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UNIVERSAL PRECAUTIONS: A SURVEY OF HEALTH CARE PROVIDERS' KNOWLEDGE, PRACTICE AND COMPLIANCE IN A TERTIARY CARE HOSPITAL IN ISMAILIA CITY

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Abstract:

Objectives: This study was conducted to assess hospital staff' knowledge, self-reported compliance and actual practice of universal precautions, identify important non adherence factors, and determine the proportion of participants exposed to blood and other body fluids with identification of the associated risk factors. **Subjects and Methods:** A total of 152 hospital staff from different job categories at risky departments in a tertiary care hospital in Ismailia City were included in this survey study where a structured questionnaire and a direct observation check list were used. **Results:** The mean percent score of participants' self-reported compliance was much higher than those of knowledge and actual practice. Moreover, a statistically significant positive correlation was found only between percent score of participants' knowledge and practice. A gab between knowledge and practice was detected where 75% of the studied participants had insufficient knowledge while 36.2% of them had insufficient practice. Insufficient knowledge was significantly revealed among males, nurses and surgical departments' staff; while insufficient practice was significantly detected among nurses, surgical departments' staff, those with > 48 working hours per week and hospital staff with > 3 constrains. The majority of the participants (65.1%) got their information from sources other than the hospital. Work-related factors were the most important compliance barriers. The majority of the participants had history of sharps injury and exposure to blood or other body fluids splashes at work; however, none of these

incidents were reported. These exposures were significantly revealed among nurses, staff in surgical departments and those with insufficient knowledge and practice of universal precautions. **Conclusions:** Hospital staff are at high risk of exposure to blood borne pathogens, yet universal precautions are not well understood or implemented. So, implementing a specifically tailored infection-control program will be most effective in protecting them.

Key words: Knowledge, practice, compliance, universal precautions, health care providers, sharps injury, blood splash, body fluids splash.

Introduction:

Health care workers especially those in areas such as operating, delivery, emergency rooms, and laboratories have a high risk of infection with dangerous blood borne viruses while performing their clinical activities. Cleaners, waste collectors and others whose duties involve handling blood-contaminated items are also at high risk (1,2,3).

Among the 35 million health care providers worldwide, about 3 million experience percutaneous exposures to blood borne viruses annually. These injuries result in 15,000 HCV, 70,000 HBV and 1000 HIV infections. More than 90% of these infections occur in developing countries (1).

Most blood exposures in health care settings are preventable. Protective strategies include implementation of universal precautions which are a set of precautions designed to protect health care workers when providing health care to all patients from the risk of infection with blood borne viruses. They have been recommended by the Centers for Disease Control and Prevention (CDC) and were mandated by the Occupational Safety and Health Administration (OSHA) in 1991 (1,4,5,6).

In developed high-income countries, universal precautions are well established in all health care settings. In developing low-income countries, they are still not well understood and often practiced partially, if at all, thereby exposing health care workers to unnecessary risk of infection (7,8,9). So, this study was conducted to; 1) assess hospital staff' knowledge, self-reported compliance and actual current practice of universal precautions, 2) identify important non adherence factors with universal precautions, and 3) determine the proportion of participants exposed to blood and other body fluids with identification of the associated risk factors.

Subjects and Methods

Study design and setting:

This survey study was carried out between January and May 2010 in the central hospital of Suez Canal Authority in Ismailia City which is a tertiary care hospital with 250 bed capacity.

Study population:

The total number of hospital staff at risky departments and units was 164; out of them 152 professionals were included in this study according to the following selection criteria: agree to participate in the study, had direct contact with either patients or patients' specimens, and had minimum experience duration of 2 years in the same department or unit. The participation rate was 92.7%.

Ethical issues:

Informed consents were obtained from the manager of the hospital before conducting the study and from all the participants while interviewing them.

Tools of the study:

A questionnaire: All participants were asked to fill a four–part questionnaire.

Part one: included personal and occupational data such as; age, gender, occupation, department or unit, hours of work per week and experience years.

Part two: included knowledge of and self-reported compliance with the main recommended 8 universal precautions' items (1,10,11) as well as the sources of participants' information where each item was given one point to make the maximum knowledge score 8 points. The knowledge score for each participant was expressed as a percentage from the total score. Sufficient knowledge was considered when the percentage of participant's knowledge score > 50%; while less than 50% was considered as insufficient knowledge.

Self-reported compliance was assessed after conducting the check list survey so that answering the leading questions about compliance with the main items of universal precautions will not influence the participants' practice. As, cleaning up spills of blood and other body fluids is a task specific item for cleaners; thus, self-reported compliance was determined for the 8 items of universal precautions for cleaners and for 7 items only for the other hospital staff. The degree of self-reported compliance for each item was given (0 = no), (1 = rarely), (2 = occasionally), and (3 = always). The compliance score for each participant was expressed as a percentage from the total score of universal precautions' items.

Part three: included the commonest non-adherence factors with universal precautions such as psychosocial or individual factors (insufficient knowledge and training, interference of barrier precautions with work performance, discomfort and inconvenience, believing that dealing with patient cautiously is sufficient to prevent infection, and believing that not all the patients are sources for infection), work-related factors (work load and limited time especially in emergency situations), and organizational factors (insufficient management support for safety, insufficient training programs and lack of supervision, and limited infection control resources and personal protective equipment) (12,13).

Incompliant participants (whose answers for one or more of the items were no or rarely or occasionally) were asked to choose one or more of these factors according to their importance.

Part four: included history of sharps injury and occupational exposure to blood and / or other body fluids and actions taken in such situations.

A check list: All participants were observed several times (2 to 3 times) while performing their clinical activities and the average practice score was taken. The observations were made over a two months period by some members of the occupational safety and health committee of the hospital after training them during the monthly meeting of the committee. The check list was designed according to the published universal precautions guidelines in health care institutions (14,15,16).

Task specific item (cleaning up spills of blood and other body fluids) and some details in other items were taken into consideration. Practicing each item in details was given one point to make the maximum practice score 8 points for cleaners and 7 points for the other hospital staff. The practice score for each participant was expressed as a percentage from the total score. Sufficient practice was considered when the percentage of participant's practice score > 50%; while less than 50% was considered as insufficient practice.

Data management:

Data were computerized and statistically analyzed using SPSS version 10 (17). Comparison between numbers was done by chi-squared test. Pearson correlation coefficient (r) was used for testing the association between two continuous variables. The significance level was considered at P-value <0.05.

Results:

Relevant demographic and occupational characteristics:

Table (1) shows that 71.7% of the participants were > 40 years old and had < 48 working hours per week. Moreover, the majority of the participants were males (61.8%) and nursing staff (46.1%). Also, 46.7% of the participants were working in the surgical departments and 52.6% of them had < 15 years experience.

Participants' knowledge, self-reported compliance and practice of universal precautions:

The results of this study demonstrated that the mean percent score of participants' knowledge, self-reported compliance and practice of universal precautions were (36.5+16.2, 89.5+10.8 and 54.7+15.1, respectively) (figure 1).

Table (2) demonstrates a statistically significant positive correlation between the percent score of participants' knowledge and practice of universal precautions (P < 0.001). On the other hand, the positive correlations between the participants' self-reported compliance and both knowledge and practice were not of statistical significance (P > 0.05)

In the present study, 75% of the studied participants had insufficient knowledge; while 36.2% of them had insufficient practice. Insufficient knowledge was significantly revealed among males, nurses and surgical departments' staff; while insufficient practice was significantly detected among nurses, surgical departments' staff, those with working hours > 48 hours / week and hospital staff with > 3 constrains (table 3).

Figure (2) demonstrates that the majority of the participants (65.1%) got their information about universal precautions from sources other than the hospital.

Non-adherence factors with universal precautions:

Table (4) demonstrates the frequency distribution of incompliant hospital staff according to the most important non-adherence factors with universal precautions as follow: time constrain in emergencies (82.8%), work load and interference of protective barriers with work performance (64.5%), lack of training and supervision (62.4%), insufficient resources (44.1%) and insufficient management support for safety (33.3%). However, discomfort and inconvenience (22.6%), believing that dealing with patients cautiously is sufficient

(16.1%) and not all patients are sources of infection (15.1%) were the least important barriers.

Proportion of staff exposed to blood and other body fluids and the associated risk factors:

Table (5) demonstrates that 65.1% of the participants experienced sharps injury and 57.9% had past history of exposure to splashes of blood and / or other body fluids. However, none of these incidents were reported. Sharps injury was significantly revealed among nurses and those with insufficient knowledge and practice of universal precautions. Also, exposure to blood and other body fluids splashes was significantly revealed among nurses, staff in surgical departments, and those with insufficient knowledge and practice of universal precautions.

Table (1): Relevant demographic and occupational characteristics of the participants.

Relevant characteristics	**N (%)**
Age (years) < 40 ≥ 40	 43 (28.3 %) 109 (71.7 %)
Gender Males Females	 94 (61.8 %) 58 (38.2 %)
Departments Surgical Intensive care & Cardiac catheterization Renal dialysis & Endoscopy units Causality Laboratory	 71 (46.7 %) 27 (17.8 %) 20 (13.2 %) 16 (10.5 %) 18 (11.8 %)
Occupation Physicians Nurses Technicians Cleaners	 32 (21.1 %) 70 (46.1 %) 12 (7.8 %) 38 (25.0 %)
Experience years < 15 ≥ 15	 80 (52.6 %) 72 (47.4 %)
Working hours per week ≤ *48* > *48*	 109 (71.7 %) 43 (28.3 %)

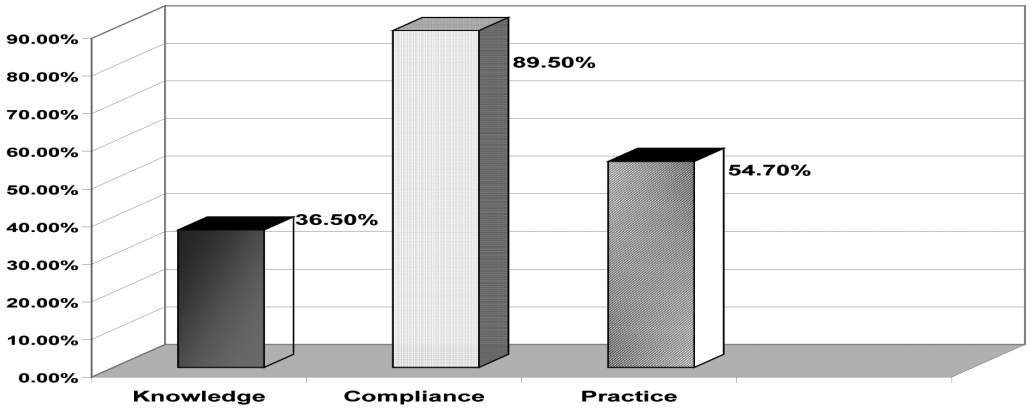

Figure (1): Frequency distribution of the studied participants according to knowledge, self-reported compliance and practice of universal precautions.

Table (2): Correlations between percent score of participants' knowledge, self-reported compliance and practice of universal precautions.

	Knowledge & self-reported compliance	**Knowledge & practice**	**Self–reported compliance & practice**
r	0.06	0.56	0.03
P-value	0.43	< 0.001	0.7

Table (3): Frequency distribution of the studied participants according to risk factors of insufficient knowledge and practice of universal precautions.

Risk factors	**Insufficient knowledge N = 114**	**Insufficient practice N = 55**	**P1**	**P2**
Gender				
Males	65 (57.1%)	36 (65.5%)	<0.05	> 0.05
Females	49 (42.9%)	19 (34.5%)		
Occupation				
Physicians	12 (10.5%)	2 (3.6%)		
Nurses	54 (47.4%)	27 (49.1%)	<0.001	< 0.001
Technicians	12 (10.5%)	4 (7.3%)		
Cleaners	36 (31.6%)	22 (40%)		
Department				
Surgical	58 (50.9%)	29 (52.7%)		
ICU & Cardiac catheterization	13 (11.4%)	3 (5.5%)		
Dialysis & Endoscopy units	16 (14%)	8 (14.5%)	< 0.05	< 0.01
Causality	12 (10.5%)	11 (20%)		
Laboratory	15 (13.2%)	4 (7.3%)		
Experience years				
< 15 years	59 (51.8%)	29 (52.7%)	> 0.05	> 0.05
≥ 15 years	55 (48.2%)	26 (47.3%)		
Working hours				
≤ 48 h / w	----------	20 (36.4%)		< 0.001
> 48 h / w		35 (63.6%)		
Non-adherence factors*				
< 3	----------	6 (23.1%)		< 0.05
≥ 3		20 (76.9%)		

P1 = P- value for chi squared test for risk factors of insufficient knowledge.

P2 = P- value for chi squared test for risk factors of insufficient practice.

* Calculated from the incompliant participants with insufficient practice (N = 26)

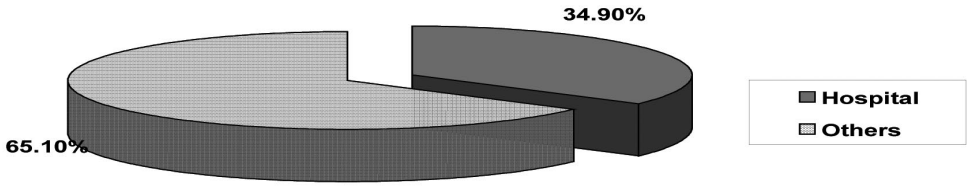

Figure (2): Frequency distribution of the studied hospital staff according to the sources of information about universal precautions.

Table (4): Frequency distribution of incompliant hospital staff according to the non-adherence factors with universal precautions.

Non – adherence factors	**Incompliant hospital staff (N = 93)**
Work – related factors	
Time constrain in emergency cases	77 (82.8 %)
Work load	60 (64.5%)
Organizational factors	
Lack of training and supervision	58 (62.4 %)
Insufficient resources	41 (44.1 %)
insufficient management support	31 (33.3 %)
Individual or psychosocial factors	
Interference with work performance	60 (64.5 %)
Discomfort and inconvenience	21 (22.6 %)
Dealing with patients cautiously is sufficient	15 (16.1 %)
Not all patients are sources of infection	14 (15.1 %)

Table (5): Frequency distribution of the studied hospital staff according to risk factors of occupational exposure to blood and other body fluids.

Risk factors	Sharps injury N = 99		blood and body fluids splashes N = 88		P1	P2
	N	%	N	%		
Gender						
Males	65	65.7 %	57	64.8 %	> 0.05	>0.05
Females	34	34.3 %	31	35.2 %		
Occupation						
Physicians	14	14.1 %	24	27.3 %	<0.01	<0.001
Nurses	47	47.5 %	48	54.5 %		
Technicians	6	6.1 %	6	6.8 %		
Cleaners	32	32.3 %	10	11.4 %		
Department						
Surgical	47	47.4 %	43	48.9 %	>0.05	<0.01
ICU & Cardiac catheterization	17	17.2 %	21	23.9 %		
Dialysis & Endoscopy units	17	17.2 %	13	14.8 %		
Causality	8	8.1 %	5	5.6 %		
Laboratory	10	10.1 %	6	6.8 %		
Experience years						
< 15 years	49	49.5 %	41	46.6 %	> 0.05	> 0.05
≥ 15 years	50	50.5 %	47	53.4 %		
Working hours						
≤ 48 / w	69	69.7 %	60	68.2 %	> 0.05	> 0.05
> 48 / w	30	30.3 %	28	31.8 %		
Knowledge						
Sufficient	19	19.2 %	8	9.1 %	< 0.05	< 0.001
Insufficient	80	80.8 %	80	90.9 %		
Actual practice						
Sufficient	49	49.5 %	40	45.5 %	< 0.001	< 0.001
Insufficient	50	50.5 %	48	54.5 %		

P1 = P- value for chi squared test for risk factors of sharps injury.

P2 = P- value for chi squared test for risk factors of blood and other body fluids splashes.

Discussion:

Most studies relied on self-reported method of assessment of practice despite that health care workers usually tend to exaggerate their compliance with universal precautions giving a less unfavorable picture than it actually is (18). The present study overcame this limitation by studying the relationship between knowledge, self-reported compliance and actual practice; where it was revealed that the mean percent score of participants' self-reported compliance (89.5+10.8) was much higher than those of knowledge and actual practice (36.5+16.2 and 54.7+15.1). Moreover, a statistically significant positive correlation was found between percent score of participants' knowledge and practice of universal precautions ($r = 0.56$, $P < 0.001$). On the other hand, the positive correlations between participants' self-reported compliance and both knowledge and practice weren't of statistical significance ($P > 0.05$). These findings agree partially with those of another study conducted in two university hospitals in Iran; where there was good self-reported practice despite of the low understanding of universal precautions along with significant positive correlation between respondents' knowledge and self-reported practice ($r = 0.58$, $P < 0.001$) (19). While, the results of our study coincide with those of two survey studies conducted on intensive care unit professionals in a general hospital in Brazil and nurses in Tanta fever hospital where no statistically significant association was found between participants' knowledge and self-reported behavior (2,20).

Although the effectiveness of universal precautions relies upon health care workers' knowledge and compliance together (21), yet many studies revealed a gab between theory and practice (2). In this study, 25% of hospital staff had sufficient knowledge; while 63.8% had sufficient practice of universal precautions. Alternatively, other studies revealed higher level of health care professionals' knowledge about universal precautions compared to the practice; where it was suggested that knowledge of universal precautions does not necessarily have an impact on compliance or practice (9,22). On the other hand, sufficient basic knowledge about these precautionary measures was detected among low proportion of health care workers in other studies (8,23). Moreover, the results of another study conducted in a general hospital in Brazil coincide with those of our study; where 36.3% of the studied health professionals had appropriate knowledge and 51% had appropriate behavior regarding hospital infection control measures where it was

suggested that most health care workers are not interested in improving their knowledge about infection control rather than focusing on the appropriate care process (2).

In the present study, insufficient knowledge was significantly revealed among males, nurses and staff in surgical departments; while, years of experience was not a significant risk factor. This result partially coincides with that of another study where women and nursing staff had statistically significant higher levels of knowledge about universal precautions while operating room staff had the lowest knowledge score. Moreover, there was no significant relationship between knowledge and years of experience (19). However, similar to the result of this study, other studies revealed that nurses' knowledge about universal precautions was inadequate (24,25).

Another interesting result was revealed by the current study where the majority of the participants (65.1%) got their information about universal precautions from sources other than the hospital such as school, university, and conferences. This finding supports that of another study conducted in a university hospital in Brazil where the majority of the studied physicians and nurses (98.2% and 69.2%) got their information about these precautionary measures from sources other than the hospital (13).

The present study revealed that insufficient practice was significantly detected among nurses and surgical departments' staff as well as those with working hours > 48 hours / week and hospital staff with > 3 constrains; while gender and years of experience were not significant risk factors. Our findings support those of another study where compliance with universal precautions in emergency rooms and surgical departments was found to be less than optimal (26). This finding was attributed to health care workers' negligence of protecting themselves in emergency situations due to the urgent needs of providing medical care to their patients (13). Moreover, our results partially agree with those of another study conducted in Indian rural health care settings where compliance with universal precautions was associated with being in the job for a longer period and perceiving fewer barriers to safe practice (7). Alternatively, our results disagree with those of other studies where nurses had significantly higher practice scores compared to other health care professionals (2,19,27). This finding was attributed to the facts that nurses' education usually includes more practical training on infection control

measures along with they are encouraged to attend more in–service training programs as opposed to other professionals (2). Our result can be attributed to insufficient training and supervision of nurses regarding implementation of universal precautions along with heavy workload and physical exhaustion that affect nurses' performance. Moreover, most of these studies relied on self-reported practice and not on direct observation as in the present study.

Besides the importance of determining the level of compliance with universal precautions determining the reasons for failure to comply with these measures is an important priority as well (13,22). In the present study, work-related and organizational factors were the most important non-adherence factors with universal precautions. In other study, individual, work-related and organizational factors were all found to influence the adherence of health care professionals to infection control measures (13). However, discrepancies between different studies regarding the importance of non-adherence factors with universal precautions were detected according to work systems and available resources in each country, level of health care provided by each health care facility, department or unit, and job category under study (9,22,23,27-30).

The present study revealed that 65.1% of the studied hospital staff experienced sharps injury and 57.9% had past history of exposure to splashes of blood and body fluids. However, none of these incidents were reported. The results of a survey study, conducted in national public hospitals in Kabul City, partially agree with those of the present study where the proportion of hospital staff who had sharps injury and direct blood and body fluids contact was slightly higher (72.6% and 68%) (23).

These exposures were significantly revealed among nurses, staff in surgical departments and those with insufficient knowledge and practice of universal precautions; while, gender, experience years and working hours per week were not of statistical significance. These results do not coincide with those of other studies where males were frequently injured than females; surgeons and anesthetists were more frequently injured than nurses; and sharps injury were inversely associated with years of experience (31,32). On the other hand, the results of a Swedish study support the results detected in the present study where the majority of reported cases of occupational blood exposure were among nurses. Moreover, regarding blood and other body fluids reporting system, the study revealed that only 9 % of these incidents had been reported (33).

Regarding insufficient knowledge and compliance with universal precautions as risk factors of occupational exposure to blood and other body fluids, the results of the present study support those of other studies where inadequate knowledge of and compliance with universal precautions constituted high risks for needle prick injuries and blood and other body fluids exposures (34,35).

Conclusions :

It could be concluded that hospital staff are at high risk of exposure to blood borne pathogens, yet universal precautions are not well understood or implemented. Work-related and organizational factors are the most important non-adherence factors with universal precautions. Moreover, the hospital role in providing and updating knowledge about universal precautions to the staff was insufficient. Finally, there was no incident reporting system for sharps injury and blood or other body fluids exposures.

Recommendations:

A specifically tailored infection-control program will be most effective in protecting health care workers from the risk of blood borne pathogens. It should take into account the followings:

1- Narrowing the gab between theory and practice through in-service educational and training activities on infection control and safe work practice.

2- Controlling risk factors of insufficient knowledge and practice where priority should be given to males, nursing staff, cleaners and staff in surgical departments when implementing any educational and training activities.

3- Maximizing the hospital role in updating the staff' knowledge about universal precautions through setting up and empowering an infection control committee and providing easily accessible written guidelines.

4- Controlling the most common universal precautions compliance obstacles with emphasis on improving working conditions; implementing workers' training program for using universal precautions and protective barriers during clinical activities; enforcing safe practices through monitoring compliance; ensuring the availability of personal protective equipment and other infection control facilities; and improving management support for safety at work.

5- Identifying and controlling risky situations and procedures.

6- Implementing sharps injury surveillance system and prevention program.

7- Establishing an immunization program against hepatitis B for all health care providers and managing cases of exposure to blood and other body fluids.

8- Establishing a safe waste disposal program.

Finally, studies investigating this issue in the future should assess compliance with or practice of universal precautions using direct observation and not self-reported method of assessment.

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References:

1- World Health Organization (WHO) Secretariat of the Safe Injection Global Network (2003). "Health care worker safety: For a strategy to protect health workers form infection with blood borne viruses". [http://www.who.int/injection_safety/toolbox/docs/AM_HCW_Safety.pdf].

2- Oliveira A.C., Cardoso C.S. and Mascarenhas D. (2009). "Intensive care unit professionals' knowledge and behavior related to the adoption of contact precautions". Rev. Latino-am. Enfermagem. 17(5):625-31 [www.eerp.usp.br/rlae].

3- AVERT (2010). "Health care workers and HIV prevention". [http://www.avert.org/needlestick.htm].

4- Centers for Disease Control and Prevention (CDC) (1983). "Acquired immunodeficiency syndrome (AIDS): Precautions for health care workers and allied professionals". MMWR. 32:450-451.

5- Centers for Disease Control and Prevention (CDC) (1985). "Recommendations for preventing transmission of infection with human T-lymphotropic virus type III / lymphadenopathy-associated virus in the workplace". MMWR. 34(45):681-686; 691-695.

6- Roup B.J. (1997). "Factors associated with compliance of critical care nurses with universal precautions: a pilot study". Am. J. Crit. Care 6(3):218-224.

7- Kermode M., Jolley D., Langkham B., Thomas M.S., Holmes W. and Gifford S.M. (2005). "Compliance with Universal/Standard Precautions among health care workers in rural north India". Am. J. Infect. Control 33(1):27-33.

8- Bamigboye A.P. and Adesanya A.T. (2006). "Knowledge and practice of universal precautions among qualifying medical and nursing students: a case of Obafemi Awolowo University Teaching Hospitals Complex, ILE-IFE". Res. J. Med. Med. Sci. 1(3):112–116.

9- Hesse A.A.J., Adu-Aryee N.A., Entsua-Mensah K. and Wu L. (2006). "Knowledge, attitude and practice universal basic precautions by medical personnel in a teaching hospital". Ghana Med. J. 40(2):61–64.

10- Centers for Disease Control and Prevention (CDC) (1999). "Universal precautions for prevention of transmission of HIV and other blood borne infections". CDC fact sheet. [http://www.cdc.gov/ncidod/dhqp/bp_universal_precautions.html].

11- Aronson S.S. (2004). "Universal, standard and transmission-based precautions as they apply to child care settings". American Academy of Pediatrics fact sheet. [http://www.ecels-healthy

childcare pa.org/content /fs-universal %20 and %20 standard %20 precautions. PDF].

12- Sulzbach-Hoke L.M. (1996). "Risk taking by health care workers". Clin. Nurse Spec. 10(1):30-37.

13- Brevidelli M.M. and Cianciarullo T.I. (2009). "Psychosocial and organizational factors relating to adherence to standard precautions". Rev. Saúde. Pública. 43(6):1-10.

14- Bjerregaard D., Anggraini T., Dhrmayanda R., Sutanto D.S., Raharjo H.R.E., Purwanto D.S. and Yektiwi H. (2000). "Universal precautions guidelines for primary health care centers in Indonesia". [http://www.initiativesinc.com/resources/publications/docs/UnivPrecGuideIndonesia.PDF].

15- London Hazards Centre (LHC) (2002). "Clinical waste: Universal precautions". LHC fact sheet. [http://www.lhc.org.uk/members/pubs/factsht/75fact.pdf].

16- Ministry of Health and Population (2004). "Egyptian doctor's guide". National guide for infection control.
[www.drguide.mohp.gov.eg/NewSite/E-Learning/InfectionControl/infctrlarp1.asp].

17-Norsus M.J. (1999). "Statistical Package for Social Sciences (SPSS) base 10.0 for windows users guide". Chicago, IL: SPSS.

18- Sadoh W.E., Fawole A.O., Sadoh A.E., Oladimeji A.O. and Sotiloye O.S. (2006). "Practice of universal precautions among healthcare workers". J. Nati. Med. Assoc. 98(5):722-726 [http://www.nmanet.org/images/uploads/journal/oc722.pdf].

19- Motamed N., BabaMahmoodi F., Khalilian A., Peykanheirati M. and Nozari M. (2006). "Knowledge and practices of health care workers and medical students towards universal precautions in hospitals in Mazandaran Province". East. Mediterr. Health J. 12(5):653-661.

20- El-Shafie I.F., Mokabel F.M. and Helmy F.E. (1995). "The relationship between the knowledge of nursing staff and their compliance to universal precautions for prevention of hepatitis B viral infection". J. Egypt. Public Health Assoc. 70(5-6):523-540.

21- Alison M. (2005). "Universal precautions: A review of knowledge, compliance and strategies to improve practice". J. Res. Nurs. 10:549-550.

22- Helfgott A.W., Taylor-Burton J., Garcini F.J., Eriksen N.L. and Grimes R. (1998). "Compliance with universal precautions: knowledge and behavior of residents and students in a department of obstetrics and gynecology". Infect. Dis. in Obstet. Gynecol. 6:123-128.

23- Salehi A.S. and Garner P. (2010). "Occupational injury history and universal precautions awareness: a survey in Kabul hospital staff". BMC Infect. Dis. 10:19 [http://www. biomedcentral. com/1471-2334/10/19].

24- Roberts C. (2000). "Universal precautions: improving the knowledge of trained nurses". Br. J. Nurs. 9(1):43-47.

25- Chan R., Molassiotis A., Chan E., Chan V., Ho B., Lai C.Y., Lam P., Shit F. and Yiu I. (2002). "Nurses' knowledge of and compliance with universal precautions in an acute care hospital". Int. J. Nurs. Stud. 39(2):157–163.

26- Courington K.R., Patterson S.L. and Howard R.J. (1991). "Universal precautions are not universally followed". Arch. Surg. 126:93-96.

27- Adinma E.D., Ezeama C., Adinma J.I. and Asuzu M.C. (2009). "Knowledge and practice of universal precautions against blood borne pathogens amongst house officers and nurses in tertiary health institutions in Southeast Nigeria". Niger J. Clin. Pract. 12(4):398-402.

28- Sax H., Perneger T., Hugonnet S., Herrault P., Charaiti M. and Pittet D. (2005). "Knowledge of standard and isolation precautions in a large

teaching hospital". Infect. Control Hosp. Epidemiol. 26(3):298-304.

29- Askarian M., Mclaws M.L. and Meylan M. (2007). "Knowledge, attitude, and practices related to standard precautions of surgeons and physicians in university-affiliated hospitals of Shiraz, Iran". Inter. J. Infect. Diseases 11:213-219.

30- Sundaram R.O. and Parkinson R.W. (2007). "Universal precaution compliance by orthopedic trauma team members in major trauma resuscitation scenario". Ann. R. Coll. Surg. Engl. 89:262–267.

31- Stein A.D., Makarawo T.P. and Ahmad M.F. (2003). "A survey of doctors' and nurses' knowledge, attitudes and compliance with infection control guidelines in Birmingham teaching hospitals". J. Hosp. Infect. 54(1):68-73.32- Tetali S. and Choudhury P.L. (2006). "Occupational exposure to sharps and splash: Risk among health care providers in three tertiary care hospitals in South India". Indian J. Occup. Environ. Med. 10(1):35-40.

33- Lymer U.B., Schutz A.A. and Isaksson B. (1997). "A descriptive study of blood exposure incidents among healthcare workers in a university hospital in Sweden". J. Hosp. Infect. 35:223–325.

34- Gershon R.R., Karkashian C.D., Vlahov D., Kummer L., Kasting C., Green-McKenzie J., Escamilla-Cejudo J.A., Kendig N., Swetz A. and Martin L. (1999). "Compliance with universal precautions in correctional health care facilities". J. Occup. Environ. Med. 41(3):181-189.

35- Zungu L.I., Sengane M.L. and Setswe K.G. (2008). "Knowledge and experiences of needle prick injuries (NPI) among nursing students at a university in Gauteng, South Africa". SA. Fam. Pract. 50(5):48 [www.safpj.co.za].