instrument. Its reliability has been verified with Cronbach's values of 0.79, which indicates that the tool is reliable.

Validity of the tools:

The validity of the tools were done by three experts in Family and Community Nursing, Medical and Surgical Nursing and Community Medicine who examined the tools for completeness and clarity (content validity), accuracy and internal validity. Also, professors were asked to judge the relevancy, clarity, fluency, and simplicity of each component in the questionnaire and their suggestions were incorporated into the tools.

2.6. Pilot study:

A pilot study was carried out on 10% of study sample to assess clarity of the tool and estimate time needed to fill each part. The necessary modification was done as revealed from pilot study. The sample of the pilot study was not included from the total sample to assure stability of result.

2.7. Ethical consideration:

The researcher followed all the ethical issues in conducting the research, the participation of nurses were voluntary; confidentiality and privacy of participants were respected and allowed to withdraw from the study at any time without compensation. Also, an informed consent of participants was taken to participate in the study.

2.8. Approval

Official letter was taken from the dean of faculty of nursing in Menoufia University to the directors of Menoufia Directorate of health affairs. Permission to carry out the study from the head of dentistry, also permission was taken from infection control department in Menoufia directorate of health affairs and from directors of selected six districts to obtain their approval to facilitate data collection.

2.9. Procedure and data collection

- This study was conducted during the period starting from June 2018 and completed by the end of January 2019.
- The researchers constructed the tool after reviewing the literature that covers the various aspects of the topic by using previous studies, books and network.
- Communication with responsible authorities was needed to facilitate conduction of the study, permission to carry out the study was obtained from the head of dentistry department and infection control department in Menoufia directorate of health and affairs, they approved conducting the study, the number and names of all rural health units in each district in Menoufia Governorate were obtained.
- After obtaining approval and written informed consent from dental nurses to conduct the study, the researcher introduces herself and explains the purpose of study to dental clinic nurses. Then, the researchers initiated data collection from dental nurses who fulfilled the selection criteria.
- From selected dental clinics, each dental nurse who approved to participate and fulfilled selection criteria was asked to fill self-administered questionnaire including sociodemographic, personal characteristics data and knowledge about infection control measures, then infection control observational practices of dental nurses and dental clinic observational checklist sheet were filled by researcher, each data collection took about 25-30 minutes.

Statistical analysis: Data was coded and transformed into specially designed form to be suitable for computer entry process. Data was entered and analyzed by using SPSS (Statistical Package for Social Science) statistical package version 22. Graphics were done using Excel program. Quantitative data as years of nurse’s experience were presented by mean (X) and standard deviation (SD). Qualitative data were presented in the form of frequency distribution tables, number and percentage. It was analyzed by chi-square (χ^2) test. However, if an expected value of any cell in the table was less than 5, Fisher Exact test was used(if the table was 4 cells), or Likelihood Ratio (LR) test (if the table was more than 4 cells). Level of significance was set as P value <0.05 for all significant tests.

III. RESULTS

Table 1: Shows that 45.8% of the studied subjects were 30-<40 years old, while only 23.4% of them were 20-30 years old with a mean age of 38.3 ± 0.5 years. In relation to the educational level, 68.3% of nurses have low education, and about one third (31.7%) had moderate education. Concerning the marital status, all studied nurses were married (100%). In addition; the majority of them have experience of 10-15 years.

Table 2: Reveals that the majority of studied nurses gave correct answer responses regarding infection transmission during dental practice from dental health care workers to patients (90%), from patient to dental care workers(83.3%) and from patient to patient (97.5%). Additionally, 72.5% had reported that infection could transmit through mucous membrane of nose, eyes, and mouth, 80% of dental nurses reported that every patient in dental clinic could transmit infection, 73.3% had reported that HIV can be transmitted during dental practice and infection control measures for prevention of HBV and HCV are the same acknowledged by 74.2%

Table 3: Demonstrates that the majority of studied nurses reported incorrect answer responses about importance of wearing mask (78.3%), changing mask between patients (83.3%), no extra precautions should be followed when dealing with patient infected with blood born viral disease (90.8%) and importance of disposing contaminated gloves before handling non clinical items (64.2%).

Table 4: Illustrates that the majority of studied nurses had correct answer responses about importance of avoid bending syringe needle before disposal in safety box and separating blood soaked waste from ordinary waste (98.3% for each).

Table 5: Shows that the majority of studied nurses had incorrect answer responses about cleaning and disinfection of hand light (74.1%) and dealing with blood spillage on surfaces and bracket table trays after each use (64.2%) for each.

Figure 1: Shows that 87.5% of dental clinic nurses had good level of knowledge and 12.5% had poor level of knowledge.

Figure 2: Reveals that there were 17.5% of studied nurses had a risky practice and 82.5% had safe practice.

Table 6: Reveals that the grand mean total practice score of dental clinics nurses were 23.4 ± 3.1 , hand hygiene score was 7.01 ± 2.7 , personal protective equipment using score was 3.5 ± 0.7 , using a septic technique score was 7.7 ± 1.5 , sharp waste disposal score was 7.7 ± 1.5 .

Table 7: Shows that, hand paper towels were available in 74% of dental clinics and alcohol-based hand rub was available in 89% of dental clinics. Appropriate personal protective equipment were presented in most of selected dental clinics. Additionally, there was a container full with soap and water for contaminated instrument in 97% of dental clinics, about three fourths of dental clinics were clean and clearly designated clean and contaminated areas. Also, the availability of infection control guidelines ranged from 54% up to 82% in rural dental clinics.

Table (1): Distribution of the studied nurses according to their socio-demographic characteristics (N=120)

Socio-demographic characteristics	No.	(%)
Age		
• 20-<30 years	28	23.4
• 30-<40 years	55	45.8
• ≥ 40 years	37	30.8
Mean age \pm SD	38.3 ± 0.5 years	

Marital status • Married	120	100
Education • Moderate • Low	38 82	31.7 68.3
Years of experience • 5-<10 years • 10-<15 years • ≥15 years	1 92 27	0.8 76.7 22.5
Total	120	100

Table 2: Distribution of studied nurses knowledge about infection transmission during dental practice (N=120)

Knowledge about infection transmission during dental practice		No.	%
Infection can be transmitted from healthcare workers to patients	Yes	108	90.0
	No	12	10.0
Infection can be transmitted from patients to healthcare workers	Yes	100	83.3
	No	20	16.7
Infection transmission from patient to patient	Yes	117	97.5
	No	3	2.5
Infection transmission through mucous membrane of nose, eyes and mouth	Yes	87	72.5
	No	33	27.5
Every patient considered to have infectious disease	Yes	96	80.0
	No	24	20.0
HIV can be transmitted during dental practice	Yes	88	73.3
	No	32	26.7
Infection control measures for prevention of HBV and HCV are the same	Yes	89	74.2
	No	31	25.8
Total mean score of infection transmission		12.7±1.2	

Table 3: Distribution of studied nurses knowledge about infection control measures that should be performed routinely (N=120)

Knowledge about infection control measures that should be performed routinely in dental clinic		No.	%
It is important to wash hands before wearing gloves	Yes	120	100.0
	No	0.0	0.0
Soap and water is better than alcohol if hands are dirty	Yes	97	80.8
	No	23	19.2
It is important to wear mask during dental practices	Yes	26	21.7
	No	94	78.3
It is important to change mask between every patients	Yes	20	16.7
	No	100	83.3
Wearing gloves can replace the need of hand wash	Yes	24	20.0
	No	96	80.0
It is necessary to wash hands after gloves removal	Yes	116	96.7
	No	4	3.3
Wearing protective eye wear is necessary during dental practices	Yes	63	52.5
	No	57	47.5
It is important to report injury incident to infection control committee, if you get injured by needle or sharp instrument	Yes	81	67.5
	No	39	32.5
No extra precautions should be followed when dealing with patient infected with blood born viral disease	Yes	11	9.2
	No	109	90.8

Disposal of contaminated gloves before handling non clinical items is necessary	Yes	43	35.8
	No	77	64.2
Total mean score of infection control measures that should performed routinely	14.8±1.1		

Table 4: Distribution of studied nurses knowledge about sharp and non-sharp waste disposal (N=120)

Knowledge about sharp and non-sharp waste disposal		No.	%
Anesthesia carpels disposed of in sharp container	Yes	103	85.8
	No	17	14.2
Bending syringe needle before disposal in safety box	Yes	2	1.7
	No	118	98.3
Separating blood soaked waste from ordinary waste	Yes	118	98.3
	No	2	1.7
Total mean score of sharp and non-sharp disposal	4.4±0.5		

Table 5: Distribution of studied nurses' knowledge about disinfection and sterilization measures after each use (N=120)

Knowledge about disinfection and sterilization measures after each use		No.	%
Dental burs should be cleaned then sterilized	Yes	115	95.8
	No	5	4.2
Dental unit surface should be cleaned then disinfected	Yes	103	85.8
	No	17	14.2
Dental hand light should be cleaned then disinfected	Yes	31	25.8
	No	89	74.1
Blood spillage on surfaces should be cleaned then disinfected	Yes	43	35.8
	No	77	64.2
Bracket table trays should be cleaned then sterilized	Yes	43	35.8
	No	77	64.2
Total mean score of disinfection and sterilization measures	7.5±0.6		

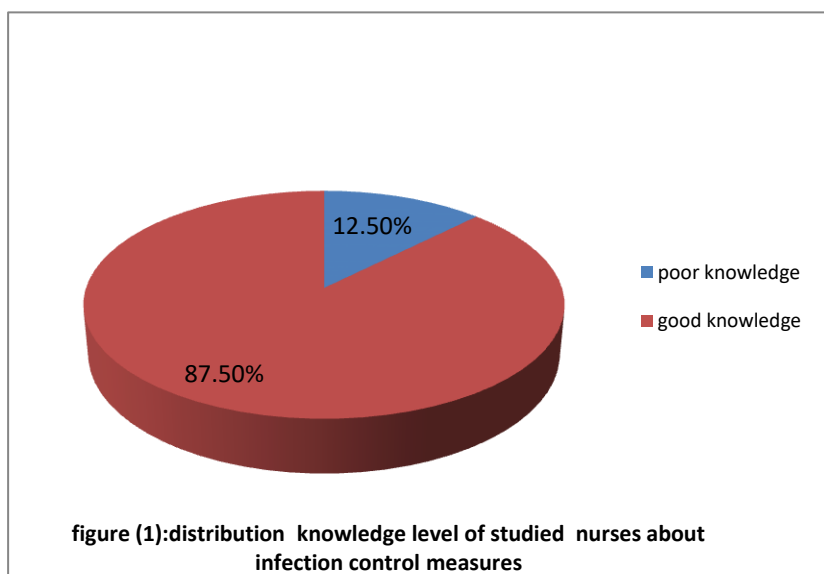


Figure 1: Distribution knowledge level of studied nurses about infection control measures (N=120)

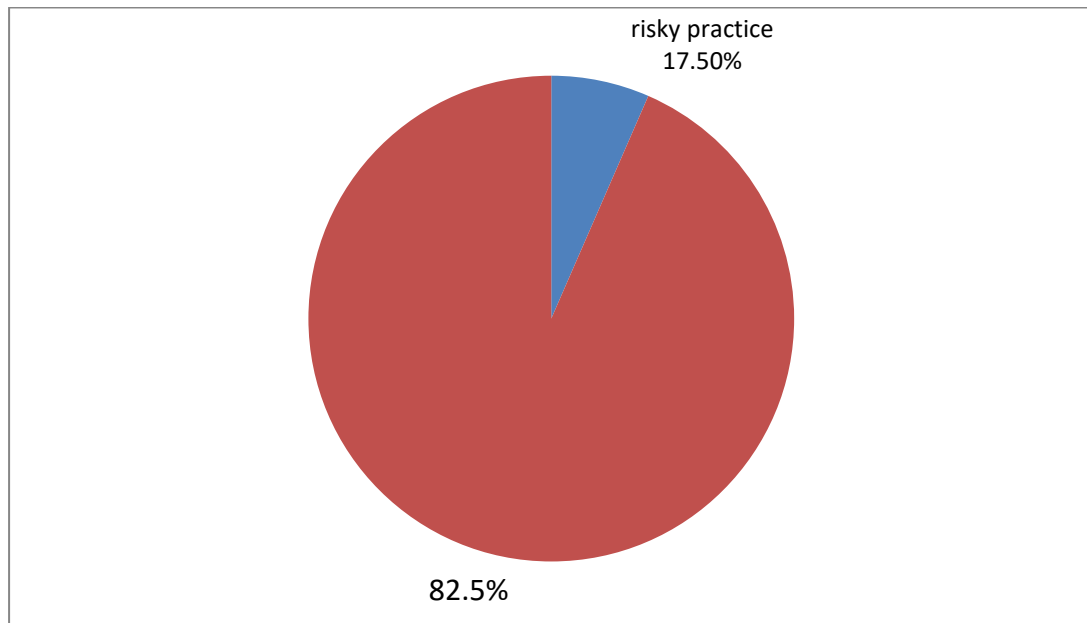


Figure (2): Distribution of level of practice of studied nurses about infection control measures (N=120)

Table 6: Distribution of mean total scores of practice subscales and grand total practice score among studied nurses (N=120)

Total score of practice subscales	Mean± SD
Hand hygiene score	7.01±2.7
Personal protective equipment using score	3.5±0.7
Using a septic technique score	5.1±0.8
Sharp waste disposal score	7.7±1.5
Grand mean total score of observed practice	23.4±3.1

Table 7: Distribution of infection control logistics and resources at dental clinics in rural health units (N= 120)

Infection control logistics and resources	No.	%
hand hygiene supplies		
Liquid soap and water	120	100
Paper towels	89	74
Alcohol-based hand rub	107	89
Presence of hand washing sink	120	100
Appropriate personal protective equipment		
Disposable gloves	120	100
Sterile gloves	113	94
Masks	120	100
Protective eyewear	109	91
Face shields	115	96
Utility gloves	120	100
Resources for instrument reprocessing		
There is a container full with soap and water for contaminated instrument	116	97
Instrument reprocessing area separate from treatment area	120	100
Cleanliness of clinic area		
Clinical area is clearly designated 'clean' and 'contaminated' areas	87	72
Dental clinic is clean	88	73
Infection control guidelines		
Hand hygiene guideline	79	66

Guidelines for decontamination of spills of blood	74	62
Post exposure management plan	65	54
A record file of training dental health care provider	75	62
A record file of vaccination status of health care workers	98	82
A training plan for health care workers on infection control procedure	95	79

IV. DISCUSSION

Most exposures to infectious agents in the dental clinics are accidental and can be avoided by using safe work practices and following infection control guidelines. However, some exposures are not preventable; immunization and appropriate post exposure management become the key defense (10). Clinical research assessing infection control knowledge and practices among dental nurses is necessary, it provides continuous assessment for the efficacy of infection control education and training programs and assists in the development of educational interventions to improve adherence to guidelines and reduce injuries (11). Therefore, the purpose of the present study was to assess infection control knowledge and practices of dental clinics nurses at rural health units.

Concerning knowledge of dental nurses about infection transmission in dental clinic, the present study showed that the majority of studied nurses gave correct answers regarding infection transmission during dental practice from dental health care worker to patient, from patient to dental care workers and from patient to patient and about three fourths of studied nurses had reported infection can be transmitted through mucous membrane of nose, eyes and mouth and every patient in dental clinic could transmit infection and HIV can be transmitted during dental practice and infection control measures for prevention of HBV and HCV are the same. This result was in agreement with Dagheretal et al., (2017) (12) they reported that nearly ninety percent of dental workers in Lebanon realizing that every patient in dental clinics must be considered to have infectious disease. Similar result was reported by by Mandourh et al., (2015) (10) they reported nearly three quarters of dental workers in private dental clinics in Makkah, Saudi Arabia, know that HIV can be transmitted during dental practice and infection control measures for prevention of HBV and HCV are the same. On the same line, (Alanazi et al., (2018)(13) they conducted a study among dental students in Al-Jouf University, Saudi Arabia, they found that the majority of dental students acknowledged infection transmission in dental clinics. Also, El Nimr, (2007) (14) assessed infection control practices of Ministry of Health and Population dental clinics in Alexandria, Egypt. She reported that the majority of dentists knew infection can be transmitted from dental health care worker to patient, from patient to dental care workers and from patient to patient and nearly all dentists knew infection could transmit through mucous membrane of nose, eyes and mouth and the majority of dentists acknowledged HIV can be transmitted during dental practice.

As regards to knowledge of dental nurses about infection control measures that should be performed routinely, the present study showed that the majority of studied nurses reported incorrect answer responses about importance of wearing and changing mask between patients, and the extra precautions should be followed when dealing with patient infected with blood born viral disease, also the importance of disposing contaminated gloves before handling non clinical items. Similar result reported by Qudeimat et al., (2006) (15) who studied infection control knowledge and practices among dentists and dental nurses at a Jordanian university teaching center. They reported that the majority of dental nurses reported incorrect answers about routine disposal of contaminated gloves before handling nonclinical items. Also, Alanazi et al., (2018) (13) they revealed only eight percent of dental students in Al-Jouf University, Saudi Arabia, reported correct responses about importance to change their mask after each patient. In contrast, Idris (2012) (16) reported that the majority of dental staff reported importance to wear masks routinely. Additionally, Motegim et al., (2010) (17) studied infection control procedures in dental Clinics in Tokyo, Japan reported nearly all responders reported importance of wearing mask. This difference may be related to increase importance and availability of personal protective equipment or strict legislation in developed countries.

Nurses are the most frequent health occupational group to suffer from needle stick and sharp injuries, which puts nurses under the risk to acquire serious blood borne diseases, the current study reported that the majority of studied nurses had correct answer responses about importance of avoid bending syringe needle before disposal in safety box and separation of blood soaked waste from ordinary waste. This result was consistent with Jarallaha and Ahmed (2016) (18) they carried out intervention study among nurses working at a military hospital in Saudi Arabia. They revealed that the majority of studied nurses had correct answer responses about importance of avoid bending syringe needle before disposal in safety

box and separation of blood soaked waste from ordinary waste. On the same line, Haridi et al., (2016) (19) reported that the majority of dental healthcare workers in Saudi Arabi reported separation of clinical waste from ordinary waste. Additionally, Jaydeep et al., (2017) (20) conducted a study in urban and rural health care settings of Ahmedabad district, Gujarat, India to assess knowledge, attitude and practice of infection control methods among health care workers. They revealed that only one fifth nurses reported bending syringe needle after using it. On contrast, Alanazi et al., (2018) (13) reported that the majority of dental students did not know that clinical waste should be discarded in specially designated and color coded bins. The difference may be related to increasing legislation of separation of wastes from environmental health sector.

As regarding to knowledge of studied nurses about disinfection and sterilization measures, the current study demonstrates that, the majority of studied nurses had incorrect answer responses about cleaning and disinfection of hand light, dealing with blood spillage on surfaces and cleaning and disinfection of bracket table trays after each use. This current result was supported by Alanazi et al., (2018) (13) they reported only small percentage of dental students have knowledge about disinfecting the dental chair after each patient, and the cause may related to increase work load.

As regards to the knowledge level of studied nurses about infection control measures in dental clinic, the present result revealed that more than three fourths of dental nurses had good level of knowledge. This result was consistent with Abdel-Rasoul et al., (2017)(21) they conducted a study to assess knowledge, attitudes and practices of healthcare workers with respect to nosocomial infections in the National Liver Institute, Egypt. They revealed that the majority of nurses had good level of knowledge about infection control measure. Moreover, Ladia and Gupta (2017) (22) who evaluated infection control measures and waste management in a private dental college, Pune, reported that nearly half of dental students had good knowledge.

Hand hygiene practice is one of the most vital components in the practice of the dental infection control process and is considered the single most important activity performed to reduce the risk of transmitting microorganisms from dental workers to patient (23). The present study showed that about one third of dental nurses washed hands before wearing gloves, this result was consistent with that reported by El-Sayed and Khalifa(2015) (24) revealed low compliance with washing hand before wearing gloves among dental nurses working at Cairo Dental Research Center. On contrast, Idris (2012) (16) who assessed infection control practices in public dental clinics in Khartoum State, Sudan, observed that vast majority of dental workers wash hands before wearing gloves. Also, Mutters, et al.,(2014) (23) who evaluated compliance with infection control practices by dental health care personnel in a German university dental clinic reported nearly all of dental workers wash hands before wearing gloves. This difference between the present study and other studies may be related to low awareness of importance of hand hygiene practice among studied nurses before wearing gloves or increase workload.

The present study showed that about three quarters of studied nurses washed hands after removing gloves. This result was higher than that reported by El-Sayed and Khalifa ,(2015) (24) revealed low compliance with washing hand after removing gloves among dental nurses working at Cairo Dental Research Center. This difference may related to increase awareness of hand hygiene after removal of gloves than before wearing gloves among studied nurses

As regards to the practice level of studied nurses about infection control measures in dental clinic, there was 17.5% of studied nurses had a risky practice and 82.5% had safe practice. The present result concurs with Ladia and Gupta, (2017) (22) demonstrated good practice observations (eighty percent) in a private dental college, Pune.

As regards to practice subscales for studied nurses in dental clinics which included hand hygiene, personal protective equipment using, using a septic technique and sharp waste disposal, the present study showed that the grand mean total practice score was 23.4 ± 3.1 . This result was supported by Nour-Eldein and Mohamed, (2016) (25) revealed that the grand mean of practice was 35.6 ± 11.3 .

As regards to availability of infection control logistics and resources at dental clinics in rural health units, the present study showed that nearly three quarters of dental clinics had appropriate supplies necessary for adherence to hand hygiene procedures and hand paper towels. Alcohol-based hand rub was available in majority of dental clinics. Appropriate personal protective equipment were presented in most of selected dental clinics. Additionally, there was a container full with soap and water for contaminated instrument in nearly all of dental clinics, about three fourths of dental clinics were clean and clearly designated clean and contaminated areas. Also, the availability of infection control guidelines ranged from 54% up to 82% in rural dental clinics. In contrast, Yadav et al., (2017) (26) they revealed there was lack of written

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infection control policies and guidelines in private dental hospital in India, so recommended that clearly written policies, procedures and guidelines can help ensure consistency, efficiency, and effective coordination of activities. Also, Wasswa et al., (2016) (27) conducted a study about infection control in health facilities in South Africa, revealed lack availability of alcohol based and rub protective eyewear, cleanliness of clinics and lack of clear infection control guidelines.

V. CONCLUSION

Based on the results of the present study, it was concluded that:

- The majority of participating nurses had good knowledge responses of different infection control measures with exception of report injury incident to infection control committee and no extra precautions should be followed when dealing with patient infected with blood borne pathogen.
- The majority of participating nurses displayed good practices of different infection control procedure, with the exception of hand hygiene practice and using personal equipment.
- There was 87.5% of dental nurses had good level of knowledge about infection control measures and 12.5% had poor level of knowledge
- There was 17.5% of studied nurses had a risky practice and 82.5% had safe practice.

VI. RECOMMENDATION

Based on the results of this study, the following recommendations were suggested:

- It highlights the need for ongoing infection control training programs and continuing professional development, which will be responsible for developing and updating infection control polices and guidelines.
- The oral health directorate and infection control directorate should undertake periodic surveys to ensure that the knowledge and skills of oral health care workers are maintained and to identify any weaknesses and modify the training accordingly.

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