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Factors Influencing Compliance to the Novel Coronavirus (COVID-19) Infection Control Precautions among Healthcare Professionals in Jordan

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ABSTRACT

Objectives: The study aims to investigate the knowledge, attitudes, and practices of healthcare professionals towards coronavirus infectious disease 2019. In addition, to assess the factors influencing compliance of HCPs with infection control precautions (ICPs) towards COVID-19. **Study Design:** A descriptive correlational design was used to investigate factors influencing compliance to the novel coronavirus (COVID-19) infection control precautions. **Methods:** A Web-based survey instrument was used to obtain responses from convenient sample of healthcare professionals who are Jordanian nationality during the month of January 2021. **Results:** A total of 2147 healthcare professionals participated in this study, of which 1527 completed the study questionnaire. The results revealed that there were positive correlations between Healthcare professionals' compliance toward COVID-19 infection control precaution and knowledge, perception, age, and years of experience. In addition, a multivariate analysis model proved that the age, knowledge, and perception accounted for significant predictors of the compliance towards COVID-19 ICPs. **Conclusions:** Healthcare professionals demonstrated a high level of compliance with infection control precautions that minimizes the risk of COVID-19.

Keywords: Standard Precaution; COVID-19; Healthcare Professionals; Compliance; Jordan

INTRODUCTION

Coronaviruses are a family of viruses that cause illnesses ranging from the common cold to more severe infections such as severe acute respiratory syndrome (SARS), Middle East respiratory syndrome (MERS), and most

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recently COVID-19. For these more severe infections, the initial transmission route of the virus was identified as animal to human. SARS was transmitted from civet cats to humans and MERS was transmitted from a camel [1]. COVID-19 is caused by coronavirus SARS-CoV-2. This outbreak was first identified in Wuhan, China in December 2019. By June 17, 2020, the virus had been reported in 216 countries and territories, resulting in almost eight million confirmed cases and 440,290 deaths, with the majority of the confirmed cases and deaths occurring in the USA [2].

Hospital infection with COVID-19 is threatening the health and safety of patients and healthcare professionals (HCPs) worldwide. The international Council of Nurses (ICN), for instance, estimated at least 90,000 healthcare workers infected with COVID-19 with more than 600 nurses died (ICN, 2020). However, the proportion of infected people who are HCPs varies widely between countries. Additionally, many countries are not recording this data, which makes meaningful international comparisons extremely challenging.

The standards precautions are guidelines to minimize the risk of transmission of blood-borne and air-borne in hospitals as recommended by the United States Centers for Disease Control and Prevention (CDC). As the incidence of COVID-19 has increased, there has been increased emphasis on standard precautions for healthcare professionals. The WHO [1], recently issued an urgent guidance report on the importance of water, sanitation, hygiene, and waste management for COVID-19 in health-care settings. The guidance encouraged frequent and proper hand hygiene as one of the most important measures to prevent infection with COVID-19, and emphasized regular cleaning and disinfection practices, and safe management of healthcare waste and excreta.

In Jordan, which the healthcare professionals are the most affected people with this disease, they should have compliance of infection control precautions towards this disease. Further, there is a lack of studies about this topic, therefore, the current study is aimed to assess the factors influencing compliance of HCPs with infection control precautions (ICPs) towards COVID-19.

METHODOLOGY

Study design

A descriptive correlational design was used to investigate factors influencing compliance to the novel coronavirus (COVID-19) infection control precautions among healthcare professionals in Jordan. This design enables the describing relationship among variables without attempting to infer connections, and efficient mean of collecting data about problem [2]. Moreover, they admit that descriptive studies are considered valuable in documenting the prevalence, nature, and amount of health related conditions as well and are crucial in the development of effective interventions.

Settings

The population in Jordan is distributed among 12 governorates over three regions (North, Middle and South). Most of the population lived in Amman Governorate (42%), followed by Irbid governorates (18.6) and then Zarqa governorate (14.3%) (NHRHO annual report, 2017) [2]. Jordan's healthcare industry representing approximately 10% of GDP (as spent on this sector), which is among the highest in the Middle East and North Africa region [3].

One of Jordan's primary assets in the medical services sector is its workforce, as the country boasts over 28,000 physicians most of whom are board certified in the United States, United Kingdom, Canada or other European countries and a growing team of nurses that are experienced in state-of-the-art patient care. Health Human Resources has 2.3 physicians, 3.0 nurses, 1.2 pharmacists and 0 .7 dentists per thousand population, which is the highest in the region.

Population and sample

The target population of this study includes all Jordanian healthcare professionals. The study population of the present cross-sectional study consisted of healthcare working force. A convenience sample of healthcare practitioners was used to gain primary data regarding factors influencing compliance to the novel coronavirus (COVID-19) infection control precautions. Based on the study objectives, the estimated sample size is 1900 participants (effect size 0.01 (small effect), a power of 0.90, a level of significance at 0.05) using linear multiple regression, fixed model. However, oversampling was planned to provide more insight, representation, and generalization. Therefore, the sample size was expanded by approximately 20% to be 2100.

Ethical consideration

Ethical approval for this study was granted by the Scientific

Research Committee at the School of Nursing/University of Jordan (#: PDs.20.11). Participation in the study was voluntary, and an informed consent form was included in the introductory section of the online survey. The participants clicked the "I agree" button before starting the survey to indicate their consent. All collected data were treated with confidentiality.

Measurement

A Web-based cross-sectional study was conducted using a survey instrument to obtain responses from Healthcare Professionals during the month of January 2021. A 54-item survey instrument was developed using WHO course materials on emerging respiratory viruses, including COVID-19 [1]. The questionnaire domains covered of healthcare professional characteristics (10 items), Knowledge of COVID-19 (11yes, no, and do not know items), perception of healthcare professionals' towards COVID-19 (seven yes, no, and do not know items), attitude towards COVID-19 infection control (11 statements/5-point Likert scale), and compliance toward COVID-19 infection control (15 statements/4-point Likert scale). The developed draft survey instrument was distributed to five randomly selected faculty members to assess the readability and validity before pretesting among 30 randomly selected healthcare professionals for clarity, relevancy, and acceptability. The developed comprehensive and well-organized questionnaire was distributed to the study population. Sufficient time was given to respondents to read, comprehend, and answer all the questions using social media; it required 20 minutes to complete.

Data collection procedure

The investigators shared the survey link throughout social media platforms (Twitter, Instagram, WhatsApp, and Facebook) and through emails to their contacts. The participants were requested to rollout the survey further. On receiving and clicking the link, participants got auto directed to the informed consent page, followed by the survey questionnaires.

Data analysis plan

The statistical Package for social Science (SPSS) version (24) was used to analyze data. The data were cleaned and screened for missing data, outliers by inspecting frequency distributions for all the study variables. Descriptive statistics were used to compute means, standard deviations, and frequencies of the study variables, and describing the socio-demographic characteristics of the participants. Univariate analysis was carried out to describe the sampled population according to demographic, socio-economic and spatial variables. Moreover, Based on the practices' variables scores, the mean difference between/among the categories of different sociodemographic characteristics were compared using the chi square or independent sample t-test (for two categories of variables), while Pearson correlation analysis was performed to measure the strength and direction of relationship between scores variables with different sociodemographic variables. A p value less than 0.05 was considered as significant.

RESULTS

A total of 2147 healthcare professionals participated in this study, of which 1527 completed the study questionnaire (71.1% response rate), including 993 (65%) females and 534 (35%) males, and most of them are below 45 years of age (90.6%). Majority of respondents are registered nurses (n=996, 65.2%), and 74.5% (n=1137) of them are married as shown in Table 1.

Table 1. Socio-demographic characteristics of healthcare workers (N=1527).

Characteristics	n (%)
Gender	
Male	534 (35)
Female	993 (65)
Age	
< 25 years	39 (2.6)
25-34 years	897 (58.7)
35-44 years	447 (29.3)
45-54 years	123 (8.1)
≥ 55 years	21 (1.4)
Marital Status	
Single	336 (22.0)
Married	1137 (74.5)
Divorced	48 (3.1)
Widow	6 (0.4)
Occupation	
Registered Nurse	996 (65.2)
Physician	330 (21.6)
Pharmacist	105 (6.9)
Dentist	51 (3.3)
Lab Technicians	45 (2.9)
Experience	
≤ 4 years	114 (7.5)
5-9 years	300 (19.6)
10-14 years	213 (13.9)
15-19 years	105 (6.9)
20-24 years	87 (5.7)
≥ 25 years	18 (1.2)
Source of Knowledge	
Family and Friends	15 (1.0)
News Media	573 (37.5)
Official Government Websites	489 (32.0)
Social Media	450 (29.5)
Heard About COVID-19	
Yes	1449 (94.9)
No	78 (5.1)
Attended Lectures/Discussion about COVID-19	
Yes	822 (53.8)
No	705 (46.2)

n: number; %: percentage

Almost every one of the participants agreed that they heard about COVID-19 (94.9%), but only 53.8% of them got the opportunity to attend lectures/discussions about COVID-19. Moreover, the primary source of information that they obtained about COVID-19 was 37.5% through news media, 32% through official government websites, 29.5% through social media, and only 1% of hem discussed COVID-19 related topics with family and friends.

Table 2 shows items related to COVID-19 compliance with the standard precautions among HCPs. The authors identified significant gaps between physicians, dentists, nurses, pharmacists, and lab-technicians using $\chi 2$ test to assess their association with compliance items. For instance, a high majority of the HCPs (97.5%) agreed that gloves are worn when touching droplets, blood, deep body fluids, mucous membranes, or non-intact skin can help to prevent COVID-19 transmission. Moreover, staff clean up droplets and blood spills immediately using disinfectant was significant different between the staff ($p < 0.05$).

Table 2. Compliance of healthcare professionals with novel COVID-19 infection control precautions (N=1527).

S. No	Item	Physicians (n=330)	Dentists (n=51)	Nurses (n=996)	Pharmacists (n=105)	Labs (n=45)	P- Value
1	Put used needles or scalpels in sharps box	98.80%	100%	98.10%	93.30%	97.80%	0.007**
2	Wash hands after taking care of patients	97.60%	100%	98.20%	99.00%	97.70%	0.697
3	Wear gloves when touching droplets, blood, deep body fluids, mucous membranes, or non-intact skin	96.70%	100%	97.80%	95.20%	97.80%	0.32
4	Wear gloves when exposed to deep body fluids or droplets, blood products	98.50%	98.00%	97.60%	98.10%	97.80%	0.91
5	Cover my wound(s) or lesion(s) with waterproof dressing before caring for patients with COVID-19	95.40%	94.10%	94.90%	92.40%	91.10%	0.6
6	Wash hands immediately after removal of gloves	98.80%	100%	97.30%	96.20%	97.80%	0.329
7	Change gloves between patients	98.80%	100%	99.70%	97.20%	97.80%	0.601
8	Pack heavily bloodstained materials are in a yellow plastic bag irrespective of patient's infectious status	90.60%	90.20%	90.50%	91.50%	91.20%	0.998
9	Clean up droplets and blood spills immediately using disinfectant	97.30%	100%	94.50%	94.30%	88.90%	0.031*
10	Decontaminate surfaces and devices after use	94.90%	98.10%	95.10%	90.50%	91.20%	0.171
11	Wear a disposable facemask whenever there is a possibility of droplets, a splash or splatter	95.80%	98.10%	96.00%	94.30%	95.60%	0.857
12	Wear a gown/apron if soiling with blood or deep body fluids is likely	90.90%	100%	96.40%	95.30%	97.80%	0.001**
13	Recap needles after giving an injection	49.40%	51.00%	29.70%	45.80%	73.80%	0.000**
14	Wear eye shield/goggles when may be exposed to the splashing of droplets, bloody discharge/fluid	77.60%	100%	85.90%	91.50%	80.00%	0.000**
15	The sharps box is only disposed of when it is full	69.70%	64.70%	69.00%	71.50%	75.60%	0.803

**p-value: significant at the 0.05 level (One tailed). **p-value: significant at the 0.01 level*

Pearson's correlation was conducted to find any significant relationship with *p* values less than 0.05. The results revealed that there was positive correlations between compliance mean score and knowledge mean score regarding ICPs (*r = 0.349, p < 0.01*) and compliance mean score and perception mean score regarding ICPs (*r = 0.119, p < 0.01*). In addition, the result showed positive relationship between age and years of experience with compliance mean score towards ICPs (*r= 0.280, p < 0.01; r= 0.320, p < 0.01, respectively*). Furthermore, the relationship between the HCPs perception, age and years of experience was found statistically significant (r= *0.170, p <0.01; r= 0.138, p < 0.01, respectively*). Finally, the results revealed that statistically significant relationship between HCPs knowledge towards COVID-19 ICPs, age and years of experience (*r= 0.316, p <0.01; r= 0.150, p < 0.01, respectively*). However, the result revealed a strong positive correlation between years of experience and age (*r= 0.830, p <0.01*) as shown in Table 3.

Table 3. Correlation between compliance, knowledge, perception, age, and years of experience.

Variables	Compliance	Knowledge	Perception	Age	Years of experience
Compliance	1				
Knowledge	0.349**	1			
Perception	0.119**	0.316**	1		
Age	0.280**	0.316**	0.170**	1	
Years of experience	0.320**	0.150**	0.138**	0.870**	1

*** Correlation is significant at the 0.01 level (2-tailed)*

Hierarchical multiple regression analysis was used to find the predictors that are significantly affecting compliance towards COVID-19 infection control precautions. The results showed that model one that contained age explained 9.4% (R^2 = 0.10) of the variance in compliance (see Table 4) and the model was significant (*p* <0.001). After entry of years of experience in the second model, the total variance explained by the model was 11% (R^2 = 0.12) and was not significant (p =0.11). The third model by adding (knowledge towards ICPs) accounted for additional 8.1% of the variance in compliance, (R^2 = 0.19) which was statistically significant (*p* <0.001). The fourth model (perception towards ICPs) was entered on the last step, and it accounted for additional 9.4% of the variance in compliance (R^2 = 0.26) which was statistically significant (*p* <0.001). The variables in the first model, third model and the fourth model accounted for 28% of the variance in overall compliance towards COVID-19 infection control precautions. The result revealed that age, knowledge and perception accounted for significant predictors of the compliance towards COVID-19 ICPs. It is noted also that participants' years of experience is appeared to be non-significant factor in model two.

To test mean differences of compliance, knowledge, and perception towards COVID-19 ICPs between the five types of the professions; RNs, MDs, DDS, Pharmacists, and Lab-Technicians, One-way ANOVA test was performed as it shown in Table 5. Homogeneity of the variance was assumed p= 0.41. There was a statistically significant difference between types of professions regarding Compliance as determined by one-way ANOVA ($F_{(4, 1522)}$ = 2.45, *p* < 0.05). A Scheffe post-hoc test revealed that there were statistically significant differences between Registered Nurses (p < 0.05), MDs (p < 0.05), and DDS (p < 0.05) compared to Pharmacists (p≥0.05) and Lab-Technicians (p≥0.05). Homogeneity of the variance was assumed p= 0.13, with an overall F was statistically significant between knowledge score and type of professions, $F_{(4, 1522)}$ = 4.365, p < 0.01. Based on Scheffe post-hoc test it was found that there were statistically significant differences between lab-technicians and RNs, MDs, and DDS in knowledge score (p < 0.05) compared to others. In addition, Homogeneity of the variance was assumed p= 0.48, with an overall F was statistically significant between perception score and type of professions, $F_{(4, 1522)}$ = 2.65, p < 0.05). Based on Scheffe post-hoc test it was found that there were statistically significant differences between RNs and DDS perception score (p < 0.05) compared to others.

Table 4. Four Steps Multiple Hierarchical Regression Analysis Model Regarding ICPs.

Variable	β	Model 1 P-value	β	Model 2 P-value	β	Model 3 P-value	β	Model 4 P-value
Age	0.35	<0.001	0.145	0.233	0.24	0.066	0.16	0.077
Experience			0.082	0.207	0.05	0.414	0.053	0.39
Knowledge					0.327	<0.001	0.315	<0.001
Perception							0.326	<0.001
R^2	0.102	<0.001	0.12	0.11	0.19	<0.001	0.28	<0.001
Adjusted R^2	0.91	≤0.001	0.082	0.12	0.22	≤0.001	0.27	≤0.001
R^2 change	0.091	≤0.001	0.012	0.13	0.089	≤0.001	0.097	≤0.001

***significant at α = 0.001 two tailed test*

DISCUSSION

This study aimed to evaluate the factors influencing the compliance of HCPs towards COVID-19 ICPs. The findings showed a positive relationship between compliance with COVID-19 ICPs and knowledge, perception, age, and years of experience. Age, knowledge and perception were the significant influencing factors of compliance with COVID-19 ICPs. Additionally, there were differences in compliance, knowledge, and perception regarding COVID-19 ICPs among the healthcare workers.

Compliance with ICPs minimizes the risk of infection and protects the healthcare professionals [4]. This study found that most of the HCPs have compliance with infection control precaution related to wearing gloves when touching droplets, blood, deep body fluids, mucous membranes, or non-intact skin can help to prevent COVID-19 transmission, which is in agreement with previous studies [5,6]. Also, this study result is inconsistent with an Egyptian study which demonstrated that health care providers have low level of compliance and knowledge towards ICPs [7]. Other studies found that HCPs have a low level of compliance among health care workers with ICPs [8,9]. This study result could probably be explained by the fact that the HCPs have recognition to the risks of exposure to transmission of diseases through direct contact especially blood borne infection [10]. Additionally, awareness of this precaution significantly minimize the risks of such pandemic outbreaks [11].

Moreover, this study found that there was a significant difference between the HCPs in cleaning up droplets and blood spills immediately using disinfectant. This difference could be related to lack of knowledge and perception regarding this precaution, and it might be due to age, years of experience, availability of resources and facilities [12], and negligence [7]. In addition to that more than one-third of the study participants did not attend lectures/discussions about COVID-19. Therefore, HCPs should be educated about the biological agents and their hazards, in addition to importance of using disinfectant to clean any droplets and blood spills [13].

Our study showed that there was a positive relationship between compliance and knowledge regarding COVID-19 ICPs. This result is consistent with previous studies conducted among different HCPs [5,14,15]. It is generally known that gaining knowledge is one of possible promoting factors for improving health behaviors [5]. It could be rationalized that having knowledge about ICPs provides remarkable effects on the healthcare professionals' compliance with these precautions [5]. Thus, knowledge was an influencing factor of compliance with COVID-19 ICPs, which is congruent with previous studies [5,15].

A positive relationship was found between compliance and perception regarding COVID-19 ICPs among HCPs. This result means that perceiving the importance of ICPs among HCPs enhancing their compliance with these precautions. This result in agreement with a previous study conducted

among dentists [6]. Our study revealed that perception was a positive determinant for compliance with COVID-19 ICPs. Thus, it is necessary to work on enhancing perceptions about the importance of ICPs among HCPs in different healthcare settings.

This study demonstrated that compliance with COVID-19 ICPs was positively correlated with age. Also, the knowledge and perception about COVID-19 ICPs were positively associated with age. These results could be interpreted as advancing age is accompanied with increasing knowledge and perception, which have an effect on increasing the compliance with COVID-19 ICPs. This result is consistent with a previous study demonstrated that old age HCPs have more compliance with ICPs [12]. On the contrary, other studies among dentists found that younger dentists have more compliance with ICPs compared with older encounters [5,15]. Further, another study conducted among nurses found that no relationship between age and compliance with ICPs [16]. This study showed that age was an influencing positive factor for compliance among HCPs with COVID-19 ICPs.

Our results showed a positive relationship between compliance with COVID-19 ICPs and years of experience. Moreover, knowledge and perception of ICPs have a positive relationship with years of experience. These findings reflect that years of experience could have a significant effect on increasing knowledge and enhancing perceptions of HCPs towards ICPs, which have an influence on compliance with ICPs. These findings are consistent with these results reported in previous studies among different HCPs [6,14]. On the contrary, El-Banna and colleagues [16] reported that there was no relationship between compliance and years of experience among nurses.

This study finding showed a difference between healthcare professionals in compliance, knowledge, and perception towards COVID-19 ICPs. This study showed that dentists followed by nurses were the most healthcare professional who have compliance, knowledge and perception towards ICPs. Tada et al. [5] found that the dentists have complete compliance with ICPs. Another study found that there was a difference, in which nurses have more knowledge and compliance in comparison with physicians and technicians [7]. Additionally, a national study found that nurses have more compliance and knowledge compared with doctors [14]. These results could be interpreted as dentists and nurses have a direct contact with the patients more than other HCPs. As a result of increasing number of patients with COVID-19 infectious disease, thus more attention to protection themselves may contribute to the high frequency of compliance with ICPs. Also, the differences between HCPs could be related to lack of participation in lectures/discussion about infection control precautions for COVID-19, and lack of education for infection precautions among staff. Therefore, health education programs about COVID-19 ICPs should be implemented for healthcare professionals. In addition to frequent supervision for application of these precautions.

Strengths and Limitations of the Study

The strengths of the study can be related to the large sample size that may increase the precision of estimations. Also, using a multilevel analysis, which assists to avoid ecological misconceptions is considered another strength. However, this study has the following limitations including, a response bias as HCPs were more likely to over report their responses. Thus, future observational studies are recommended to follow-up observations of all respondents would help to verify self-reported information.

FUNDING

No funding was obtained for this study.

CONFLICT OF INTEREST

The author(s) declare that they have no competing interests.

MATERIAL AND DATA AVAILABILITY

The authors confirm that the datasets generated during and/or analyzed during the current study are available from the corresponding author on reasonable request.

AUTHORS' CONTRIBUTIONS

All authors contributed to the study conception and design. Material preparation, design, data collection were performed by Mahmoud Al-Hussami, Raeda Al-Ghananim, and Razan Al-Hussami. Analysis and interpretation of data were performed by Sanaa Deifallaha Saidat, Mamdouh El-Hneiti and Malakeh Malak. The first draft of the manuscript was written by Mahmoud Al-Hussami and Mamdouh El-Hneiti and all authors commented on previous versions of the manuscript. All authors read and approved the final manuscript.

ETHICAL APPROVAL

The researchers conducted their study in compliance with the designated university's ethical conduct guidelines, and as approved by the school research unit. Every participants was informed that his/her participation in this study is voluntary.

INFORMED CONSENT

Written informed consents were then obtained from each participating healthcare practitioners by completing the online survey. To ensure confidentiality, the distributed questionnaires were anonymously identified with numeric codes only. Furthermore, none of the sought demographic information was identifying of any participant.

CONSENT TO PUBLISH

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REFERENCES

1. World health organization. (2020). Emerging respiratory viruses, including COVID-19: methods for detection, prevention, response, and control. Available online: https://openwho.org/courses/introduction-to-ncov (Accessed on January 1, 2021).
2. Dillman DA, Smyth JD, Christian LM. (2014). Internet, phone, mail and mixed mode surveys: The tailored design method (4th ed.). New York, NY: John Wiley and Sons. Department of statistics Jordan (DOS) (2019). Available at: http://dosweb.dos.gov.jo/DataBank/Population_Estimares/PopulationEstimatesbyLocality.pdf
3. USAID. (2017). Jordan Investment Commission. Accessed online on March 24th, 2021 from https://www.jic.gov.jo/wp-content/uploads/2018/07/Sector-Profile-HealthCare-Final-Mar-2018-JIC-HAS-020418-1.pdf
4. Kotwal A, Taneja D. (2010). Health Care Workers and Universal Precautions: Perceptions and Determinants of Non-compliance. Indian J Community Med. 35(4): 526-528. https://doi.org/10.4103/0970-0218.74373
5. Tada A, Watanabe M, Senpuku H. (2014). Factors influencing compliance with infection control practice in Japanese dentists. Int J Occup Environ Med. 5(1): 24-31.
6. Cleveland JL, Bonito AJ, Corley TJ, Foster M, Barker L, Gordon Brown G. (2012). Advancing infection control in dental care settings: factors associated with dentists' implementation of guidelines from the Centers for Disease Control and Prevention. J Am Dent Assoc. 143(10): 1127-1138. https://doi.org/10.14219/jada.archive.2012.0044
7. Abdel Wahab SS, Bassiouni NA, Zein Eldin YK. (2019). An Observational Study: Health Care Providers' Knowledge and Its Relationship to Compliance with Standard Infection Control Precautions at Damanhour Fever hospital. International Journal of Novel Research in Healthcare and Nursing. 6(2): 1686-1699.
8. Al-Mahdali G. (2015). A Literature Review of HealthCare Workers Compliance to, and Knowledge of Standard/Universal Precautions. MOJ Public Health. 2(5): 1-12.
9. Ogoina D, Pondei K, Adetunji B, Chima G, Isichei C, Gidado S. (2015). Knowledge, attitude and practice of standard precautions of infection control by hospital workers in two tertiary hospitals in Nigeria. J Infect Prev. 16(1): 16-22.
10. Rice BD, Tomkins SE, Ncube FM. (2015). Sharp truth: health care workers remain at risk of bloodborne infection. Occup Med (Lond). 65(3): 210–214. https://doi.org/10.1093/occmed/kqu206

11. Danzmann L, Gastmeier P, Schwab F, et al. (2013). Health care workers causing large nosocomial outbreaks: a systematic review. BMC Infect Dis. 13: 98. https://doi.org/10.1186/1471-2334-13-98.

12. Angaw DA, Gezie LD, Dachew BA. (2019). Standard precaution practice and associated factors among health professionals working in Addis Ababa government hospitals, Ethiopia: a cross-sectional study using multilevel analysis. BMJ Open. 9: e030784.

13. Ağalar C, Öztürk Engin D. (2020). Protective measures for COVID-19 for healthcare providers and laboratory personnel. Turk J Med Sci. 50(SI-1): 578–584. https://doi.org/10.3906/sag-2004-132

14. Nofal M, Subih M, Al-Kalaldeh M. (2017). Factors influencing compliance to the infection control precautions among nurses and physicians in Jordan: A cross-sectional study. J Infect Prev. 18(4): 182-188.

15. Tada A, Senpuku H. (2011). Attitudes towards HIV Infected Patients, Knowledge Related to HIV/Universal Precautions, and Infection Control Practices in Japanese Dentists. J Dent Health. 61(3): 273-281.

16. El-Banna HM, Abou-Zeid NA, Shurafi S. (2016). Nurses' Compliance to Infection Control Precautions: Management of Patient Care Equipment at the Medical and Surgical Departments. Journal of Health, Medicine, and Nursing. 33(2016): 124-135.