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POTENTIAL RISK OF OCCUPATIONAL BLOOD HAZARDS AMONG STUDENTS AT THE HEALTH COLLEGES IN PRINCESS NOURAH BINT ABDULRAHMAN UNIVERSITY

By

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Abstract

Introduction: Clinical trainee students are potentially at high risk of exposure to blood-borne pathogens because of their underestimation of the risk of blood exposure and limited clinical experience. **Aim of work:** To assess the potential risk among health colleges' students at Princess Nourah bint Abdulrahman University (PNU) regarding occupational blood hazards (OBHs), to determine the frequency of their exposure to OBHs incident during their clinical training and to assess their awareness towards potential risks of blood hazards, vaccination, and safety measures. **Materials and methods:** A questionnaire based on a cross-sectional study was carried out among 565 clinical trainee students of health colleges from December 2017 to March 2018. **Results:** The majority (83%) of the students had poor knowledge score. More than half of them did not receive any educational material or even orientation on standard precautions. Almost half of them had received HBV vaccine. Nearly 11% of them stated that they had been exposed to incident of blood hazards at least once during

their clinical practice, whereas only 7.6% of them reported the incident to their corresponding institute. **Conclusion and recommendations:** The study showed that there was inadequate knowledge of the students and their non-compliance with safety measures which necessitate the needs for effective curricular and extracurricular program with systemic evaluation of students about potential risk of occupational blood hazards. Further post educational clinical trial survey as well as direct observational study is needed.
Key words: Occupational hazards, HBV, HCV, HIV, Saudi Arabia, Medical students and Blood hazards

Introduction

Occupational health and safety among health care worker (HCWs) is an important global issue for its high morbidity and mortality of exposed workers during their routine work of caring for patients, or during medical procedures, such as contaminated instruments, tooth extraction, insertion of intravenous (IV) line, and contact with blood and body fluids (Al-Hazmi, 2015). Exposure to occupational blood hazards can end up with a variety of serious consequences for person involved starting from distressing anxiety up to chronic illness that may lead to premature death (Yimechew Z et al., 2013). Acquiring serious blood-borne infections such as HCV, HBV, and HIV among susceptible HCWs and apprenticing students is usually anticipated from percutaneous and mucocutaneous incident exposure to contaminated blood or other body fluids (Alam, 2002). Worldwide, such occupational incidents had been implicated in approximately 2.5% of HIV infections and 40% of HCV and HBV infections among HCWs (Samargandy et al., 2016).

In 2002, World Health Organization (WHO) estimated that among 35 million HCW's worldwide, 3 millions are exposed to blood borne pathogens each year (Alam, 2002 and Al-Hazmi 2015). Approximately, sharps exposures may result in 500 HIV, 70,000 HBV, and 15,000 HCV approximately every year (Samargandy et al., 2016).

Although dearth epidemiological studies had been reported from Saudi Arabia regarding the incidence of exposure to occupational blood hazards (OBHs) including percutaneous injuries among health care providers, such data is lacking specially from the central region of the country. Samargandy et al (2016) reported that the incidence of OBHs among health care providers in King Abdulaziz University, Jeddah was approximately 43 staff per 1000 individual per year. In another study, a

total of 73 self-reported percutaneous injuries had been documented during a period of two years (2002-2003) by HCWs in one of secondary care hospital in Buraidah , Saudi Arabia;nurses were involved in 66% of instances, physicians in 19%, technicians in 10%, and nonclinical support staff in 5.5% (Jahan S, 2005).

Standard precautions (SPs) guidelines are designed by Centers for Disease Control (CDC) (1988) to reduce and protect HCWs and their patients (Siegel et al., 2007). The principles of SPs include: proper hand washing, using personal protective equipment (PPEs) e.g. surgical masks, gloves, protective eye goggles, correct handling and disposal of needles and sharps, effective cleaning, management of waste, usage of appropriate disinfectants, decontamination and sterilization of equipments, instruments and environment (Haridi et al., 2016).

The clinical trainee of health colleges are at higher risk of exposure to blood-borne infections than health professional (Yimechew Z et al., 2013); because of their limited clinical experience, restricted training, insufficient knowledge, and the underestimation of the risk of blood exposure (Mandourh et al., 2017).

Aim of work

To assess the potential risk among health colleges' students at Princess Nourah bint Abdulrahman University (PNU) regarding occupational blood hazards (OBHs), to determine the frequency of their exposure to OBHs incident during their clinical training and to assess their awareness towards potential risks of blood hazards, vaccination, and safety measures.

Materials and methods

Study Design: This is a cross-sectional study.

Place and duration of the study: The study was conducted on 565 students of Health College's campus in PNU including the college of Medicine, Dentistry, Pharmacy, Nursing, and college of Rehabilitation Sciences from December 2017 to March 2018.

Study Sample: Students of clinical stages of each college were selected to be included in the study after taking their acceptance to participate.

Study methods: A structured questionnaire was created after a thorough review of literature. Our own experience has assessed the reliability and validity of the survey (Cronbach's alpha was found to be 0.81). The question-

naire sheets included 60 questions were distributed among the health colleges' students. The questionnaire was divided into three parts. The first part includes the socio-demographic data of the students (age, parent's education, college, academic year, and duration of clinical practice). Personal history of exposure to the potential risk of blood hazards of each participant, such as the participant's status of immunization, and the incidence of exposure to the risk OBHs, if any, is noted. The second part includes 40 questions inquiring about blood hazards, such as blood borne infections, standard precautions (SPs) to avoid its hazardous risk. The third part includes 9 questions that were formulated to assess the participant's perception and compliance towards the SPs of potential blood hazards including percutaneous injuries, such as usage of personal protective equipments.

Consent

Verbal consent was taken after explaining the objective of the study to the participants.

Ethical approval

The study was approved by Princess Nourah bint Abdulrahman University (PNU) Research and Ethical Committee. Institutional review board (IRB) log number: 17-0205.

Data Management

Data was entered and analyzed in Microsoft Excel spread sheet and SPSS v21. Data was verified for completeness, and accuracy. Descriptive statistics included were means, standard deviations, median and interquartile ranges. Differences between means were tested statistically using t test, and ANOVA as appropriate. The association between qualitative variables was tested by chi-square test. Pearson Correlation was used to assess the degree of relationship among socio-demographic characteristics, knowledge score. The cutoff point for the good knowledge score was set at values above 60% of the total score. p-value <0.05 was considered statistically significant.

Results

1.1 Socio-demographic profile of the studied group:

This study was conducted on 565 PNU health colleges' students attending clinical courses from all academic years. Their age ranged from 19 to 25 years (means 21.9± 1.2 years).

Table 1: Socio-demographic characteristics of the studied group

Socio-demographic variables	No (%)
Age/years	
≤21	269 (38.8%)
>21	346 (61.2%)
Mother education:	
Bachelor and higher	299 (52.9%)
Lower than high school	230 (40.7%)
Illiterate	36 (6.4%)
Father education	
Bachelor and higher	366 (64.8%)
Lower than high school	175 (31.0%)
Illiterate	23 (4.1%)
Do you have any member of your family who is working in the health field?	
NO	321 (56.8%)
Yes	244 (43.2%)
College:	
Medicine	94 (16.6%)
Nursing	108 (19.1%)
Health & Rehabilitation Science	114 (20.2%)
Pharmacy	109 (19.3%)
Dentistry	140 (24.8%)
Academic Year	
First	0 (0%)
Second	6 (21.4%)
Third	32 (15.5%)
Fourth	29 (17.3%)
Fifth	9 (12.3%)
Internship	16 (28.6%)
Duration of clinical training /years:	
0-1	237 (41.9%)
2-3	258 (45.7%)
> 5	70 (12.3%)

Table 1 showed that more than 61% of the students were above 21 years, more than half of the respondents' parents education were bachelor and higher education, about half (56%) of the students had a member of their family was working in the health field, 24% were coming from Dentistry, 28.6% were in internship and 45.7% had a duration of training from 2-3 years.

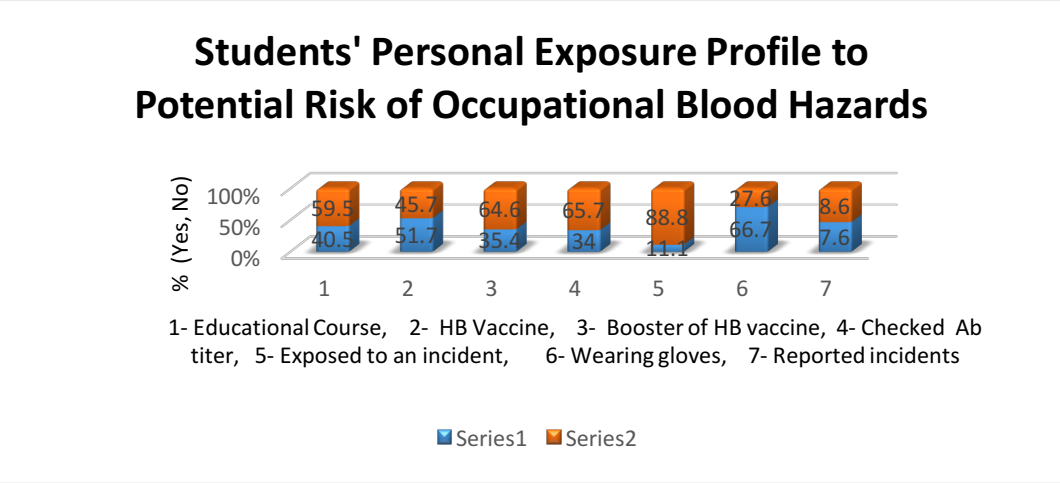

Figure (1): Personal data on potential risk of occupational blood hazard.

Series 1: Percentage of students who answered (Yes).

Series 2: Percentage of students who answered (NO).

Figure 1 showed that more than half (59.5%) of the participants did not receive any educational material or even orientation on safety practice of OBHs. The majority of the students (66.7%) stated that they used to wear gloves. Sixty three students (11.1%) stated that they had exposed to at least one of the blood hazards during their clinical practice, whereas only 7.6% of them had reported the incident to their corresponding institute.

The highest incident (No=18, 16.7%) was reported by nursing students and the lowest was reported by medical students. Although approximately half of them had received HBV vaccine, 65.7% of them were not aware about their immune status, and almost one third of them had taken booster dose of the vaccine and checked their antibody titer (Results are not tabulated).

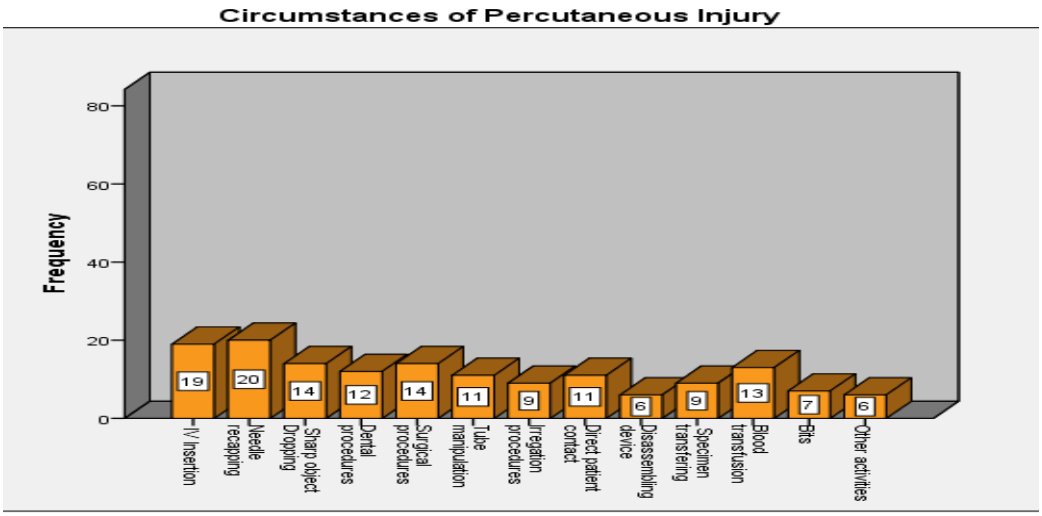

Figure (2): Circumstances which lead to the exposure to blood hazards.

Figure 2 showed that the commonest procedure by which the studied group were exposed to blood hazards were needle recapping and IV insertion.

1.2 Knowledge of OBHs and its Safety Measures:

Table 2: PNU health colleges students' knowledge towards occupational blood hazards :

Representative Items for Knowledge Assessment	Correct answer
	No (%)
1. Have you ever heard about standard universal precaution guidelines of blood hazards?	295 (52.2%)
2. The first precaution to be taken after accidental exposure is to promote active bleeding at site of injury.	223 (39.5%)
3. Universal precautions are applied to patients with HIV& HBV only.	244 (43.2%)
4. Hand washing is the single most effective way to prevent the spread of infections.	275 (48.7%)
5. Use of gloves replaces the need for hand washing.	248 (43.9%)
6. The correct route of disposal of needles and other sharps is by disposing it into a closed box after injection.	269 (47.9%)
7. Gloves and masks can be re-used after proper cleaning.	349 (61.8%)
8. To avoid needle stick injuries, needles should be recapped/bent after use.	171 (30.3%)
9. Is it more likely to become infected with HIV than with HBV as a result of single needle stick injury with a contaminated needle?	52 (26.9%)
10. Acute infection of HBV may cause nonspecific symptoms.	201 (35.6%)
11. Vaccination is the most predictable way for prevention of Hepatitis B.	104 (18.4%)
12. Are you aware of post accidental blood exposure prophylaxis?	173 (30.6%)
13. There is effective anti-HCV vaccine.	171 (30.3%)
14. Standard hand washing includes washing of both hands and wrists.	262 (46.4%)
15. Blood spills should be cleaned up promptly with sodium hypochloride.	199 (35.2%)
16. Alcohol hand rub substitutes hand washing even if the hands are soiled.	171 (30.3%)
17. Washing with soap and water for 5 minutes is my 1st step after contact with infective material.	245 (43.4%)
18. The correct route of disposal of needles and other sharps is by bending the sharps and put in dustbin.	201 (35.6%)
19. The first precaution to be taken after accidental exposure is wash in running water and detergent.	230 (40.7%)
The total score of knowledge *(*14.4±6.4)	
Poor knowledge	83%
Acceptable knowledge	17%

Table 2 showed that the majority (83%) of the students had poor knowledge score (< 60%). Surprisingly, few of them (18.4%) knew that vaccination is the most predictable way for preventing HBV. Only 30.3% of them knew that bending or recapping of needle is a good practice for avoiding needle sticks injuries. Moreover, less than half of them knew that gloves must not replace hand washing, and promoting active bleeding at site of injury is the first precaution to be taken after accidental percutaneous injury.

Although our study results pointed out that the acceptable knowledge score was almost the same between different health colleges' students, nursing students had the highest good score (24.3%).

Our results showed that the acceptable knowledge score (>60%) was associated significantly with the participants' mother education, as well as, duration of the students' clinical practice ($p<0.001$), while there was no significant association with colleges' program, age, father education, nor academic year.

Moreover, high significant association was found between the acceptable knowledge score and receiving HBV vaccination, and the good safety practices such as wearing gloves during clinical training ($p<0.001$). Surprisingly, it was found no significant association between acceptable knowledge score and attending education courses about blood hazards and standard precautions, receiving the vaccine booster dose, checking the Anti HBs titer, or self-reported percutaneous incidents (Results are not tabulated)

1.3 Subjective Self-assessment of Compliance with Hygienic Measures:

Table (3): Perception and attitude towards occupational blood hazards and its safety practice.

Statements	Responses				
	Strongly Disagree No (%)	Disagree No (%)	Natural No (%)	Agree No (%)	Strongly Agree No (%)
1. Health providers are at risk of blood borne infections (HIV/ AIDS, Hepatitis B, Hepatitis C ...).	50 (8.8%)	28 (5.0%)	136(24.1%)	128(22.7%)	221(39.1%)
2. Impaired ability to palpate veins is the most common cause that prevents wearing protective gloves.	48 (8.5%)	98 (17.3%)	296(52.4%)	82 (14.5%)	41 (7.3%)
3. Personal protective equipments such as masks and head caps provide protective barriers against infection.	30 (3.5%)	56 (9.9%)	145(25.7%)	177(31.1%)	157(27.8%)
4. Emergency situations prevent the use of personal protective equipments.	82 (14.5%)	109(19.3%)	192(34.0%)	136(24.1%)	44 (7.8%)
5. Skin irritation and contact allergies are the most common causes that prevent the use of latex gloves.	28 (5.0%)	83 (14.7%)	201(35.6%)	162(28.7%)	89 (15.8%)
6. Implementation of hygienic measures and vaccination protect health workers from possible risks associated with their work.	15 (2.7%)	37 (6.5%)	184(32.6%)	169(29.9%)	106(28.3%)
7. Evaluation of anti HBs antibody titter regularly is essential.	25 (4.4%)	33 (5.8%)	199(35.2%)	152(26.9%)	156(27.6%)
8. Insufficient training on occupational health and safety is the most common cause that prohibits the use of personal protective equipments.	25 (4.4)	51 (9.0%)	189(33.5%)	200(35.4%)	94 (16.6%)
9. The first precaution to be taken after accidental exposure is wiping with alcohol or any other anti-infective agents.	57 (10.1%)	71 (12.6%)	182(32.2%)	180(31.9%)	75 (13.3%)

Table 3 showed analysis of the students' perception regarding potential risk of occupational blood hazards and the reasons of noncompliance for usage of personal protective equipments during clinical training. The percentage of students who appreciated the causes that might prevent wearing gloves during clinical practice for insufficiency of educational training, skin irritation, emergency situation, and im-

1.4 Source of information:

Our study found that school/college was the most important source of information (92%) for occupational blood hazards and universal safety precautions awareness of PNU students. Unfortunately neither scientific meeting, training courses, nor medical journals had fulfilled their expected role for improving the students' knowledge (9.6%, 13.6%, and 10.6% respectively). The training courses were received by health colleges' students of Nursing, Medical, Pharmacy, Dental, and Rehabilitation Science consequently in descending order (Results are not tabulated)

Discussion

Occupational diseases burden is increasing and training in occupational health and safety is essential (Siegel et al., 2007). Epidemiological data on awareness towards OBHs and its safety measures among junior trainee healthcare providers is essential for determining the defects which need to be improved in their curriculum program to reduce their potential risk of exposure to OBHs.

1. Potential Risk to OBHs among Health Colleges' Students:

Blood-borne infections including HBV, HIV, and HCV constitute a foremost occupational hazard for the trainee students and healthcare providers, where individuals continuously handle blood and other body fluids.

In our study, 11.1% of the participants had stated that they had been exposed to one or more of OBHs during their clinical practice, while only 7.6% of them reported their incidents to their corresponding institute (Figure 1). It seems that lack of knowledge of the participants regarding the importance of reporting their incident is the main reason of this low number of reporting incidents. This necessitates the high need for emphasizing the importance of such self-reporting among the students who will be enrolled in clinical training courses. In a similar study that was conducted on medical clinical trainee students from eleven universities in Europe and UK, 34% of them had been exposed to one of blood or body fluids hazards (Salzer et al., 2011). A higher incidents was reported among Lima, Peru medical students, as 46.7% of them suffered at least one incident during their clinical training (Ghomraoui et al., 2016).

Our work also found that nursing students had the highest incidence of exposure OBHs (16.7%) in contrast to medical students who began treating patients only in internship (5.3%). This was in agreement with the results detected by Hussain and his colleagues (2016). In another local study which was conducted on hospital staff of King Abdulaziz University in western region of Saudi Arabia, the estimated incidence of their exposure to blood or body fluids hazards was 1093 staff per year, and 92% of these incidents caused through percutaneous exposures with highest rate of exposure to nursing staff and students (45.6%) (Samargandy et al., 2016).

Exposure of HCWs to the risk of OBHs can occur through several medical care procedures and instruments as indicated in the literature. In this study intravenous injection and needle recapping were the most frequent self-reported pricking agent (Figure 2). Similar results were also found in previous study conducted by Jahan (2005). According to WHO guidelines since 1987 and CDC standards since 1988, needle recapping is banned in order to minimize the risk of transmission of blood borne pathogens (Taylor et al., 2010).

2. Students' Compliance with HBV Vaccination:

This study found that 65.7% of the students were not aware about their HBV immune status and only half of them (51.7%) had received HBV vaccine with almost third of them receiving complete vaccination of three doses (Figure 1). Almost similar percentage of vaccinated students who had received the vaccination was reported in previous local studies conducted in King Khaled University hospital (Ghomraoui et al., 2016), and in Aljouf University (Al-Hazmi, 2015). While, a higher percentage of vaccinated students (88.9%) was reported among dental students in Hail region of Saudi Arabia (Haridi et al., 2016), which was explained by receiving of adequate training courses and the availability of mandatory free of charge vaccination to all health care workers. A lower percentage was reported in a study conducted in Serbia, as only 10% of clinical trainee medical students were immunized by HBV (Marusic et al., 2017).

3. Students' Compliance with SPs and Usage of PPE:

Educational training on safety procedures include wearing personal protective tools such as gloves which are

necessary for prevention of OBHs among students who will be enrolled in different health colleges. In the current work, 58% of participants were able to identify that implementation of SPs will protect the HCWs from OBHs. Majority (66.7%) of this study participants stated that they wore gloves. When the respondents questioned about indications for the use of gloves, they said that scenario such as avoiding risk of contact with body fluids or blood especially when HCWs have cutaneous lesions is one of major indicator to wear gloves (Table 4). This in consistent with other past studies reported by Tavolacci et al. (2008) and Kulkarni et al. (2013)

In the present study, the participants agreed that barriers of non-compliance of HCWs to use PPE might be skin irritation and allergy from used gloves, insufficiency of training, emergency situation, and interference of glove with accuracy of clinical examination in consequent (44.5%, 42%, 32.9%, and 21.8% respectively) (Table 4). Similar reasons were also indicated by Garuspakowska et al., (2017) in a nationwide study conducted on polish HCWs. Unlike, Yimechew et al. (2013) study in Ethiopia found that lack of PPE is the major reason for not using them.

4. Students' Knowledge towards OBHs and its Safety Measures:

The current work found that students' knowledge score towards OBHs and its safety precautions were insufficient, as only 17% of them had got a score above 60%. Although similar low knowledge score for SPs was reported among medical students in other regional studies (Shariati et al., 2007 and Amin et al., 2013)

Also our work detected that knowledge score varied according to the particular specific areas as the highest scores were noticed for the knowledge of standard precautions related to use of disposable gloves (61.8%), hand washing (48.7%), and disposal of needles and sharps objects (47.9%), while knowledge related to action taken post accidental exposure prophylaxis, risks of needle stick injuries, and vaccination for HBV showed the least score (30.6%, 26.9%, 18.8% respectively) (Table 2). This is consistent with Tavolacci et al. (2008) who found that the highest knowledge scores were attained for items concern with hand hygiene and SPs and the lowest score was for knowledge of nosocomial infections.

Despite of the poor knowledge score of this study group regarding

potential risk of OBHs and their poor compliance for hand hygiene, completing the booster dose of HBV vaccine and checking their immune status, they had a little fair compliance in wearing gloves (66.7%) (Figure 1). Likewise discrepancy between the knowledge score and the compliance with SPs was reported by Haridi et al. (2016) who tried to explain such discrepancy with the obligatory roles of their institution that necessitate the use of PPE including gloves. Also, they assumed that this discrepancy may reflect the tendency of individuals to inflate their socially desirable behaviors when self-reporting. Finally, this point out the necessities of educational awareness sessions especially during their clinical practice

Furthermore, our study found a significant association between good knowledge score of the students and their mother educational level, duration of their clinical training, receiving of vaccination, and safety practices. However surprisingly, there was no significant association between this good knowledge score and their attendance of educational courses (Table 3). In contradictory, Telali and Choudhury (2006) found that occupational exposure to sharps and splashes among healthcare providers in India was inversely related to training. Similar finding was reported in other studies conducted in Austria, Germany and UK, which found improvement in knowledge with conducting training courses (Elliott et al., 2005). This reinforce the need for setting educational training programs early in the curriculum of PNU health colleges' students.

5. Students' Source of Information towards OBHs:

The present study found that school/college was the most important source of students' information regarding universal standard precautions (92%) (Results are not tabulated) Kulkarni et al. (2013) found in a similar study that only 19% of medical students receiving their information from academic textbooks. In agreement to our results, Tavolacci et al. (2008) reported that curricular teaching was the main source of information about standard universal precautions and they emphasized that nursing students need more curricular training courses than other health colleges' students.

Conclusion and recommendations

This study outcome point out to a serious potential risk of blood-borne

infections among health colleges' students at PNU. As it revealed that their knowledge towards potential risk of OBHs and its universal safety measures were inadequate and this implies a poor compliance to the universal precautions. Hence, an effective curricular and extracurricular training program with systemic evaluation of students about occupational risks and safety practices should be reinforced early in the curriculum of health colleges' students with emphasizing on the importance of HBV vaccination and immunization rechecking. Testing for serum HBs antibody titer post vaccination after completion of three injections is recommended by CDC for checking its effectiveness, hence health trainee students should not be neglect checking it regularly to guard against potential risks of OBHs. Hence, we suggest that upon admission to medical schools, history of vaccination against HBV and its serological markers should be determined. In addition, raising the awareness of reporting percutaneous injuries among clinical trainee students in their training places and guide them with its procedures. Further post educational clinical trial survey as well as another direct observational study are needed to determine knowledge and compliance of the students after conducting educational training courses and to estimate their real compliance with SPs guidelines.

Conflicts of interests

The authors have no conflict of interest to disclose.

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