

USE OF PERSONAL PROTECTIVE DEVICES AMONG HEALTH CARE WORKERS IN A TEACHING HOSPITAL IN CAIRO, EGYPT.

By

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Abstract

Introduction: Personal protective equipment (PPE) provide a physical barrier between the user and micro-organisms by preventing micro-organisms from contaminating the mucous membranes, airways, skin, clothing, hair and shoes of health care workers. **Aim of the work:** To describe the practice of nurses and physicians as regards usage of PPE and identify the factors affecting their adherence to using these equipment. **Materials and Methods:** A cross sectional study among health care workers at El-Demerdash hospital (a teaching hospital in Cairo, Egypt). The study included (269) physicians (from demonstrators to professors) and (331) nurses. Participants answered a questionnaire which included items on socio-demographic and occupational characteristics, questions on practice, attitude of health care workers regarding the usage of personal protective equipments. A health education poster was prepared and used by researchers to transmit a message on the importance of using personal protective equipments among health care workers through face to face interviews. **Results:** It was found that the independent predictors of adherence among physicians were dealing with a patient known to have a blood borne disease, availability of PPE, senior example and past experience. While in nurses the independent predictors were also dealing with patients known to have a blood borne disease, availability of PPE together with no time to use PPE and training on a clear hospital policy. **Conclusion:** Increasing the awareness of health care workers about the importance of adherence to usage of PPE is very important and will help in reducing transmission of infection to them. Protection of health care workers from acquisition of infectious diseases can be achieved by compliance to established infection control guidelines including rigorous infection control practices, perspective instructions for the use of PPE and post exposure antiviral prophylaxis **Keywords:** Personal protective devices, Protection of health care workers, Adherence to PPE, Physicians and Nurses

Introduction

Use of personal protective devices and safety engineered medical devices (safety devices) is mandated by the Occupational Safety and Health Administration (OSHA) for health care workers who may be exposed to patients' blood (OSHA, 2014), the purpose of which is to prevent infection with human immunodeficiency virus (HIV), hepatitis B virus (HBV) and hepatitis C virus (HCV) (NIOSH, 2010). Safety climate is defined as employees' shared perceptions regarding safety within their work organization (Gershon et al., 2009). It has been associated with use of personal protective equipment and safety devices in a variety of work settings (Gershon et al., 1995, Rivers et al., 2003).

Exposure to blood and body fluids (BBF) can occur through a percutaneous injury (needle stick injury or NSI) or muco-cutaneous incident. Awareness regarding this occupational risk led to the issue of guidelines by CDC as universal precautions in 1987, later updated in 1996 (CDC, 2008). Prospective studies of health care workers have estimated that the average risk for transmission

after a percutaneous exposure is approximately 0.3%, 6 to 30% and 1.8% for HIV, hepatitis B and hepatitis C, respectively. Over 90% of these infections are occurring in low income countries and most are preventable (World Health Report, 2002).

In the developing countries, the health care workers are at greater risk due to sub-optimal infection control practices like lack of equipment, training, compliance with universal precautions (Sagoe-Moses et al., 2001). A study amongst health care workers in rural health care facilities showed that proportion exposed to BBF and was 37.1% and 63.2% respectively (Kermode et al., 2005).

In one study, health care workers cited various reasons for not using the personal protective equipment (PPE) and emergencies were the reason cited by most of them (91.43%) for not using the PPE. This was followed by non use of PPE by co-workers (67.14%), busy schedule (37.14%), risk of offending the patient (27.14%), discomfort (24.29%) and difficulty in carrying out the job (18.57%) (Med et al., 2011).

In another study, 87.5% of respondents believed that use of appropriate PPE would confer adequate protection for health care workers. Half of respondents reported that PPE use was inconvenient, while 21.2% believed that PPE use would interfere with patient care, with no difference observed between physicians and nurses. With regards to organization factors, 63.2% of respondents reported that appropriate PPE was readily available in their working place. As to behaviors of PPE use, about 21% of respondents reported that their colleagues often forgot to use PPE during patient care, while a similar proportion reported themselves to forget to change PPE between patients (Xiaoyun et al., 2012)

Aim of the work

To describe the practice of nurses and physicians as regards usage of PPE and identify the factors affecting their adherence to using these equipments.

Materials and Methods

- **Study design:** A cross sectional study among health care workers.

- **Place and duration of study:** at El-Demerdash hospital (a teaching

hospital in Cairo, Egypt). Work in this study was during the period from August 2015 to January 2015.

- **Study sample:** Sample size calculation: guided by the following data power =80% and confidence level of 99%, accepted margin of error of 1% with expected response of 50% together with the total population surveyed accordingly total sample = 600 which will further will be classified according to the available doctors and nurses. The study included (269) physicians (from demonstrators to professors) and (331) nurses.

- Study methods

- **Questionnaire:** Participants answered a questionnaire which included items on socio-demographic and occupational characteristics as age, gender, marital status, job nature, job title, work duration, working years, questions on practice, attitude of health care workers regarding the usage of personal protective equipment.

- **Health education poster:** After data collection and initial analysis, a health education poster was prepared and used by researchers to transmit a

message on the importance of using personal protective equipment among health care workers. This happened through visits to 4 main departments (general medicine, general surgery, pediatrics, obstetrics and gynecology) and taking a random sample of physicians and nurses available on the days of visit and through face to face interviews using the pre-designed poster the above mentioned message was delivered.

Statistical analysis

Data was coded and entered on SPSS program version 16 and analyzed using frequency tables, chi square test. Binary logistic regression was used to find out significant independent predictors.

Ethical consideration: confidentiality was assured by using anonymous questionnaires and respect to participants was ascertained through explaining the objectives of the study and its benefits.

Results

Table (1): Socio-demographic and occupational characteristics of the study participants:

Variables	No. (%)
General surgery	148 (24.7)
General medicine	179 (29.8)
Pediatrics	78 (13)
Obstetrics and gynecology	48 (8)
Other surgical departments*	147 (24.5)
Job nature	
Physicians	269 (44.8)
Nurses	331 (55.2)
Job title	
Professors and assistant professors	166 (27.7)
Lecturers, assistant lecturers and lecturers	81 (13.5)
Nurses	331 (55.2)
Gender	
Male	223 (37.2)
Female	377 (62.8)
Age (mean \pm SD)	36.9 \pm 9.4
Work duration (mean \pm SD)	11.7 \pm 7.97
Working hours/day (mean \pm SD)	10.5 \pm 2.45
Marital status	
Married	381 (63.5)
Single	208 (34.7)
Divorced and widow	11 (1.9)
Shift work	
Yes	379 (63.2)
No	221 (36.8)
Did you receive a training program on the importance of PPE?	
Yes	247 (41.2)
No	353 (58.8)

*others include orthopedics, urology, neurosurgery, ophthalmology and ENT.

Most of the study participants were nurses (55.2%), from general medicine department (29.8%), females (62.8%) with mean age 37 years old, married with mean work duration of 11.7 years and mean working hours /day of 10.5 hours. Most of the study participants have experienced shift work (63.2%) and did not receive any training program on the importance of PPE.

Table (2): Attitude of health care workers towards usage of PPE:

Variables	No. (%)
The degree to which you think your work environment is risky	
Low risk	65 (10.8)
Medium risk	231 (38.5)
High risk	304 (50.7)
The extent to which usage of PPE can reduce the work hazards	
Strongly agree	106 (17.7)
Agree	274 (45.7)
Disagree	214 (35.7)
Strongly disagree	6 (1)
Your rating of overall usage of PPE	
Always	91 (15.2)
Usually	178 (29.7)
Sometimes	247 (41.2)
Rarely	84 (14)
Your opinion on idea that hospital policy on PPE usage will	
Increase adherence	
Strongly agree	82 (13.7)
Agree	211 (35.2)
Disagree	300 (50)
Strongly disagree	7 (1.2)

Most of those included in the study considered their work environment as highly risky (50.7%). Although most of them agreed that usage of PPE can reduce the work hazards (45.7%), the highest percentage of them stated that they only (sometimes) used PPE (41.2%). Moreover, most of them disagreed that a hospital policy on PPE usage will increase adherence.

Table (3): Comparison between nurses and physicians in some items of practice:

	Wear 2 pairs of gloves				P value
	All patients	Suspected patients	Known patients	Never	
Physicians Nurses	44(16.4) 125(37.8)	80 (29.7) 29 (8.8)	76 (28.3) 135(40.8)	69 (25.7) 42 (12.7)	< 0.05*
	Wearing a face mask				
	All patients	Suspected patients	Known patients	Never	
Physicians Nurses	50 (18.6) 78 (23.6)	47 (17.5) 87 (26.3)	118 (43.9) 129 (39)	54 (20.1)	< 0.05*
	Wearing eye protection				
	All patients	Suspected patients	Known patients	Never	
Physicians Nurses		15 (5.6) 24 (7.3)	143 (53.2) 86 (26)	111 (41.3) 221 (66.8)	< 0.05*
	Wearing apron				
	All patients	Suspected patients	Known patients	Never	
Physicians Nurses		11 (4.1) 14 (4.2)	45 (16.7) 105 (31.7)	213 (79.2) 212 (64)	< 0.05*
	Trying to avoid sharp injuries				
	All patients	Suspected patients	Known patients	Never	
Physicians Nurses	94 (34.9) 186 (56.2)	43 (16) 25 (7.6)	132 (49.1) 120 (36.3)		< 0.05*
	Disinfecting blood spills				
	All patients	Suspected patients	Known patients	Never	
Physicians Nurses	46 (17.1) 79 (23.9)	12 (4.5) 78 (23.6)	110 (40.9) 82 (24.8)	101 (37.5) 92 (27.8)	< 0.05*
	Covering cuts				
	All patients	Suspected patients	Known patients	Never	
Physicians Nurses	78 (29) 76 (23)	67 (24.9) 77 (23.3)	94 (34.9) 110 (33.2)	30 (11.2) 68 (20.5)	< 0.05*

* = significant

On comparing between nurses and physicians in some items of practice, the percentage of nurses wearing 2 pairs of gloves, a face mask, trying to avoid sharp injuries, disinfecting blood spills with all patients they dealt with was significantly higher than that of physicians. While physicians covered cuts significantly higher than nurses when dealing with all patients.

Table (4): Factors affecting adherence to usage of PPE among study participants:

	Previous inoculation				P value
	Strong influence	Some influence	Limited influence	No influence	
Physicians	60 (22.3)	81 (30.1)	90 (33.5)	38 (14.1)	< 0.05*
Nurses	157 (47.4)	78 (23.6)	78 (23.6)	18 (5.4)	
	Past experience				
	Strong influence	Some influence	Limited influence	No influence	
Physicians	37 (13.8)	101 (37.5)	87 (32.3)	44 (16.4)	< 0.05*
Nurses	73 (22.1)	81 (24.5)	76 (23)	101 (30.5)	
	Peer example				
	Strong influence	Some influence	Limited influence	No influence	
Physicians	20 (7.4)	54 (20.1)	91 (33.8)	104 (38.7)	< 0.05*
Nurses	83 (25.1)	76 (23)	125 (37.8)	47 (14.2)	
	Senior example				
	Strong influence	Some influence	Limited influence	No influence	
Physicians	9 (3.3)	94 (34.9)	86 (32)	80 (29.7)	< 0.05*
Nurses	45 (13.6)	103 (31.1)	121 (36.6)	62 (18.7)	
	Hospital policy				
	Strong influence	Some influence	Limited influence	No influence	
Physicians	52 (19.3)	62 (23)	85 (31.6)	70 (26)	< 0.05*
Nurses	13 (3.9)	123 (37.2)	130 (39.3)	65 (19.6)	
	Dealing with a patient with blood borne disease				
	Strong influence	Some influence	Limited influence	No influence	

Physicians Nurses	137 (50.9) 163 (49.2)	106(39.4) 148(44.7)	26 (9.7) 20 (6)		> 0.05
	Dealing with a patient suspected of having a blood borne disease				
	Strong influence	Some influence	Limited influence	No influence	
Physicians Nurses	85 (31.6) 111 (33.5)	120(44.6) 156(47.1)	62 (23) 63 (19)	2 (0.7) 1 (0.3)	> 0.05
	Wearing PPE interferes with doing my work tasks				
	Strong influence	Some influence	Limited influence	No influence	
Physicians Nurses	5 (1.9) 13 (3.9)	19 (7.1) 19 (5.7)	89 (33.1) 176 (53.2)	156 (58) 123 (37.2)	< 0.05*
	No time available to wear PPE				
	Strong influence	Some influence	Limited influence	No influence	
Physicians Nurses	82 (30.5) 54 (16.3)	102(37.9) 117(35.3)	54 (20.1) 103(31.1)	31 (11.5) 57 (17.2)	< 0.05*
	Availability of PPE at work				
	Strong influence	Some influence	Limited influence	No influence	
Physicians Nurses	79 (29.4) 148(44.7)	112(41.6) 126(38.1)	60 (22.3) 41 (12.4)	18 (6.7) 16 (4.8)	< 0.05*
	Urgent patient needs				
	Strong influence	Some influence	Limited influence	No influence	
Physicians Nurses	45 (16.7) 59 (17.8)	133 (49.4) 123 (37.2)	73 (27.1) 141(42.6)	18 (6.7) 8 (2.4)	< 0.05*
	Patient objection				
	Strong influence	Some influence	Limited influence	No influence	
Physicians Nurses	4 (1.5) 4 (1.2)	60 (22.3) 86 (26)	134(49.8) 117(35.3)	71 (26.4) 124(37.5)	< 0.05*

* = significant

On studying the factors affecting adherence to usage of PPE among participants, the percentage of nurses was significantly higher than that of physicians to believe the following factors have strong influence: previous inoculation, past experience, peer or senior example, wearing PPE interferes with doing their work tasks, availability of PPE at work, urgent patient needs. While physicians found that hospital policy, not enough time, patient objection are factors with a significant strong influence on adherence to PPE usage.

Table (5): Effect of different factors to the adherence for use of PPE among physicians and nurses:

Independent predictors of physicians	Beta-coefficient	P	Odd's(95% CI)
Dealing with a patient with blood borne disease	0.99	< 0.05*	1.4(0.8-12.8)
Availability of PPE	0.67	< 0.05*	1.34(0.4-15.5)
Senior example	0.44	< 0.05*	1.2(0.6-17.9)
Past experience	0.30	< 0.05*	1.1(0.3-18.7)
Independent predictors of Nurses	Beta-coefficient	P	Odd's(95% CI)
Dealing with a patient with blood borne disease	0.59	< 0.05*	1.7(0.9-22.8)
Availability of PPE	0.38	< 0.05*	1.3(0.4-19.5)
No time to use PPE	0.24	< 0.05*	1.3(0.8-19)
Hospital policy training	0.20	< 0.05*	1.26(0.4-16)

* = significant

It was found that the independent predictors of adherence among physicians were dealing with a patient known to have a blood borne disease, availability of PPE, senior example and past experience. While in nurses the independent predictors were also dealing with patients known to have a blood borne disease, availability of PPE together with no time to use PPE and training on a clear hospital policy.

Discussion

Personal Protective Equipment consists of specialized clothing or equipment worn by health workers and personnel involved in disease control activities. It is an integral part of routine infection control practice and it is an important component of prevention and control activities. Compliance with the use of PPE and recommended infection control precautions is critical to prevent the transmission of the pathogens.

The finding that physicians wore aprons, eye protection significantly higher than nurses can be explained by the fact that surgeons are especially at higher risk as shown from the results of a prospective study which was conducted to determine the incidence of blood splashes to the masks and goggles of surgeons. The study observed that the rate of blood splashes was 62.5% on surgeons' masks, 63.2% on surgeons' goggles, 11.1% on scrub nurses' masks and 16% on scrub nurses' goggles (Aisien and Ujah, 2006). Alamgir et al., 2008, in their study observed that splashes most frequently occurred at the patient's bedside (46.1%) and predominantly affected the eyes or face/

mouth of health care workers. A study in Nigeria observed that about 56.5% had never worn goggles during birth deliveries (Sadoh et al., 2006). Ganczak and Szych, 2007 in their study observed a high compliance for glove use (83%) but much lower for protective eye wear (9%). All nurses in another study stated that surgical aprons should be worn during surgery but only 98% actually used surgical aprons always during surgery. Also, 99% were of the opinion that masks should be worn at all times during surgery but only 93% were actually using masks always during surgery. Double gloves were worn by only 28% of 344 relevant health care workers observed in one study; using double gloves were highest for physicians than nurses in this work (Deniz et al., 1999). These findings show how attitude of health care workers towards using personal protective equipment can differ from their actual practice (Jayadevan et al., 2010). This was also found in the current work where 45.7% agreed that using personal protective equipment can reduce the work hazards but when asked to rate their overall usage of these devices most of them stated that they

only (sometimes) use them (table 2). This discrepancy between attitude and practice was also found in another study in such cases as use of facemasks: low favorable attitude but high compliance, use of eye protection: high favorable attitude but low compliance (David et al., 2012).

The current study revealed the concern of health care workers regarding needle stick injuries whether in sometimes having to wear 2 pairs of gloves or in stating they tried to avoid sharp injuries (table 3). A study conducted in an Australian tertiary care hospital revealed an accident rate of 47% for sharp objects – related injuries and 68% for body fluid exposures among nurses and also reported rates of 38% and 16% respectively among other medical staff (Peng et al., 2008). Zafar et al, 2008 identified that about 45% of personnel reported having had a needle stick injury in the past and the frequency of injury was significantly higher among doctors compared to nurses.

Regarding causes for non compliance, the most commonly stated reason in one study was non availability

of personal protective devices (Ganczak and Szych, 2007). Some of the reasons for non compliance included: health care workers being too busy to use PPE (Cutter and Jordan, 2004), PPE were uncomfortable to wear (Madan et al., 2002) and difficult to access (Luo et al., 2010).

In another study, the reasons for not using personal protective equipment ranged from busy schedule (37.14%), non use of PPE by coworkers (67.14%), emergencies (91.43%), risk that patients might get offended by use of PPE by health care workers (27.14%) to discomfort while using them (24.29%) (Med et al., 2011).

In the current study most participants disagreed that existence of a hospital policy was enough for increasing adherence to usage of PPE (table 2) but existence and training on a clear hospital policy was from the independent factors affecting adherence among nurses (table 5). Several studies suggested that improving safety climate may be a powerful tool for increasing use of PPE (Jack, 2014), (Gershon et al., 2009). Hospital policy as a factor which may affect adherence agrees with the finding

of one study where senior management support for safety programs, absence of workplace barriers to safe work practices and cleanliness/orderliness of the work site were significantly related to compliance. In addition, both senior management support for safety programs and frequent safety related feedback/training were significantly related to workplace exposure incidents. Thus, the most frequent finding in terms of enhancing compliance and reducing exposure incidents was the importance of the perception that senior management was supportive of the blood borne pathogen safety program (Gershon et al., 2000). In another study, several barriers were identified that interfere in matters of safety and personal protective equipment such as communication, work overload, physical structure, accessibility of protective equipment and organizational and management aspects. Adherence to personal protective equipment is determined by the context experienced in the workplace, as well as by individual values and beliefs, but the decision to use the personal protective equipment is individual (Neves et al., 2011).

Conflict of interest:

Authors have declared that no conflict of interests exists

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