

**Original article:**

## **The knowledge and practices of Universal Precautions among the Interns of Gauhati Medical College: a cross sectional study**

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### **Abstract**

**Background:** Universal Precautions should be followed by all personnel at all times on all patients. They are meant to reduce the risk of transmission of infections during care of the patients. Proper knowledge of the universal health precautions is very important for the health care providers.

**Objectives:** 1) To assess the knowledge of universal precautions among the interns. 2) To assess the practices of universal health precautions among the interns.

**Methodology:** Study design: Cross sectional study. Study place: Gauhati Medical College and Hospital. Study period- from 1<sup>st</sup> June 2015 to 30<sup>th</sup> September 2015. Study population: All the interns of the 2015-16 batch attending respective duties during the study period were included in the study. Sample size: total 138 interns were assessed. Data collection tool and technique: Knowledge and practices of universal health precautions among the interns were assessed by a pre-designed and pre-tested schedule containing both open and closed ended questions and also through observation of the participants while attending patients.

**Results:** Knowledge about hand washing before and after patient contact was 82.6%, knowledge about importance of wearing gloves was 86.3%, 47.9% knew needles should not be re-capped, and 49.3% knew about the basic PEP regimen for HepB and HIV. Practice of hand washing after patient contact was 64%, 62.5% followed correct waste management protocols.

**Keywords:** Universal Precautions, Centre for Disease Control and Prevention (CDC), World Health Organisation (WHO), Hand Hygiene, Personal Protective Equipment (PPE), Occupational Exposure Management, Bio-Medical Waste disposal protocol (BMW), Interns.

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### **Introduction:**

Health care workers are always at risk of exposure to infection from patients during the course of their work. Blood and certain body fluids of all patients are considered potentially infectious for HIV HBV and others blood borne diseases. Globally it is estimated that about 40% of HBV and HCV infections and 2.5% of HIV infections in HCWs are attributable to occupational sharps exposures.<sup>(1-4)</sup> As exposure is a constant premise for professionals, intervention measures have been proposed to

minimize this situation, with the implementation of Universal precautions as one of the strategies.

Universal precautions, also known as Standard Infection Control Precautions (SICP) are a set of evidence based clinical work practices published by the Centre of Disease Control (CDC) in 1996 and updated in 2007, designed to prevent transmission of human immunodeficiency virus (HIV), hepatitis B virus (HBV), and other blood-borne pathogens when providing first aid or health care. Under universal precautions, blood and certain body fluids

of all patients are considered potentially infectious for HIV, HBV and other blood-borne pathogens.<sup>(5-7)</sup> Universal precautions apply to blood; other body fluids like cerebrospinal, synovial, pleural, peritoneal, pericardial, and amniotic fluids and also apply to tissues. Universal precautions do not apply to faeces, nasal secretions, sputum, sweat, tears, urine, and vomitus unless they contain visible blood. Universal precautions do not apply to saliva except when visibly contaminated with blood or in the dental setting where blood contamination of saliva is predictable.<sup>(5-7)</sup> Among the universal precautions advocated, hand hygiene is considered as a most important one. Hand hygiene has been known to reduce health care-associated infections (HAIs) since Ignaz Semmelweis<sup>8,9</sup> demonstrated dramatic reductions in puerperal sepsis after instituting a hand washing regimen in the Vienna Lying-in Hospital in 1847. Other important measures are the use of protective barrier such as gloves gowns aprons masks or protective eye wear, adoption of safe practices for handling needle sticks and other sharp objects etc.

Despite detailed guidelines the knowledge and understanding of universal precautions among HCWs even in developed countries has been found to be inadequate. In developing countries including India, the situation is worse and occupational safety of HCWs remains neglected issue.<sup>10,11</sup> Interns are vulnerable to all these infections. The major load of duties whether inpatient or out-patient department is carried out by the interns. They constitute a particularly high-risk group since they are inexperienced in invasive procedures and are hurried for time and are often tempted to ignore universal precautions to finish the work assigned to them. They are also likely to be less informed about the dangers of percutaneous exposure to body fluids and the steps to be taken thereafter and are thus at a great risk of occupational exposure to all

kinds of blood borne pathogens including HIV. So this study was undertaken to determine the awareness of medical intern regarding universal precautions and to assess whether they follow these precautions in their duties in a tertiary care hospital.

### **Methodology**

The cross sectional study was conducted from 1<sup>st</sup> June 2015 to 30<sup>th</sup> September 2015 among the 138 interns of 2015-16 batch at Gauhati Medical College and Hospital, Guwahati, India. Permission to conduct the study was obtained from the institutional ethical committee. There are total 141 interns in the 2015-16 batch, but out of them, 138 interns present during the study period were included. A pre-designed semi-structured schedule was prepared by selecting relevant items from the “2007 Guideline for Isolation Precautions” published by CDC<sup>25</sup> and “WHO Guidelines on Hand Hygiene in Health Care 2009”<sup>26</sup>, and modified according to the working conditions in GMCH and available resources.

The schedule had 3 parts. Part 1 collected demographic data including age, sex, department of posting, Hepatitis B immunisation status etc. Part 2 assessed the knowledge of the interns regarding universal precautions. Depending on their responses, knowledge was categorised into “correct” and “incorrect” as per guidelines. Part 3 assessed the practices of the interns regarding universal precautions. Depending on their responses to the questions asked and observing them in the wards while attending their respective duties, practice of universal precautions was categorised as “always practiced” and “not always practiced”. The schedule was then pre-tested among 10 post graduate trainees from different clinical disciplines at the same hospital and further modifications were incorporated. The interns were interviewed at the in-patient wards of various

departments at different time intervals after taking informed consent. Adherence to the correct practices of different components of universal precautions was assessed by analysing the responses of the participants who expressed correct knowledge regarding those components. The purpose was to determine whether or not correct knowledge had also been translated into correct practice.

**Results:**

Table 1 showing the baseline variables.

VARIABLES		Number	Percentage
Gender	Male	76	55.0
	Female	62	45.0
Clinical posting in any one of the dept (Med/Surg/Paed/O&G/Caualty)	Yes	105	76.0
	No	33	24.0
Hepatitis vaccine	Received	81	58.6
	Not received	57	41.4
History of percutaneous in last one year	Yes	12	8.6
	No	126	91.4

There were total 138 participants in our study, 76 were male (55%) and 62 were female (45%). Mean age of the participants was 22.4±1.8 years. Most of them, 105 participants (76%) had completed posting in any one of the departments of medicine, surgery, obstetrics & gynaecology, paediatrics and casualty. Hepatitis B vaccine was taken by 81 (58.6%) of them and 12 (8.6%) reported previous history of percutaneous injury. (Table:1)

Hand hygiene: During the study, correct knowledge about hand washing before and after patient contact was shown by 114 (82.6%) whereas only 79 (57.2%) participants knew about the correct steps of hand washing. Out of the 114 participants who had correct knowledge, only 51 (44.7%) practiced hand-washing before patient contact and 64% practised hand-washing after patient contact, 46 (40.3%) practiced hand washing after contact with patient surroundings and 37(32.4%) used hands-free technique while washing hands except in the operation theatres.(Table 2,3)

Personal Protective Equipment: While assessing knowledge of use of Personal Protective

Equipments (PPE), 119(86.3%) out of the 138 participants, had correct knowledge that gloves and apron must be worn for all aseptic and invasive procedures and 104 (75.4%) had correct knowledge about importance of wearing face mask and goggles during invasive procedure to prevent exposure to contaminated body fluid. Out of the 119 participants who knew about the importance of wearing gloves, 79 (66.3%) practiced changing gloves between procedures on different patients. Out of the 104 participants who had correct knowledge about importance of wearing face mask and goggles during invasive procedure, only 67 (64.4%) practiced wearing mask. (Table 2,3)

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Occupational Exposure management: While the correct knowledge regarding the risk of serious infection like HepB, HepC, HIV following exposure to contaminated needle stick injury was shown by 117 (84.8%)

Assessing the knowledge		Correct	Incorrect
Hand hygiene	Hand washing can reduce the risk of hospital acquired infection (n=138)	121(87.6%)	17(12.3%)
	Know the basic steps of hand washing (n=138)	79(57.2%)	59(42.7%)
	Knowledge about hand washing before and after patient contact (n=138)	114(82.6%)	24(17.4%)
Personal Protective Equipment	Know the importance of wearing gloves and apron for all aseptic and invasive procedures (n=138)	119(86.3%)	19(13.7%)
	Know the importance of wearing face mask, goggles and disposable apron during invasive procedure (n=138)	104(75.4%)	34(24.6%)
Occupational Exposure Management	Know that exposure to contaminated needle stick injury carries risk of serious infection like HepB, HepC, HIV (n=138)	117(84.8%)	21(15.2%)
	Know that needles must not be recapped (n=138)	66(47.9%)	72(52.1%)
	Know where and whom to report when exposed to infected blood or body fluid or accidental needle injury (n=138)	77(55.8%)	61(44.2%)
	Know about the basic PEP regimen for HepB and HIV (n=138)	68(49.3%)	70(50.7%)
	PEP drugs are best effective when started within 2 hours following exposure (n=138)	51(37.0%)	87(63.0%)
	When needed PEP drugs must be continued for 4 weeks(n=138)	46(33.4%)	92(66.6%)
	Know the rate of transmission of HIV when injured by a contaminated needle (0.3%)	54(39.1%)	84(60.9%)
	Know the rate of transmission of HepB when injured by a contaminated needle (30%)	56(40.6%)	82(59.4%)
Biomedical Waste management	Know about proper disposal of gloves according to BMW disposal guidelines (n=138)	91(65.9%)	47(34.1%)
	Knowledge about proper disposal of sharps according to BMW guidelines (n=138)	72(52.1%)	66(47.9%)

Table 2 showing the knowledge regarding universal precautions.

participants, 72 (52.1%) did not know that needles must not be recapped. Regarding accidental needle stick injury, 77(55.8%) out of 138 had knew where and whom to report and out of them only 49(64%) actually reported any such injury. The knowledge of the post-exposure prophylaxis regimen (49.3%), the proper time of initiation of PEP (37%) following NSI and the minimum duration of PEP (33.4%) was also found to be poor. (Table 2,3)

BMW management: We also found that out of the 138 participants, 47 (34.1%) and 66 (47.9%) did not know about the proper method disposal of contaminated gloves and sharps according to BMW disposal guidelines respectively; whereas 62.5% properly followed BMW management protocols. (Table 2,3)

Table 3 showing practice regarding universal precautions.

Assessing the Practice	Always practiced	Not always practiced
Hand washing before and after patient contact (n=114)	51(44.7%)	63(55.3%)
Hand washing after patient contact (n=114)	73(64.0%)	41(35.9%)
Hand washing after contact with patient surroundings (n=114)*	46(40.3%)	68(59.7%)
Use 'hands-free' technique to turn off taps (n=114)*	37(32.4%)	77(67.6%)
Change gloves between procedures on the same patient (n=119)	41(34.5%)	78(65.5%)
Change gloves between procedures on different patients (n=119)	79(66.3%)	40(33.7%)
Wear gloves and apron during all invasive procedures (n=119)*	86(72.3%)	33(27.7%)
Re-cap needles after use (n=66)	43(65.2%)	23(34.8%)
Wear face-mask during invasive procedures (n=104)*	67(64.4%)	37(35.6%)
Report all kind of occupational exposure injury (n=77)	49(64.0%)	28(36.0%)
Follow waste management protocols (n=72)	45(62.5%)	27(37.5%)

In this study, female interns were observed to be showing better knowledge regarding hand hygiene (p=0.04) and PPE (p=0.006). Also, practice among the females was higher regarding hand-washing (p=0.03), PPE (p=0.04) and PEP (p=0.03). (Table 4, 5)

Higher knowledge regarding hand hygiene (p=0.002) and PEP (p=0.04) was also observed among the interns completing posting in any one of

the clinical subjects like medicine, surgery, paediatrics, obstetrics and gynaecology and casualty. Those interns also showed better practice regarding hand-washing (p=0.002), PPE (p=0.002) and PEP (p=0.02). (Table 4, 5) Interns who had previous history of percutaneous injury were observed to have higher knowledge regarding PEP (p=0.002) and also showed better practice of PEP (p=0.04) and hand-washing (p=0.03). (Table 4, 5)

Table 4: showing the association of the baseline variables with the knowledge of universal precautions.

Variables		Correct knowledge about hand hygiene		Correct knowledge about use of PPE		Correct knowledge about PEP	
Gender	Male(n=76)	<b>58(76.3%)</b>	<b>P=0.04</b> <b>OR=0.34</b> <b>95%</b> <b>CI=0.12-0.93</b>	<b>60(78.9%)</b>	<b>P=0.006</b> <b>OR=0.19</b> <b>95%</b> <b>CI=0.05-0.68</b>	<b>36(47.3%)</b>	P=0.73
	Female(n=62)	<b>56(90.3%)</b>		<b>59(95.1%)</b>		<b>32(51.6%)</b>	
Clinical posting in any one of the Med/Surg/O&G/ Paed/Casualty	Yes(n=105)	<b>93(88.5%)</b>	<b>P=0.002</b> <b>OR=4.42</b> <b>95% CI=1.74-11.22</b>	<b>94(89.5%)</b>	P=0.07	<b>57(54.2%)</b>	<b>P=0.04</b> <b>OR=2.37</b> <b>95%</b> <b>CI=1.04-5.39</b>
	No(n=33)	<b>21(63.6%)</b>		<b>25(75.7%)</b>		<b>11(33.3%)</b>	
Hepatitis B vaccine taken	Yes(n=81)	<b>69(85.1%)</b>	P=0.36	<b>67(82.7%)</b>	P=0.21	<b>41(50.6%)</b>	P=0.73
	No(n=57)	<b>45(78.9%)</b>		<b>52(91.2%)</b>		<b>27(47.3%)</b>	
Previous history of percutaneous injury	Yes(n=12)	<b>9(75.0%)</b>	P=0.43	<b>11(91.6%)</b>	P=1.0	<b>11(91.6%)</b>	<b>P=0.002</b> <b>OR=13.31</b> <b>95%</b> <b>CI=1.66-106.32</b>
	No(n=126)	<b>105(83.3%)</b>		<b>108(85.7%)</b>		<b>57(45.2%)</b>	

Table 5: showing the association of the baseline variables with the practices of universal precautions.

Variables		Practice of hand washing(51 out of 114)*		Practice of using PPE(86 out of 119)*		Practice of exposure management(49 out of 77)*	
Gender	Male	<b>20(34.4%)</b>	<b>P=0.03</b> <b>OR=0.42</b> <b>95%</b> <b>CI=0.19-0.90</b>	<b>38(63.3%)</b>	<b>P=0.04</b> <b>OR=0.39</b> <b>95%</b> <b>CI=0.17-0.91</b>	<b>19(51.3%)</b>	<b>P=0.03</b> <b>OR=0.35</b> <b>95%</b> <b>CI=0.13-0.92</b>
	Female	<b>31(55.3%)</b>		<b>48(81.3%)</b>		<b>30(75.0%)</b>	
Clinical posting in any one of the Med/Surg/O&G/ Paed/ Casualty	Yes	<b>48(51.6%)</b>	<b>P=0.002</b> <b>OR=6.4</b> <b>95%</b> <b>CI=1.76-23.21</b>	<b>76(80.8%)</b>	<b>P=0.0002</b> <b>OR=6.33</b> <b>95%</b> <b>CI=2.44-16.39</b>	<b>38(73.0%)</b>	<b>P=0.02</b> <b>OR=3.45</b> <b>95%</b> <b>CI=1.27-9.38</b>
	No	<b>3(14.2%)</b>		<b>10(40.0%)</b>		<b>11(44.0%)</b>	
Hepatitis B vaccine taken	Yes	32(41.5%)	P=0.84	47(70.1%)	P=0.68	27(61.3%)	P=0.81
	No	19(55.8%)		39(75.0%)		22(66.6%)	
Previous history	Yes	<b>7(77.7%)</b>	<b>P=0.03</b>	<b>9(81.8%)</b>	<b>P=0.72</b>	<b>10(90.9%)</b>	<b>P=0.04</b>

of percutaneous injury	No	42(40.0%)	OR=5.25 95% CI=1.03-26.51	77(71.2%)		39(59.0%)	OR=6.92 95% CI=0.83-57.32
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\*depicts the correct practice of universal precaution observed among the respondents having the correct knowledge.

**Discussion:**

**Hand Hygiene**

In our study, correct knowledge about hand hygiene was found among 82.6% and this knowledge was translated into practice among 44.8%. Similar findings were seen in a study done by **Mahfouz AA and co-workers**<sup>12</sup>. They found overall hand hygiene non-compliance was 41%, alcoholic rub use 36.2% and hand washing 20.8%. Hand hygiene non-compliance increased from 16.9% after patient care to 59.3% before patient contact and 72% before an aseptic procedure. Hand hygiene non-compliance was higher among physicians 54.8% compared to nurses 32.6%. After adjusting other potential risk factors, the events before patient contact, being a physician as HCW, and working in the IMCU were significant risk factors for hand hygiene non-compliance. In a study done by **Gebresilassie A and co-workers**<sup>13</sup>, they observed that 61.5% HCWs always washed hands after patient contact. **Shuvankar mukharjee et al**<sup>14</sup> observed that most of participants conveyed knowledge of the importance of hand-washing 90%. The practice of hand-washing was poor (54.7%) among the participants who had correct knowledge of it. In a study done by **Saad-Al-Zahrani and co-workers**<sup>15</sup>, among interns of two medical colleges CM and CAMS, Taif region, KSA, the researchers found that, overall knowledge about infection control measures was 73.5%. Awareness about hand-washing technique was 96.5%, knowledge regarding hand hygiene 91.6%,

and 96.5% received training regarding hand washing. In another study by **M Jawaid and co-workers**<sup>16</sup>, it was seen that, total 95% respondents were vaccinated against hepatitis B virus. Majority of the doctors, 52.5% did not knew anything about Centre for Disease Control guideline for standard precautions while 40% of the respondent had some idea and only 7.5% knew them well. According to a study done by **Salehi AS and Garner P**<sup>17</sup>, In terms of knowledge, responses were poor, most thought universal precautions were for HIV and hepatitis only (67.9%), and used needles could be re-capped (82.9%).

**Personal Protective Equipment**

In our study, the knowledge about the importance of wearing gloves (86.3%) and face mask, eye wear (75.4%) was adequate, but in practice, 72.3% were seen to use gloves and apron during all invasive procedures (66.3% changed gloves between procedures on different patients and 34.5% changed gloves between procedures on the same patient), whereas only 64.4% respondents were observed to be using face-mask during invasive procedures. **Shuvankar mukharjee et al**<sup>14</sup> found in their study that the majority of correct knowledge was observed to be relating to the use of gloves and aprons, but knowledge relating to the use of goggles was found to be poor (54.6%). Among the components for which correct knowledge was expressed, practice of always using gloves, aprons/gowns and goggles was reported by only 62.4%, 56.2% and 22.5% of the respondents,

respectively. **Helfgott et al**<sup>18</sup> found that compliance (by type of barrier device) appeared to be best for the use of latex gloves (100% for all procedures). The most commonly neglected barrier was the face shield for eye protection, used in only 67% of the procedures for which it is recommended. **M Jawaid and co-workers**<sup>16</sup> observed that among the respondents, 56.7% changed gloves for each patient. Protective goggles were not used by any of the respondents. **Oguwamanam and co-workers**<sup>19</sup> observed that over half (58.2% = 89/153) of the respondents routinely use an apron while working with patients requiring a procedure. This was significantly higher among the doctors, nurses and laboratory scientists compared to the orderlies and waste handlers ( $\chi^2 = 14.7$ ,  $p = 0.005$ ). 56.2% (86/153) of the respondents routinely use face masks while handling wastes; while 66.7% and 64.6% of the doctors and nurses use face masks. **Sari SYI et al**<sup>20</sup> found that knowledge of UP was fairly good; means of correctness level reached  $71.8\% \pm 7.56$  with maximum value of 100%. Knowledge of hand washing, personal protective equipment, medical waste disposal and post exposure prophylaxis was high, both among staff and students. However, knowledge of instrument processing and medical sharps disposal was poor, especially among the students. All respondents showed favourable attitude on UP but almost all (95.8%) reported low adherence to UP standards.

#### Occupational Exposure Management

In our study, knowledge about needle-stick injury was 84.8%, only 47.9% knew that needles should never be re-capped, and out of them only 34.8% followed it in actual practice. Knowledge about the PEP regimen (49.3%), time of initiation (37%) and duration of the regimen (33.4%) was also poor. **Oguwamanam and co-workers**<sup>19</sup> observed that 68% respondents knew of post-exposure prophylaxis, largest proportion of healthcare

providers who had a needle stick injury in the last one year were doctors (50% of them). Only 30.7% (42/137) knew there was a hospital needle-prick injury accidents management (NPIAM) protocol and register for post-exposure prophylaxis. In a study done by **Gebresilassie A and co-workers**<sup>13</sup>, it was observed that 11.8% of the HCWs re-cap needles after injection, 60.2% HCWs were exposed to splash of blood or body fluid on their mucus membrane in the last one year and 22.2% were exposed to sharp or needle stick injury. **Viswanathan et al**<sup>21</sup> observed that 29.4% knew whom to contact in case of accidental exposure. Of all the respondents, only 50.5% knew about the time of initiation of PEP, 18.8% knew all the three drugs and only 26 (30.6%) knew the duration of post exposure prophylaxis. **Shuvankar mukharjee et al**<sup>14</sup> found that most of participants conveyed knowledge of the risk of bending or recapping used needles 83.1%, and safe disposal of sharp instruments 89.2%. Only 66.3% of respondents who were aware of the policy to never bend or recap used needles adhered to its correct practice. Only 63.8% of the respondents were actually aware of the fact that any incidence of occupational exposure must be reported to the superior officer on-duty; and only 69.2% expressed the correct knowledge of basic PEP regimen and even fewer could correctly name the drugs included in the expanded regimen. In a study by **Khapre MP and co-workers**<sup>22</sup>, it was observed that 11.7% of interns and 18.37% of residents had history of needle stick injuries in past three months. Among interns 18.75% had immediate hand wash, 50% consulted physician, 50% started ART while 50% did nothing. 100% of residents had immediate hand wash, 66.67% consulted physician 77.78% started ART. There is strong positive correlation ( $r = 0.967$ ) between awareness score and usage of safety precautions score.



#### BMW Guideline

In our study, knowledge about proper disposal of gloves was found to be 65.9% and 52.1% about sharps; out of which only 52.1% followed the waste management protocols in actual practice.

**Oguwamanam and co-workers**<sup>19</sup> observed that 54% knew of or had seen colour coded bins; in a study done by **Saad-Al-Zahrani and co-workers**<sup>15</sup>, it was seen that knowledge about proper methods of waste disposal was 89.6% and 96.5% received training on proper method of disposal of sharps. According to a study done by **Shah H et al**<sup>23</sup>, it was observed that proportion of hub was cut after every injections was 90% out of 237 as proportion of hub cutter was around was 94.4%. 82.5% subjects had disposed the injections related waste to the puncture proof plastic bags. Proportion of puncture proof bag was filled up more than three-fourth was 30% and the container of that waste was stored more than 48 h was 19.1% in observations.

#### Conclusion:

In this study we assessed the knowledge and practice of Universal precautions under the four

broad categories, 'hand hygiene', 'personal protective equipments', occupational exposure management' and 'biomedical waste management'. We observed that the overall knowledge regarding importance of hand washing, wearing gloves, risk of needle stick injury, disposal of biomedical waste were satisfactory, but there was poor response regarding knowledge of steps of hand washing, recapping of needles, PEP. Practice regarding hand hygiene and PPE was satisfactory, but poor regarding exposure management. Insufficient practical training and supervision, and lack of interest may be among the reasons for poor practice. Workshop on practical hands-on training may be conducted periodically. Good clinical practices should be inculcated from undergraduate life and there needs to be constant motivation and supervision by the seniors and faculties.

Universal precautions are to be followed by all health care workers at all levels of health care delivery system. This requires a wide scale study including HCWs from different fields. But due to constraints of resources and time, the study was limited to interns only.

#### Bibliography:

- 1) Melo Dde S, Silva e Souza AC, Tipple AF, das Neves ZC, Pereira MS (2006) Nurses' understanding of standard precautions at a public hospital in Goiania-GO, Brazil. *Rev Lat Am Enfermagem* 14: 720-727.
- 2) WHO (2004) Reducing risks, promoting healthy life. Geneva, Switzerland World Health Organization.
- 3) Boozary A, Dugani SB (2011) Institute of social justice and medicine: developing a think tank to promote policy formation. *Clin Invest Med* 34: E259.
- 4) Prüss-Ustün A, Rapiti E, Hutin Y (2005) Estimation of the global burden of disease attributable to contaminated sharps injuries among health-care workers. *Am J Ind Med* 48: p482-490.
- 5) Siegel JD, Rhinehart E, Jackson M, Chiarello L, and the Healthcare Infection Control Practices Advisory Committee, 2007 Guideline for Isolation Precautions: Preventing Transmission of Infectious Agents in Healthcare Settings <http://www.cdc.gov/ncidod/dhqp/pdf/isolation2007.pdf>
- 6) Guideline for Isolation Precautions: Preventing Transmission of Infectious Agents in Healthcare Settings. CDC. 2007. (<http://www.cdc.gov/ncidod/dhqp/pdf/guidelines/Isolation2007.pdf>)
- 7) Universal Precautions for Prevention of Transmission of HIV and Other Bloodborne Infections. CDC. Fact Sheet. [[http://www.cdc.gov/ncidod/dhqp/bp\\_universal\\_precautions.html](http://www.cdc.gov/ncidod/dhqp/bp_universal_precautions.html)]

- 8) Semmelweis I. Etiology, concept, and prophylaxis of childbed fever. Translated by K. Carter. Madison, WI: University of Wisconsin Press; 1983.
- 9) Best M, Neuhauser D. Ignaz Semmelweis and the birth of infection control. *Qual Saf Health Care*. 2004, Jun; 13(3): p233-234.
- 10) Gammon J, Morgan-Samuel H, Gould D (2008) A review of the evidence for suboptimal compliance of healthcare practitioners to standard/universal infection control precautions. *J Clin Nurs* 17: 157-167.
- 11) Thu TA, Anh NQ, Chau NQ, Hung NV (2012) Knowledge, Attitude and Practices Regarding Standard and Isolation Precautions among Vietnamese Health Care Workers: A Multicenter Cross-Sectional Survey. *Internal Medicine* 2(4).
- 12) Mahfouz AA, Mohammad N. El Gamal El, Tarik A, Al-Azraqi. Hand hygiene non-compliance among intensive care unit health care workers in Aseer Central Hospital, south-western Saudi Arabia. *International Journal of Infectious Diseases* 17 (2013) e729–e732.
- 13) Gebresilassie A, Kumei A, Yemane D (2014) Standard Precautions Practice among Health Care Workers in Public Health Facilities of Mekelle Special Zone, Northern Ethiopia. *J Community Med Health Educ* 4: 286. doi:10.4172/2161-0711.1000286.
- 14) Mukherjee S et al. Knowledge and Practice of Standard Precautions and Awareness Regarding Post-Exposure Prophylaxis for HIV among Interns of a Medical College in West Bengal, India. *Oman Medical Journal* (2013) Vol. 28, No. 2:p141-145.
- 15) Al-Zahrani SS, Al-Amry F, Ghonaim MM, Abo-Salem OM. Awareness & knowledge of medical students & interns about infection control measures. *Int J Med Sci Public Health* 2013; 2:p317-323.
- 16) Jawaid M, Iqbal M, Shahbaz S. Compliance with Standard Precautions: A long way ahead. *Iranian J Publ Health*, Vol.38, No.1, 2009, p85-88.
- 17) Salehi and Garner: Occupational injury history and universal precautions awareness: a survey in Kabulhospital staff. *BMC Infectious Diseases* 2010 10:19.
- 18) Helfgott AW, Burton JT, Garcini FJ, Eriksen NL, Grimes R. Compliance With Universal Precautions" Knowledge and Behavior of Residents and Students in a Department of Obstetrics and Gynecology. *Infectious Diseases in Obstetrics and Gynecology* 6:123-128 (1998).
- 19) Enwere OO, Diwe CK. Knowledge, perception and practice of injection safety and healthcare waste management among teaching hospital staff in south east Nigeria: an intervention study. *Pan African Medical Journal*. ISSN 1937-8688. [<http://www.panafrican-med-journal.com/content/article/17/218/full/>]
- 20) Sari SYI et al. 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* 2011, v7:i4.
- 21) Viswanathan S, Jain R, Adhikari MP, Jain A. Awareness of Post – Exposure Prophylaxis Guidelines against Occupational Exposure to HIV Among Post Graduate Residents at Mangalore, India. *Int. J. Med. Public health*. April-June 2011; 1(2). p51-56.
- 22) Khapre MP, Mudey A, Chaudhary S,Wagh V, Goyal RC. Awareness and Compliance with Universal Precaution Guidelines among Interns and Residents: An Interview Based Study in Rural Tertiary Care

Teaching Hospital. Int. J. of Health Sciences & Research. ISSN: 2249-9571. Vol.1; Issue: 2; Jan. 2012. p95-100.

- 23) Shah HD, Mangal AD, Solanki HR, Parmar DV. Unsafe injection practices: An occupational hazard for health care providers and a potential threat for community: A detailed study on injection practices of health care providers. Int J Health Allied Sci 2014;3:28-32.
- 24) Kotwal A, Taneja DK. Health Care Workers and Universal Precautions: Perceptions and Determinants of Non-compliance. Indian J Community Med. 2010 Oct-Dec; 35(4): p526–528.
- 25) Siegel JD, Rhinehart E, Jackson M, Chiarello L, and the Healthcare Infection Control Practices Advisory Committee, 2007 Guideline for Isolation Precautions: Preventing Transmission of Infectious Agents in Healthcare Settings <http://www.cdc.gov/ncidod/dhqp/pdf/isolation2007.pdf>
- 26) WHO Guidelines on Hand Hygiene in Health Care: First Global Patient Safety Challenge, Clean Care is Safer Care. World Health Organization 2009. [[http://www.who.int/csr/resources/publications/EPR\\_AM2\\_E7.pdf](http://www.who.int/csr/resources/publications/EPR_AM2_E7.pdf)]