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ABSTRACT

Background: COVID-19 is the novel pandemic that has caused exponential deaths worldwide and damaged health care systems of developed as well as developing regions. Many of the HCWs across the countries are getting affected by this infection and losing their lives

Aims: The aim of this study was to investigate the level of compliance with SPs for the prevention of COVID-19 transmission among HCWs and identify its associated factors.

Methods: An analytical cross sectional study was conducted on 877 HCWs in nine different tertiary care hospitals of Sindh. HCWs were retrieved using universal sampling. Data was collected using self-reporting questionnaire. A multivariate logistic regression analysis was applied using a forward stepwise technique. The variable studied included SPs' compliance and Demographics, SPs' Knowledge, Knowledge and organizational factors.

Results: Logistic regression analysis confirmed various factors including some highly significant factors. The lack of knowledge regarding gloves for central lines, OR: 3.15 (95%CI: 1.29-7.68), providing bath OR: 6.60 (95%CI: 2.95-14.78), Non-compliant HCWs due to lack of management interest OR: 6.73, (95% CI: 4.01-11.29), HCWs following protections against HCAIs; OR: 3.52, (95% CI: 2.20-5.64). HCWs noncompliance with mask; OR: 6.73, (95% CI: 3.92-11.55) and HCWs knowledge about protection; OR: 3.61, (95% CI: 1.43-9.15).

Conclusion: Lack of knowledge, practices, and as well, as lack of the hospital administrative interest toward the safety of the employee's standard precaution regarding COVID-19 prevention were the main associated factors identified in our study. These factors should be addressed to increase compliance among HCWs.

Keywords: COVID-19; Infections; Dose selection; Patient allocation; Seamless design; Utility function

ABBREVIATIONS

SARS: Severe Acute Respiratory Syndrome; HCWs: Health Care Workers; HCIAs: Health Care Associated Infections; WHO: World Health Organization; PPE: Personal Protective Equiments; SPs: Standard Precautions

INTRODUCTION

COVID-19 has been announced as a pandemic situation which to a massive extent spread rapidly across the globe causing Severe Acute Respiratory Syndrome (SARS). It has affected the health system to a large extent and raised mortality rate globally on a catastrophic scale [1,2].

Novel Corona Virus is associated with the family of B beta coronaviruses that further contains SARS-CoV (Severe Acute Respiratory Syndrome Coronavirus). Due to highly contagious nature, the transmission of infection is too quick for COVID-19. Hence, the alteration hazards and the source of the virus (how it is spreading) are not confirmed [3-7].

The microorganisms transmit from patient to Healthcare Workers (HCWs) as well as patient to patient in hospitals can only be controlled by infection control measures. The report published by World Health Organization (WHO) in 2011 stated, that 25% to 40% of Health Care Associated Infections (HCAIs) are found globally, the developed countries have HCAIs from 5% to 10% while the developing countries have from 2% to 20%.

Numerous studies conducted. The majority stated that the privation of Standard Precautions (SPs) compliance among HCWs subsidizes the patients being affected, overall treatment cost, and hospital stay of the patients secondary to HCAIs. Age of the patient, his/her immunity status, previous co-morbidity, and susceptibility to diseases are not limited factors hence there are various factors

leading to HCAIs. Conversely, the elongated hospital stay is also the risk of developing adverse effects of hospitalization, including HCAIs [8-10].

Tada et al. reveal in their study that SPs' knowledge is directly proportional to its application in the health care facility, the more HCWs are aware, educated and trained for SPs, the more they are likely to implement SPs in patient's care [11]. In addition, another study has been done by Hassel in 2016 stated, that the CDC notified twenty years back that the prevention of HCAIs is possible only with the SPs' compliance. These are relevant and necessary for all the HCWs in contact with patient his/her environment. SPs include hand hygiene, Personal Protective Equipment (PPE) use, sharps proper use and disposal, patient position and location including linen, and waste management [12,13].

Numerous HCWs reported various hurdles that inhibit SPs' compliance while taking care of patients. These hurdles included accidental/emergency situations, prioritizing patients care to save life and give less priority to SPs. Conversely, restricted or lack of PPE availability is substantial challenge for the health care system. Another barrier of compliance with SPs mentioned by HCWs is; they often face hindrance while performing the nursing skills because of PPE. Two more studies explored the hurdles/barriers in practicing SPs. The causes found were: Lacking awareness and training of SPs, deprived resources, massive workload, financial hurdles and structure (Non-supportive organizational) [14,15]. Another study carried out in 2018 by Suliman et al. observed that the HCWs possesses worthy knowledge and the cause for their non-compliance are deprived resourses and massive workload, in public as well as private hospitals [16]. Consequently, more health knowledge, censoring, and avalibilty of resources in the healthcare settings have been suggested. In addition, one more study led in 2015 recognized five forecasters among nursing students which are highly associated with SPs' compliance. These forecasters are: SPs' education, Sufficient training for SPs, Support and encouragement from administration for the SPs' compliance, the supposed hurdles, and the impact of seniors, which means that if their senior nurses are not compliant with SPs it will impact the compliance of the nursing students and novice nurses as well [17]. Therefore, CDC promotes the training programs to improve the precautionary measures to inhibit the transmission of infectious diseases. The purpose of this study was to recognize the level of SPs' compliance as well as the associated factors with SPs' compliance among HCWs for the prevention of COVID 19 spread, working in nine different tertiary care hospitals in Sindh, Pakistan.

METHODOLOGY

Research design and duration and setting

To attain the objective of the study this research have used an analytical cross-sectional study to recognize the self-reported level of compliance to SPs and its associated factors for the prevention of COVID 19 spread among HCWs, between 2nd March 2019 till 10th May, 2019 at Karachi and 14th June till 26th October in Larkana, Mirpurkhas and Hyderabad after ERC approval.

Study setting and sampling strategy

Study was conducted in nine different hospitals of Sindh province, Pakistan. The total number of HCWs working in nine different hospitals are on rotation basis. Therefore this study took the universal sampling technique to cover almost all the HCWs. The selected hospitals are having the range of 150 to 1000 beds with the availability of all forms of services including outpatient departments and tertiary care services. For participant recruitment, each hospital's management was approached for the permission, based on eligibility criteria and consent participants were included in the study.

Inclusion and exclusion criteria

All HCWs within the 45 years of age and less and having at least 3 months of experience, directly involve in patient care and willing to participate in the study were included with in the study. All the HCWs working at management posts, on leave, and on notice period of the resignations were excluded from the study.

Data collection tool

The tool use for the data collection was adopted from Gershon et al., Kermode et al. [18,19]. The tool was focusing the demographic, organizational and psychosocial factors, which can affect the SPs' compliance among HCWs. The permission was taken from Dr. Kermode. Content validity index was calculated for each module after the review of experts of that field. Crobach;s alpha was used for assessing the internal consistency of the questionnaire, which value falls between 0 and 1, the higher values propose higher internal consistency [20]. The content validity was checked which was within the ranges of 0.56 and 0.85, however the Mean Cronbach's alpha was 0.73. which is acceptable [20].

Variables

The outcome variable "Compliance" was defined as the HCWs' behavior regarding SPs with the recommendation by experts [21,22]. SPs guidelines are to reduce the transferring or spreading of microorganisms among patients to patients and HCWs. These are the elementary and simple manners through which infection can be prevented that require precautions during patient handling. It also includes, suspecting all patients and their body fluids as potentially infectious either diagnosed or not [21,22].

Data analysis

This study involved the development, translation and tool validity. Pot data collection data was analyzed using stepwise approach from descriptive towards inferential analysis. Frequency and percentages were calculated for the categorical variables and Mean with standard deviation was computed for continuous variable. Data was analyzed by SPSS version 20. Uni-variate and multi-variate logistic regression models were accomplished with the Confidence Interval (CI) of 95% for assessing the association between SPs' compliance and demographics, SPs' knowledge, knowledge about gloves use, organizational factors as well as the Reasons for having unsafe practices by the HCWs.

RESULTS

Table 1 shows the socio-demographic characteristics of the HCWs. Overall, 877 HCWs working nine different tertiary care hospitals were identified. Out of these, total 258 Doctors, 422 Registered Nurses and 197 Allied health staff participated in the study. The mean age of participants calculated was 32.7 years and mean working experience calculated was 8 years. Less than half, i.e., 45.8% of the participants were female, whereas 54.2% were male. The population of the study comprises 44.8% were working in Non critical units, and 30.9% were working in critical care units, 17 and 6% were working from Gynae and Peads department respectively. Furthermore, it was identified that the 25% HCWs were not been

vaccinated against hepatitis B.

Table 1: Pediatric patient profile.

Socio-demographic characteristics	Mean age of participants
Mean age of the participants in years	32.7 ± 7.6*
Gender	
Male	475 (54.2)
Female	402 (45.8)
Designation	
Doctor	258 (48.1)
Registered nurse	422 (29.4)
Allied health staff	197 (22.5)
Mean working experience in years	8.05 ± 6.3*
Area of specialty	
Critical unit	271 (30.9)
Non critical units	393 (44.8)
Peads	62 (7.1)
Gynae	148 (16.9)
Laboratory	3 (0.3)
Participants who heard about Hepatitis B and C	
Yes	838 (95.6)
No	39 (4.4)
Participants who heard about standard recautions	
Yes	825 (94.1)
No	51 (5.9)
Hepatitis B vaccination (participants)	
Vaccinated	658 (75.0)
Not vaccinated	219 (25.0)
Participants doses of Hepatitis B vaccine	
1 Dose	32 (3.6)
2 Doses	103 (11.8)
3 Doses	462 (52.7)
4 or more doses	122 (13.9)
Not sure about number of dosing	46 (5.2)
Not applicable	112 (12.8)

Note: *Mean and standard deviation

Table 2 shows logistic regression of Demographics factors point out the association of Non-compliance of SPs; Female gender is significantly associated with noncompliance, [OR: 1.68 (95% CI: 1.27-2.27), P-value: 0.001], being Registered Nurse and Doctor, respectively [OR: 1.99 (95% CI: 1.35-2.95), P-value: 0.001], [OR: 2.42 (95% CI: 1.59-3.68), P-value: 0.001], Age [OR: 1.06 (95% CI: 1.03-1.08), P-value: 0.001] which mean that lower the age will lead to enriched SPs' compliance, Experience [OR: 1.06 (95% CI: 1.04-1.09), P-value: 0.001] its mean that low experience will lead to the increased non-compliance with SPs.

Table 3 logistic regression for Knowledge of HCWs regarding the SPs, point out the association of Non-compliance of SPs with the HCWs' inappropriate Knowledge regarding SPs. This shows that HCWs having non-compliance with SPs are having the inadequate knowledge regarding SPs; SPs' Effectiveness in the prevention of infections [OR: 1.66 (95%CI: 1.252.20), P-value: 0.001], Treating patients' body fluids as infectious [OR: 1.90 (95% CI: 1.40-2.60), P-value: 0.001], Surgical and Obstetric patient routinely monitoring for infection [OR: 1.58 (95% CI: 1.18-2.13), P-value: 0.002], Gloves use for all patients [OR: 1.98 (95% CI: 1.48-2.64), P-value: 0.001], Safety for the using same pair of gloves on many patients [OR: 1.50 (95%CI: 1.08-2.07), P-value: 0.013], Hand washing after the removal of gloves [OR: 1.90 (95% CI: 1.41-2.57), P-value: 0.001], Hand washing after direct patients' contact [OR: 1.54 (95% CI: 1.16-2.04), P-value: 0.002], Recapping of the needle [OR: 1.44 (95% CI: 1.07-1.93), P-value: 0.016], and separate disposal of sharp objects from other waste [OR: 1.57 (95%CI: 1.19-2.08), P-value: 0.001], while Multivariate showed that factors related to the inadequate knowledge of SPs that were found statistically significant included, being female; (adjusted OR 1.48, CI: 1.11-1.99), More experience; (adjusted OR 1.05, CI: 1.02-1.08) which means higher the experience will increase the non-compliance with SPs, use of gloves for all procedure involving body fluids' contact (adjusted OR 1.63, CI: 1.13-2.35), Hand wash after gloves removal; (adjusted OR 1.62, CI: 1.12-2.33), treating the blood and body fluids of all patients as infectious; (adjusted OR 1.54, CI: 1.06-2.22).

Table 4 logistic regression for the Knowledge about gloves use, shows the association of Non-compliance of SPs with the HCWs' inappropriate Knowledge. This shows that HCWs who are non-compliant with SPs are having the inadequate knowledge about gloves use for; handling central line [OR: 3.15 (95%CI: 1.29-7.68), P-value: 0.012], intra muscular injections [OR: 1.36 (95%CI: 1.02-1.79), P-value: 0.03], mouth care of patient [OR: 2.81 (95%CI: 1.39-5.65), P-value: 0.004], washing used surgical instrument [OR: 2.34 (95%CI: 1.16-4.71), P-value: 0.017], Handling of a newborn [OR: 2.57 (95%CI: 1.71-3.87), P-value: 0.001], Cleaning incontinent patient [OR: 2.08 (95%CI: 1.29-3.35), P-value: 0.002], Giving bath to patient [OR: 6.60 (95%CI: 2.95-14.78), P-value: 0.001], as well as suturing a wound [OR: 5.80 (95%CI: 1.56-21.57), P-value: 0.009], Moreover, Multivariate analysis was also performed for assessing the possible confounding factors. For SPs' Noncompliance, factors regarding the inappropriate knowledge for the gloves use, that were statistically significant included, being female; (adjusted OR 1.56, CI: 1.15-2.11), Age; (adjusted OR 1.04, CI: 1.02-1.07), which mean that age decreasing by one year will be 1.04 times more non-compliant with SPs, Incorrect knowledge regarding gloving while; giving care to the patient (adjusted OR 3.15, CI: 1.51-6.58), handling newborn (adjusted OR 1.82, CI: 1.17-2.85), taking blood sample of the patient (adjusted OR 1.65, CI: 1.00-2.71), cleaning an incontinent patient (adjusted OR 2.51, CI: 1.33-4.74), giving bath to a patient (adjusted OR 5.06, CI: 2.16-11.86), and suturing (adjusted OR 4.67, CI: 1.12-19.38).

Table 2: Univariate and demographics factors.

Variable	Compliant n (%)	Non compliant n (%)	OR	95% CI		P-value
Gender (Male)	336 (70.7)	139 (29.3)	1			
Gender (Female)	237 (59)	165 (41)	1.68	1.27	2.27	0.001
*Mean age (Score)	33.8 ± 7.7	30.7 ± 6.9	1.06	1.03	1.08	0.001
Designation (Allied health staff)	153 (77.7)	44 (22.3)	1			
Designation (RN)	268 (63.5)	154 (36.5)	1.99	1.35	2.95	0.001
Designation (Doctor)	152(58.9)	106 (41.1)	2.42	1.59	3.68	0.001
* Mean experience (Score)	8.8 ± 6.6	6.6 ± 5.3	1.06	1.04	1.09	0.001
Specialty (Critical care units)	169 (62.4)	102 (37.6)	1			
Specialty (Non critical unit)	275 (70)	118 (30)	0.3	0.02	3.37	0.33
Peads	46 (74.2)	16 (25.8)	0.21	0.02	2.39	0.211
Gynae	82 (55.4)	66 (44.6)	0.17	0.01	2.05	0.165
Laboratory	1 (33.3)	2 (66.7)	0.4	0.04	4.54	0.461

Note: *Mean and standard deviation

Table 3: Knowledge regarding standard precautions.

S. No	Inappropriate knowledge regarding standard precautions of	Non-compliant n(%)	Compliant	Univariate			Multivariate		
				OR	95% CI		aOR	95% CI	
1	Gender (Female)	237 (59)	165 (41)	*1.68	1.27	2.27	1.48	1.11	1.99
2	Experience (Score)	6.6 ± 5.3	8.8 ± 6.6	*1.06	1.04	1.09	1.05	1.02	1.08
3	Application in work	156 (32.8)	319 (67.2)	0.84	0.63	1.11			
4	Perceived as a nursing barriers.	241 (33.8)	472 (66.2)	0.82	0.58	1.16			
5	Effectiveness in preventing HCWs from Blood Borne and air borne Infections	153 (29.8)	360 (70.2)	*1.66	1.25	2.2			
6	Treating the blood of all patients as potentially infectious	201 (30.8)	452 (69.2)	*1.90	1.4	2.6			
7	Routinely testing of all surgical and Obstetric patients	190 (31.4)	416 (68.6)	*1.58	1.18	2.13			
8	Wearing gloves for all the procedure that may involve contact with blood or body fluids.	166 (29.1)	404 (70.9)	*1.98	1.48	2.64	1.63	1.13	2.35
9	Safety of the use of same pair of gloves for many patients	218 (32.4)	454 (67.6)	*1.50	1.08	2.07			
10	Safety for the use of same pair of gloves for different procedure on same patient	245 (33.6)	485 (66.4)	0.75	0.52	1.09			
11	Hands washing after gloves removal	188 (30.3)	433 (69.7)	*1.90	1.41	2.57	1.62	1.12	2.33
12	Hand washing after every procedure that involves direct patient contact.	154 (30.4)	352 (69.6)	*1.54	1.16	2.04			
13	Needle recapping	192 (32)	408 (68)	*1.44	1.07	1.93			
14	Needle and sharp disposal separately from other waste	152 (30.2)	351 (69.8)	*1.57	1.19	2.08			
15	Treating the blood and body fluids of patients as potentially infectious	194 (33.3)	338 (66.7)	0.84	0.63	1.13	1.54	1.06	2.22
16	Hand hygiene for the prevention of micro-organism transmission	12 (58.6)	17 (41.4)	1.43	0.67	3.06			

Note: *For the significant value of p-value less than 0.05.

Table 4: Knowledge about gloves use.

S. No	Inappropriate knowledge regarding the use of gloves for	Non-compliant n(%)	Compliant	Univariate			Multivariate		
				OR	95% CI		aOR	95% CI	
1	Gender Female	165 (41)	237 (59)	1.68	1.27	2.27	1.56	1.15	2.11
2	Age (Score)	30.7 ± 6.9	33.8 ± 7.7	1.06	1.03	1.08	1.04	1.02	1.07
3	Handling central line	13 (59.1)	9 (40.9)	*3.15	1.29	7.68			
4	Giving an intravenous injections	54 (29.2)	131 (70.8)	0.73	0.51	1.03			
5	Giving an intramuscular injections	145 (31.4)	317 (68.6)	*1.36	1.02	1.79			
6	Giving mouth care to the patient	20 (58.8)	14 (41.2)	*2.81	1.39	5.65	3.15	1.51	6.58
7	Washing instrument used during surgery	18 (54.5)	15 (45.5)	*2.34	1.16	4.71			
8	Taking bed pan away from the patient	14 (27.5)	37 (72.5)	0.69	0.37	1.31			
9	Care of a bleeding patient	5 (55.6)	4 (44.4)	2.38	0.63	8.92			
10	Performing IV cannulation	10 (23.8)	32 (76.2)	0.57	0.28	1.19			
11	Dressing using no-touch technique	52 (35.4)	95 (64.6)	1.04	0.71	1.5			
12	Handling a new born infant	59 (54.6)	49 (45.4)	*2.57	1.71	3.87	1.82	1.17	2.85
13	Checking patient temperature	216 (33.6)	426 (66.4)	0.85	0.62	1.16			
14	Taking blood from the patient	56 (32.7)	115 (67.3)	0.89	0.63	1.28	1.65	1	2.71
15	Making a patient bed	75 (32.2)	158 (67.8)	0.86	0.62	1.18			
16	Cleaning an incontinent patient	24 (21.6)	87 (78.4)	*2.08	1.29	3.35	2.51	1.33	4.74
17	Giving bath to a patient	26 (76.5)	8 (23.5)	*6.60	2.95	14.78	5.06	2.16	11.86
18	Suturing a wound	9 (75)	3 (25)	*5.80	1.56	21.57	4.67	1.12	19.38
19	Examining a placenta	27 (62.8)	16 (37.2)	*3.39	1.8	6.4			

Note: *For the significant value of p-value less than 0.05.

Table 5 logistic regressions for the HCWs' attitude when they caring for patient with droplet, blood borne or air borne infections indicated the association of SPs' non-compliance with HCWs attitude. This shows that HCWs are non-complaint to SPs who have lack of; worry while caring for droplet, blood borne or air borne infection; [OR:2.02, (95% CI: 1.42-2.87), P-value: 0.001], separately dealing the patient having droplet, blood borne or air borne infections; [OR:1.95, (95% CI: 1.44-2.62), P-value: 0.001], routinely testing of all surgical and obstetric patients for droplet, blood borne or air borne infection; [OR:2.50, (95% CI: 1.44-4.37), P-value: 0.001], willing to assist during the surgery of patient having droplet, blood borne or air borne infection; [OR:1.62, (95% CI: 1.14-2.29), P-value: 0.006], willing to assist during the delivery case of a patient having droplet, blood borne or air borne infection; [OR:2.29, (95% CI: 1.63-3.24), P-value: 0.001], perception that every patient can be infected; [OR:1.53, (95% CI: 1.15-2.03), P-value: 0.003], while Multivariate analysis was performed for checking the possible confounding factors. For SPs' noncompliance, factors related to the HCWs attitude included being female; (adjusted OR 1.406, CI: 1.02-1.94), and Lack of worry while dealing the patient having droplet, air borne or blood borne infections (adjusted OR: 3.533, CI: 2.25-5.52), Lack of perception that all surgical and obstetric patient need to be tested for droplet, blood borne and air borne infection (adjusted OR: 2.545, CI: 1.38-4.69), Lack of opportunity for doctors and nurses to refuse for the care of droplet, blood borne and air borne infections (adjusted OR: 2.116, CI: 1.48-3.01), Lack of willing for assisting during the surgery of infected patients; (adjusted OR: 1.48, CI: 1.07-2.04) and HCWs prefer to avoid patients having droplet, blood borne and air borne infection: (adjusted OR: 3.205, CI: 2.11-4.85).

Table 6 logistic regressions for the safety at workplace indicated the association of SPs' non-compliance. This shows that non-compliant HCWs have lack of; management curiosity about employees' safety; [OR: 6.73, (95% CI: 4.01-11.29), P-value: 0.001], Management giving priority for the protection of the HCWs from exposure to blood borne/air borne diseases; [OR: 4.83, (95% CI: 3.05-7.64), P-value: 0.001], HCWs use of recommended precautions for their protection against HCAIs; [OR: 3.52, (95% CI: 2.20-5.64), P-value: 0.001], Training for their protection against HCAIs; [OR: 4.19, (95% CI: 2.82-6.23), P-value: 0.001], Safe working environment by management; [OR: 5.01, (95% CI: 3.14-7.96), P-value: 0.001], Seniors' strictness for adherence to recommended precautions; [OR:2.85, (95% CI: 1.97-4.12), P-value: 0.001], equipment for protection themselves from HCAIs; [OR: 1.65, (95% CI: 1.20-2.25), P-value: 0.002], cleanliness of work area; [OR: 5.39, (95% CI: 3.33-8.73), P-value: 0.001], work related problem discussion with seniors; [OR: 5.94, (95% CI: 2.85-12.36), P-value: 0.001], HCW's supporting each other; [OR: 8.47, (95% CI: 3.43-20.88), P-value: 0.001], and HCWs satisfaction with job; [OR: 2.96, (95% CI: 1.48-5.91), P-value: 0.002], while Multivariate analysis was done for assessing the possible confounding factors. For noncompliance with SPs, factors related to workplace safety included being female; (adjusted OR 1.367, CI: 1.01-1.85), lack of management curiosity about the HCWs' safety; (adjusted OR:3.445, CI: 1.70-6.97), lack of senior strictness for following SPs' guidelines; (adjusted OR:1.734, CI: 1.14-2.63), lack of infection control committee; (adjusted OR: 1.441, CI: 1.05-1.96), lack of work related problem discussion with seniors; (adjusted OR: 4.366, CI: 1.96-9.70), and lack of support between HCWs; (adjusted OR: 3.925, CI: 1.49-10.33).

Table 5: Attitude of HCWs while caring for droplet, blood borne and airborne infection's patients.

S. No	Lack of ...	Non-compliant n(%)	Compliant	Univariate			Multivariate		
				OR	95% CI		aOR	95% CI	
1	Gender (Female)	165 (41)	237 (59)	1.68	1.27	2.27	1.41	1.02	1.94
2	feel worried while caring for people with Droplet, Air borne or Blood borne infections	51 (23.5)	166 (76.5)	*2.02	1.42	2.87	3.84	2.51	5.88
3	extra infection control precautions for patients with Hepatitis B, Hepatitis C, Congo, Tuberculosis, Measles and HIV/AIDS	2 (20)	8 (80)	0.47	0.09	2.22			
4	Patient with Hepatitis B, Hepatitis C, Congo, Tuberculosis, Measles and HIV/AIDS need to be nursed separately from other patients	86 (25.7)	249 (74.3)	*1.95	1.44	2.62			
5	All surgical and obstetric patients should be routinely tested for Hepatitis B, C, Congo, T.B, Measles and HIV/AIDS on admission to hospital.	30 (55.6)	24 (44.4)	*2.50	1.44	4.37	2.5	1.37	4.58
6	In our hospital we would always know if a patient was infected with Hepatitis B, Hepatitis C, Congo, Tuberculosis, Measles and HIV/AIDS	138 (34.5)	262 (65.5)	0.99	0.75	1.3			
7	Doctors and Nurses should be allowed to refuse to care for people with Hepatitis B, Hepatitis C, Congo, Tuberculosis, Measles and HIV/AIDS	113 (38)	184 (62)	1.25	0.93	1.67	2.04	1.44	2.9
8	I am willing to assist with an operation on a patient with Hepatitis B, Hepatitis C, Congo, Tuberculosis, Measles and HIV/AIDS	55 (26.7)	151 (73.3)	*1.62	1.14	2.29	1.37	1	1.88
9	I am willing to assist with the delivery of a baby born to a mother with Hepatitis B, Hepatitis C, Congo, Tuberculosis, Measles and HIV/AIDS	53 (22.1)	187 (77.9)	*2.29	1.63	3.24			
10	I would prefer not to care for patients with Hepatitis B, Hepatitis C, Congo, Tuberculosis, Measles and HIV/AIDS	87 (38.2)	141 (61.8)	1.23	0.89	1.68	3.57	2.4	5.32
11	People can be infected with Hepatitis B, Hepatitis C, Congo, Tuberculosis, Measles and HIV/AIDS and look healthy	117 (29.5)	280 (70.5)	*1.53	1.15	2.03			

Note: *For the significant value of p-value less than 0.05.

Table 6: Work place safety.

S. No	Lack of ...	Non-compliant n(%)	Compliant	Univariate			Multivariate		
				OR	95% CI		aOR	95% CI	
1	Gender (Female)	165 (41)	237 (59)	1.68	1.27	2.27	1.37	1.01	1.85
2	Management's curiosity about my safety at work	62 (74.7)	21 (25.3)	*6.73	4.01	11.29	3.44	1.7	6.97
3	Managements priority for protection of staff from exposure to blood borne and Air borne diseases	64 (68.1)	30 (31.9)	*4.83	3.05	7.64			
4	Using recommended precautions for protecting themselves against HCAIs.	51 (62.2)	31 (37.8)	*3.52	2.2	5.64			
5	Adequate training of protecting themselves from HCAIs.	80 (64)	45 (36)	*4.19	2.82	6.23			
6	Management role for providing safe working environment	64 (68.8)	29 (31.2)	*5.01	3.14	7.96			
7	Strictness of senior staffs in following recommended precautions.	77 (55.8)	61 (44.2)	*2.85	1.97	4.12	1.73	1.14	2.63
8	Provision of equipment to protect from HCAIs.	97 (43.3)	127 (56.7)	*1.65	1.2	2.25			
9	Infection Control Committee.	162 (33.8)	317 (66.2)	0.92	0.69	1.22	1.44	1.05	1.96
10	Cleanliness of work area.	62 (70.5)	26 (29.5)	*5.39	3.33	8.73			
11	Understanding the procedure in case of needle stick injury.	58 (36.5)	101 (63.5)	1.1	0.77	1.58			
12	Understanding of reporting in case of needle stick injury.	58 (38.2)	94 (61.8)	1.2	0.84	1.72			
13	Work related problem discussion with senior staff.	29(74.4)	10(25.6)	*5.94	2.85	12.36	4.36	1.96	9.7
14	HCPs supporting each other	25 (80.6)	6(19.4)	*8.47	3.43	20.88	3.92	1.49	10.33
15	HCPs' Satisfaction with job	21(60)	14(40)	*2.96	1.48	5.91			

Note: *For the significant value of p-value less than 0.05.

Table 7 logistic regressions for the PPE's availability indicated the association of non-compliance with SPs. HCWs found to be non-complaint with SPs who have lack of; mask; [OR: 6.73, (95% CI: 3.92-11.55), P-value: 0.001], gloves (Plastic/Latex); [OR:6.91, (95% CI: 3.92-12.17), P-value: 0.001], plastic apron; [OR:4.51, (95% CI: 3.20-6.34), P-value: 0.001], gown; [OR:5.84, (95% CI: 3.96-8.60), P-value: 0.001], eye protection (glasses/goggles); [OR:2.38, (95% CI: 1.79-3.18), P-value: 0.001], sharp's container; [OR:6.67, (95% CI: 4.36-10.20), P-value: 0.001], basin with soap and hand rubs in adequate number; [OR: 1.306, (95% CI: 0.98-1.73), P-value: 0.066], while Multivariate analysis was done for assessing the possible confounding factors. For noncompliance with SPs, factors related to PPE's availability that were found significant included experience; (adjusted OR 1.05, CI: 1.01-1.07), which means that decreasing the experience lead to more non-compliance with SPs, the unavailability of plastic apron; (adjusted OR:1.75, CI: 1.07-2.88), unavailability of gown; (adjusted OR: 1.86, CI: 1.04-3.34), unavailability of sharp container; (adjusted OR: 2.91, CI: 1.68-5.04).

Table 8 logistic regressions for the reason of unsafe practices indicated the association of noncompliance with SPs. HCWs were found noncompliant to SPs, who; don't know how to protect themselves from infections; [OR:3.61, (95% CI: 1.43-9.15), P-value: 0.007], have busy working hours; [OR:1.46, (95% CI: 1.02-2.08), P-value: 0.036], work mates avoid recommended precautions; [OR:1.40, (95% CI: 1.05-1.87), P-value: 0.020], think that their use of PPE can offend the patient; [OR:1.41, (95% CI: 1.00-1.98), P-value: 0.050], feel uncomfortable by wearing PPE; [OR: 2.13, (95% CI: 1.59-2.84), P-value: 0.001], have difficulty in doing job properly while wearing PPE; [OR: 2.78, (95% CI: 2.06-3.74), P-value: 0.001], while Multivariate analysis was done for assessing the possible confounding factors. For noncompliance with SPs, factors found to be significant related to unsafe practices included being female; (adjusted OR 1.57, CI: 1.16-2.12), age; (adjusted OR 1.05, CI: 1.03-1.07) which mean that decreasing the age will increase the non-compliance with SPs, and who do not know how to protect themselves by using recommended precautions; (adjusted OR: 5.59, CI: 2.09-14.94), who do not use recommended precautions because their work mates do not use; (adjusted OR:1.61, CI: 1.18-2.20), and wearing PPE make it difficult to properly do their job; (adjusted OR:2.48, CI: 1.81-3.39).

Table 7: Availability of personal protective equipment.

S.No	Unavailability of .... in the work area:	Non-compliant n(%)	Compliant	Univariate			Multivariate		
				OR	95% CI		aOR	95% CI	
1	Experience (Score)	6.6+5.3	8.8+6.6	1.06	1.04	1.09	1.05	1.01	1.07
2	Mask	57 (75)	19 (25)	*6.73	3.92	11.55			
3	Plastic and Latex gloves	53 (75.7)	17 (24.3)	*6.91	3.92	12.17			
4	Water proof plastic apron	116 (62.7)	69 (37.3)	*4.51	3.2	6.34	1.75	1.07	2.88
5	Gown	101 (69.2)	45 (30.8)	*5.84	3.96	8.6	1.86	1.04	3.34
6	Eye protection (Goggles/Glasses)	155 (47.1)	174 (52.9)	*2.38	1.79	3.18			
7	Sharp container	90 (72.6)	34 (27.4)	*6.67	4.36	10.2	2.91	1.68	5.04
8	Adequate number of basin with soap and hand rubs	128 (38.4)	205 (61.6)	1.306	0.98	1.73			

Note: *For the significant value of p-value less than 0.05.

Table 8: Reasons for unsafe practices.

S.No	Characteristics/Variables	Non-compliant n(%)	Compliant	Univariate			Multivariate		
				OR	95% CI		aOR	95% CI	
1	Gender (Female)	165 (41)	237 (59)	1.68	1.27	2.27	1.57	1.16	2.12
2	*Age (Score)	30.7 + 6.9	33.8 + 7.7	1.06	1.03	1.08	1.05	1.03	1.07
3	Don't know how to protect myself from blood and air borne diseases	13 (4.3)	291 (95.7)	*3.61	1.43	9.15	5.59	2.09	14.94
4	Not follow recommended precautions due to busy working hours	251 (82.6)	53 (17.4)	*1.46	1.02	2.08			
5	I do not use recommended precautions because my workmates do not use.	194 (63.8)	110 (36.2)	*1.40	1.05	1.87	1.61	1.18	2.2
6	My use of recommended precautions can offend the patients.	195 (64.1)	109 (35.9)	1.11	0.83	1.48			
7	In emergency situation, it is not possible to protect myself	245 (80.6)	59 (19.4)	*1.41	1	1.98			
8	It is not essential for staff to protect themselves against contact with patients' blood if the patient is not diagnosed.	142 (46.7)	162 (53.3)	0.97	0.74	1.29			
9	Not adequately trained in the correct use of protective equipment.	68 (22.4)	236 (77.6)	0.76	0.55	1.05			
10	Wearing protective equipment make me feel uncomfortable	138 (45.4)	166 (54.6)	*2.13	1.59	2.84			
11	Wearing protective equipment make it difficult to do job properly.	138 (45.4)	166 (54.6)	*2.78	2.06	3.74	2.48	1.81	3.39
12	Needles can be re-used after being autoclaved.	63 (20.7)	241 (79.3)	1.38	0.97	1.98			
13	Syringes can be re-used after being autoclaved	58 (19.1)	246 (80.9)	1.37	0.95	1.98			
14	Re-using needle or syringes that are autoclaved cannot spread Blood borne and Air Borne diseases.	77 (25.3)	227 (74.7)	1.23	0.89	1.7			

Note: *For the significant value of p-value less than 0.05.

DISCUSSION

There are six distinctive steps to switch the infection from one person to another, therefore to sickness transmission theory: Such as transmission form an External source into the portal of entry and it is regularly transfer from HCWs or other patients. Then "Evasion of primary host defenses such as pores and skin or stomach Acid" whilst this contamination is exposed to health experts, if their immune system is good they're able to fight, whilst it may not they can also sufferers. Adherence to mucous normally by way of bacterial pili, then colonization by using boom of the bacteria on the site of adherence at instances while HCWs are transferring cross infection, the onset of contamination no longer start, it occur after sufficient take place. The signs and symptoms of a disease is a result of toxin production or invasion accompanied by irritation. Lastly, the Host response to each nonspecific and specific immunity, it can be occurs after some time. If patient is infective they convey infection from sanatorium to domestic and if HCWs infected they suffer in later degree of lifestyles while its miles performing with either ailment sign or symptoms later. Therefore, SPs are important and need to be followed by all the HCWs and should observe strictly by the management [23-25].

This study have diagnosed that trendy precautions are vital and needed to be observed in depth. However there are many elements which may have an effect on of not following the SPs. The principal categories recognized such as Knowledge of SPs, availability and glove use for all procedures, attitude closer to following the SPs and agency factors are important to be compliant with SPs.

Educational and individual factors

The significances of the study shows that accurate knowledge of disease transmission, SPs recommendations, expertise and knowledge of SPs, the use of gloves is found to be directly proportional with SPs' compliance. This suggests that the higher the knowledge, the higher the compliance with SPs and prevention of COVID-19. It has additionally been observed that the younger HCWs are not following the compliant with general precautions due to lack of expertise about popular precautions. In Pakistan the information of SPs are extra clear and strictly followed with extra publicity and seniority, as they're exposed to exceptional continuous schooling and are also the ones clinically train the scholar and novice HCW. A similar outcomes being diagnosed by a research done in Palestine, in which the researchers discovered that the participants (age 31-40 years), having master's degree, 5 years of experience, and those attended educational periods, had an excessive know-how rating, and while there has been no affiliation among age, gender, and education with the score of understanding. For the mean compliance rating, it has been discovered that age 20-30 years, academic background (bachelor's degree), 5 or more year experience, and formerly attended educational periods on SPs have been found significantly associated with the high practice rating [26]. Furthermore, another descriptive cross-sectional study in china revealed that nursing students having 1-2 years of scientific exposure have 8.8 times more compliance with SPs when as compared with students having less clinical exposure, while students having 3-4 years of scientific exposure have been 9.5 more criticism with SPs [27]. However, newly graduated and more youthful nurses need greater attention to be trained for SPs.

Our study also found that HCWs are having lack of required attitude (professional attitude) to be compliant with SPs. Among them male individuals, who have been found taking extra compliance are actually those who fear the transmission of infection the most. Our findings are consistent with other studies, In an Egyptian research conducted for examining the effect of infection control program on attitude of nurses; it was found that the health education/ hands on training improved the attitude as well as knowledge of the HCWs regarding infection control practices. Therefore, they advocated that more training and health education need to be made obligatory for the HCWs to reduce HCAIs and the fee of their treatment [28]. As this will enhance the attitude of nurses towards compliance with SPs, which is not only important for their own health, but also for patient and their families at large. Instead of PPE, in the regions with sufficient measures taken for SP`s during COVID-19, HCWs have been reported to have been either positive with infection or losing their lives to this pandemic, which indicates the lack of compliance with SP`s including other causes [29,30].

Another study evaluated the knowledge of medical as well as nursing students regarding HCAIs' prevention and hand hygiene, found the score of nursing students higher when compared with medical students. thus study recommended new methods of training along with assessment of curricula of nursing education to facilitate the stake holders of medical education in the region [31].

Use of gloves is the most important component of SPs. The use of gloves is not only handiest interrupting the infection transfer to HCWs for themselves but also to patients and attendants. In today current situation of COVID 19, gloves are the best way of protecting the HCWs. Our study identified that HCWs are using gloves only if they came to know that patient is contagious, on the contrary, it is mandatory for health care workers to use the gloves with any type of patients especially when they are dealing with blood and body fluids.

Some studies added that compliance of HCW`s is essential in preventing nosocomial infections and maintaining quality of care, however there are other factors that affect the compliance with SP`s including socio demographic Model, Individual Model, and Institutional Model, these Models were significantly connected toward the hospital types, hospital administrative support, behavior change, attitude, and safety climate. One of the solution could be the reward system, which is necessary to change the attitude of HCWs toward SPs, as well supportive management is required to maintain the quality of care [32,13].

Organizational factors

The Current study reveals that HCWs are more non-compliant with the SP`s when management had least priorities towards employ`s safety. This finding was found consistent with other study which revealed that management lack of interest leads to the policy implementation, continuous monitoring, discussion about current issues in providing quality care, SP`s guidelines and eventually lack of PPE`s and necessary resources result in staff noncompliance with SP`s [16]. Another study also found that lacking performance and poor condition of the working environment are associated with noncompliance of SPs [33].

Moreover, another study found lack of knowledge to be significant variable along with unawareness of consequences of non-compliance. Study further adds that among the PPE`s and resources lack of basic things like water had also been an issue; which plays basic role in prevention of infection transmission with in the health care settings [34-36]. According to center for disease control to prevent the infection transmission and avoid deaths, it

is important to detect and eliminate the symptomatic staff, restrict the visitors. In addition strengthening the infection prevention control guideline and using PPE can minimize the exposure of the peoples from corona virus infectious disease 2019. Moreover, it is also important to provide health information regarding the clients and their relatives and as well to the communities along with stake holder, leaders, and those who are working for health to endorse a guideline for the management of this outbreak [29].

Overall the result of current study are similar to any other study [17] which confirmed the perceived boundaries of SPs' compliance, which can be SPs' knowledge (p-value=0.009), perceiving nursing care as obstacle (P-value=<0.001), privation of training (P-value=0.0041), privation of support (P-value=0.026), and impact of seniors (P-value=0.031). Similarly, the result of the current study shown that the elements related to the noncompliance with SPs are: Nursing care as obstacles (P-value=0.047), management support privation (P-value=0.017), and have an effect of seniors (P-value=0.01),

Challenges faced during research

Limitations: In engaging this take a look at, some elements were identified as barriers and described.

This take a look at become deliberate to seize a larger population and the researcher planned for fifteen different hospitals, while simplest nine hospitals gave permission. Finally, the major difficulty was study design, the "cross-sectional take look layout", as it cannot discover any causal relationships.

Strength of study: This take a look at has numerous strengths. Firstly, the study has been conducted in nine different hospitals of Sindh, Pakistan, which is very diverse from the previous studies, which had been limited to one setting only.

Moreover, the previous research had been conducted in one hospital, either private or public hospital, while the current study focused nine different hospitals both private and public. Hence, the effects of this examine is more generalizable from the previous studies.

Recommendations: Some recommendations are highlighted for future, that is for both educational and clinical/scientific purposes.

• Everyday schooling sessions and refresher courses about waste disposal management and preventive practices need to be there for enhancing SPs in health care settings.

• All health care settings need to have their own department who only work on the control and prevention of infection, in which nurses need to be involved, with a purpose to share know-how with other newbie nurses. This will improve every day tracking and evaluation of the excellent practices regarding infection control and prevention.

• For the better compliance with SPs, All hospitals and HCWs should be provided with adequate resources.

• Curricula for both Nursing and Medical undergraduate need to be revised for the recognition the importance of infection control and prevention practices and there's a need to enhance the guidelines of SPs' tips with the aid by the students of both (nursing and medical). Every health Centre's control also needs to add infection management practices and tips in the orientation phase.

The effects of this have a look at have also highlighted some suggestion for future researches that are index below.

• A qualitative approach needs to be accomplished for producing profound information about risky behavior of HCWs.

• An interventional take a look at is wanted to evaluate the pre and post-intervention practices of the HCWs and to evaluate their results.

• Similar study design has been needed to be performed in exclusive health care settings of various districts in all the four provinces of Pakistan, for the real and true picture of the observe results.

CONCLUSION

The findings of the current study displays that the nurses and doctors have terrible compliance to SPs in both critical and non-critical units. Therefore not only the management of the hospital need to work but also the HCWs need to work at the SPs' obstacles, which are: Lacking information concerning blood borne ailment transmission, insufficient knowledge as well as practices concerning SPs, inadequate expertise and exercise of rightly use of gloves, lacking administrative center protection and area cleanliness, place of work's stress, and vaccination/immunization of the HCWs. It has been recognized that future studies are needed for a higher know-how of the hurdles to the compliance of SPs.

REFERENCES

1. Lipsitch M, Swerdlow DL, Finelli L. Defining the epidemiology of COVID-19-studies needed. New England J Med. 2020; 382(13): 1194-1196.

2. Guarner J. Three emerging coronaviruses in two decades: The story of SARS, MERS, and now COVID-19. 2020.

3. Ungaro RC, Sullivan T, Colombel JF, Patel G. What should gastroenterologists and patients know about COVID-19? Clinical Gastroenterol Hepatol. 18(7); 1409-1411.

4. Jiang S, Xia S, Ying T, Lu L. A novel coronavirus (2019-nCoV) causing pneumonia-associated respiratory syndrome. Cellular Mol Immunol. 2020; 17: 554-554.

5. AlTakarli NS. Emergence of COVID-19 infection: What is known and what is to be expected-narrative review article. Dubai Med J. 2020; 3: 13-18.

6. Chen X, Shang Y, Yao S, Liu R, Liu H. Perioperative care provider's considerations in managing patients with the COVID-19 infections. Transl Perioper Pain Med. 2020; 7(2): 216-223.

7. Del Rio C, Malani PN. COVID-19-new insights on a rapidly changing epidemic. JAMA. 2020; 323: 1339.

8. Ferreira E, Pina E, Sousa-Uva M, Sousa-Uva A. Risk factors for health care–associated infections: From better knowledge to better prevention. American J Infect Cont. 2017; 45(10): e103-e107.

9. Wolkewitz M, Zortel M, Palomar-Martinez M, Alvarez-Lerma F, Olaechea-Astigarraga P, Schumacher M. Landmark prediction of nosocomial infection risk to disentangle short-and long-stay patients. J Hospital Infec. 2017; 96(1), 81-84.

10. Blumberg TJ, Woelber E, Bellabarba C, Bransford R, Spina N. Predictors of increased cost and length of stay in the treatment of postoperative spine surgical site infection. The Spine J. 2018; 18(2): 300-306.

11. Tada A, Watanabe M, Senpuku H. Factors influencing compliance with infection control practice in Japanese dentists. Int J Occup Environ Med (The IJOEM). 2014; 298: 224-231.

12. Hessels A J, Genovese-Schek V, Agarwal M, Wurmser T, Larson EL. Relationship between patient safety climate and adherence to standard precautions. American J Infection Control. 2016; 44(10): 1128-1132.

13. World Health Organization. Rational use of personal protective equipment for coronavirus disease 2019 (COVID-19). 2020.

14. Hedayati H, Marjadi B, Askarian M. Barriers to standard precautions adherence in a dental school in Iran: A qualitative study. American J Infection Control. 2014; 42(7): 750-754.

15. Efstathiou G, Papastavrou E, Raftopoulos V, Merkouris A. Factors influencing nurses' compliance with standard precautions in order to avoid occupational exposure to microorganisms: A focus group study. BMC nursing. 2011; 10(1): 1.

16. Suliman M, Aloush S, Aljezawi M, AlBashtawy M. Knowledge and practices of isolation precautions among nurses in Jordan. American J Infection Control. 2018; 46(6): 680-684.

17. Cheung K, Chan CK, Chang MY, Chu PH, Fung WF, Kwan KC, et al. Predictors for compliance of standard precautions among nursing students. American J Infect Cont. 2015; 43(7): 729-734.

18. Gershon RR, Vlahov D, Felknor SA, Vesley D, Johnson PC, Delcios GL, et al. Compliance with universal precautions among health care workers at three regional hospitals. American J Infection Control. 1995; 23(4): 225-236.

19. Kermode M, Jolley D, Langkham B, Thomas MS, Holmes W, Gifford SM. Compliance with universal/standard precautions among health care workers in rural north India. American J Infection Control. 2005: 33(1): 27-33.

20. Polit DF, Beck CT. Essentials of nursing research: Appraising evidence for nursing practice: Lippincott Williams ad Wilkins. 2010.

21. CDC. Centre of Disease control and Prevention. Summary of Infection prevention practices.

22. Kohn WG, Collins AS, Cleveland JL, Harte JA, Eklund KJ, Malvitz DM. Guidelines for infection control in dental health-care settings-2003. 2003.

23. Erdem AL, Avelino F, Xicohtencatl-Cortes J, Girón JA. Host protein binding and adhesive properties of H6 and H7 flagella of attaching and effacing Escherichia coli. J Bacteriology. 2007; 189(20): 7426-7435.

24. Belser JA, Rota PA, Tumpey TM. Ocular tropism of respiratory viruses. Microbiol Mol Biol Rev. 2013; 77(1): 144-156.

25. Lu CW, Liu XF, Jia ZF. 2019-nCoV transmission through the ocular surface must not be ignored. The Lancet. 2020; 395(10224): e39.

26. Fashafsheh I, Ayed A, Koni M, Hussein S, Thultheen I. Midwives and Nurses Compliance with Standard Precautions in Palestinian Hospitals. Open J Nur. 2016; 6(04): 294-302.

27. Colet PC, Cruz JP, Alotaibi KA, Colet MK, Islam SM. Compliance with standard precautions among baccalaureate nursing students in a Saudi university: A self-report study. J Infection Public Health. 2017; 10(4): 421-430.

28. Galal YS, Labib JR, Abouelhamd WA. Impact of an infection-control program on nurses' knowledge and attitude in pediatric intensive care units at Cairo University hospitals. J Egyptian Pub Health Asso. 2014; 89(1): 22-28.

29. McMichael TM. COVID-19 in a long-term care facility-King County, Washington, February 27–March 9, 2020. MMWR. Morbidity and Mortality Weekly Report, 69. 2020.

30. Hessels AJ, Wurmser T. Relationship among safety culture, nursing care, and Standard Precautions adherence. American J Infection Control. 2020; 48(3): 340-341.

31. D'Alessandro D, Agodi A, Auxilia F, Brusaferro S, Calligaris L, Ferrante M, et al. Prevention of healthcare associated infections: Medical and nursing students' knowledge in Italy. Nurse Edu Tod. 2014; 34(2): 191-195.

32. Oh E, Choi JS. Factors influencing the adherence of nurses to standard precautions in South Korea hospital settings. American Journal of Infection Control. 2019; 47(11): 1346-1351.

33. Awases MH, Bezuidenhout MC, Roos JH. Factors affecting the performance of professional nurses in Namibia. Curationis. 2013; 36(1): 1-8.

34. Sahiledengle B, Gebresilassie A, Getahun T, Hiko D. Infection prevention practices and associated factors among healthcare workers in governmental healthcare facilities in Addis Ababa. Ethiopian J Health Sci. 2018; 28(2): 177-186.

35. Sarani H, Balouchi A, Masinaeinezhad N, Ebrahimitabs E. Knowledge, attitude and practice of nurses about standard precautions for hospital-acquired infection in teaching hospitals affiliated to Zabol University of Medical Sciences (2014). Global J Health Sci. 2016; 8(3): 193.

36. World Health Organization. Towards universal access to diagnosis and treatment of multidrug-resistant and extensively drug-resistant tuberculosis by 2015: WHO Progress Report. 2011.