

## Original Research Article

# Knowledge and practices of universal safety precautions among interns and first year resident doctors in a tertiary care hospital

Ashish A. Wadekar, Vijaykumar S. Singh\*, Soujannya K. Chowdhury, Maheshchandra M. Chape

Department of Community Medicine, LTMMC and GH, Sion, Mumbai, Maharashtra, India

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### \*Correspondence:

Dr. Vijaykumar S. Singh,

E-mail: [drvijaykumarsingh@yahoo.com](mailto:drvijaykumarsingh@yahoo.com)

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## ABSTRACT

**Background:** Universal safety precautions also known as standard precautions are a set of evidence based clinical work practices published by Centers for Disease Control and Prevention (CDC) in 1996 and updated in 2007; the extension of blood and body-fluid precautions to all patients is referred to as universal precautions. Despite detail guidelines, the knowledge and understanding of universal safety precautions among health-care workers is found inadequate.

**Methods:** This was a cross-sectional study carried out among interns and first year resident doctors in medical college attached to a tertiary care hospital. Around 200 doctors are enrolled in this study.

**Results:** In our study, correct knowledge about hand hygiene found in interns was 84.1% and clinical residents 93.3% and this knowledge was practiced by 83.6% interns and 84.1% clinical resident. The knowledge about the importance of wearing the gloves was 95.5% among interns and 95.4% among residents and facemask, eye wear was 78.5% among interns and 92% among residents, but in practice 78.5% interns and 71.5% residents were seen to use gloves and apron. Knowledge about needle stick injury was 95.5% among interns and 97.1% among resident doctors. The knowledge of interns was 81.25% for disposal of gloves and 70.5% for disposal of sharps whereas among resident doctors, it was 72.7% for gloves and 70.4% for sharps.

**Conclusions:** In this study, we observed that overall knowledge regarding importance of hand washing, wearing gloves, risk of needle stick injury, disposal of biomedical waste were satisfactory. There was poor response regarding the steps of hand washing and recapping of needles.

**Keywords:** Hand hygiene, Personal protective equipment, Biomedical waste, Interns, Resident doctors

## INTRODUCTION

Universal safety precautions also known as standard precautions are a set of evidence based clinical work practices published by Centers for Disease Control and Prevention (CDC) in 1996 and updated in 2007.<sup>2,3</sup> In 1983, The US CDC published a document that recommended blood and body fluids precautions when a patient was known or suspected to be infected with blood-borne pathogens.<sup>4</sup> In 1987, the CDC recommended that regardless of patient's infection status, the precautions must be consistently used. This extension of blood and

body-fluid precautions to all patients is referred to as universal precautions.<sup>4</sup>

Infection is one of the most important problems in health care services worldwide. It constitutes one of the most important causes of morbidity and mortality associated with clinical diagnostic and therapeutic procedures.<sup>1,2</sup> Healthcare workers are always at a risk of occupational hazards as they perform their clinical activities in the hospital they are exposed to blood-borne infections by pathogens like human immunodeficiency virus (HIV), hepatitis C, and hepatitis B from sharp injuries and contact

with deep body fluids.<sup>5</sup> According to World Health Organization (WHO) estimate in the year 2002, sharp injuries resulted in 16,000 hepatitis C virus infections 66,000 hepatitis B virus infections and 1000 HIV infections in health care workers worldwide.<sup>1,5</sup> Globally it is estimated that about 40% of the hepatitis-B and hepatitis-C infection and 2.5% of HIV infections in healthcare workers (HCWs) are accountable to occupational sharps.<sup>4,5</sup> Developing countries where the prevalence of HIV-infected patients is very high, record the highest no of needle stick injuries.<sup>11,12</sup>

Despite detail guidelines, the knowledge and understanding of universal safety precautions among health-care workers even in developed countries has to be found inadequate. In developing countries like India, the situation is even worse and occupational safety of HCW remains neglected issue.<sup>9</sup> Interns and clinical residents are vulnerable to all these infections. The major load of duties whether in-patient or out-patient department is carried out by interns and first year clinical residents. They constitute a particularly high risk group since they are inexperienced in invasive procedures and are hurried and often tempted to ignore the universal precautions to finish the work assigned to them. They are also likely to be less informed about the dangers of per cutaneous exposure to body fluids and the steps to be taken thereafter and are thus at a greater 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 and first year clinical resident doctor regarding universal precaution and to assess whether they follow them.

### ***Aims and objectives***

The objectives of the research were to study awareness regarding universal safety precautions among interns and resident doctors in tertiary care hospital and to assess the knowledge regarding the universal safety precautions and to find out practices and compliance regarding the same; to study the socio demographic profile of the study subjects and their working conditions; to suggest recommendations based on this study.

## **METHODS**

This was a cross-sectional study carried out after getting the approval of institutional ethics committee.

### ***Study setting***

The setting of the study was at medical college attached to a tertiary care hospital.

### ***Study place***

The study was conducted at Lokmanya Tilak Municipal Medical College and General Hospital, Sion, Mumbai

### ***Study period***

The duration of the study was from May 2017 to May 2019.

### ***Study population***

The population of the study consists of interns and first year clinical resident doctors.

### ***Sample size with justification***

The sample size was 200, 112 medical interns undergoing internship at the institute and 88 residents of first year in various clinical departments of the medical college attached to tertiary care hospital.

### ***Inclusion criteria***

The study included subjects giving consent, and interns and first year clinical resident doctors.

### ***Exclusion criteria***

The study excluded subjects who remained absent during test and subjects who are not willing to participate in the study.

### ***Sampling procedure***

In the sampling procedure all study subjects were included.

### ***Measurements***

Data was analyzed, tabulated in the following proposed area: socio demographic profile, score for knowledge, attitude, practices associated with universal safety precautions.

### ***Data collection methods***

An informed consent in the language that subject understands was taken. The study tool in the form of a questionnaire was administered for measuring the knowledge and practices among study subjects.

### ***Statistical analysis***

Data was tabulated and analyzed with the help of statistical package for the social sciences (SPSS) in the required area. All responses were given a code which will be finally analyzed using score values.

### ***Method***

Prior to the assessment of the protocol, every participant was explained the purpose of the study and a well informed consent was taken. This cross-sectional study was conducted from 01 August 2017 to 30 September 2017

among the 112 interns and 88 clinical resident doctors. A pre structured validated questionnaire was administered by selecting it from the 2007 guidelines for isolation precautions published by the CDC (3) and WHO guidelines on hand hygiene in health care 2009, and modified according to the working conditions of the hospital.<sup>7</sup>

The schedule had 3 parts. Part 1 collected demographic data including age, sex, department of posting, hepatitis B immunization status etc. Part 2 assessed the knowledge of the interns and clinical first year resident doctors regarding universal precautions. Depending on their responses, knowledge was categorized 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 were categorized 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. Adherence to the correct practices of different components of universal precautions was assessed by analyzing 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 shows the base line variables like socio-demographic factors, as the table shows there were 112

respondents of the study. There were 68 males and 54 females included in the intern category. It also shows the baseline variables for first year clinical resident doctors. There were 57 male doctors and 31 female doctors, the total no of respondents were 88.

**Table 1: Baseline variables of intern and clinical resident doctor.**

| Variables (gender)              | Numbers | Percentage |
|---------------------------------|---------|------------|
| <b>Intern</b>                   |         |            |
| Male                            | 68      | 60         |
| Female                          | 54      | 40         |
| <b>Clinical resident doctor</b> |         |            |
| Male                            | 57      | 64.7       |
| Female                          | 31      | 35.3       |

Table 2 shows that various parameters are studied to obtain a percentage of respondents showing correct responses. Similar procedure is followed for first year clinical residents.

Also the knowledge of resident doctors in every aspect is greater than that of intern. This can be attributed to their clinical knowledge and experience. However the knowledge regarding biomedical waste management among resident doctors is less than that of interns which is shown in Table 2.

Table 3 shows the comparison between the practices of universal safety precautions. Bold figures indicate that the USP are practiced more by interns than resident doctors. It also shows comparative features of practice found in resident doctors and interns.

**Table 2: Assessing the knowledge (interns, n=112 and clinical residents, n=88) and comparative features of correct knowledge among interns and resident doctors.**

| Parameter  | Correct (%) | Incorrect (%) |
|--|-------------|---------------|
| <b>Interns</b>   |             |               |
| <b>Hand hygiene</b>  |             |               |
| Hand washing can reduce the risk of hospital acquired infection  | 108 (96.4)  | 4 (3.6)       |
| Know the basic steps of hand washing   | 73 (65)     | 39 (35)       |
| Knowledge about hand washing before and after patient contact  | 102 (91)    | 10 (9)        |
| <b>Personal protective equipment</b>   |             |               |
| Know the importance of wearing gloves and aprons for all aseptic and invasive procedures   | 107 (95.5)  | 5 (4.5)       |
| Know the importance of wearing face mask, goggles and disposable apron during invasive procedures                                    | 88 (78.5)   | 24 (21.5)     |
| <b>Occupational exposure management</b>  |             |               |
| Know that the exposure to contaminated needle stick injury carries a risk of serious infection like hepatitis B, hepatitis C and HIV | 107 (95.5)  | 5 (4.5)       |
| Know that needles must not be recapped   | 79 (70.5)   | 23 (29.5)     |
| Know where and whom to report when exposed to infected blood or body fluid or accidental needle injury                               | 86 (76.7)   | 26 (23.3)     |
| Know about the basic PEP regimen for hep-B and HIV   | 81 (72.3)   | 31 (27.7)     |
| PEP drugs are best effective when started within 2 hours after exposure  | 66 (58.9)   | 46 (41.1)     |
| When needed PEP drugs must be continues for 4 weeks  | 57 (50.8)   | 55 (49.2)     |

Continued.

| Parameter  | Correct (%) | Incorrect (%) |
|--|-------------|---------------|
| Know the rate of transmission of HIV when injured by a contaminated needle (0.3%)  | 62 (55.3)   | 50 (44.7)     |
| Know the rate of transmission of hep-B when injured by a contaminated needle (30%)   | 64 (57.1)   | 48 (42.9)     |
| <b>Biomedical waste management</b>   |             |               |
| Know about the proper disposal of gloves according to BMW disposal guidelines (upgraded)   | 91 (81.25)  | 21 (18.75)    |
| Knowledge about the proper disposal of sharps according to BMW rules (upgraded)  | 79 (70.5)   | 33 (29.5)     |
| <b>Clinical residents</b>  |             |               |
| <b>Hand hygiene</b>  |             |               |
| Hand washing can reduce the risk of hospital acquired infection  | 84 (95.4)   | 4 (4.6)       |
| Hand washing can reduce the risk of hospital acquired infection  | 80 (90.9)   | 8 (9.1)       |
| Know the basic steps of hand washing   | 84 (95.4)   | 4 (4.6)       |
| Knowledge about hand washing before and after patient contact  | 84 (95.4)   | 4 (4.6)       |
| <b>Personal protective equipment</b>   |             |               |
| Know the importance of wearing gloves and aprons for all aseptic and invasive procedures   | 84 (95.4)   | 4 (4.6)       |
| Know the importance of wearing face mask, goggles and disposable apron during invasive procedures                                    | 81 (92)     | 7 (8)         |
| <b>Occupational exposure management</b>  |             |               |
| Know that the exposure to contaminated needle stick injury carries a risk of serious infection like hepatitis B, hepatitis C and HIV | 86 (97.1)   | 1 (2.3)       |
| Know that needles must not be recapped   | 76 (86.3)   | 12 (13.7)     |
| Know where and whom to report when exposed to infected blood or body fluid or accidental needle injury                               | 78 (88.6)   | 10 (11.4)     |
| Know about the basic PEP regimen for hep-B and HIV   | 68 (77.2)   | 20 (22.8)     |
| PEP drugs are best effective when started within 2 hours after exposure  | 69 (78.4)   | 19 (21.6)     |
| When needed PEP drugs must be continues for 4 weeks  | 63 (71.1)   | 5 (28.5)      |
| Know the rate of transmission of HIV when injured by a contaminated needle (0.3%)  | 57 (64.7)   | 3 (35.3)      |
| Know the rate of transmission of hep-B when injured by a contaminated needle (30%)   | 59 (67.0)   | 29 (33)       |
| <b>Biomedical waste management</b>   |             |               |
| Know about the proper disposal of gloves according to BMW disposal guidelines (upgraded)   | 64 (72.7)   | 24 (27.3)     |
| Knowledge about the proper disposal of sharps according to BMW rules (upgraded)  | 62 (70.4)   | 26 (29.6)     |
| <b>Comparative features of correct knowledge among interns and resident doctors</b>  |             |               |
| <b>Hand hygiene</b>  |             |               |
| Hand washing can reduce the risk of hospital acquired infection  | 96.4        | 95.4          |
| Know the basic steps of hand washing   | 65          | 90.9          |
| Knowledge about hand washing before and after patient contact  | 91          | 95.4          |
| <b>Personal protective equipment</b>   |             |               |
| Know the importance of wearing gloves and aprons for all aseptic and invasive procedures   | 95.5        | 95.4          |
| Know the importance of wearing face mask, goggles and disposable apron during invasive procedures                                    | 78.5        | 92            |
| <b>Occupational exposure management</b>  |             |               |
| Know that the exposure to contaminated needle stick injury carries a risk of serious infection like hepatitis B, hepatitis C and HIV | 95.5        | 97.7          |
| Know that needles must not be recapped   | 70.5        | 86.3          |
| Know where and whom to report when exposed to infected blood or body fluid or accidental needle injury                               | 76.7        | 88            |
| Know about the basic PEP regimen for hep-B and HIV   | 72.3        | 77.2          |
| PEP drugs are best effective when started within 2 hours after exposure  | 58.9        | 78.4          |
| When needed PEP drugs must be continues for 4 weeks  | 50.8        | 71.5          |

Continued.

| Parameter  | Correct (%) | Incorrect (%) |
|--|-------------|---------------|
| Know the rate of transmission of HIV when injured by a contaminated needle (0.3%)        | 55.3        | 64.7          |
| Know the rate of transmission of hep-B when injured by a contaminated needle (30%)       | 57.1        | 67            |
| <b>Biomedical waste management</b>   |             |               |
| Know about the proper disposal of gloves according to BMW disposal guidelines (upgraded) | 81.25       | 72.7          |
| Knowledge about the proper disposal of sharps according to BMW rules (upgraded)          | 70.5        | 70.4          |

**Table 3: Practices regarding universal precautions (interns n=112, clinical residents n=88) and comparative features of practice found in resident doctors and interns.**

| Assessing the practice  | Always practiced (%) | Not always practiced (%) |
|---|----------------------|--------------------------|
| <b>Interns</b>  |                      |                          |
| Hand washing before and after patient contact                                 | 56 (50)              | 56 (50)                  |
| Hand washing after patient contact  | 88 (78.5)            | 24 (21.5)                |
| Hand washing after contact with patient surroundings                          | 48 (42.8)            | 64 (57.2)                |
| Use hands free technique to turn off taps                                     | 37 (33)              | 75 (77)                  |
| Change gloves between procedures on the same patient                          | 29 (29)              | 83 (74.2)                |
| Change gloves between procedures on different patients                        | 86 (76.7)            | 26 (23.3)                |
| Wear gloves and aprons during all invasive procedures                         | 88 (78.5)            | 24 (21.5)                |
| Re-cap needles after use  | 89 (79.4)            | 23 (20.6)                |
| Wear face mask during all invasive procedures                                 | 67 (59.8)            | 45 (40.2)                |
| Report all kinds of occupational exposure injury                              | 79 (70.5)            | 33 (29.5)                |
| Follow waste management protocols   | 89 (79.4)            | 23 (20.6)                |
| <b>Clinical residents</b>   |                      |                          |
| Hand washing before and after patient contact                                 | 78 (88.6)            | 10 (11.4)                |
| Hand washing after patient contact  | 82 (93.1)            | 6 (6.9)                  |
| Hand washing after contact with patient surroundings                          | 61 (69.3)            | 27 (30.7)                |
| Use hands free technique to turn off taps                                     | 57 (64.7)            | 31 (35.3)                |
| Change gloves between procedures on the same patient                          | 48 (54.5)            | 40 (45.5)                |
| Change gloves between procedures on different patients                        | 62 (70.4)            | 26 (29.6)                |
| Wear gloves and aprons during all invasive procedures                         | 63 (71.5)            | 25 (28.5)                |
| Re-cap needles after use  | 57 (64.7)            | 31 (35.5)                |
| Wear face mask during all invasive procedures                                 | 53 (60.2)            | 35 (39.8)                |
| Report all kinds of occupational exposure injury                              | 68 (77.2)            | 20 (22.8)                |
| Follow waste management protocols   | 51 (57.9)            | 37 (42.1)                |
| <b>Comparative features of practice found in resident doctors and interns</b> |                      |                          |
| Hand washing before and after patient contact                                 | 50                   | 88.6                     |
| Hand washing after patient contact  | 78.5                 | 93.1                     |
| Hand washing after contact with patient surroundings                          | 42.8                 | 69.3                     |
| Use hands free technique to turn off taps                                     | 33                   | 64.7                     |
| Change gloves between procedures on the same patient                          | 29                   | 54.5                     |
| Change gloves between procedures on different patients                        | 76.7                 | 70.4                     |
| Wear gloves and aprons during all invasive procedures                         | 78.5                 | 71.5                     |
| Re-cap needles after use  | 79.4                 | 64.7                     |
| Wear face mask during all invasive procedures                                 | 59.8                 | 60.2                     |
| Report all kinds of occupational exposure injury                              | 70.5                 | 77.2                     |
| Follow waste management protocols   | 79.4                 | 57.9                     |

## DISCUSSION

### *Hand hygiene*

In our study, correct knowledge about hand hygiene found in interns was 84.1% and clinical residents 93.3% and this knowledge was translated into practice by 83.6% interns and 84.1% clinical residents. Regarding interns a similar study was done by Mahfouz et al, they found that overall hand hygiene noncompliance was 41%. Hand hygiene noncompliance increased from 16.9% after patient care to 59.3% before patient contact and 72% before an aseptic procedure.<sup>12</sup> Hand hygiene noncompliance was higher among physicians 54.8% compared to nurses 32.6%.

Another study titled, compliance with universal precautions: knowledge and behavior of students and residents in a department of obstetrics and gynecology, done at USA showed that 30 residents (100%) knew appropriate barrier equipment required for each type of procedure performed.<sup>18</sup> The study concluded that knowledge regarding universal safety precautions was nearly 100% but the overall observed compliance was just 89%. Compliance of universal safety precautions was better among students (96%) than among resident doctors (88%). Compliance with universal precautions is inversely related to years of experience. In a study done by Gebresilassie and coworkers they observed that 61.5% HCW always washed hands after patient contact.<sup>13</sup>

Mukharjee et al observed that most of the participants conveyed knowledge of the importance of hand washing 90%.<sup>14</sup> The practice of was poor (54.7%) among the participants who had correct knowledge of it. In a study done by Al Zahrani and co-workers among interns of medical colleges, researchers found that overall knowledge regarding infection control was 73%, awareness about hand washing technique was 96.5%, and knowledge regarding hand hygiene 91.6% and 96.5% received training regarding hand washing.<sup>15</sup>

### *Personal protective equipment*

In our study, the knowledge about the importance of wearing the gloves was 95.5% among interns and 95.4% among residents and facemask, eye wear was 78.5% among interns and 92% among residents, it was adequate, but in practice 78.5% interns and 71.5% residents were seen to use gloves and apron during all invasive procedures, whereas 59.8% intern respondents and - 60.2% resident respondents were observed to be using face-mask during invasive procedures. Shuvankur found that in their study, the knowledge relating the use of goggles was found to be poor (54.6%) here it is 78.5% in interns and 92% in residents.<sup>14</sup>

Helfgott et al found that compliance was best for use of latex gloves (100%). Here also it was 100% compliance for latex gloves.<sup>18</sup>

Jawaid and co-workers found that 56.7 % changed gloves for each patient. Here it was 86% for interns and 62% for clinical residents.<sup>16</sup>

Oguamanam and co-workers found that over half 58.2% respondents routinely use aprons while working with patients requiring a procedure.<sup>24</sup>

### *Occupational exposure management*

In our study, knowledge about needle stick injury was 95.5% among interns and 97.1% among resident doctors.

Only 70.5% interns and 86.3% resident doctors knew that needles should not be recapped and 20.6% interns and 35.5% resident doctors practiced, knowledge about post exposure prophylaxis regimen, time of initiation and duration of regimen was also poor. Viswanathan et al found that 29.4% knew whom to contact in case of accidental exposure. Of all the respondents, only 26% knew the duration of post exposure prophylaxis.<sup>20</sup> Mukharjee et al found that 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.<sup>14</sup> Khapare and co-workers it was observed that 11.7% interns and 18.37% residents had a history of needle stick injuries in the past three months.<sup>21</sup> Among interns, 50% consulted physician, 50% started ART while other 50% did nothing. 100% residents had immediate hand wash, 66.7% consulted physician, and 77% started ART.

### *Biomedical waste guidelines*

Here there was a major observation; the knowledge of interns was 81.25% for disposal of gloves and 70.5% for disposal of sharps whereas among first year resident doctors, it was 72.7% for gloves and 70.4% for sharps. Hence it is indicated that the knowledge is more in interns due to conduction of lectures of biomedical waste management in undergraduate curriculum. Also for practice, 79.9% interns practiced biomedical waste management protocols and only 57.9% of first year clinical resident doctors practiced the waste protocols. This was found similar to the research which was conducted and titled that compliance with universal safety precautions: knowledge and behavior of residents and students in a department of gynecology and obstetrics done at USA concluded that, compliance regarding universal safety precautions was better among students than residents and compliance universal safety precautions was inversely related to the years of experience.<sup>18</sup>

## CONCLUSION

In this study, we assessed the knowledge and practices of universal safety precautions under the four broad categories – hand hygiene, personal protective equipment, occupational exposure management and biomedical waste

management. We observed that overall knowledge regarding importance of hand washing, wearing gloves, risk of needle stick injury, disposal of biomedical waste were satisfactory. There was poor response regarding the steps of hand washing recapping of needles. Insufficient practical training and supervision and lack of interest may be the reasons for poor practice. Interns have fresh knowledge about biomedical waste management; residents should be given more knowledge regarding biomedical waste management protocols. Also resident doctors should be motivated for practicing universal safety precautions as their compliance regarding USP is low as compared to interns. Besides many of the interns also prepare for their post graduate entrance examinations and hence the neglect universal safety precautions due to study load. Also workshops for resident doctors must be conducted so as to keep themselves updated regarding the new emerging infections and rules of government regarding biomedical waste management. Good clinical practices must be inculcated right from the undergraduate level and needs constant motivation and supervision by senior teachers. Universal safety precautions are to be followed by all health care workers and at all levels of healthcare system.

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#### REFERENCES

- Gerber Ding JL. Incidence and prevalence of human immunodeficiency virus, hepatitis b virus, hepatitis c virus and cytomegalovirus among health care personnel at risk of blood exposure: final report from longitudinal study. *J Infect Dis.* 1994;170:1410-7.
- Siegel JD, Rhinhert E healthcare infection control practices advisory committee, 207 guidelines for isolation precautions. Available at: <http://www.cdc.gov/ncidod/dhqp/pdf/isolation2007pdf>. Accessed on 24 February 2021.
- Guidelines for isolation precautions. Available at: <http://www.cdc.gov/ncidod/dhqp/pdf/isolation2007pdf>. Accessed on 24 February 2021.
- Recommendations for protection against viral hepatitis. *Morb Mortal Wkly Rep.* 1985;34(22):75-8.
- Aids epidemic update. December 2003 Geneva, joint United Nations programme on HIV and world health organization. Available at: <https://www.who.int/hiv/pub/epidemiology/epiupdate2005/en/>. Accessed on 24 February 2021.
- Alagoz AZ, Kocasoy G. Determination of the best appropriate management methods for the healthcare wastes in Istanbul. *Waste Manag.* 2008;28:1227-35.
- World health organization. The world health report 2002: reducing the risks, promoting health life world health organization, Geneva. Available at: World health organization. The world health report 2002: reducing the risks, promoting health life world health organization, Geneva. Accessed on 24 February 2021.
- Center for disease control and prevention. Recommendations for preventing and control of hepatitis c virus. *MMWR.* 1998;47(19):1-39.
- Sridhar MR, Bhoopati S, Lodha R. Standard precautions and post exposure prophylaxis for prevention of infection. *Indian J Pediatr.* 2004;71:617-26.
- Boozary A, Dugani SB. Institute of social justice and medicine: developing a think tank to promote policy formation. *Clin Invest Med.* 2011;34: 259.
- Prüss-Ustün A, Rapiti E, Hutin Y. Estimation of the global burden of disease attributable to contaminated sharps injuries among health-care workers. *Am J Ind Med.* 2005;48: 482-90.
- 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. *Int J Infect Dis.* 2013;17:729-32.
- Gebresilassie A, Kumei A, Yemane D. Standard Precautions Practice among Health Care Workers in Public Health Facilities of Mekelle Special Zone, Northern Ethiopia. *J Comm Med Health Educ.* 2014;4:286.
- Mukherjee S. 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 Med J.* 2013;28(2):141-5.
- 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;2:317-23.
- Jawaid M, Iqbal M, Shahbaz S. Compliance with Standard Precautions: A long way ahead. *Iranian J Pub Health.* 2009;38(1):85-8.
- Salehi, Garner. Occupational injury history and universal precautions awareness: a survey in Kabul hospital staff. *BMC Infect Dis.* 2010;10:19.
- 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. *Infect Dis Obstet Gynecol.* 1998;6:123-8.
- Sari SYI. 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;7:4.
- 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*. 2011;1(2):51-6.
21. 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. *Int J Health Sci Res*. 2012;1(2):95-100.
  22. Dasa M, Ojahn J. Practices of Universal Precautions among the Interns of Gauhati Medical College: a cross sectional study. *Indian J Basic Appl Med Res*. 2016;5(2):805-15.
  23. Saddha W. Practice of USP among health care workers. *J Nat Med Assoc*. 2006;98(5).
  24. Enwere OO, Diwe KC. Knowledge, perception and practice of injection safety and healthcare waste management among teaching hospital staff in south east Nigeria: an intervention study. *Pan Afr Med J*. 2014;17:218.

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