كلية نبتةالجامعية

NAPATA COLLEGE

Knowledge and Practice of Doctors and Nurses in ICU About Personal Protective Equipment at Al Ribat University Hospital

BY

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(MAY REST IN EVERLASTING PEACE)

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Preface

قَالَ تَعَالَىٰ:

﴿وَلَا تُلْقُوا بِأَيْدِيكُمْ إِلَى التَّهْلُكَةِ وَأَحْسِنُوا ۛ إِنَّ اللَّهَ يُحِبُّ الْمُحْسِنِينَ ﴿١٩٥﴾﴾ ال بقرة:٥٩١

DEDICATION

This dissertation is dedicated to our friend, colleague and brother Dr. Abdelmahmood M. Ali, who's untimely passing left an everlasting psychological scar on us. Abdelmahmood played a key role in the writing, editing and analysis of this work. If it were not for his efforts; this work would not have come to be .

And dedicated to our families , to our friends , to all helped or tired to help us during the our entire education life .

Table of Contents

List of Tables

List of figures

List of Abbreviations

PPE	Personal protective equipment
WHO	World Health Organization
SARS	severe acute respiratory syndrome
ICU	Intensive Care Unit
CDC	Center for Disease Control and Prevention
IPC	Infection prevention and control
EVD	external ventricular drain
HCW	healthcare worker

Acknowledgements

We would like to express and show deep gratitude to our supervisor Dr. Meisa Elmamoun, Obstetrician and Gynaecologist, for her kind supervision, unlimited support, inspirational instruction and guidance, this work would not have been possible without the benefit of her generous help and leading advices.

I would like to express my special gratitude and thanks to all the staff in the hospitals at El-Ribat Hospital for their cooperation in data collection, for revising, this work.

My thanks extended to doctors and nurses included in this study, for offering us information to carry out this study. We are very pleased to thank everyone who helped me in this study.

I would like to convey my thanks to our family members, for all goodwill during difficult times and urging us to keep fighting.

Abstract

Background: Personal protective equipment are designed to protect health care providers from serious workplace injuries or illnesses. Personal protective equipment provides a physical barrier between microorganism and wearer.

Objective: This study aimed to evaluate knowledge and practice among doctors and nurses regarding personal protective equipment in El Ribat Hospital.

Method: This study was a descriptive cross sectional study conducted in El Ribat University Hospital during December 2019 to February 2020. All ICU staff including doctors and nurses The researchers used a well designed valid questionnaire. The data were analyzed by computerized program; statistical package for social sciences (SPSS).

Results: the study found that 27(37.5%) of participants were male, while 45(62.5%) were female. the average availability of protection tools in hospital was 60%. Availability of medical showed was 35%, while availability of gloves was 84%. 50(69.4%) of participants had weak knowledge, 18(25%) had moderate knowledge, while 4(5.6%) had strong knowledge. 76.9%) of doctors had weak knowledge while 65.2%) of nurses had weak knowledge. And 0% of doctors had strong knowledge while 8.75) of nurses had strong knowledge. This differences between doctors and knowledge was not significant (P. Value >0.05). low practice was 0%, moderate practice was 53(73.6%), while high practice was 19(26.4%). there was significant differences between practice of nurses and practice of doctors, nurses had higher levels of practice than doctors.

Conclusion: The present study concluded that level of knowledge among ICU staff doctors and nurses was lower than previous studies. No statistically significant differences between knowledge of nurses. The level of practice was similar to the previous studies, nurses are significantly more compliance with PPEs than doctors. Knowledge was significantly associated with qualification and availability of tools, while practice just significantly associated with availability of tools.

المستخلص

الخلفية: تم تصميم معدات الحماية الشخصية لحماية مقدمي الرعاية الصحية من الإصابات أو الأمراض الخطيرة في مكان العمل توفر معدات الحماية الشخصية حاجزاً ماديًا بين الكائنات الحية الدقيقة ومرتديها.

الهدف : هدفت هذه الدراسة إلى تقييم المعرفة والممارسة بين الأطباء و الممرضين فيما يتعلق بمعدات الوقاية الشخصية في مستشفى الرباط التعليمي.

الطريقة : كانت هذه دراسة وصفية مستعرضة أجريت في مستشفى الرباط التعليمي خلال الفترة من ديسمبر 2019 إلى فبراير 2020 على جميع العاملين في وحدة العناية المركزة بما في ذلك الأطباء والممرضين. استخدم الباحثون استبيانًا صالحًا ومصممًا جيدًا .تم تحليل البيانات بواسطة برنامج محوسب؛ برنامج الحزمة الإحصائية للعلوم الاجتماعية (SPSS) .

النتائج : وجدت الدارسة أن 27 (37.5%)من المشاركين كانوا من الذكور،في حين أن 45 (62.5%) كانوا من الإناث. كان متوسط توافر أدوات الحماية في المستشفى 60% . كان أدنى توافر هو للحذاء الطبي 35%، في حين كان توافر القفازات 84% . 50 (69.4%)من المشاركين لديهم معرفة ضعيفة ، 18 (25%) لديهم معرفة متوسطة ، بينما 4 (5.6%) لديهم معرفة قوية. (76.9%) من الأطباء لديهم معرفة ضعيفة بينما(65.2%) من الممرضين لديهم معرفة ضعيفة. وكان (0%) من الأطباء لديهم معرفة قوية في حين أن (8.75%) من الممرضين لديهم معرفة قوية. ليس هنالك اختلاف ذو دلالة إحصائية في المعرفة بين الأطباء والممرضين (.Pالقيمة> 0.05). كانت نسبة الممارسة المنخفضة (0%) ، وكانت نسبة الممارسة المتوسطة 53 (73.6%) ، في حين أن الممارسة العالية كانت 19 (26.4%). كان هناك اختلافات كبيرة بين ممارسة الممرضين وممارسة الأطباء، حيث ان مستويات الممارسة للمرضين أعلى من الممارسة للأطباء.

الخلاصة : خلصت الدراسة الحالية إلى أن مستوى المعرفة بين الأطباء و الممرضين العاملين في وحدة العناية المركزة كان أقل من الدراسات السابقة . لا توجد فروق ذات دلالة إحصائية بين معرفة الممرضين والأطباء .وكان مستوى الممارسة مماثل للدراسات السابقة ، ممارسة الممرضين أعلى من ممارسة الأطباء .ارتبطت المعرفة بدلالة احصائية بتأهل أدوات الحماية وتوافرها، بينما ارتبط التدريب بدلالة احصائية بتوافر أدوات الحماية.

Chapter One

Introduction

Chapter One

Introduction

Background:

Personal protective equipment are designed to protect health care providers from serious workplace injuries or illnesses.(1) Personal protective equipment provides a physical barrier between microorganism and wearer. It offers protection by preventing microorganism from contaminating hands, eyes, clothing, hair and shoes.(2)

A breach in infection control practices facilitates transmission of infection from patients to health care workers, other patients and attendants. Personal protective equipment (PPE) includes gloves, protective eye wear (goggles), mask, apron, gown, boots/shoe cover, hair cover. PPE should be used by all health care providers, supporting staffs, laboratory staffs, and family members who provide care to patients in situations where they have contact with blood, body fluids, secretions or excretions. (3)

Health workers are among the first to respond when an infectious pathogen threatens a community. Indeed, they are often among the first to be affected a cluster of cases of severe illness in health care workers can be the first sign that something unusual is going on. Before the cause of an outbreak has been identified and before infection-control measures have been put in place, health workers can find themselves at heightened risk of infection. This was the case in 2014, when the Ebola epidemic began in West Africa. Many doctors, nurses and other health workers became infected in the workplace and died. Responding to an urgent request from Member States, the World Health Organization (WHO) undertook the development of a rapid advice guideline on Personal Protective Equipment, an important component of Infection Prevention and Control. (4)

Problem Statement :

The emergence of life-threatening infections such as severe acute respiratory syndrome (SARS) and reemerging infectious diseases like plague and

tuberculosis had highlighted the need for efficient infection control programs in all health care settings(5) and research into standard precautions has been carried out in many countries. (6)(7)

Justification:

Nosocomial infections transmitted by direct-contact can be prevented by adapting standard precautions guidelines. Appropriate use of PPE is the easiest way to prevent contact from secretions and transfer of pathogens. It's important to assess the level of compliance with use of PPE by the various HCWs who make direct contact with patients. Hence this study attempted. The objective of this study was to evaluate the appropriate use of PPE among health care providers in ICU in El Ribat Teaching Hospital, Khartoum, Sudan.

Objectives:

General Objectives:

This study aimed to evaluate knowledge and practice among doctors and nurses regarding personal protective equipment in El Ribat Hospital.

Specific Objectives:

1. To determine levels of knowledge and practice among doctors and nurses regarding personal protective equipment.
2. To measure the availability of personal protective equipment in El Ribat Hospital.
3. To determine the contributing factors associated with level of knowledge and practice among doctors.

Chapter Two

Literature Review

Chapter Two

Literature Review

Background:

In 1983, the US Center for Disease Control and Prevention (CDC) recommended blood and body fluid precautions when a patient was known or suspected to be infected with blood-borne pathogens. (8)(9) In 1987, the CDC recommended that regardless of patient's infection status, the precautions must be consistently used. This extension of blood and body fluid precautions to all patients is referred to as "universal blood and body fluid precautions" or simply "universal precautions." (10)(11)

These precautions include set of precautions devised to prevent transmission of all known blood-borne pathogens including HIV, hepatitis B virus, and hepatitis C virus to/from health care personnel when providing first aid or other health care services. In 1996, the CDC included the universal precautions in a new prevention concept the so-called "standard precautions." (12)

The "standard precautions," which are devised to be used for the care of all patients in hospitals regardless of their diagnosis or presumed infection status, now replace the "universal precautions." Standard precautions are the underpinning principles for routine safe practices. They are precautions that should be practiced by all clinical staff without exception, to limit the risk of potentially harmful organisms being transmitted to the patient, healthcare worker, visitor or the environment. Standard precautions include hand hygiene, Use of personal protective equipment (PPE), Safe management and disposal of sharps, Safe disposal of clinical waste, Cleaning and decontamination of re-usable equipment, Maintenance of a clean clinical environment, Safe management of laundry, Safe management of body fluid spillages. (13)

Infection prevention and control :

To prevent virus transmission in health care settings, procedures and protocols referred to as “controls” need to be applied. These are (in decreasing order of IPC effectiveness): administrative controls,

environmental and engineering controls, and personal protective equipment. While PPE is the most visible control used to prevent transmission, it must be used in conjunction with administrative and engineering controls (such as facilities for barrier nursing and work organization, water and sanitation, hand hygiene infrastructure, waste management and ventilation). (14)

PPE must be correctly selected and used in a safe manner; safety concerns are especially important when PPE is put on, removed or decontaminated. The current document deals only with the choice of PPE; information on safe use of PPE is given elsewhere. (15)

The practices of health workers are equally important in preventing infections. Standard precautions are the basic IPC measures, which should be used, as a minimum, in the care of all patients. They are designed both to protect health workers and to prevent infections from spreading to other patients. It is not always possible to identify patients with filovirus infection, because early symptoms are nonspecific. For this reason, it is important that health workers use standard precautions consistently with all patients, regardless of their diagnosis. Rigorous adherence to these precautions is crucial for the control of outbreaks. (16)

Details of standard precautions and best practices for prevention and control of filovirus infection in health care settings can be found in the WHO IPC guidance mentioned above. (17)

Safety and well-being of health workers :

Safeguarding the health and well-being of health workers in the workplace, including providing facilities for hand hygiene and appropriate PPE, is a priority, and is the responsibility of policy-makers, employers, and managers. The steps to be carried out are summarized below: (18)

- A risk assessment of the workplace should be carried out by competent IPC experts appointed by the employer.
- All health workers at risk should be provided with adequate, effective and sustainable protective measures commensurate with the risk.
- Health workers should be informed of the risks they may face, and the mitigating effects of PPE when used consistently and correctly. Compliance with all control measures is the responsibility of the health worker.

- ❖ Policy-makers and managers need to consider issues such as climate conditions and cultural norms, to ensure that protection measures are adopted and to maximize compliance.
- ❖ The recommended PPE should be available and accessible to health workers. Health workers need to be adequately trained in the use of PPE; refresher training should be available.
- ❖ All health workers with symptoms of EVD should seek rapid medical attention. They should avoid working, in order to avoid transmitting infection to colleagues. Employers are responsible for notifying the labour inspectorate of cases of occupational diseases.

Importance of Personal Protective Equimpent at ICU

Patients with severe acute febrile respiratory illness caused by pathogens such as respiratory syncytial virus and influenza are often cared for in intensive care units (ICUs); effective infection prevention and control in routine care of such patients is essential to limiting nosocomial spread of disease. It is likely that many patients presenting with febrile respiratory illness caused by virulent novel pathogens (e.g., pandemic influenza or severe acute respiratory syndrome SARS coronavirus) will also require ICU care(19). Such patients may be expected to remain contagious for longer periods than those infected with seasonal pathogens, and the risk of secondary transmission of respiratory viruses may be particularly high in the ICU(20).

Data from outbreaks of respiratory syncytial virus and SARS have demonstrated that an infection prevention and control program, including the use of transmission-based barrier precautions, can have a significant impact on healthcare-associated infection rates. (21)

The contribution of administrative and environmental measures (e.g., ventilation and disinfection) to such comprehensive programs should not be underestimated. However, effective use of transmission-based precautions, including personal protective equipment (PPE), is also a key part of annual respiratory virus infection control. Further, PPE use will be an even more important part of efforts to minimize healthcare worker (HCW) risk and maintain a healthy ICU workforce in an outbreak of a novel respiratory

pathogen, particularly in light of potential limitations in available prophylactic and treatment measures. (22)

Previous Studies:

Several studies conducted around the world concerning knowledge and practice of health care providers regarding personal protective equipment. Unfortunately, no studies conducted in Sudan as per the knowledge of the researchers. But some studies conducted in the Arab and African regions which were as follow:

A descriptive cross sectional study conducted in KSA by (Abukhelaif, et al. 2019)(23) aimed to determine the knowledge, practice and factors that influence compliance with usage of Personal Protective Equipment (PPE) among nurses working at Al-Baha King Fahad Hospital, KSA. The study conducted between October and December 2017 among staff nurses working at Baha KFH. One hundred eighty five nurses were enrolled in this study. Data were collected and analyzed using SPSS software. The study found that most of the studied nurses were female, young in the age group of less than 40 years, carry bachelor's degree and work as staff nurses for more than 3 years (78.4% 81.1%,74.6% & 61.6%) respectively. There is strong evidence of positive relationship between awareness of the respondents with PPE, gloves (as an effective barrier for infection control), hand mediated transmission and catheter care practices with most of the nurse's demographic characteristics however there was no association between the age and wearing of gloves. The study concluded that nurses had excellent knowledge with and appropriate use of PPE as vital in safeguarding HCWs and spread of infection.

Another cross sectional study conducted in India by (LAKSHMI, et al. 2016)(24) aimed to evaluate appropriate use of PPE among health care providers in tertiary centres Tamil Nadu. The study conducted during November 2014 to October 2015 in two tertiary health care institutions. All health care providers (Doctors, nurses and technicians) who had more than one year experience and gave informed consent were included. Data collected by pretested structured questionnaire. Data analysis was done using SPSS 20v and summarized by descriptive statistics. Proportion and Chi-square was calculated at 5% α. The study found that HCPs included in the

study were 1060. Among them, there were 412(38.9%) doctors, 550 (51.9%) nurses and 98 (9.2%) technicians. Among 862 HCPs who work outside the operation theatre (OT) and ICU, appropriate uses of PPE were only 156 (18.1%). It was high among doctors 109 (31.5%) followed by nurses 39 (9.3%) and technicians 8 (8.2%) which was statistically significant p=0.0001. HCPs working in OT and ICU were 423 and 183 respectively. Among HCPs working in OT, appropriate use of gloves, mask, apron, gown and hair cover was 100%. But the use of goggles and shoe cover was very low. The reasons for inappropriate use of PPE was non availability 562 (78%) followed by not aware of the importance 77 (11%). The study showed inappropriate use and lack of adequate knowledge on infection control practices emphasizing that periodic re-training is needed.

Another cross sectional study conduced in Israel by (Schwartz, et al. 2014)(25) aimed to evaluate knowledge and confidence among health care workers regarding personal protective equipment in Israel. A validated questionnaire was distributed to 617 HCWs (nurses and physicians) in 21 hospitals and 40 primary care clinics in Israel at the peak of the A/H1N1 pandemic. The study found that PPE confidence was higher among HCWs with higher tested and self-perceived knowledge. Confidence was also higher among nurses compared with physicians and among employees in hospitals compared with those in primary care clinics. Experience treating A/H1N1 patients was related to higher self-perceived knowledge and PPE confidence. The study concluded that high levels of PPE knowledge were significantly correlated to HCWs' confidence in PPE and may help increase PPE usage and reduce absenteeism.

Another cross sectional study conducted in Nigeria by (Ogoina, et al. 2015)(26) aimed to describe the knowledge, attitude and practice (KAP) of standard precautions of infection control among HCW of two tertiary hospitals in Nigeria is described. The study was undertaken in 2011/2012 among HCW in two tertiary hospitals in Nigeria. Data was collected via a structured self-administered questionnaire assessing core elements of KAP of standard precautions. Percentage KAP scores were calculated and professional differences in median percentage KAP scores were ascertained. A total of 290 HCW participated in the study (76% response rate), including

111 (38.3%) doctors, 147 (50.7%) nurses and 32 (11%) laboratory scientists. The study found that Overall median knowledge and attitude scores toward standard precautions were above 90%, but median practice score was 50.8%. The majority of the HCW had poor knowledge of injection safety and complained of inadequate resources to practise standard precautions. House officers, laboratory scientists and junior cadres of nurses had lower knowledge and compliance with standard precautions than more experienced doctors and nurses. Another descriptive cross sectional study conducted in Nigeria by (Aguwa, et al. 2016)(27) aimed to identify the compliance to using personal protective equipments among hospital workers in a tertiary hospital, Southeast Nigeria. The study used to obtain information from health workers in a tertiary institution in South-east, Nigeria. Study instrument was semi-structured self administered questionnaire. Stratified sampling method was used to select the study population. The study found that out of these 511 health workers, 59% were females; 69% were married and 41% were within the age range of 30 - 39 years. Most of the respondents were nurses (40%). Most (89%) had heard of personal protective equipments but only 38% could correctly define it. Although almost half 45% had received training on personal protective equipments majority 96% had not seen any policy on personal protective equipments. Only 22 (4.3%) of health workers claim to always wear the appropriate personal protective equipments during work. Availability of personal protective equipments (59%) is the commonest conditions that enable respondents comply with use of personal protective equipments. The commonest inhibiting factor to use of PPEs even when available was perception of low risk to hazard. The study concluded that Training, provision and use of personal protective equipments is poor in study area. There should be development of health safety policies, regular training on personal protective equipments, provision of personal protective equipments and changing health care attitude to “think safety first ” .

Chapter Three

Methodology

Chapter Three

Methodology

Study Design:

This study was a descriptive cross sectional study.

Study area:

This study conducted in El Ribat University Hospital which established in 1989 and the same time established ICU. Found in ICU 8 mechanical ventilators and 14 beds and 14 montioring systems to monitor vital organs .And present HDU 4 bed and 3 montior to monitor vital organs (BP – RR – HR _ SPO – Temp) .

Study Period:

The study conducted during December 2019 to February 2020.

Study Population:

All ICU staff including doctors and nurses in El Ribat University Hospital.

Sample size and sampling:

Total coverage method was applied due to the limited population. 46 nurses were covered in addition to 26 doctors.

Method of data collection:

The researchers used a well designed valid questionnaire (Annex A) to estimate the levels of knowledge and practice among doctors and nurses, the researchers distributed the questionnaire themselves using face to face method of data collection.

Data analysis:

The data were analyzed by computerized program; statistical package for social sciences (SPSS), results presented in tables and graphs. 95 percent confidence interval (CI), and statistical significant level (α) at 5 percent.

Inclusion Criteria:

All doctors and nurses working in ICU in El Ribat University Hospital.

Exclusion Criteria

Subjects refused to participate in the study. Doctors and nurses working in other divisions were excluded.

Variables:

The study variables are: demographic, knowledge and practice.

Ethical considerations:

Written approval obtained from administration of El Ribat University Hospital.

Chapter Four

Results

Chapter Four

Results

Demographic Information:

Figure (1) showed the distribution of participants according to age, 3(4.2%) were aged from 20 to 22 years, 17(23.6%) aged between 22 to 24 years, 31(43.1%) aged between 24 to 26 years, while 21(29.2%) aged more than 26 years old.

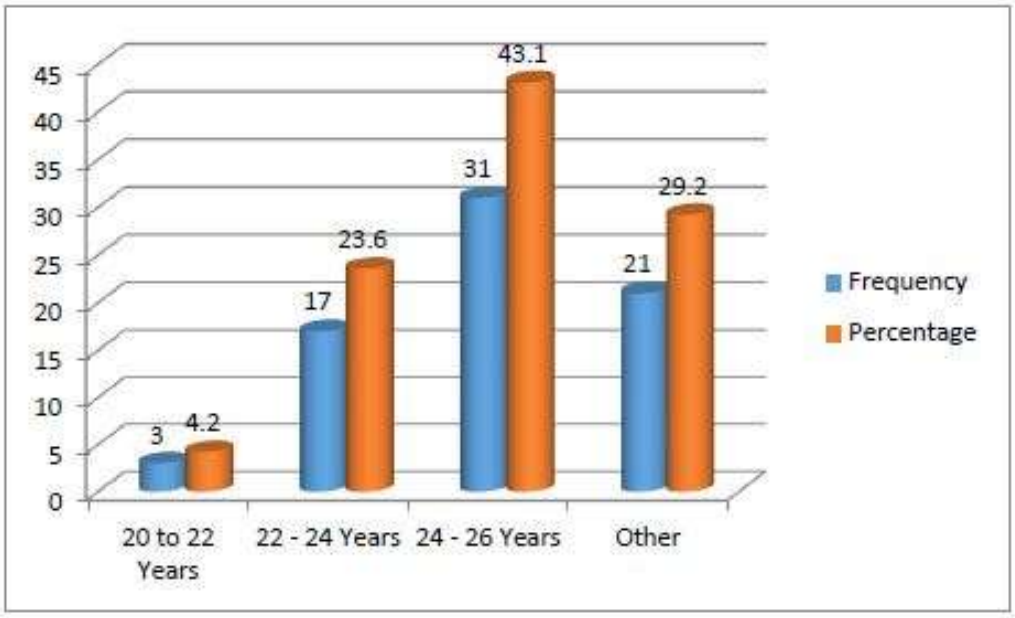


Figure (2) showed distribution of participants according to gender, 27(37.5%) were male, while 45(62.5%) were female.

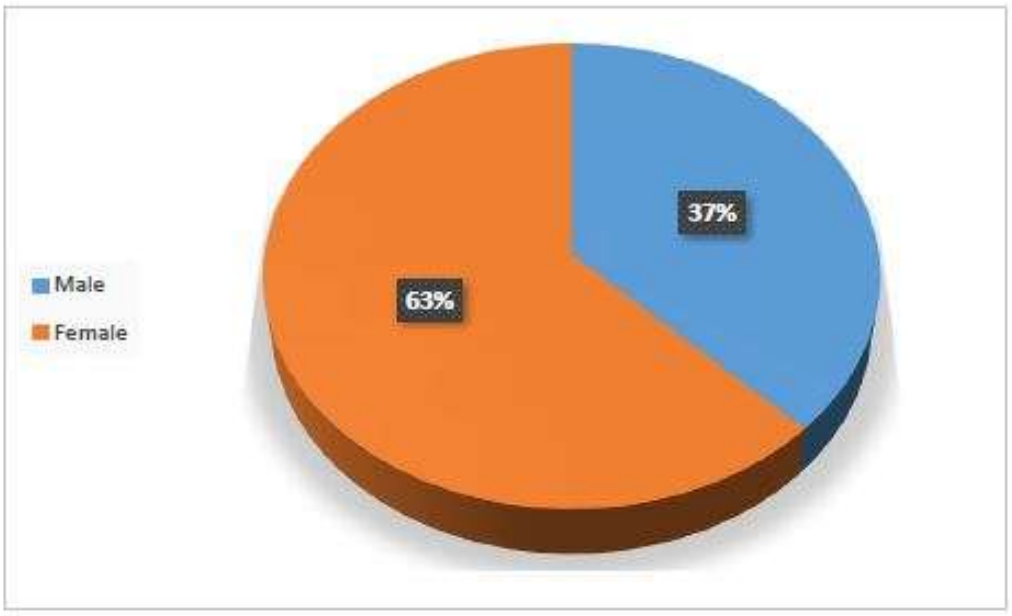


Figure (3) showed that 1(2.2%) had diploma, 41(89.1%) had BSc, 3(6.5%) had MSc, while 1(2.2%) had others.

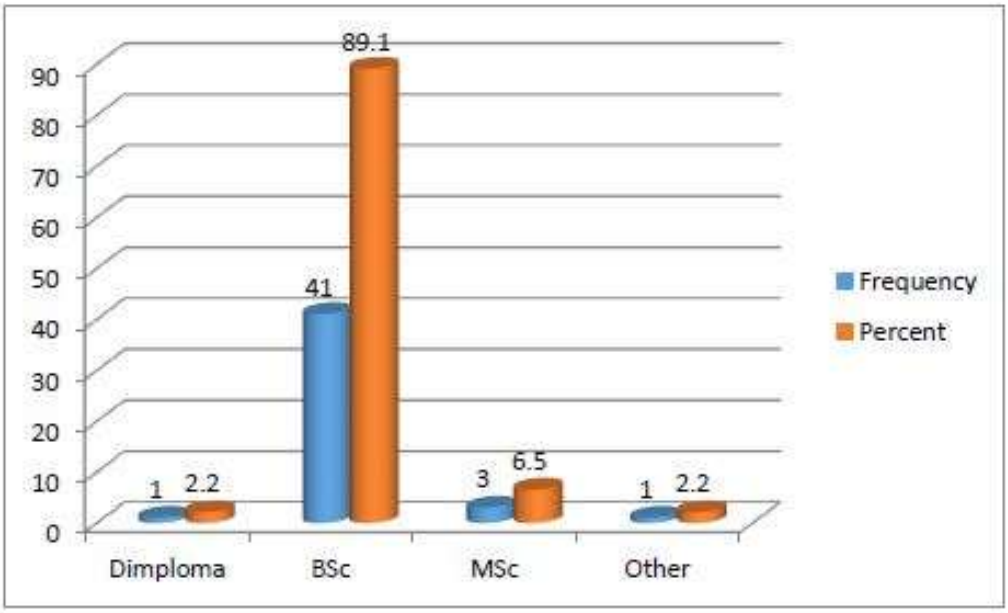


Figure (4) showed that 1(2.2%) of Doctors were general Practitioners, 14(53.8%) were registrar, 1(3.8%) were specialist, while 1(3.8%) were consultants.

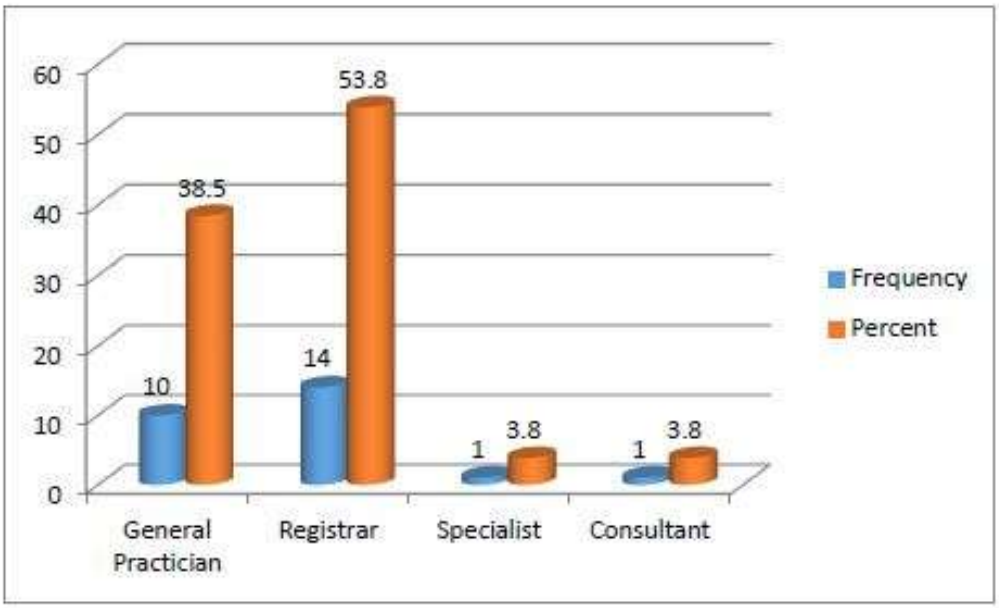
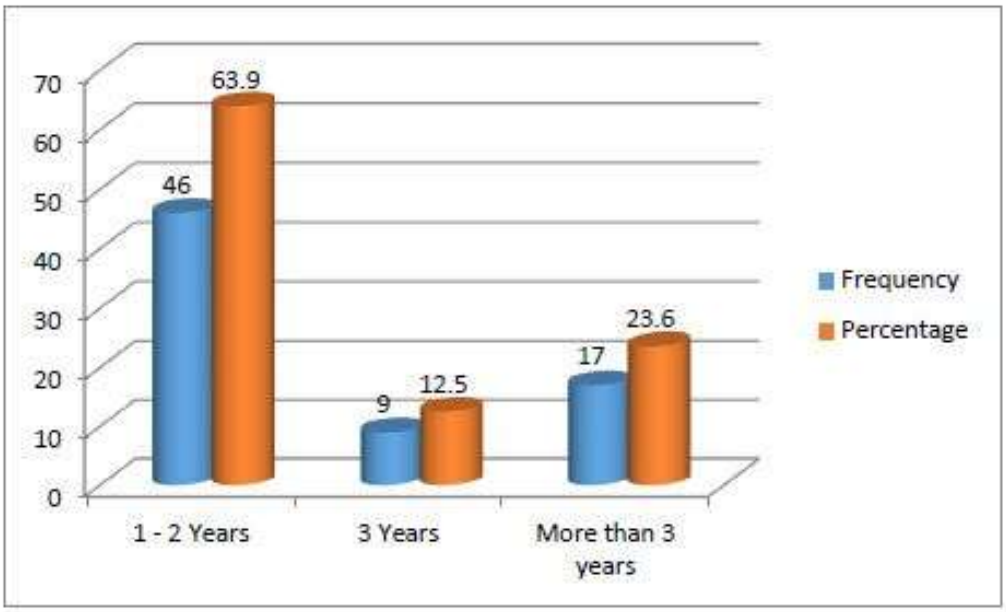


Figure (5) showed the distribution of participants according to experience, 46(63.9%) had experience 1 to 2 years, 9(12.5%) had experience 3 years, while 17(23.6%) had experience more than 3 years.



Availability of Protection Tools in Hospitals :

Table (1) showed that the average availability of protection tools in hospital was 60%. Availability of medical showed was 35%, while availability of gloves was 84%.

Table 1. Availability of Protection Tools :

Availability (N = 72)	Percentage
Availability of different sizes of gloves	50 %
Availability of medical masks	67 %
Availability of medical shoes	35 %
Availability of personal protection tools	62 %
Availability of Gloves	84 %
Average of Availability	60 %

Knowledge Levels of Doctors and Nurses

Table (2) showed that 50(69.4%) of participants had weak knowledge, 18(25%) had moderate knowledge, while 4(5.6%) had strong knowledge.

Table (2) Levels of Knowledge :

Knowledge	Frequency	Percent
Weak Knowledge	50	69.4%
Moderate Knowledge	18	25.0%
Strong Knowledge	4	5.6%
Total	72	100%

Table (3) showed that 76.9%) of doctors had weak knowledge while 65.2%) of nurses had weak knowledge. And 0% of doctors had strong knowledge while 8.75) of nurses had strong knowledge. This differences between doctors and knowledge was not significant (P. Value >0.05).

Table 3. Level of Knowledge per nurses and doctors :

		Knowledge			Total	P. valuee
		Weak Knowledge	Moderate Knowledge	Strong Knowledge		
Specialization	Doctors	20	6	0	26	0.266
		76.9%	23.1%	0.0%	100.0%	
	Nurses	30	12	4	46	
		65.2%	26.1%	8.7%	100.0%	
Total		50	18	4	72	
		69.4%	25.0%	5.6%	100.0%	

Practice levels of doctors and nurses:

Table (4) showed that low practice was 0%, moderate practice was 53(73.6%), while high practice was 19(26.4%).

Table 4. Levels of Practice among doctors and nurses:

Practice (N = 72)	Frequency	Percent
Low Practice	0	0%
Moderate Practice	53	73.6%
High Practice	19	26.4%
Total	72	100%

Table (5) showed that there was significant differences between practice of nurses and practice of doctors, nurses had higher levels of practice than doctors.

Table 5. Levels of Practice per doctors and nurses :

		Practice		**Total**	**P . valuee**
		Moderate Practice	**High Practice**		
Specialization	**Doctors**	25	1	26	0.266
		96.2%	3.8%	100.0%	
	Nurses	28	18	46	
		60.9%	39.1%	100.0%	
Total		53	19	72	
		73.6%	26.4%	100.0%	

Factors Associated with knowledge and practice

Table (6) showed that knowledge and practice were significantly associated with availability of tools of protection, while not associated with age, gender and experience.

Table (6) Factors associated with knowledge and practice :

	Knowledge		**Practice**	
	P. Value	**Significance**	**P. Value**	**Significance**
Age	0.495	NS	0.122	NS
Gender	0.638	NS	0.414	NS
Qualification	0.039	S	0.519	NS
Experience	0.063	NS	0.422	NS
Availability of tools	0.005	S	0.002	S

Chapter Five

Discussion and Conclusion

Chapter Five

Discussion and Conclusion

Discussion:

Present study set out to assess the use of PPEs among health workers in a El Ribat University Hospital. This is because proper use of appropriate PPEs is an important standard precaution in preventing the ever increasing presence of nosocomial infections especially in these countries. These PPEs are mainly to protect the worker from biological and chemical hazards to which they are exposed.

This study was carried out during the Corona epidemic that occurred in 2020 in China and spread all over the world. Although no cases of Corona detected in Sudan, but still precautions are required and PPEs play an important role to protect health care providers and patients in the same time.

The present study observed that most of participants had weak knowledge 50(69.4%), and 18(25%) had moderate knowledge, while 4(5.6%) had strong knowledge. Level of knowledge on PPEs from previous studies ranged from poor to good. Among several different professions the level of knowledge, attitude and use of appropriate PPEs was poor, the result of the present study was similar to the study conducted in India by (LAKSHMI, et al. 2016) who found that appropriate uses of PPE were only 156 (18.1%). The result of the current study was in contrast with the findings of the Israeli study (Schwartz, et al. 2014) who found that found that PPE confidence was higher among HCWs with higher tested and self-perceived knowledge. Confidence was also higher among nurses compared with physicians and among employees in hospitals compared with those in primary care clinics. The reason for contrast between the Israeli study and the present study, that hospitals in Israel always follow certain protocol for PPEs, although there was a protocol for PPE in El Ribat University, but the knowledge of doctors and nurses about this protocol was very weak.

The results of level of knowledge regarding PPEs in the current study was also in contrast with the findings of the Nigerian study conducted by (Ogoina, et al. 2015) who found that Overall median knowledge and attitude scores toward standard precautions were above 90%. The difference between

the present study and the Nigerian study may be due to the scale used in then present study. Score less than 50% was considered weak knowledge, 50 to 75 was considered as moderate study. Also the present study used just two question about knowledge, and the training of PPEs was one of the two question.

A study in West Indies showed most of the health workers was knowledgeable on universal precautions. (28) Another on funeral home workers (29) also showed that they were knowledgeable on use of common PPEs relevant to their work. It is doubtful if most health facilities have their health safety and environment policy.

The present study found that the score of availability of PPEs was 60%, medical shows was the lowest in availability35%, while gloves was highest (84%). In most situations more than one PPE is required for protection e.g. facemask, gloves and coveralls may be necessary at same time for standard precaution. Appropriate PPEs are hardly always available in most facilities in Sudan when needed due to the economic crisis. Present study was conducted in a tertiary hospital which is expected to always have these PPEs being readily accessible. Similar findings were obtained from previous work which reported inadequate provision of PPEs to health workers. (30) Indeed shortage and improper use of PPEs when available were observed to be contributing factors to the challenge of control of current epidemic of Corona Virus (Covid 19). Poor utilization of PPEs was however not always reported in previous studies: in a study there was high use of PPEs such as gloves and gowns among nurses. (31)

The present study found that 19(26.4%) had high practice, while 53(73.6%) had moderate practice. work environment were strong determinants to utilization of PPEs specially in our cases which conducted in ICU staff. A different view from yet another study opined that professionals' knowledge on risks in the work environment does not always guarantee compliance with the use of protective measures. (32) A study among nursing students showed only 25% compliance with PPE and safety regulations. (33) Other reasons include non-availability, work overload, stress, interference with patient care, lack of time and feeling that the PPE was inefficient. (34) Similarly, another study on emergency medical technicians done during SARS indicated the

following reasons for non-compliance to air filter: emergency nature of condition, PPE not necessary or required for prevention and PPEs impaired movement.

Conclusion:

The present study concluded that level of knowledge among ICU staff doctors and nurses was lower than previous studies. No statistically significant differences between knowledge of nurses. The level of practice was similar to the previous studies, nurses are significantly more compliance with PPEs than doctors. Knowledge was significantly associated with qualification and availability of tools, while practice just significantly associated with availability of tools.

Recommendations:

The study recommended the following: 1. Policies that foster training of Health Care Workers in standard precautions and guarantee regular provision of infection control and prevention resources in health facilities are required in Sudan. 2. Similar comparison studies are needed to compare between knowledge and practice of nurses and doctors in tertiary hospitals and private hospitals.

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