

Developing Proactive Protocol for Blood-borne and Body Fluids Infections Prevention among Students of Health Professional Colleges in King Khalid University

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Abstract

Background: Exposure to blood and body fluids is an important hazard for health professional students, which places them at a high risk for blood-borne infections. They are exposed to blood-borne diseases most commonly through accidental needle sticks and sharp injuries. Blood-borne infections are associated with significant morbidity and mortality. The introduction of safety measures guide to prevent accidental blood-borne infections in health professional college curricula are essential. Hence, the present **study aims** develop proactive protocol for prevention of blood borne and body fluids infections among nursing, medical, and dental students in King Khalid University. **Setting;** the study was conducted at Faculty of Medicine, Dental, and Nursing in University Center for the Study of Female Students at King Khalid University, Saudi Arabia. **Subjects;** a purposive sample of 300 female students, 130 from nursing, 126 from medical, and 44 from dental program were included in the present study. **Tool;** a questionnaire sheet developed by researchers based on reviewing related literature and consists of five parts was used for data collection. **Results and Conclusion;** the majority of studied participants reported the needle-stick injuries occur when drawing intravenous blood and giving patient intravenous injection, the primary factor lead to sharp injures is broken some ampoule and using sharp instruments, they need to know preventive and precautions to prevent blood-born infection and equipment uses to avoid it. Also it was found no significant difference between participant students regarding their attitude toward standard percussion and preventive measures for blood borne infection. **Recommendations;** Findings of the present study have important implication for developing a Proactive Protocol of Blood-borne and Body Fluids Infections prevention among students of nursing, medical, dental colleges. This focused on proactive and controlling blood-borne infection diseases, needle-stick, and sharp injuries and lead to a healthy life of students.

Key words: proactive protocol, blood-borne infection, Needle stick injuries, Sharps injuries, health professional collages

Abbreviations: HCWs healthcare workers, HIV immunodeficiency virus, HBV hepatitis B virus, HCV hepatitis C virus, NSISIs needle stick & sharp injuries, OSHA Occupational Safety and Health Administration, PEP post-exposure prophylaxis, CDC Disease Control and Prevention, SPs standard precautions, UP universal precautions, BBFEs blood and body fluid exposures, PPE personnel protective equipment.

1. Introduction

Worldwide, occupational exposure to blood and body fluids is a significant threat for Health Care Workers (HCW), which places them at a high risk for blood-borne infections⁽¹⁾. Not only healthcare workers but also for health professional students need to pay attention to these risks⁽²⁾. They are risky for human immunodeficiency virus (HIV), hepatitis B virus (HBV), and hepatitis C virus (HCV) infections at their practical training. Blood-borne and body fluid infections are a great burden to healthcare workers around the world because of the high probability of exposure to blood in the workplace⁽³⁾. It constitutes one of the most important causes of morbidity and mortality⁽⁴⁾. The Centers for Disease Control and Prevention⁽⁵⁾ has estimated that as many as 384,325 HCWs are exposed to blood and body fluids via sharp and mucocutaneous injuries per year. HCWs are exposed to blood-borne diseases most commonly through accidental needle sticks, cuts from scalpels and glass, and splashes of infected body fluids⁽⁶⁾. The transmission of blood-borne pathogens may occur through percutaneous (needle-stick injury or cut with a sharp object) and mucocutaneous (intact or non-intact skin, and contact with mucous membranes) routes, and sometimes through exposure to other body fluids⁽⁷⁾.

Needle stick injuries (NSIs) are defined as the introduction of a hollow-bore needle into the body of a healthcare worker with the possibility for contamination with blood or other potentially infectious material. Sharps injuries relate to injuries caused by lancets, scalpels and glass, as well as hollow-bore needles. NSIs and sharps injuries can result in the transmission of disease. According to the Royal College of Nursing⁽⁸⁾, there are more than 20 blood-borne infections that can be contracted following a NSI or sharps injury. Almost 90 % of all the needle stick injuries occurred for health care workers of third world countries where there is lack of knowledge, resources and training. Two millions needle stick injuries are

reported in health care providers every year ⁽⁹⁾. These injuries not only potentiate health consequences but also cause psychological and emotional distress for those students ⁽⁶⁾.

In clinical placement, medical, dental, and nursing students have a high risk for occupational exposure to blood-borne pathogens because they may have insufficient background knowledge to recognize the level of risk posed by a particular patient and their inexperience with procedural skills and infection control procedures ⁽¹⁰⁾. Needle stick/ sharp injuries (NSISIs) are the most important problems for health professional students as they increase the risk of spread of infection and diseases ⁽¹¹⁾. Therefore, The Needle Stick Safety and Prevention Act were developed to prevent occupational exposure to blood-borne pathogens. In 1991, the Occupational Safety and Health Administration issued a standard regulating occupational exposure to blood-borne pathogens ^(10, 12).

Efforts to avert exposures consist of teaching universal precautions to health care providers ⁽¹³⁾. Internationally, standard universal precautions have been regarded as fundamental in the control and prevention of infection and are considered an effective means of protecting healthcare practitioners, patients and the public. In addition, they are regarded as effective in reducing the healthcare-associated infections ⁽¹⁴⁾. Compliance with prescribed 'universal precautions' has been shown to reduce the risk of acquiring blood borne viral infection. In addition, there is a set of guidelines to prevent exposure, but unfortunately, despite the simplicity and clarity of these guidelines, compliance with these guidelines is reported low ⁽¹⁵⁾.

A single needle stick injury can cost anywhere, from a few hundred thousand to a million dollars. More important than the economic factors of blood and body fluid exposure is the psychological trauma to the individual as well as the co-workers and family members. Whereas the cost of follow-up for a high-risk exposure per needle sticks injury without infection is generally in the range of \$3,000 ⁽¹⁶⁾. Millions of dollars invested in follow up and treatment after exposure to blood and body fluid can be saved with proper planning for funding to purchase safe needles boxes and equipment ⁽¹⁰⁾.

Reported factors that contribute to non-compliance with standard precautions were lack of knowledge, lack of time, forgetfulness, negative influence of the inadequate equipment on practical skills, uncomfortable equipment, skin irritation, and lack of training, conflict between the need to provide care and self-protection, and distance to necessary equipment or facility ⁽¹⁷⁾. Thus, it is crucial to develop an effective strategy to monitor and manage needle stick injuries (NSIs) among health professional students ⁽¹⁸⁾. Several preventive measures have been proposed including pre-exposure (e.g., education, use of standard precautions, use of needle protective devices, and vaccination) and post-exposure (e.g., post-exposure prophylaxis and early detection of disease) ^(1, 19).

2. Significance of the study:

Blood-borne infections are associated with significant morbidity and mortality. These infections carry a great burden to healthcare workers specially students of health professional colleges because of the high probability of exposure to blood and body fluids during their clinical training ⁽²⁰⁾. The risk of seroconversion after a single percutaneous exposure to infected blood ranges from 39.0% for hepatitis C to 37% for hepatitis B and to 4.4% for HIV. According to the World Health Organization, 16000 Hepatitis C (HCV), 66000 Hepatitis B (HBV) and 1000 cases of HIV may have occurred worldwide in the year 2000 among health care worker especially nurses through their exposure to needle stick injuries. Published reports on the incidence of NSIs in nursing and medical students probably underestimate their actual frequency because many NSIs are not promptly or accurately reported. Prompt reporting is essential for appropriate risk assessment, treatment, post-exposure prophylaxis (PEP) and follow-up. In health professional colleges, lack of practical experience and/or technical expertise leaves medical and nursing students at high risk of acquiring blood-borne infections during their training. Most students are eager to learn about preventive measures for blood borne infections. The introduction of safety measures to prevent accidental blood-borne infections in health professional college curricula is essential. Hence, the present study aims to develop proactive protocol of blood borne and body fluids infections prevention among nursing and medical students.

3. Aim of study:

Study aimed to develop proactive protocol for prevention of blood borne and body fluids infections among nursing, medical, and dental students in King Khalid University.

4. Study objectives:

1. To identify factors causing needle-stick and sharps injuries among health professional students during their clinical practice.
2. To assess students' knowledge and attitudes regarding NSIs, blood-borne and body fluid infection to assess students' learning needs.
3. Based on the identified factors and learning needs assessment' results, the researchers will develop a proactive protocol for prevention of blood borne and body fluids infections among nursing, medical, and dental students.

5. Methodology:

5.1. Study Design:-

A cross sectional descriptive study design was used

5.2. Setting:-

The study will be conducted at Faculty of Medicine, Dental, and Nursing in University Center for the Study of Female Students at King Khalid University, Saudi Arabia.

5.3. Subjects:-

A purposive sample of 300 female students affiliated to faculties of medicine, dental, and nursing in University Center for the Study of Female Students will be included in this study. Primary levels students excluded because they have not pass with clinical experience. The sample contained 130 nursing, 126 medical, and 44 dental students

5.4. Tools:

The tool used in this study was a structured questionnaire. It was developed by the researchers based on literature review for the previous studies^(9, 10, 11, 21- 22). It was divided into four parts.

The first part was used to identifying personal characteristics of the participant students namely: faculty, age, academic level, receiving of training programs related to infection control before starting clinical training, as well as if they have vaccine for HBV before clinical training and questions related to needs for training on universal precautions.

The second part was a structured questionnaire of 11 items that was developed to assess factors causing NSIs, blood-borne, and body fluid infection during their clinical training from participant student point of view. It covered the following: needle-stick factors (7 items) and sharp injury factors (4 items).

The third part includes 13 items that was develop to assess students' attitudes regarding universal precautions and preventive measures of NSISIs and blood-borne and body fluid infection. Students were asked to score each item on a 4-points Likert Scale ranging from "always occurred" (4 points) to "never occurred" (1 point) with total scores ranged from 13 to 52. The level of attitude was categorized as negative < 50% (26 scores), fair 50% - 65% (26 – 33.8 scores), and positive > 65% (33.8 scores).

The fourth part includes five ended questions assessed students' knowledge regarding five areas namely; blood-borne infectious diseases transmitted by needle-stick & sharp injuries; mode of transmission; protective equipment; universal precautions; and post-prophylaxis measures. The researchers assigned a score of "1" for a correct answer and "0" for an incorrect answer. A student who obtained a total score of "5" was considered "very knowledgeable;" "4 or 3" "somewhat knowledgeable;" and "1 or 0" "not knowledgeable.

The fifth part includes open ended questions to identify participant students' learning need for enhancing their knowledge and behaviors regarding precautions and preventive measures of blood-borne infections.

5.5. Methods:

❖ A permission to conduct the study was obtained from the dean of University Center for the Study of Female Students at King Khalid University. As well as voluntary acceptance to participate in the study was taken from the students. Students were told that anonymity would be maintained. They were informed of the purpose of the study and assured that their answers would be kept confidential and would not be used to evaluate them.

❖ Tool was developed and tested for its **content validity and relevance** by three faculty members in nursing field, one infection control specialist from faculty of medicine, and 9 students from health professional colleges (nursing, medical, dental).

❖ **The internal consistency and reliability** of the questionnaire items was assessed by using coefficient alpha and it was 0.84.

❖ A **pilot study** was conducted on 15 students in health professional colleges, in order to ascertain its clarity and feasibility.

❖ The questionnaire was distributed to the participant students by the researchers. Each sheet took 15 – 20 minutes to be answered. Data collected in three months starting September 2012.

❖ A **safety measures guide** for preventing or decreasing NSISIs and blood-borne and body fluid infection among health professional students in clinical training was developed based on the analysis of the students' responds related to factors perceived as causing NSISIs and blood-borne infection.

❖ The safety measures guide was reviewed by experts in infection control field, nursing field, and health professional students for content validity.

Statistical analysis

Data were analyzed using Statistical Package for the Social Sciences (SPSS) Version 15 Qualitative variables were presented as number and percentage. Quantitative variables were presented as mean \pm SD. To check the difference between groups Chi-square test were used. $P \leq 0.05$ was considered statistically significant.

6. Results:

Table (1) Personal characteristics of the study subjects (n=300)

Characteristics	Med (n=126) No &%	Dent (n=44) No. & %	Nur (n=130) No &%	Tot =300 No &%
Age	Mean & S.D= 21.72 ± 1.136			
Clinical areas in which NSISIs occurred				
Medical & Surgical Units	(9) 7.14	-----	(10) 7.69	(19) 6.33
Emergency	(21)16.67	-----	(20) 15.38	(41)13.67
Intensive Care Units	(10)7.94	-----	(11) 8.46	(21)7
Pediatric Unit	(8) 6.35	-----	(14)10.77	(22) 7.33
Outpatient	----	(15) 34.09	(2)1.54	(17) 5.67
Take vaccine before training	(57) 44.5	(8) 18.2	(48) 36.9	(113) 37.67
Training about infection control	(17) 13.3	(23) 52.3	(52) 40.0	(92) 30.67
Faculty have policy & rules for infection control	(11) 8.6	(14) 31.8	(18)13.8	(43) 14.33
Have needle stick accident	(22)17.46	(10) 22.73	(37) 28.46	(69) 23
Reported oral about needle stick	(2)1.6	(5)11.4	(15)11.5	(22) 7.33
Needle stick occur with glove	(34) 26.6	(17) 38.6	(23) 17.7	(74) 24.67

Table 1 shows characteristics of study participant's students. In this table the mean age for studied sample was 21.72 years old. The majority of the students 126 and 130 had enrolled from medical and nursing program respectively. This table also showed that the largest number of needle injury among medical and nursing students occurred in emergency department (16.67% & 15.38%) respectively, while among dental students occurred in outpatient department (34.09%). About 24.67% of the studied sample attending training program for infection control and 43.67% of them take vaccine before clinical training. As well as 23% of the studied sample have needle-stick injury and minority of them (7.33%) reporting it.

Table (2) Distribution of participants according to their level of knowledge regarding standard precautions and preventive measures of blood-borne pathogen infectious disease (n=300)

Items	Very knowledgeable No (%)	Somewhat knowledgeable No (%)	Not knowledgeable No (%)
Infectious diseases transmitted by needle-stick & sharp injuries	181 (60.33)	95 (31.67)	24 (8)
Mode of transmission	163 (54.33)	110 (36.67)	27 (9)
Protective equipment	227(75.67)	60 (20)	13(4.33)
Universal precautions	218 (72.67)	61(20.33)	21(7)
Post-prophylaxis measures	135 (45)	76 (25.33)	89 (29.67)

Table 2 shows distribution of participants students according to their level of knowledge regarding standard precautions and preventive measures of blood-borne pathogen infectious diseases. The majority of students (75.67%) were knowledgeable regarding protective equipment followed by 72.67% of them were knowledgeable regarding universal precautions. While, 29.67% of study sample were not knowledgeable for post-prophylaxis measures.

Table 3 shows distribution of participant students according to their attitude toward standard precautions and preventive measures of NSISIs and blood-borne infection. It was clear from this table that, about two thirds of participant students from the three colleges had a fair attitude toward standard precautions and preventive measures of NSISIs and body fluid and blood-borne infection. Also there was no significant difference among them in relation to their attitudes (p=0.13).

Table (3) distribution of participant students according to their attitudes toward standard precautions and preventive measures of NSISIs and blood-borne infection

Student attitude	Medicine(n=126)No (%)	Dental(n=44) No (%)	Nursing(n=130) No (%)	Total No (%)	χ^2 & P
Positive	28 (22.2)	11(25)	32 (24.6)	71(23.7)	2.488 0.13
Fair	80 (63.5)	28 (63.7)	78 (60)	186(62)	
Negative	18 (14.3)	5 (11.3)	20 (15.4)	43(14.3)	

Figure 1 revealed the distribution of participant students' according their perceptions regarding factors contributing to needle-stick injuries. In this figure the majority of studied sample reported the needle-stick injuries occur when drawing intravenous blood and giving patient intravenous injection. While the minority reported needle-stick injuries occur when they do not use glove when dealing patient.

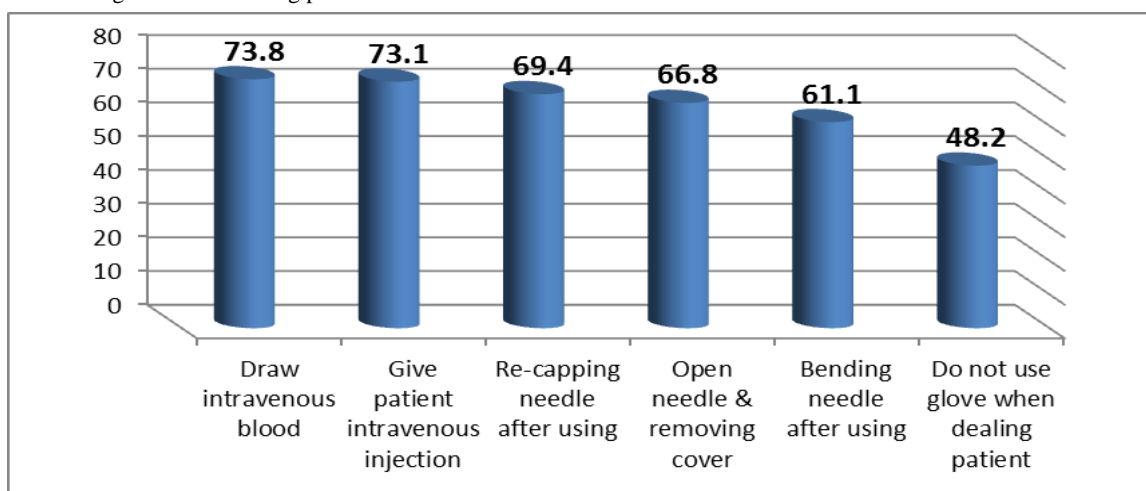


Figure (1) Distribution of participant students' according their perceptions regarding factors contributing to needle-stick injures. (n=300)

Figure 2 shows distribution of participant students' according their perceptions regarding factors contributing to sharp injures. In this figure the majority of studied sample reported sharp injures occur when broken some ampoule and followed by using sharp instruments for patient. While the lowest percent was 58.8%reported for opening ampoule.

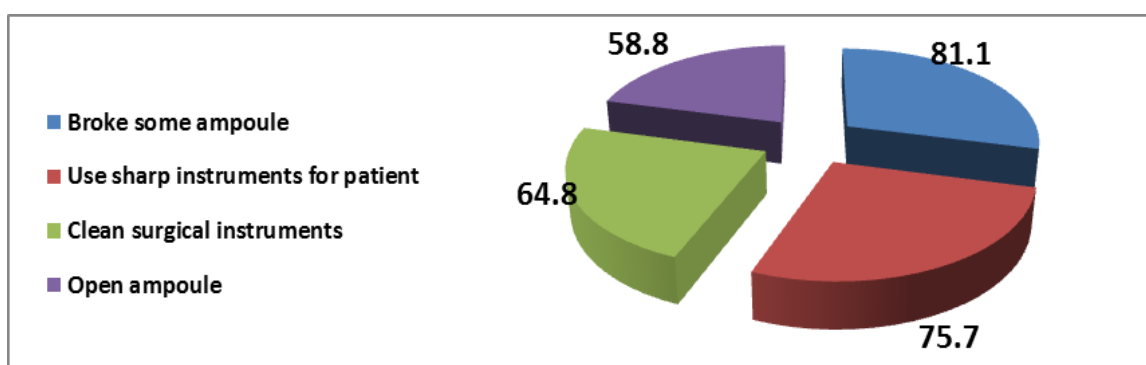


Figure (2) Distribution of participant students' according their perceptions regarding factors contributing to sharp injures (n=300)

Figure3 depicts distribution of participant students' according their agreement about their learning needs for proactive and preventing measures for blood-borne infections. The majority of 89.7% students reported that they need to know preventive and precautions to prevent blood-born infection and equipment needed to avoid it. While 88.7% reported they need training program for managing needle-stick and sharp injures.

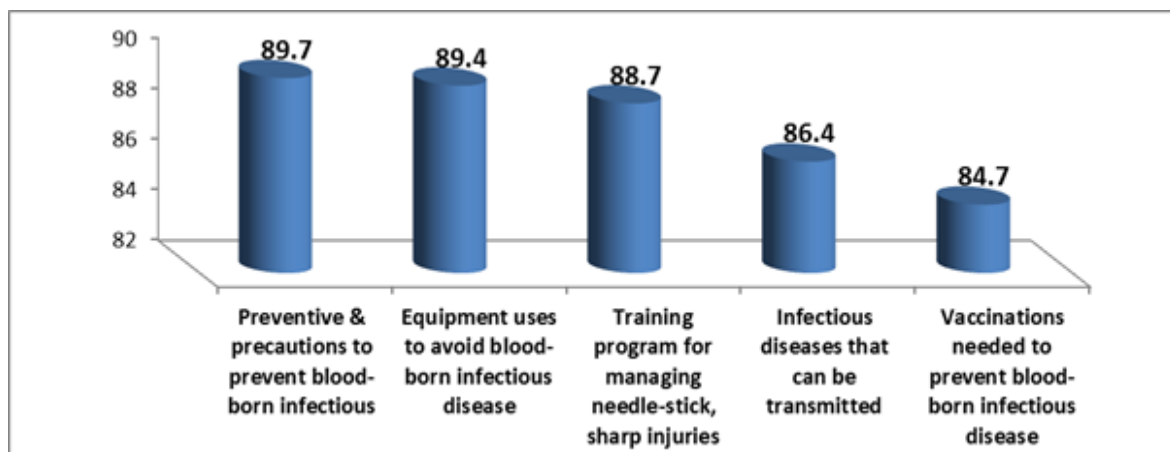


Figure (3) Distribution of participant students' according their agreement about their learning needs for proactive and preventing measures for blood-borne infections (n=300)

7. Discussion:

Occupational exposure to blood and body fluids is a serious concern for health care workers and presents a major risk for the transmission of infections, such as HIV, HBV, and HCV. Therefore, the U.S. Centers for Disease Control and Prevention (CDC) recognizing this threat and proposed a series of procedures for preventing occupational exposures and for handling potentially infectious materials such as blood and body fluids (23). This Centers developed standard precautions (SPs) that concerning blood-borne and body fluid infection, advise HCWs to practice regular personal hygiene; use protective barriers such as gloves and gown whenever there is contact with mucous membranes, blood and body fluids of patients; and dispose of sharps, body fluids, and other clinical wastes properly (13). Training and education in standard precautions (SPs) that concerning blood-borne and body fluid infection and NSI prevention is essential measure to control the risk of transmission of blood-borne infection. Findings of the present study revealed that almost of the study subjects' reported that they not attended training program about universal precautions for infection control and do not vaccinated before clinical training and their colleges not have policy and guidelines for infection control that must train students before clinical training. However RCN⁽⁸⁾ recommended infection control educational strategies for students and ongoing education are required. This is the same view of Talas⁽¹²⁾ who recommended before health professional students commence their first clinical placement and they should be educated in universal safety precautions. advice and psychosocial support (8).

As regards common clinical areas in which NSIs and sharps injuries to occur, findings of the present study revealed that about 23% students at health professional colleges reported have needle-stick injury in emergency, medical and surgical units. This is the same results of Talas⁽¹²⁾, Blackwell et al⁽²⁴⁾ who concluded injuries occur in surgical departments, medical, critical care areas and operating rooms. While Yao et al⁽²²⁾ found other common locations include obstetrics and gynecology, pediatrics, oncology outpatient departments. However, Smith & Leggat⁽²⁵⁾ found that 45% of NSIs and sharps injuries were sustained outside the clinical area in nursing laboratories during practical simulation. Therefore, WithKebede et al⁽²⁶⁾ recommended effective training, ongoing awareness on the risk of hazards, preventive measures such as engineering control, and post exposure prophylaxis following NSSIs are essential to reduce the risk of such injuries.

Findings of the present study revealed most of students who had NSIs and sharps incident not report the incident. This may be because they did not know how to report the NSIs and the importance of reporting this event. In addition they may believe that nothing will be done and so no benefit from reporting NSIs sharps injuries. This is agreed with Stein et al.,⁽²⁷⁾ who stated most doctors and nurses had suffered a needle-stick injury with a used needle. This is agreed with Simon⁽²⁸⁾ who found most of nurses were too embarrassed and thought that the accident was their fault. This is the same line of Trueman et al⁽²⁹⁾ who identified nurses in the UK regularly do not report NSIs because they feel that it reflects bad practice and that reporting procedures are not always in place. Habib et al.,⁽⁹⁾ reveals that almost of nurses didn't report their injury to any concerned authority and they considered non availability of effective reporting system as main cause for that. Study done by Askarian et al,⁽³⁰⁾ in Iran and concluded that all needle stick injuries of studied sample went unreported. As well as Kebede et al.,⁽²⁶⁾ found absence of written protocol for reporting NSSIs, and lacks of safety instructions were associated with NSSIs.

In relation to participant students' knowledge of blood-borne infectious disease, the findings of the present study indicated that most of the students were knowledgeable about personal protective equipment and universal precautions but not knowledgeable about post-prophylaxis measures and mode of transmission. This may be due to students acquire limited knowledge about transmission of BBP through their program courses. While Zhang et al.,⁽³³⁾ found medical students had a

good grasp of most knowledge related to transmission routes of blood-borne pathogens and suggesting the current curriculum on preventing HIV, HBV, and HCV was adequate. All students should have complete knowledge about the universal precautions which is an administrative control measure that calls for the implementation of practices and equipment to protect the health care workers whenever the potential for exposure to blood exists.

Considering, factors contributing to needle-stick & sharp injuries, the results of the present study indicated most students reported draw intravenous blood and gave patient intravenous injection were the priority two factors that caused needle-stick injury. In addition to broke some ampoule and use sharp instruments for patient were the two primary reasons for sharp injury. This is agreed with **Yao et al**⁽²²⁾, **Talas**⁽¹²⁾ who concluded injuries can occur when nursing students are 'discharging air' from the syringe, during the injection procedure and when withdrawing medication from the ampoule. The most common type of injection associated with NSIs is intramuscular injection^(34, 22). Less common causes include disassembling the needle and syringe after use, being struck accidentally by a colleague and sharps disposal^(35, 26, 22).

However, **Talas**⁽¹⁾, **Yao et al**⁽²²⁾ have proposed many possible reasons why NSIs and sharps injuries occur so commonly in the nursing and medical student population. It is thought that nursing students are at increased risk because of their limited clinical experience and underdeveloped skills. However, **Perry & Jagger**⁽³⁶⁾ have stated that the risk of injuries is associated not only with skill, which is related to the frequency that a procedure is performed, but also with hazards inherent in the instruments and the procedures. Insufficient training has been cited as a significant factor, as most injuries occur during the early phase of a student's training⁽²¹⁾. Nursing and medical student may have insufficient background knowledge to recognize the level of risk posed by intramuscular and subcutaneous injection procedures. Another consideration suggested by **Talas**⁽¹²⁾ is inadequate supervision in clinical practice.

Findings of the present study revealed the most percentage NSIs and sharps injuries commonly occur in the nursing student population because of not sufficiently familiar with the procedures or equipment, they did not consult their clinical supervisors in the unite. However, **Perry & Jagger**⁽³⁶⁾ have stated that the risk of injuries is associated not only with skill which is related to the frequency that a procedure is performed, but also with hazards inherent in the instruments and the procedures, for example the type of needles and glass products used. Insufficient training has been cited as a significant factor, as most injuries occur during the early phase of a student's training⁽³⁵⁾. While **Serinken et al**⁽³⁷⁾ concluded factors such as a more chaotic environment and perceived need to hurry up may pave the way to these sorts of injuries in emergency departments. Lack of experience in many procedures, insufficient training, work overload and fatigue were the probable causes that led to occupational sharp injuries^(30, 38).

Regarding to students attitudes for prevention and precautions of blood-borne infection by needle-stick and sharp injures, findings of the present study revealed no significant difference between study students in relation to their attitudes and behaviors of precautions and preventive measures of blood-borne diseases. Most of the students reported the needle must be bended and recapped after use and lowest of them reported that they wear glove and changed it between handling patients. As well as accidental needle-stick-related exposures were caused by recapping. This is agreed with **Talas**⁽¹²⁾ who found recapping is one of the most frequent causes of NSIs among HCWs and students. Another study done by **Jahan**⁽³⁹⁾ concluded that about 26% of nurses using recapping method which might be one of a cause for NSI. Likewise Saudi Arabian study also show high incidence of NSI due to recapping. Also **Habib, et al**⁽⁹⁾ found that the majority of nurses sustained needle stick injuries 2-5 times whereas only 17% have sustained one injury. This is supported by **Yao et al**⁽²²⁾ who mentioned that needle-stick injuries present the single greatest risk to nursing and medical personnel.

Furthermore, findings of the present study revealed that recapping of needles and stuck by improperly disposed needle are important contributing factors in occurrence of NSIs. This is supported by **Simon**⁽²⁸⁾ who found NSIs and sharps injuries commonly occur during disposal. These injuries were caused by overfilling the disposal bins and on transporting needles to the sharps bin. It has been reported that most NSIs occur during the day. This could be because of increased nursing activity during this time. In other studies done by **Smith & Leggat**⁽²⁵⁾ which found opening needle caps, opening ampoules and inserting needles major causative activity for needle-stick injuries among nursing students. These causative devices have been identified by nursing and medical students in Hong Kong demonstrated more NSIs due to normal syringe needles than their counterparts in Taiwan. This might be due to the local extant practice on 'no recapping', and use of the one-hand technique for recapping if necessary. The opening of needle caps can occur in a variety of contamination situations. Hence **Cheung et al.**⁽¹¹⁾ recommended special attention must be given to these activities when teaching students the proper and safe procedure.

In addition to **Bilski**⁽⁴⁰⁾ reported the most common cause of injuries from needles among students was an improper handling of syringes and needles after injections as removing a needle from a syringe or placing the needle in a full container for medical waste. Reuse of the syringe and use of multi dose vials involves manipulation, including recapping and disassembly, which puts providers at risk of SI. Reuse of injection equipment is also one of the major risk factors for HBV and HCV transmission in Pakistan⁽⁴¹⁾. Therefore, it is suggested that the determination of nursing students' injuries from needles and sharp instruments during their clinical rotations will draw attention to the need for students to receive special education about invasive procedures, and infection control and for nursing school administrators and instructors to ensure that students receive hepatitis immunization prior to beginning their first clinical rotation⁽¹²⁾.

Concerning students' learning needs findings of the present study indicated that most of students needed training programs of precautions and preventive measures to prevent blood-borne infection diseases and needle-stick and sharp injuries. This is on the same line of **Reda et al.** ⁽¹³⁾ who reported standard precautions (SPs) training are effective in preventing both occupational exposure incidents and infections and have given attention to standard precautions by initiating post-exposure prophylaxis (PEP) and increased supply of materials such as safety boxes. **Petrucci, et al.**, ⁽⁴²⁾ recommended the reduction of occupational exposure to mucocutaneous and percutaneous injuries is the most important measure in preventing blood-borne infections. All HCWs should adhere to universal precautions (UP), including the appropriate use of hand washing, protective barriers, and care in the use and disposal of needles and other sharp instruments.

Students' safety is an important issue to be considered in the organization. Therefore, designed a BBP prevention program for student to minimize the risk of occupational infection was recommended by **Wang et al.** ⁽⁴³⁾. The commonly recommended preventive strategies for reducing occupational injuries and to increase conformity with standard precautions include education, awareness campaigns, risk reducing devices such as single use needles, reduction of unnecessary injections, legislative action, provision of personal protective equipment (PPE), introduction of safety guidelines and reporting mechanisms, and creating a compliance-enabling environment ⁽²⁶⁾.

8. Conclusion;

A major finding of this study was that, the majority of studied sample reported the needle-stick injuries occur when drawing intravenous blood and giving patient intravenous injection. While the minority reported needle-stick injuries occur when they do not use glove when dealing with patient. The primary factor lead to sharp injures occur is broken some ampoule and using sharp instruments for patient. While the lowest percent was 58.8% reported for opening ampoule. The majority of students reported that they need to know preventive and precautions measures to prevent blood-born infection and equipment uses to avoid it. Also students need training program for managing needle-stick and sharp injuries.

8. Recommendation and implications

So to prevent the spread of blood-borne infections among health professional students, a hands-on skills training program is recommended as part of the curriculum. Furthermore, new standardized national blood-borne pathogen prevention guidelines should be set. Findings of the present study have important implication for developing Safety measures guide of Blood-borne and Body Fluids Infections for Students Health Professional Colleges. The design of safety measures guide for Health Professional students focused on preventing blood-borne infection diseases and needle-stick and sharp injuries.

8.1. Proactive Protocol for Blood-borne and Body Fluids Infections prevention among Nursing, Medical, and Dental Students

Students of Health Professional Colleges whom have potential contact with blood and/or body fluids of patients have an occupational risk of acquiring infection with hepatitis B virus, hepatitis C virus and/or human immunodeficiency virus. The best interests of students, faculty, patients, and the health care system will be served by adoption of blood-borne and body fluids safety measures. The purpose of this protocol is to effectively prevent or control blood-borne and body fluids infections, by providing proper management and students involvement in the identification and resolution of transmission of infectious diseases, providing training, besides this protocol is intended to provide guidance about the most appropriate follow-up for students exposed to the blood or body fluids of potentially infected individuals and medical management as an ongoing students' clinical training.

Administrative (faculty policy) safety measures

include:

- Students must be provided with a training program that will be given an orientation on communicable disease, physiology of the immune system, epidemiology, universal precautions specially for the prevention of transmission of HIV, Hepatitis B virus and other Blood-borne and how to protect themselves prior to or pre-clinic.
- Students hands-on skills training program is recommended as part of the curriculum.
- Students should be completed series of HBV immunizations either on admission to the academic program or before any contact with patients
- Faculty members who might be exposed to blood in the clinical supervision of students should be required to undergo HBV vaccination
- Students who do not have serological evidence of immunity to HBV from vaccination or from pervious infection should know HBeAg status
- Each academic program in the faculty of health science should craft a specific, written policy and guidelines in anticipation of cases of infection among students and faculty

- Students should receive printed and oral information and instructions on universal precautions for blood-borne pathogen and body fluids infections.
- Students should be provided with appropriate information regarding personal health habits, HIV prevention, and risk behaviors as a part of their preclinical preparation
- Students instructions should be continually reinforced, and clinical supervision should be managed to ensure compliance in all clinical experiences
- Faculty members should be competent role models in the care of HIV/HBV infected patients.
- Before entering any health science program, a student must complete a physical examination, medical history and examination form is part of the student's permanent record and is kept on file in the offices of the Program Director.
- Certain immunizations are required specially mandatory hepatitis B
- The professional health college program encourages students, and faculty who believe that they are at risk for HIV infection to seek testing and counseling.
- Yearly training sessions will be held for all faculty, and students according to OSHA Standards and workshops or continuing education for enhancement of policies and procedures concerning blood-borne infectious disease
- Information on the evaluation and follow-up required after an exposure incident must be offer by Office of Academic Advising and counseling at faculty
- Develop Student Health Service department in Health Professional Colleges that play a particular role as well as an important responsibility in providing clinical care for health professional college students.

Clinical training environment safety measures

- Students should expect and required close supervision in their clinical experiences
- Protective clothing will be provided for students in the following manner
 - Gloves worn for all patient treatment procedures in which hand may be contact with blood and other potential infectious materials
 - Gown to be used in procedures that will involve splash.
 - Mask worn in a combination with eye goggles and face shields are required whenever there is a possibility that splashes, spray, spatter, or droplets of blood or other potentially infectious materials may be generated
 - Clinic Jacket worn for all patient treatment procedures
 - Protective eyewear worn for all patient treatment procedures sterilization procedures and all lab procedures
 - Utility gloves worn when handling instruments during cleaning & sterilization procedures
 - Students' personal protective equipment available at clinical training environment will be cleaned, laundered, and disposed of by the clinic.
- When student experiences an exposure incident, it should be reported to Program Director and Clinic Supervisor.
- Students are encouraged to receive a confidential medical evaluation and follow-up. This follow-up will include the following:
 - Documentation of the route of exposure and the circumstances related to the incident
 - If possible, the identification of the blood of the source individual will be tested if consent is obtained for HIV/HBV infectivity.
 - Results of testing of the source individual will be made available to the exposed individual with the exposed individual informed about the applicable laws and regulations concerning disclosure of the identity and infectivity of the source individual.
 - The exposed individual will be offered post exposure prophylaxis
 - The exposed individual will be given appropriate counseling concerning precautions to take during the period after the exposure incident and will also be given information on what potential illnesses to be alert for and to report any related experiences to appropriate personnel.
 - Contaminated sharps are to be placed immediately, or as soon as possible, after use into appropriate sharps containers. Sharps containers are located in each operator, the sterilization room and the laboratory for sharps disposal. Sharps shall not be removed from sharps containers.
- If student have incident in clinical training the student must be:
 - Immediate antiseptic procedures should be followed after possible exposure
 - Confidential testing and appropriate counseling should be offered and student is obligated to be tested when is exposed to patient's blood
 - If needle stick, test for HIV to establish sero negativity first, then retest at 6weeks , 3months, 6months, and then after 1year
- Engineering and training practice environment controls must be used to minimize student exposure and personal proactive equipment also must be used.

- Hand washing facilities must be available and feasible
- Contaminated needles and other contaminated sharps must not be bent, recapped, or removed from syringes and must be placed in appropriate labeled containers
- HBV vaccines must be available within 10 days of assignment to all students who are exposed to blood during training
- Health professional students who have contact with patients or blood, and are at ongoing risk for percutaneous injuries should be tested 1–2 months after completion of the three dose vaccination series for anti-HBs. Once the appropriate antibody level achieved, booster doses of hepatitis B vaccine are not necessary, and periodic serologic testing to monitor antibody levels after completion of the vaccine series is not recommended.

Personal safety measures

- Students must be attended education and orientation program that will be conducted prior to initial training where occupational exposure may occur.
- Personal protective equipment will be chosen based on the anticipated exposure to blood or other potentially infectious materials.
- Students who have been identified as having exposure to blood or other potentially infectious materials are encouraged to obtain the Hepatitis B vaccine unless they have previously had the vaccine or wish to submit to antibody testing which shows them to have sufficient immunity.

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References:

1. Bahadori, M. & Sadigh, GI. Occupational Exposure to Blood and Body Fluids. *International Journal of Occupational & Environmental Medicine*, 2012; 1 (1):1-10.
2. Schmid, K. Schwager, C. Drexler, H. Needlestick injuries and other occupational exposures to body fluids amongst employees and medical students of a German university: incidence and follow-up. *J Hosp Infect.* 2007;65:124–130.
3. Kessler, C., McGuinn, M., Spec, A, Christensen Rashmi Baragi, R. & Hershow.R. 2011. Underreporting of blood and body fluid exposures among health care students and trainees in the acute care setting: A 2007 survey, *Am J Infect Control*, 2011;39:129-34
4. Vaz, K., McGrowder, D., Alexander-Lindo, R., et al. Knowledge awareness and compliance with universal precautions among health care workers at the university hospital of the West Indies Jamaica. *The International Journal of Occupational and Environmental Medicine*, 2010; **1:171-80**.
5. Centers for Disease Control and Prevention. Fatal and nonfatal injuries, and selected illnesses and conditions: bloodborne infections and percutaneous exposures, 2004: www.cdc.gov/niosh/docs/2004-146/ch2/ch2-2.asp. Accessed March 4, 2009.
6. Sharma, R., Rasanias, SK., Verma, A. & Singh, S. Study of Prevalence and Response to Needle Stick Injuries among Health Care Workers in a Tertiary Care Hospital in Delhi, India. *Indian Journal of Community Medicine*, 2010; 35(1):74-77.
7. Alvaro R, Petrucci C & Cicolini G, Cerone MP & Loreto, L. Percutaneous and Mucocutaneous Exposures in Nursing Students: An Italian Observational Study. *Journal of Nursing Scholarship*, 2009; 41:4, 337–343.
8. Royal College of Nursing. Needle-stick Injuries: The Point of Prevention. RCN, London, 2009.
9. Habib, H., Khan, E., & Aziz. A. Prevalence and Factors Associated with needle Stick Injuries among Registered nurses in Public Sector Tertiary Care Hospitals of Pakistan, *International Journal of Collaborative Research on Internal Medicine & Public Health*, 2011; 3 (2):124-130.
10. Moazzam, A. et al. Needle Stick Injuries: An Overview of the Size of the Problem, Prevention & Management, *Ibnosina Journal of Medicine and Biomedical Sciences*, 2010; 2(2):53-61.

11. Cheung,K et al. Analysis of needle-stick injuries among nursing students in Hong Kong, *Accident Analysis and Prevention*,2010; 42, 1744–1750
12. Talas, M S. Occupational exposure to blood and body fluids among Turkish nursing students during clinical practice training: frequency of needle-stick/sharp injuries and hepatitis B immunization, *Journal of Clinical Nursing*, 2009; 18, 1394–1403.
13. Reda, AA. , Fisseha, S., Mengistie, B., &Jean-Michel,V. Standard Precautions: Occupational Exposure and Behavior of Health Care Workers in Ethiopia. *PLoS ONE* | www.plosone.org.2010; 5(12):14420.
14. Golan, YD., Griffith, J., El Gamal, H., et al. The impact of gown-use requirement on hand hygiene compliance. *Clinical Infectious Disease*, 2006; 42: 370–376.
15. Gammon,J., Samuel, H. & Gould, D. A review of the evidence for suboptimal compliance of healthcare practitioners to standard/universal infection control precautions *Journal of Clinical Nursing*, 2008; 17: 157-167.
16. Stoker, R. Needle sticks Injury Prevention: Business Briefing: Long Term Healthcare, 2009; 144-146. Available from: <http://www.touchbriefings.com>
17. Oliveira, AC., Cardoso, CS. & Mascarenhas, D. Contact precautions in intensive care units: facilitating and inhibiting factors for professionals' adherence. *Rev Esc Enferm USP*,2010; 44(1):161-165.
18. Shah, SM., Merchant, AT. & Dosman, JA. Percutaneous injuries among dental professionals in Washington. *STATEBMC Public Health*, 2006; 6:269.
19. Kakizaki, M., Ikeda, N., Ali, M, et al. Needlestick and sharps injuries among health care workers at public tertiary hospitals in an urban community in Mongolia. *BMC Research Notes* 2011, 4:184. <http://www.biomedcentral.com/1756-0500/4/184>
20. Pruss-Ustun, 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(6):482-90.
21. Hambridge, K.Needlestick and sharps injuries in the nursing student population. *Nursing Standard*, 2011; 25, 27, 38-45.
22. Yao, W. et al. Needlestick injuries among nursing students in China, *Nurse Education Today* ,2010;30, 435–437.
23. Lee, J., Botteman, M., Xanthakos, N., et al. Needlestick injuries in the United States: epidemiologic, economic, and quality of life issues. *AAOHN J*. 2005; 53:117-33.
24. Blackwell, L., Bolding, J., Cheely, E. et al. Nursing students' experiences with needle stick injuries. *Journal of Undergraduate Nursing Scholarship*. 2007, 9, fall, 1.
25. Smith, DR.& Leggat, PA. Needle-stick and sharps injuries among nursing students. *Journal of Advanced Nursing*,2005; 51, 5: 449-455.
26. Kebede, G., Molla,M., & Sharma,H. Needle stick and sharps injuries among health care workers in Gondar city, Ethiopia, *Safety Science*,2012; 50 : 1093–1097
27. Stein, AD., Makarawo, TP. & Ahmad, MF. A survey of doctors' and nurses' knowledge, attitudes and compliance with infection control guidelines in Birmingham teaching hospitals. *J Hosp Infect* 2003; 54(1):68-73.
28. Simon, LP. Prevention and management of needle-stick injury in Delhi. *British Journal of Nursing*,2009; 18, 4, 252-256
29. Trueman, P., Taylor, M., Twena, N., &Chubb, B. The cost of needle-stick injuries associated with insulin administration. *British Journal of Community Nursing*, 2008; 13, 9, 413-417.
30. Askarian, M., Malekmakan, L., McLaws,ML., & Zare, N. Patterson, JM. Prevalence of needle sticks injuries among medical students at a university in Iran. *Infect Control Hosp Epidemiol*, 2006; 27(1):99-101.
31. Wiwanitkit, V. Knowledge survey concerning universal precaution among the Thai preclinical year medical students: a medical school-based study. *Am J Infect Control*, 2002; 30:255–256.
32. Zhang , Z., Yamamoto, T. Wu, X., Moji, K. et al. Educational intervention for preventing bloodborne infection among medical students in China, *Journal of Hospital Infection*, 2010; 75 : 47–51.

33. Yang, YH., Wu, MT., Ho, CK., Chuang HY, et al. Needle-stick/sharp injuries among vocational school nursing students in southern Taiwan. *American Journal of Infection Control*,2004; 32, 431–435
34. Shiao, JSC., McLaws, ML., Huang, KY. & Guo, YL. Student nurses in Taiwan at high risk for needlestick injuries. *Annals of Epidemiology*,2002; 12, 197–201
35. Perry J, & Jagger, J. Cutting sharps risks in ICUs and CCUs. *Nursing*, 2005; 35,8, 17.
36. Serinken, M., et al. A survey of needlesticks and sharp instrument injuries in emergency health care in Turkey. *J Emerg Nurs*, 2009; 35:205-10.
37. Elliott, SK., Keeton, A., &Holt, A. Medical students' knowledge of sharps injuries. *J Hosp Infect* 2005;60(4):374-377
38. Jahan, S. Epidemiology of needle sticks injuries among health care workers in a secondary care hospital in Saudi Arabia. *Ann Saudi Med*, 2005; 25(3):233-238.
39. Bilski B. Needlestick injuries in nurses—the Poznan study. *Int J Occup Med Environ Health*, 2005; 18:251-4.
40. Naveed, Z. et al. Sharp injuries and their determinants among health care workers at first-level care facilities in Sindh Province, Pakistan, *Tropical Medicine and International Health*, 2010; 15 (10): 1244–1251.
41. Petrucci C, et al. Percutaneous and mucocutaneous exposures in nursing students: an Italian observational study. *Journal of Nursing Scholarship*, 2009; 41, 4, 337-343.
42. Wang, H., Fennie, K., He, G., Burgess, J., &Williams, AB. A training programme for prevention of occupational exposure to blood-borne pathogens: impact on knowledge, behavior and incidence of needle-stick injuries among nursing students in Changsha, People's Republic of China. *J. Advan. Nurs.*, 2003; 41, 2, 187-194.