Direct RESEARCH JOURNALS

Knowledge and practice of infection control among health workers in a tertiary hospital in Edo state, Nigeria

Direct Research Journal of Health and Pharmacology (DRJHP) Vol.1 (2), pp.20-27, November 2013
Available online at directresearchpublisher.org/drjhp

Research Paper

Tobin Ekaete Alice[1*], Asogun Danny Akhere[1], Odia Ikponwonsa[2] and Ehidiamhen Grace[3]

[1]FWACP. Institute of Lassa Fever Research and Control, Irrua Specialist Teaching Hospital, Irrua, Edo state, Nigeria.
[2]MLT,Institute of Lassa Fever Research and Control, Irrua Specialist Teaching Hospital, Irrua, Edo state, Nigeria.
[3]Institute of Lassa Fever Research and Control, Irrua Specialist Teaching Hospital, Irrua, Edo state, Nigeria.
.

ABSTRACT

The study investigated the knowledge and practice of standard precautions (SP) among health providers in a Lassa fever endemic community in Edo state. A Descriptive cross sectional study was carried out among consenting doctors, Nurses, Laboratory personnel and Orderlies in the clinical departments of a rural tertiary teaching hospital in Edo state. Data was collected through structured self- administered questionnaires, and focused on knowledge and practice of hand hygiene, use of gloves and protective gowns and sharp management. Data was analysed using SPSS version 16. Results were presented as tables, means and standard deviations. Associations were tested with chi-square, with p set as < 0.05. One hundred and ninety three (93.2%) respondents had ever heard of standard precautions. Of this number, 11 (5.7%) respondents had poor knowledge of SP, 85(44.0%) had fair knowledge, and 97 (50.3%) good knowledge. Knowledge was significantly associated with profession (p =0.00), with doctors having the highest proportion with good knowledge, and porters, the lowest. Eight (3.9%) respondents were found to have poor compliance to standard precaution, 103 (49.8%) fair and 96 (46.8%) good compliance. Compliance was significantly associated with profession (p = 0.00) , with nurses as the profession with the highest proportion with good practice.

Key words: Health workers, Knowledge,Standard precautions, Tertiary.

*Corresponding Author E-mail: ekatobin@yahoo.com, +234(8)37544369

Accepted 20 November 2013

INTRODUCTION

Healthcare workers (HCWs) are potentially exposed to blood-borne pathogens through contact with infected body parts, blood and body fluids in the course of their work (Sreedharan *et al.,*2001; Foster *et al.,* 2010; Jahan 2005).It has been estimated that each year, as many as three million HCWs all over the world experience percutaneous exposure to blood-borne viruses Hepatits C and B and HIV viruses (World Health Report, 2002). The World Health Organization estimates that about 2.5% of HIV cases and 40% of HBV and HCV cases among HCWs worldwide are the result of these exposures (Guilbert, 2003; Wicker *et al*., 2007; Mizuno *et al*., 1997).Apart from these pathogens, Lassa virus is fast gaining prominence as an emerging nosocomial transmitted pathogen with significant public health impact in the West African sub region.

The most important mechanism of spread of these pathogens is via the contaminated hands of the healthcare givers or relatives/friends of the patients (Mayank *et al.,* 2009; Joseph *et al*., 2010). Contaminated environmental surfaces , drugs, intravenous solutions or by foodstuffs are all potential sources of infection (Mayank *et al.,* 2009; Joseph *et al*., 2010). Standard precautions are intended to protect the patient by

ensuring that healthcare personnel do not transmit infectious agents to patients through their hands or equipment during patient care.(Wang *et al.,* 2010; Siegel *et al.,* 2007; Garner, 1996). The Centers for Disease Control (CDC) has recommended that standard precautions be used on all patients, regardless of knowledge about their infectious status(World Health Organization, 1988).

Compliance with standard precautions measures is therefore essential to prevent and control healthcare-associated infections in both health care workers and patients (Siegel *et al.,* 2007; Garcia-zapata *et al.,* 2010; Chan *et al.,* 2002; Jawaid *et al.,* 2009).

Standard Precautions have been widely promoted in high-income countries, and to a lesser extent, in low-income countries. (Kermode *et al.,* 2005). However, despite the development of detailed guidelines, (Roberts, 2000) in many developing countries, knowledge of standard precautions is grossly low, and standard precautions are not only insufficiently established and inappropriately applied, but also only selectively adhered to (Kermode *et al.,* 2005; Okechukwu and Modreshi, 2012; Kolude *et al.,*2013; Oliveira *et al.,*2009; Vaziri *et al.,* 2008; Motamed *et al.,* 2006; Chan *et al.,* 2002; Luo *et al.,* 2010).

Lassa fever, has since its discovery in Nigeria in 1967, accounted for the deaths of a number of HCWs. Unfortunately within health care setting, the disease is transmitted by poor compliance to standard precautions. In the wake of recent upsurge in the number of health care staff coming down with Lassa fever during sporadic outbreaks from different parts of the country, the study set out to assess the knowledge and degree of compliance to standard precautions among health care workers in a tertiary hospital in an endemic area state. The tertiary hospital serves as a referral facility for diagnosis and management of Lassa fever cases from across the south, and particularly the southern states. The study will reveal the knowledge level and degree of compliance to SP among health workers in a typical scenario where there is an obvious need for such.

MATERIALS AND METHODS

Study area

The descriptive cross sectional study took place in Irrua Specialist Teaching Hospital, in Esan central LGA of Edo state, Nigeria. Established in 1993, It is a 375 bedded federal tertiary institution located along the Benin-Abuja express way , 87 kilometers from Benin, the state's capital. The main function of the hospital is the provision of facilities and personnel for the diagnosis and treatment of patients drawn from Edo and neighboring states, provision of facilities and personnel for the training and continuing education of various cadres of medical and related manpower and medical research. The centre is also home to the Institute of Lassa fever research and control, a centre of excellence for the diagnosis and management of Lassa fever in the country.

Study population included all health care providers in the clinical departments of Internal Medicine, Surgery, Obstetrics and gynaecology, Ophthalmology, Pediatrics and the Laboratories as they are directly concerned with patient care and clinical management .

Sample size was calculated using the formula for prevalence study (Araoye, 2004) with z , standard normal deviate, taken as 1.96 representing a 95% confidence interval, p as 13%, the proportion of health workers with good knowledge of standard precautions In a study carried out in Borno state (Abdulraheem *et al.,* 2012) a desired precision of 5%, and a 10% non-response rate. Minimum sample size was calculated as 174. Sample size was increased to 250 for validity.

HCWs of the categories of doctors, nurses (trained and auxiliary), laboratory scientists , porters and ward orderlies (as they were directly involved in patient care and management) , were full time employees of the hospital, had spent at least one year on the job and who gave consent were recruited. HCWs who were on leave or absent during the time of the survey, those who refused consent, were excluded.

Total number of eligible health care workers was 625. Proportional allocation, and thereafter simple random sampling was used to select respondents by department and job category.

Data was collected through the use of structured self administered questionnaires, that had been designed by the researchers after extensive literature search and consultations with experts in the field . The questionnaire was divided into three parts. Part 1 focused on sociodemographic characteristics, Part two contained 15 questions seeking to ascertain the level of knowledge of the concept of standard precautions . Questions covered the basic concepts, content, and activity requirements of the standard precautions with possible responses of 'yes' and 'no'. Part 3 comprised 32 questions on the level of adherence to standard precautions. Standard precaution measures of interest included handwashing (7 items), use of gloves (6 items), use of nose mask/face shield (3 items) , sharps practices (12 items) and use of gown/apron (4 items).

Maximum possible score for each of these measures was 14, 12, 6, 24 and 8 respectively. A practice that was deemed right when undertaken always was scored 2, sometimes was scored and 1 and never scored 0 (Labrague *et al.,*2012).

Content , comprehensibility , clarity and format of the questionnaire has been validated on input of a

Table 1. Socio-demographic characteristics of respondents.

Variable	Frequency (%)
Age (years)	
20-29	50 (24.2)
30-39	97 (46.9)
40-49	41(19.2)
50-59	19 (9.2)
Sex	
Male	88 (42.5)
Female	119 (57.5)
Religion	
Christianity	184 (88.9)
Islam	7 (3.4)
None	16 (7.7)
Marital status	
Single	57 (27.5)
Married	147 (71.0)
Separated	1 (0.5)
Widowed	2 (1.0)
Designation	
Doctors	48 (23.2)
Nurse	83 (40.1)
Laboratory scientist	34 (16.4)
Orderlies	42 (20.3)
Level of education	
Primary	6 (2.9)
Secondary	31 (15.0)
tertiary	170 (82.1)
Duration of work (years)	
>1	14 (6.7)
1-5	134 (64.7)
6-10	21 (10.1)
>10	38 (18.4)

volunteer sample of 30 local government health workers in a pilot test. Research assistants were scientific officers of the institute who were given a one-day hands on training on questionnaires/checklist administration.

Data from the questionnaire were coded and entered into a SPSS version 15 (SPSS, Inc., Chicago, IL, USA). Knowledge of standard precautions was graded by assigning a score of "1" for a correct answer and "0" for an incorrect or 'do not know' answer . This scoring system has been used in an earlier study to investigate universal precautions among health workers in Borno state, Nigeria (Abdulraheem *et al.,* 2012) and student nurses in the Philippines (Federal Ministry of Health and John Snow Inc, 2006). Scores for each respondent were summed up and graded as good , fair or poor.

Compliance with standard precautions was graded by assigning scores to Likert scale responses on a scale of 0–-2 points: 0 = never, 1 = sometimes, 2 = always. Maximum total score for practice was 64, respondents were graded for assessment of compliance as good, fair or poor if their summed scores fell <50% , between 50 and 74% and $\geq$ 75% of the total score for practice.

Categorical data were displayed as frequencies, percentages, and continuous data as means, standard deviations, medians and percentiles. Cross-tabulations of pairs of qualitative (categorical or ordinal) variables will be produced and assessed using the Chi-square test of homogeneity and related tests of the strength of associations. To determine the association between knowledge , demographic and basic characteristics of HCWs, multiple logistic regression analysis was performed with knowledge grade as the outcome dependent variable and demographic and basic characteristics as predictor variables. Throughout, statistical significance was assessed at $p < 0.05$.

Ethical approval was obtained from the hospital's ethical committee. Individual informed consent was obtained from participants.

The study is conducted on the assumption that health care workers in the hospital had been exposed to educational material either in the form of lectures, posters or pamphlets and thus were aware of the infection control measures required to be practiced. Being a cross sectional study, actual performance of standard precaution was not assessed , and so findings may be an over-representation.

RESULTS

Two hundred and seven completely filled questionnaires were analysed. Mean age was 35.7 $\pm$ 7.9 years (median age 34.0 years),females were in the majority, 119 (57.5%); Christians and married respondents both made up the majority, 184 (88.9%) and 147 (71.0%) respectively. Respondents with tertiary education and nurses made up the highest proportions, 170 (82.1%) and 83 (40.1%) respectively. Mean number of years of work in the hospital was 5.8 $\pm$ 6.5 years (Table 1).

One hundred and ninety three (93.2%) respondents had ever heard of standard precautions (SP) , and further questions on SP were directed at them. The school provided information for the majority, 100 (52.1%). Other sources include the media (internet) 40 (20.3%), sponsored training 28 (14.6%), fellow colleagues 17 (8.9%) and IEC material 8 (4.2%).

One hundred and thirty nine (72.0 %) of the respondents knew SP aims to protect both health care workers and patients from transmission of infection. One hundred and five (85.5 %) agreed that all patients were potentially infectious irrespective of their diagnostic status, 180 (93.3%) opined SP should be applied to all patients regardless of their infectious status. SP

Table 2. Practice of Standard Precautions by respondents.

Item	Frequency		
	Always n (%)	**Sometimes n (%)**	**Never n (%)**
Hand washing (n = 207)			
On arrival at work	55 (26.6)	90 (43.5)	62 (30.0)
Before patient contact	75 (36.2)	82 (39.6)	50 (24.2)
After patient contact	171 (82.6)	28 (13.5)	8 (3.9)
After contact with contaminated equipment or surfaces	168 (81.2)	24 (11.6)	15 (7.2)
Before wearing gloves	58 (28.0)	61 (29.5)	88 (42.5)
After wearing gloves	150 (72.5)	27 (13.0)	30 (14.5)
After using the toilet	186 (89.9)	14 (6.8)	7 (3.4)
Use of gloves (n = 207)			
Wear gloves when touching blood or other body fluid or mucus membrane	182 (87.9)	17 (8.2)	8 (3.9)
Change gloves between patient contacts	166 (80.2)	30 (14.5)	11(5.3)
Change gloves between different procedures on the same patient	84 (40.6)	91 (44.0)	32 (15.5)
Reuse disposable gloves	17 (8.2)	7 (3.4)	183 (88.4)
Face mask (n = 207)			
Wear facemask when undertaking procedures likely to generate splashes	106 (51.2)	78 (37.7)	23 (11.1)
Wear nose mask when working within 1-2metres of patients with expectoration	67 (32.4)	98 (47.3)	42 (20.3)
Reuse disposable nose mask	9 (4.3)	29 (14.0)	169 (81.6)
Gown (n = 207)			
Wear gown/apron to protect skin/clothing when undertaking procedures likely to generate splashes	104 (50.2)	55 (26.6)	48 (23.1)
Wear impermeable gown	58 (28.6)	56 (27.1)	93 (45.0)
Remove soiled /wet gown as soon as possible	138 (66.7)	26 (12.6)	43 (20.8)
Reuse disposable gown	22 (10.6)	51 (24.6)	134 (64.8)
Sharps management (n = 165)*			
Recapping	24 (14.5)	36 (21.8)	105 (63.6)
Detaching needle from syringe	31 (18.8)	47 (28.5)	87 (52.7)
Manipulate needles (bending, breaking)	19 (11.5)	15 (9.1)	131 (79.4)
Use syringe with needle on agitated patient	113(68.5)	24 (14.5)	28 (17.0)
Protect fingers when breaking glass ampoule/bottle	95 (58.2)	36 (21.8)	33 (20.0)
Dispose sharp immediately in safety box	132 (80.0)	28 (17.0)	5 (3.0)
Reuse disposable needle and syringe for same patient	32 (19.4)	10 (6.1)	123 (74.5)

was said to apply to blood and body fluids by 187 (96.6%), mucus membrane by 169 (87.6%) and non-intact skin by 151 (78.2%) respondents. Ninety seven (50.3%) respondents correctly identified all groups at risk of health care associated infections to include patients, health care workers and communities .

Concerning the knowledge of hand hygiene, 182 (94.3%) correctly knew hand hygiene to be the most important procedure for reducing transmission of germs, though 129 (66.8%) agreed that hand jewellery made hand hygiene difficult to achieve. Times when hand washing was necessary were stated as after wearing gloves 176 (91.2%), and before and after patient care 179 (92.7%) respectively. Others included, on arrival at work by 140(72.3%), between different procedures on the same patient, 132 (68.4%), and before wearing gloves 113 (58.5%).

Poor sharps practices were stated as reuse of syringe and needles by 182 (94.3%), recapping 165 (85.5%) and improper disposal 176 (91.2%).

Eleven (5.7%) respondents had poor knowledge of SP, 85(44.0%) had fair knowledge, and 97 (50.3%) good knowledge. Knowledge was significantly associated with profession (p =0.00), such that doctors had the highest proportion with good knowledge , and porters the reverse. There was no association with sex (p= 0.59) , duration of employment (p = 0.54) and age (p = 0.81).

Regarding practice of standard precautions, hand washing was always carried out by 186 (89.6%) respondents after use of toilet, 168 (81.2%) after contact with contaminated instruments or surfaces, and 171 (82.6%) after patient contact. Hand washing was less frequent at other times (Table 2).

One hundred and eighty two (87.9%) respondents claimed to wear hand gloves regularly when touching blood , body secretions or mucus membranes, 166 (80.2%) wore regularly between contact with different patients, 84 (40.6 %) between different procedures on the same patient and 17 (8.2%) agreed to always reusing disposable gloves.

The regular use of face mask when undertaking a procedure that could generate splashes of blood or other body fluid was reported by 106 (51.2%) respondents, 67 (32.4%) claimed to always use nose mask when working within 1-2 metres of a patient with cough, and a minority , 9 (4.3%) attested to consistently reusing nose mask.

Regarding sharp management, 24 (14.5 %) of 165 respondents (excluding orderlies, as they did not directly handle sharps) admitted to always recapping needles, 31(18.8%) to detaching needles from syringes and 19 (11.5%) to manipulating needles (including bending, cutting or breaking). One hundred and thirteen (68.5%) claimed never to use syringes with needles on agitated patients, and 95 (58.2%) claimed to protect their fingers anytime they had to break a glass ampoule or bottle.

Assessment of compliance to four items of infection control (hand washing, use of gowns, nose mask ,hand gloves) found 8 (3.9%) respondents to have poor practice, 103 (49.8%) fair and 96 (46.8%) good compliance. Compliance was significantly associated with profession (p = 0.00) , with nurses as the profession with the highest proportion with good , and lowest proportion with poor practice. The reverse was the case for Orderlies/porters .

There was no statistically significant relationship with gender (p = 0.84), duration of employment (p= 0.11) or age (p = 0.73) (Table 3). Mean scores for the selected items of standard precaution showed significantly different scores between the professions for handwashing practice, use of nose mask and use of gowns , doctors having the lowest mean for the first two items, and orderlies for use of gowns (Table 4). Good knowledge of SP was significantly associated with good practice (p = 0.02).

DISCUSSION

Most of the health workers in this study were in the 30 years age bracket, similar to what was documented in some studies (Sreedharan *et al*., 2001; Johnson *et al*., 2013; Janjua *et al*., 2007; Reda *et al*., 2010) emphasizing the need to protect this group of workers in the prime of their life from hospital infections.

Data from the study reveal the high awareness of standard precautions, as has been reported in some studies (Sreedharan *et al*., 2001; Isara and Ofili, 2010) . The classroom provided the most information for the majority,while in some other study, seminars and workshops were sources of information(Abdulraheem *et al.,* 2012). IEC materials were not a common source of information probably because they are largely unavailable within the facility, and where found are either not visibly placed, worn out or outdated. This is unfortunate,as IEC materials provide for reinforcement of the health message.

About half of the respondents were found to have good knowledge of standard precaution . Knowledge was found to be higher than what was reported in Northern Nigeria (Abdulraheem *et al.,* 2012), and in the Federal Medical centre, Asaba (Isara and Ofili, 2010) ,and lower than what was recorded in other studies (Johnson *et al*., 2013; . Vaz *et al*., 2010; . Labrangue *et al*., 2010) . The narrow margin between awareness and knowledge seen in this study is in contrast with what has been reported in some studies, where awareness levels among health workers were high, and deep knowledge found to be low (Okechukwu and Modreshi 2012; Kolude *et al.,* 2013; Isara and Ofili, 2010).

Table 3. Association of profession with knowledge and selected standard precaution practices (N = 207).

	Knowledge of standard precautions				
Profession	**Poor n(%)**	**Fair n (%)**	**Good n (%)**	**Total**	**P -value**
					0.00
Doctors	1(2.1)	11(22.9)	36(75.0)	48(100.0)	
Nurses	4(4.9)	40(48.8)	38(46.3)	82 (100.0)	
Lab	1(3.6)	11(33.3)	21(63.6)	33 (100.0)	
Orderlies/porters	5(16.7)	23(76.7)	2(6.7)	30(100.0)	
Total	11(5.7)	85 (44.0)	97 (50.3)	207 (100.0)	
	Practice of standard precautions				
	Poor n(%)	**Fair n (%)**	**Good n (%)**	**Total**	**P -value**
Doctors	5(10.4)	29(60.4)	14 (29.2)	48 (100.0)	0.00
Nurses	1(1.2)	31(37.3)	51 (61.4)	83 (100.0)	
Lab	3(8.8)	12 (35.3)	19 (55.9)	34 (100.0)	
Orderlies/porters	5(11.9)	25 (59.5)	12 (28.6)	42 (100.0)	
Total	14(6.8)	97 (46.9)	96 (46.4)	207 (100.0)	

Table 4. Mean scores for selected SP practices by profession.

Profession	**Hand washing Mean (S.D.)**	**Gloves Mean (S.D.)**	**Nose mask Mean (S.D.)**	**Sharps Mean (S.D.)**	**Gown Mean (S.D.)**
Doctors	8.81 (2.03)	9.98(1.78)	3.18 (1.21)	18.27 (3.55)	3.88 (2.05)
Nurses	11.0(2.21)	10.59 (1.80)	4.51 (1.39)	18.16 (3.70)	4.43 (2.13)
Lab	9.5 (2.33)	9.65 (2.43)	4.44 (1.44)	19.03 (3.16)	4.97 (1.38)
Orderlies/porters	9.36 (2.69)	9.88 (2.18)	4.29 (1.44)	-	2.69 (2.42)
F test	0.00	0.06	0.03	0.47	0.00

The higher proportion of doctors who were found to be more knowledge than other health workers was equally observed in a study carried out in Uyo (Johnson *et al*., 2013), and is not surprising as doctors have more in-depth training than others in the health team.

Areas for improvement in hand hygiene are identified as the knowledge and practice as regards timing for hand hygiene and use of jewellery during hand hygiene. Hand hygiene was least known to be carried out before wearing gloves , and correspondingly, poorly practiced. Interestingly, porters had better hand hygiene practice than other health workers. This might be due to their often times greater perception of risk, and the fact that their work often necessitates handling waste, and hand washing thereafter becomes needful .

Poor needle handling (re-capping, manipulation and detaching) was practiced at a rate lower than what was reported in previous studies (Reda *et al*., 2010; Sadoh *et al*., 2006; Tadesse and Tadesse, 2009; . Kermode *et al*., 2005) . While this is encouraging, it is still worthwhile

to emphasize that the practice be discouraged amongst the few who still manipulate sharps. The likelihood of NSI is multiplied during such processes (Luo *et al*., 2010; Reda *et al*., 2010). Reasons commonly given for the act are that it reduces the chances of persons getting pricked by the needle, and that the needle can be re-used on the same patient if recapped or detached. This practice has been found to be more common among nurses, little wonder the significantly higher prevalence of NSI found among nurses in this study. There was no difference found in prevalence of NSI among professionals in Ethiopia (Reda *et al*., 2010).

Prevalence of needlestick injury from this study is similar to what was reported among health care workers in a teaching hospital in Indonesia (Sari et al., 2011). Similar prevalence has been reported in other studies (Wicker *et al.,* 2008; Smith *et al.,*2006 ; Janjua *et al.,*2010). Prevalence was higher than what was reported in Eastern Ethiopia (Abdulraheem *et al.,*2012).The adequacy of syringes and gloves reported in this study is similar to finding from Uyo (. Johnson *et al.,*2013), may be because these items are purchased by the patient at the time of admission. Items provided by the facility are more likely the ones to be in short supply. The inadequacy of soap and single use towels may in fact make hand washing infrequent and ineffective. There is also a need to promote hand rub with alcohol under these circumstances.

The low practice of SP among the workers is noted in other studies (Isara and Ofili, 2010; Kermode et al., 2005; Vaz et al., 2010) and contrary to what was observed in other (Isara and Ofili, 2010; Labrangue *et al.,*2010; Knight and Bodsworth,1997). The finding of better practice of SP among nurses compared to other professions is contrary to previous studies (Johnson *et al.,*2013; . Kim *et al.,*2001). The lower practice among doctors has similarly been reported(Stein *et al.,*2003). The positive association between knowledge and practice of SP is reported in other studies (Taneja, 2009; Vij *et al.,*2001; Luo *et al.,*2013; Chan *et al.,*2008),and reinforces the need for training on SP. However, as it can be seen , training alone is not sufficient for compliance and must be backed with availability of materials for implementation of SP.

Conclusion

Interventions to improve knowledge and compliance to standard precaution should target identified groups, and focus on behaviour change communication.

ACKNOWLEDGMENTS

The authors are immensely grateful to all the research assistants, and the management of the hospital. Health workers who participated are also acknowledged.

REFERENCES

Abdulraheem IS, Amodu MO, Saka MJ, Bolarinwa OA, Uthman MMB (2012).Knowledge, Awareness and Compliance with Standard Precautions among Health Workers in North Eastearn Nigeria. J. Community Med Health Edu 2:131. doi:10.4172/jcmhe.1000131.

Araoye MO (2004). Research methodology with statistics for health and social sciences. Ilorin: Nathadex

Chan MF, Ho A, Day MC (2008). Investigating the knowledge, attitudes and practice patterns of operating room staff towards standard and transmission-based precautions: results of a cluster analysis. J Clin Nurs. 17, 1051-62.

Chan R, Molassiotis A, Chan E, Chan V, Ho B (2002). Nurses' knowledge of and compliance with universal precautions in an acute care hospital. Int J Nurs. Stud. 39: 157–163.

Federal Ministry of Health and John Snow Inc. (2006). Do no harm: Injection safety in the context of infection prevention and control trainer's guide. /Making medical injections safe. Nigeria.

Foster TM, Lee MG, McGaw CD, Frankson MA (2010). Knowledge and practice of occupational infection control among health care workers in Jamaica. West Indian Med. J. 59 (2):147-152.

Garcia-zapata MR, Souza A, Guimaradaes J, Tipple A, Prado M, Garcia-zapata M (2010). Standard precautions ; knowledge and practice among nursing and medical students in a teaching hospital in Brazil. Int . J. inf. control., 6(1):122-123.

Garner JS(1996). Guideline for isolation precautions in hospitals. The Hospital Infection Control Practices Advisory Committee. Infect Control Hosp Epidemiol., 17: 53-80.

Guilbert JJ (2003). The world health report 2002 - reducing risks, promoting healthy life. Educ Health (Abingdon). 16:230.

Isara AR, Ofili AN (2010). Knowledge and practice of standard precautions among health care workers in the Federal Medical Centre, Asaba, Delta state, Nigeria. Niger Postgrad. Med. J., 12(3): 204-209

Jahan S (2005). Epidemiology of needle stick injuries among health care workers in a secondary care hospital in Saudi Arabia. Ann Saudi Med., 25(3): 233-238.

Janjua NZ, Khan NL, Mahmood B (2010). Sharps injuries and their determinants among health care workers at first level care facilities in Sindh Province, Pakistan. Trop. Med. Internat., 10:1244-1251.

Janjua NZ, Razaq M, Chandir S, Rozi S, Mahmood B (2007). Poor knowledge predictor of nonadherence to universal precautions for blood borne pathogens at first level care facilities in Pakistan. BMC Infect Dis., 7: 81.

Jawaid M, Iqbal M, Shahba S (2009). compliance with standard precautions : a long way ahead. Iranian J. Publ. Health. 38(1):85-88.

Johnson OE, Asuzu MC, Adebiyi AD (2013). Knowledge and practice of universal precautions among professionals in public and private health facilities in Uyo, Southern Nigeria- a comparative study. Ibom Med. J. 6(1): 9-19.

Joseph NM, Sistla S., Dutta, T.K., Badhe, A.S., Rasitha, D, Parija, SC (2010). Role of intensive care unit environment and health-care workers in transmission of ventilator associated pneumonia. J. Infect Dev.,4:282-291.

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

Kim KM, Kim MA, Chung YS, Kim NC (2001). Knowledge and performance of the universal precautions by nursing and medical students in Korea. Am. J. Infect Control, 29:295-300.

Knight VM, Bodsworth NJ (1997). Perceptions and practices of universal blood and body fluid precautions by registered nurses at a major Sydney teaching hospital. J.Advan.Nurs. 27(4): 746–751.

Kolude OO, Omokhodion FO, Owoaje ET (2013). Universal Precaution: Knowledge, Compliance and perceived risk of infection

among doctors at a University Teaching Hospital. Poster Exhibition: The XV International AIDS Conference: Abstract no. MoPeD3676" [Cited 2013, Available from: http://www.iasociety.org/Abstracts/A2172508.aspx

Labrague LJ, Rosales RA, Maricel MT(2012). Knowledge of and compliance with standard precautions among student nurses . Int. J. of Advancing nursing studies. 1(2): 84-97.

Labrangue LJ, Rheajane AR, Tizon MM (2010). Knowledge of and compliance with standard precautions among student nurses . IJANS. 1(2): 84-97.

Luo Y, He GP, Zhou JW, Luo Y. (2010). Factors impacting compliance with standard precautions in nursing, China. Int. J. Infect Dis. 14 (12):1106-1114 (Cited 2013 May 23). Available from: http://dx.doi.org/10.1016/j.ijid.2009.03.037.

Mayank D, Anshuman M, Singh RK, Afzal A, Baronia AK, Prasad KN (2009). Nosocomial cross-transmission of pseudomonas aeruginosa between patients in a tertiary intensive care unit. Indian Pathol Microbiol. 52:509-513.

Mizuno Y, Suzuki K, Mori M, Hayashi K, Owaki T, Hayashi H (1997). Study of needlestick accidents and hepatitis C 6. virus infection in healthcare workers by molecular evolutionary analysis. J. Hosp. Inf., 35:149–154.

Motamed N, BabaMahmodi F, Khalilian A, Peykanheirati M, 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.12:653-661.

Okechukwu EF, Modreshi C (2012). Knowledge and practice of standard precautions in public health facilities in Abuja, Nigeria. Int. J. Inf. Control., 8(3) doi:10.3396.

Oliveira AC, Cardoso CS, Mascarenhas D (2009). Intensive care unit professionals' knowledge and behavior related to the adoption of contact precautions. Rev. Latino-Am. Enfermagem . 17(5): 625-631.

Reda AA, Frisseha S, Mengistie B, Vanderweerd J (2010). Standard precautions: occupational exposure and behavior of health care workers in Ethiopia. Plos One, 5 (12): e14420.

Roberts C (2000). Universal Precautions: Improving the knowledge of trained nurses. Br J Nurs.;9:43–47.

Sadoh WE, Fawole AO, Sadoh AE, Oladimeji, A.O., Sotiloye, O.S. (2006). Practice of universal precautions aomogn health care workers. J Natl Med Assoc. 98(5): 722-726.

Sari SYI, Ibrahim K, Haroen H, Afriandi I, Sunjaya DK, Hinduan ZR (2011). Knowledge, attitude and perceived adherence with universal precautions among health care workers in the Obstetrics and Gynaecology department of an Indonesian Teaching Hospital. Int. J. Infect. Control., 7:14.

Siegel JD, Rhinehart E, Jackson M, Chiarello L (2007).Healthcare Infection Control Practices Advisory Committee, 2007 Guideline for isolation precautions: Preventing transmission of infectious agents in healthcare settings. Public Health Service, US Department of Health and Human Services, Centers for Disease Control and Prevention. Atlanta, Georgia.

Smith DR, Mihashi M, Adachi Y, Nakashima Y, Ishitake T (2006). Epidemiology of needle stick injuries among nurses in a Japanese teaching hospital. J. Hosp. Infect ., 64:44-49.

Sreedharan J, Muttappillymyalil J, Venkatramana M (2001). Knowledge about standard precautions among university hospital nurses in the United Arab Emirate. Eastern Med. Health J. 17(4): 331-334.

Stein DD, Makarawo TP, Ahmad MF (2003). A survey of doctors' and nurses' knowledge, attitudes and compliance with infection control guidelines in Birmingham teaching hospitals. J. Hosp. Infect. ,54:68-73.

Tadesse M, Tadesse T (2009). Epidemiology of needlestick injuries among health-care workers in Awassa City, Southern Ethiopia. Tropical Doctor.:111–113.

Taneja J (2009). Evaluation of knowledge and practice amongst nursing staff toward infection control measures in tertiary care hospital in India. The Can. J. Infect. Control., 24(2):104-107.

Vaz K, McGrowder D, Alexander-Linda R, Gordon L, Brown P, Irving R. (2010). Knowledge, attitude and compliance with universal precautions among health care workers at the university hospital of West Indies , Jamaica. Theijoem. 1(4):171-181

Vaziri S, Najafi F, Miri F, Jalalvandi F, Almasi A (2008). Practice of standard precautions among health care workers in a large teaching hospital . Ind J. Med. Sc.; 62(7): 292-294.

Vij A, Williamson SN, Gupta S (2001). Knowledge and Practice of Staff towards Infection Control Measures in a Tertiary Care Hospital. J. Acad. Hosp. Admin., 13:31-35.

Wang H, Fennie K., Burgess L, Williams AB (2003). A training programme for the prevention of occupational exposure to blood borne pathogens: Impact on knowledge, behavior and incidence of needle stick injuries among student nurses in Changsha, People's Republic of China. J.Advan. nurs., 41(2)**:**187–1194.

Wicker S, Gottschalk R, Holger FR (2007). Risk of needle stick injuries from an occupational medicine and virological viewpoint. Dtsch Arztebl. 104(A5): 3102-3107.

Wicker S, Jung J, Allwinn R, Gottschalk R, Rabenau HF (2008). Prevalence and prevention of needle stick injuries among health care workers in a German university hospital. Int Arch Occup Environ Health. ; **81:** 347-354.

World Health Organisation. (1988). Update: universal precautions for prevention of transmission of human immunodeficiency virus, hepatitis B virus, and other blood borne pathogens in health-care settings. Morbidity and Mortality Weekly Report., 37: 377–388.

World Health Report (2002). Reducing risks, promoting healthy life. [Cited 2013 May 21]. Available from: http://www.who.int/whr/en.