credentials of nurses in the standard precaution for infection control, Saudi Arabia

Researcher's name:
Senior, Azizah Ahmad Banafi, Public Health Specialist.

Abstract:
As frontline health workers, nurses play a huge role in implementing standard practices that prevent the spread of infections in healthcare facilities. Infection control is critical in healthcare delivery, especially in densely populated areas such as Mecca, Saudi Arabia, which has an influx of pilgrims annually for religious purposes. Implementing these precautions effectively requires these nurses to have tailor-made competencies in Mecca's unique context. This paper will discuss various aspects of the program, including content, delivery methods, participant feedback, and outcomes, which will be evaluated to determine critical strengths, weaknesses, and areas for future improvement. As a result, this evaluation's findings would help enhance the training program's efficiency and spread more efficient infection control practices among nurses in Mecca. Infection control is a global concern for the national healthcare system since it is critical to controlling the development of infectious diseases and ensuring public safety. Standard precautions are recommendations from the World Health Organization and the Centers for Disease Control and Prevention focused on preventing healthcare-related infections. These include hygiene, personal protective equipment, vaccination, safe injection practices, respiratory hygiene, and environmental cleanliness.

This study focuses on one of sup-aim using a cross-sectional method to reach main aim.

Sup Aim of the study: To assess the effectiveness of the improvised BISCL training program for standard precautions of infection control among nurses in Mecca, Saudi Arabia..

Result:

comparing demographic and professional attributes of healthcare professionals across the Maternity and Child Hospital and King Abdul-Aziz Hospital reveals insightful differences and similarities. The majority of participants in both hospitals were female, The nurse's qualifications showed varied representation, with Registered Nurses making up 42.57% of the total participants, showcasing a higher concentration at the Maternity and Child Hospital. Staff Nurses formed another significant group, constituting 35.15% of the total, with a relatively balanced presence in both hospitals. Both hospitals show increasing knowledge and improvement in attitude and development in their practices.

Keywords: *assess, impact, factors, compliance* of basic infection control course, Saudi Arabia or Basic Infection Control Skills License program (BICSL).

Background:

Nurses, Assistant Medical Officers, and allied health personnel account for the vast majority of medical personnel at hospitals overseen by the Ministry of Health (Saudi Arabia). Because of the increasingly complex duties and responsibilities they perform, healthcare workers (HCWs) are more likely to make mistakes if they are not professionally competent in their everyday work. Medical knowledge and technology have revolutionized not only the work environment for healthcare practitioners but have also provided new and difficult therapeutic approaches and procedures. The public's understanding of safe, effective, and economical medical treatment has grown as a result of the internet, newspapers, and other kinds of media where medical information is freely accessible.

As a result, hospitals must have a system in place to verify that all healthcare providers are competent in the procedures they conduct. Defining clinical privileges has become a crucial task for hospitals and medical institutions. The procedure, which is an important part of any credentialing system, has also become an important part of a hospital's risk management strategy. Despite the fact that various healthcare professionals provide services, the hospital is responsible for all actions that occur on its premises. A hospital must satisfy itself as to the competence of individuals delivering patient care services in the hospital in order to discharge this responsibility.

The Basic Infection Control Skills License Program (BICSL) was established by the Ministry of Health to provide basic infection control skills for health practitioners to use in health facilities to reduce the risk of infection transmission and to create a safe working environment for patients, health workers, and visitors. The following topics are covered in the BICSL training: (i) Training on hand hygiene and disinfection (ii) Training in the proper use of personal protective equipment (PPE) (iii) Training on safe injection procedures (iv) Perform respiratory masks fitting procedure (N95) (v) Perform annual Influenza vaccination (vi) Confirm receiving Meningococcal vaccination. BICSL is an initiative that is implemented by the Ministry of Health (Saudi Arabia) to ensure credentialing and privileging for HCWs in the standard precautions for infection control.

Credentialing is a two-step process that involves setting prerequisites and assessing individual qualities for admittance into a specific status or specialization based on pre-determined professional training and experience. The first step in credentialing is to consider and establish professional training and experience. The second part of credentialing is gathering and evaluating proof of individual applicants' qualifications. A healthcare provider's privilege is the right to give specialized care that is compatible with his or her training, experience, and skill. Both credentialing and privileging HCWs through BICSL are essential to ensuring the application of Standard precautions (SP).

Standard precautions (SP) are the fundamental standards for infection prevention and control practice in healthcare settings. Adaptation of standard precautions (SP) helps to protect both health care personnel and patients against microorganism cross-transmission (1).

Problem statement & Study rationale

In the Kingdom of Saudi Arabia (KSA), certain urban hospitals recorded 2.2 percent of hospital infections monthly, while other data showed that hospital infections are still one of the country's most prevalent health issues (2). More than a quarter (37%) of HCWs in the KSA had insufficient awareness of hand hygiene, according to Al Ra'awji et al. (2018), and there is a strong demand for training for HCWs in this nation (3). KSA has been attempting to implement all infection control recommendations in order to raise the level of infection control operations (4).

Such an attempt was made with the introduction of the Basic Infection Control Skills License program (BICSL). BICSL was established to provide scientifically consistent training to healthcare personnel throughout all regions of KSA. The BICSL program license is provided by the Saudi Ministry of Health.

all healthcare personnel in various regions of KSA, including Mecca, the old strategy's effectiveness is questionable, especially during the COVID-19 pandemic. COVID-19 has impacted not only the public but healthcare workers as well. According to research from KSA, 88% of infections in HCWs were obtained in hospitals, with the majority of infections occurring during a single hospital outbreak (4,5).

Literature review:

Infection control is vital in delivering health care and stopping the spread of infectious diseases among patients and health workers. Standard precautions are guidelines that healthcare workers must adhere to, providing the minimum protection for transmitting infections in healthcare. Since nurses are the first-line healthcare providers, they must protect themselves and their patients by adhering to these precautions. Due to the importance of ensuring proper infection control, the Be In Safe Control and Live training program was established in Mecca. It was created in Saudi Arabia to improve the knowledge and skills of

nurses to reduce infection.

Formal credentialing is a method of validating the qualifications of licensed health service providers by determining if their aptitude and proficiency correspond to the set standards of the medical field (5). It reviews the aptitude of personnel who have acquired a definite certification in their respective fields and are licensed to practice their professions. It is significant for hospitals to conduct formal credentialing to ensure patient safety.

Infections are common issues that prevent patients from rapidly recovering from illness or injury, and they lead to many complications, which significantly contribute to healthcare costs (6). As a result, adequate measures are needed to reduce infections and improve health outcomes amongst patient populations. The credentialing process confirms practitioners' qualifications, skills and abilities to practice in a safe and competent manner (7). Individuals are credentialed by an independent agency, which validates their abilities to safely practice and undertake their roles in the health sector (8).

Nurses with specialised qualifications improve health outcomes by reducing mortality rates and preventing major complications from occurring after surgical procedures (9). Therefore, credentialing may be a useful measure for helping practitioners understand and improve the complexity of infection control.

Patient safety is a public health priority and may be improved by credentialing health practitioners. Research has been mixed concerning the effects of credentialing practitioners on reducing infection and improving health outcomes. Credentialing surgeons using robotic training simulations reduced estimated operating times during hospital procedures and reduced large hospitals' costs. However, this study was biased because it offered voluntary training participation to surgeons and included a limited sample size of just 16 surgeons, who only completed basic training (10).

An exploratory study conducted in Australia and New Zealand determined some potential benefits of credentialing infection control practitioners. For example, accredited individuals were more likely to enhance their knowledge within their careers, having access to infection control resources and educational materials (11).

In previous studies, determining the health outcomes that correlate to credentialing amongst public health nurses was difficult due to the limited number of credentialed nurses sampled (12). Therefore, further research must survey a larger number of credentialed, public health practitioners before assessing the health outcomes and benefits that credentialing may offer.

Limited evidence exists for understanding the relationship between credentialing nurses and patients' health outcomes. Therefore, a well-developed framework, with various indicators, is required for more fully assessing this relationship between credentialing, better health outcomes and improved infection rates (13).

Healthcare-associated infection (HCAI) is a worldwide problem. According to estimates, 6.4 percent of hospitalized patients in England (14) and 7.1 percent in Europe contract HCAI, resulting in 37,000 deaths (15). It is estimated that known therapies, such as standard precautions, can prevent between 15% and 30% of HCAI cases (16). However, compliance with infection prevention and control precautions has been repeatedly identified as insufficient across a wide range of global measures (17).

Standard precautions are regarded as critical for the prevention and control of HCAI and are an effective method of protecting healthcare personnel, patients, and members of the general public. However, it is widely acknowledged, and a systematic review has revealed, that international compliance with conventional procedures is suboptimal (18).

Hand hygiene is the most important intervention in cross-infection prevention; however, compliance is often low (19, 20). Poor compliance levels with regard to glove use have also been reported (21, 22). A link has also been found between the use of gloves and hand hygiene compliance. Girou et al. (2004) discovered in their observational study of 120 healthcare professionals in France that hand hygiene was not performed in 64% of cases due to incorrect glove use (23). In an observational study of 12 randomly selected wards, Flores and Pevalin (2006) discovered that wearing gloves had a negative impact on hand cleanliness (24). There is so much clear evidence that workers believe that wearing gloves negates the need for hand hygiene when this is not the case. In the United Arab Emirates, poor adherence to conventional precautions has been identified as a risk factor for sharp injuries, with the risk of injury nearly tripling as a result of poor adherence (25). It has also been claimed that only 37% of people follow isolation precautions (26).

Other less investigated safeguards continue to have low levels of good practice. In one study, only 46% of personnel did not re-sheath needles after use, and only 55% wore eye protection when required (27). As a result, it is clear that overall compliance is suboptimal. This can have a negative impact on infection rates (28), with infection rates rising as practice deteriorates, as seen in a neonatal intensive care unit (29,30). As a result, we must look into ways to improve practice and, as a result, lower infection rates. There is compelling evidence that compliance varies, and that infection prevention and control procedures are used selectively by healthcare personnel. Poor compliance has serious consequences for patient and staff safety as well as care quality. As a result, issues that affect or increase compliance must be addressed.

Research Question(s)

1. What is the effectiveness of the improvised BISCL training program for standard precautions of infection control among nurses in Mecca, Saudi Arabia.

*Subobjective will be used as the first step to test the Tittel and the main aim of the study.
SubObjective: To assess the effectiveness of the improvised BISCL training program for standard precautions of infection control among nurses in Mecca, Saudi Arabia.
The overall objective of the study is to assess whether BISCL training is effective in increasing KAP on standard precautions for infection control among nurses after going through BISCL training. With the assessment, we may be able to capture the change in KAP but we are not collecting hospital data therefore we can't establish the prevalence/incident for HAIs.

Methodology:

Study setting:

This study was conducted among Nurses in two hospitals King Abdul Aziza, Maternity and Children Hospital, MCH in Makkah city, Saudi Arabia.

Study Population

The study population will be nurses from the aforementioned hospitals. Since nurses are the frontline workers in the hospital setting, it is important to assess the KAP of infection control among these specific HCW .The study population consists of Nurses in two hospitals in Makkah city, Saudi Arabia.

Study Design
Cross-sectional, analytic study, systematic random sample.

Inclusion criteria

1. Registered nurse who work at Maternity & Children Hospital, MCH &King Abdul-Aziz hospitals
2.Intend to undergo BISCL training
3.All nationalities

Exclusion Criteria:

Nurse students, other government and private hospitals, than MCH &King Abdul-Aziz hospitals.

Sample size:

According, to sub aims of this study is to assess the effectiveness of the BICSL training course will approximate 300 nurses between two hospitals MCH & king Abdulaziz. computed utilizing Rao Soft's sample size calculator assuming a 95 percent level of confidence, a 5 percent error, a 50 percent response distribution, and a +10% dropout. We intend to recruit approximately 169 nurse participants. However, was conducted from both hospitals 203 nurses participants.

Sample Technique & method:
Simple random sampling (SRS) is the most basic and widely used method of sample selection, in which the sample is drawn unit by unit with an equal probability of selection for each unit at each draw. In other words, simple random sampling is a method of picking a sample s of n units from a population of size N by providing all units an equal chance of selection. It is a sampling strategy in which all conceivable combinations of n units with the same likelihood of selection can be produced from a population of N units.

Sample Method:
A random number table will be used to select the first nurse from the list. Mecca has a total of 300 nurses therefore the sample size needed is 169 making every 10th (300/169) from the list a potential study subject. SPSS `Sample Cases `will be used to select the sample size from a list of all eligible nurses. This takes into account 50% recruiting success and 10% dropout of respondents between the pre and post-tests. After sample case, I will contact with selected participants send an advertisement of the study to the participants, describe the study and get permission to join the study which will be done by filling Google form agreement application. Then I will contact each participant separately to give code & questionnaire. The study one group. Duration of participant involvement -40 mins for 73 questions. A recruitment notice will be sent to all nursing professionals who qualify for the study. Managers will assist with the process. A list will be made for nurses who expresses their interest in participating in the study. If we have an adequate sample size, a simple randomized technique will be used to create a final sample of the nurses. *The participants in this study are 203 nurses.*

Data collection method:

A self-administered questionnaire was given to all participants in both Arabic &English language questionnaires.

Questionnaire:

A set of questionnaires will be used for data collection to analyze the credentials of nurses in the standard precautions for infection control in Mecca, Saudi Arabia. This questionnaire is consisting of five (5) sections:
-          Section 1 : Social demographic data: this will include information on age, gender, nursing categories, hospital department, years of experience, and place of work.

- Section 2: This section will contain three questions about the SP training of nurses: if nurses have received SP training in the past, open questions, for problems or factors that influence in BISCL training program and other open questions, solution may improve BISCL training program.
- Section 3: This section of the questionnaire will contain questions about the knowledge and attitude of nurses regarding standard precautions for infection control.
- Section 4: This section will assess the nurses' practice and/or compliance.

Data Entry & Analysis:

SPSS software will be used for data entry and analysis. Descriptive statistics will be run on nurse characteristics and KAP measurements. The normality distribution of all variables will be evaluated. The mean and standard deviation of numerical variables with normal distributions will be presented. The median and interquartile range (IQR) of numerical variables with skewed distributions will be presented. The frequency of observation and its percentage were provided for categorical variables.

Descriptive statistics

Descriptive statistics will be provided following the frequencies and percentages of nurses, KAP measures, and other covariates such as age, gender, nationality, education level, etc for each hospital for assessments.

Pilot Study:

A pilot study has been done on 30 Nurses in both hospitals who meet the study's eligibility criteria. The pilot study has mainly helped examine both the instrument's content validity and construct validity issues, alongside other needed information.

Ethic Consideration:

The study was approved by the research department at Makkah Health Affairs under the Ministry of Health.

Budget:

 Self-funded.

Result:

1: Socio-Demographic Data:

Table (6) comparing demographic and professional attributes of healthcare professionals across the Maternity and Child Hospital and King Abdul-Aziz Hospital reveals insightful differences and similarities. In terms of gender distribution, a striking majority of participants in both hospitals were female, with the Maternity and Child Hospital reporting 98.65% female participants compared to King Abdul-Aziz Hospital's 90.56%. This leads to an overall female representation of 96.53% across both institutions. Males, on the other hand, comprised a minimal percentage, with 1.35% in the Maternity and Child Hospital and 9.44% in King Abdul-Aziz Hospital, culminating in an aggregate of 3.47%.

The Maternity and Child Hospital exhibited a higher proportion of Non-Saudi participants (87.25%) compared to Saudi nationals (12.75%). King Abdul-Aziz Hospital presented a more balanced mix, with nearly equal percentages of Saudi (50.94%) and Non-Saudi (49.06%) nationals, leading to an overall distribution of 22.77% Saudi and 77.23% Non-Saudi participants across the two settings.

The nurse's qualifications showed varied representation, with Registered Nurses making up 42.57% of the total participants, showcasing a higher concentration at the Maternity and Child Hospital. Staff Nurses formed another significant group, constituting 35.15% of the total, with a relatively balanced presence in both hospitals. Senior Nursing staff accounted for 8.91% overall, predominantly from the Maternity and Child Hospital. Practical Nurses and Midwives, although represented in smaller numbers, indicated a diverse professional composition within the participant pool.

Department-wise, the Neonatal Intensive Care Unit at the Maternity and Child Hospital had a notably high representation (83.89%), starkly contrasting with its presence in King Abdul-Aziz Hospital (1.89%). Other departments such as the Male Medical Ward and the Dialysis Department saw higher figures in King Abdul-Aziz Hospital, pointing to differing departmental focuses between the two hospitals.

Regarding Basic Infection Control and Safety Measures (BICSL) training, a high level of training was observed among participants from both hospitals, with 94.63% from the Maternity and Child Hospital and 98.11% from King Abdul-Aziz Hospital, making an overall 95.54%. This reflects a strong emphasis on infection control and safety training among the healthcare professionals surveyed.

Finally, the mean age and years of experience among participants were closely matched across both hospitals, with an overall mean age of approximately 34 years and mean years of experience around 10. This demographic profile outlines a workforce that is predominantly female, highly trained in basic infection control and safety measures, with a significant proportion being Non-Saudi nationals, especially in the Maternity and Child Hospital.

Table 6. Distribution of demographical variables (N=202)

Hospital Demographical	Maternity and child hospital		King Abdul-Aziz hospital		Total	
	N(149)	%	N(53)	%	N(202)	%
Gender						
Female	147	98.65	48	90.56	195	96.53
Male	2	1.35	5	9.44	7	3.47
Nationality						
Saudi	19	12.75	27	50.94	46	22.77
Non-Saudi	130	87.25	26	49.06	156	77.23
Nurse's qualification						
Nurse register	67	44.97	19	35.85	86	42.57
Nurse assistant	3	2.01	1	1.89	4	1.98
Nurse diploma	2	1.34	8	15.09	10	4.95
Stuff nurses	54	36.24	17	32.08	71	35.15
Senior nursing	16	10.74	2	3.77	18	8.91
Junior nursing	3	2.01	0	0.00	3	1.49
Practical Nurses	2	1.34	4	7.55	6	2.97
Practical midwife	1	0.67	0	0.00	1	0.50
Staff midwife	1	0.67	0	0.00	1	0.50
Head of Nursing	0	0.00	2	3.77	2	0.99
Department						
Neonatal intensive care unit	125	83.89	1	1.89	126	62.38
Department of Internal Medicine	0	0.00	3	5.66	3	1.49
Dialysis department	0	0.00	9	16.98	9	4.46
Male Medical ward	3	2.01	16	30.19	19	9.41
Pediatric emergency	12	8.05	0	0.00	12	5.94
Neurosurgery Department	0	0.00	5	9.43	5	2.48
obstetrics and gynecology	6	4.03	2	3.77	8	3.96
Day Procedure Unit	0	0.00	6	11.32	6	2.97
Artificial Kindy unit	1	0.67	4	7.55	5	2.48
Emergency room	2	1.34	3	5.66	5	2.48
Out Patient Department	0	0.00	4	7.55	4	1.98
BICSL						
Yes	141	94.63	52	98.11	193	95.54
No	8	5.37	1	1.89	9	4.46
Age						
Mean (STD)	34.19 (7.34)		34.69 (6.44)		34.32 (7.10)	
Year of experience						
Mean (STD)	10.43 (5.81)		10.54 (6.13)		10.46 (5.88)	

4.2: Knowledge of Stander Precaution

A. Distribution of participants regarding their knowledge about Stander Precaution of disease transmitted through blood.

Table 7: knowledge about Stander Precaution of disease transmitted thought blood.

| Item NO.	Items	Correct answers (%)
١	Do you think that practicing SP measures protects against blood-borne infections?	97
٢	Blood and body fluids are the most likely sources of transmission of HIV and hepatitis B virus?	98.5
٣	Hepatitis B can be transmitted by needle stick injury or acute injuries?	96
٤	Hepatitis C can be transmitted by needle stick injury or acute injuries?	75.2
٥	HIV can be transmitted by needle stick injury or acute injuries?	91.6
٦	Is the transmission of hepatitis after acute infection or a needle prick more likely than the transmission of hepatitis type C and more likely to transmit AIDS?	71.8
٧	There is a vaccine currently available for AIDS?	76.2
٨	There is a vaccine currently available for hepatitis B?	97
٩	There is a hepatitis C vaccine	51
Total Mean (STD)		7.54 (1.24)
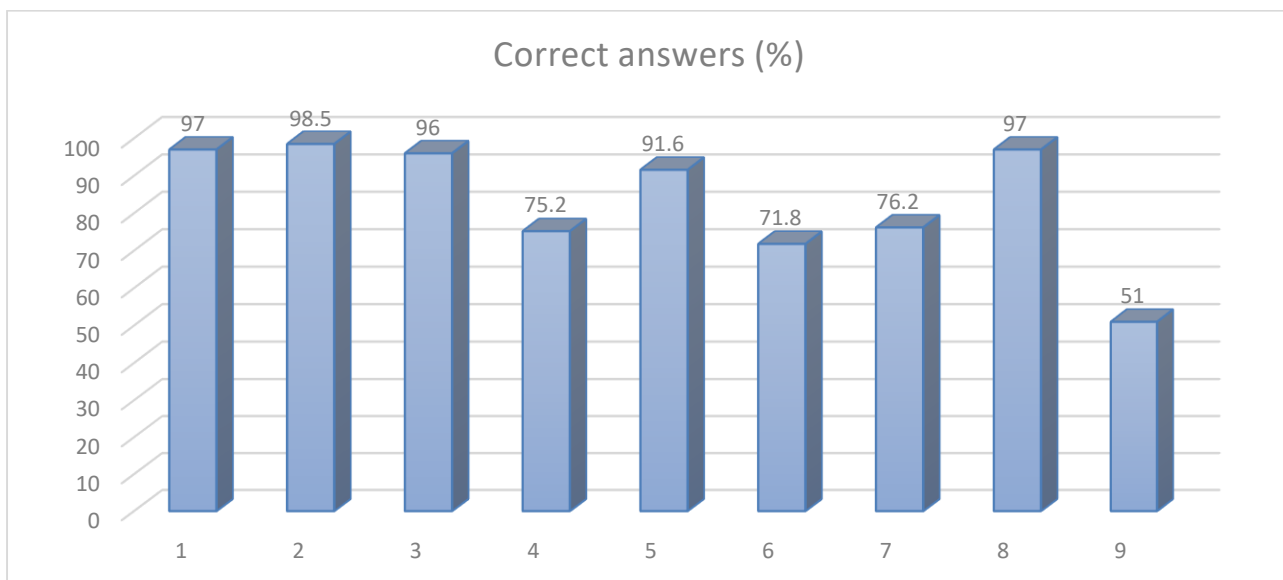
Figure 1: The percentages of correct answers of Stander Precaution of disease transmitted thought blood

Table (7) assessing healthcare professionals' knowledge on standard precautions (SP) related to diseases transmitted through blood, the total mean score of 7.54 (with a standard deviation of 1.24) signifies a robust understanding among the participants. This high average score indicates that the majority of healthcare workers are well-informed about the critical aspects of infection control and prevention regarding blood-borne pathogens.

Participants demonstrated commendable knowledge across various specific areas, as reflected in the percentages of correct answers to the presented items. Notably, 97% recognized that practicing SP measures is effective against blood-borne infections, illustrating widespread acknowledgment of SP's importance. The awareness that blood and body fluids are primary sources of HIV and hepatitis B virus transmission was nearly unanimous, with 98.5% agreement. This high level of understanding is crucial for the proper application of protective measures in healthcare settings.

Knowledge about the transmission risks associated with needlestick injuries or acute injuries was also high, with 96% and 91.6% of respondents correctly understanding the risks for hepatitis B and HIV, respectively. However, the knowledge regarding hepatitis C transmission through similar means was slightly lower at 75.2%, indicating an area where further educational interventions could be beneficial.

A detailed understanding was evident in the comparison of transmission risks among hepatitis B, hepatitis C, and HIV, with 71.8% of respondents correctly identifying the relative likelihood of transmission following an acute infection or needle prick. This nuanced comprehension highlights a sophisticated grasp of infection risks among healthcare professionals.

Despite the high overall knowledge level, there were notable misconceptions about vaccine availability. While the existence of a hepatitis B vaccine was accurately acknowledged by 97%, misunderstandings were apparent regarding AIDS and hepatitis C vaccines. A significant 76.2% incorrectly believed in the availability of an AIDS vaccine, and 51% mistakenly thought a hepatitis C vaccine exists, pinpointing specific misconceptions that need addressing through targeted educational programs.

The total mean score reflects a healthcare workforce that is generally well-informed about the risks and precautions associated with blood-borne pathogens. Nonetheless, the disparities in understanding, particularly concerning vaccine availability, suggest a need for ongoing education and clarification to ensure all healthcare professionals have the most current and accurate

information.

B. Distribution of participants regarding their knowledge about of Standard Precaution in General.
Table 8: knowledge about Stander Precaution in general **.**

| Item NO.	Items	Correct answers (%)
١	(SP) should be used when handling each patient	98.5
٢	(SP)consider that all patients are carriers of blood-borne pathogens	91.6
٣	Hands must be washed before handling the patient	98
٤	Gloves must be worn when handling the patient and there is a possibility of blood or liquid splashes coming out	99
٥	The mask should worn when handling the patient and there is a possibility of blood or body fluids splashing through the mucous membranes	43.6
٦	Protective goggles must be worn when dealing with the patient and there is a possibility of blood or body fluids dropping out of mucous tissue of the eye.	5.4
٧	A Gown must be worn when handling the patient, as there is a possibility of mists and liquids coming out	95
٨	Hands should be washed after handling the patient	99
٩	Hands should be washed after sudden exposure to blood and fluids.	98.5
Total Mean (STD)		7.28 (0.8)
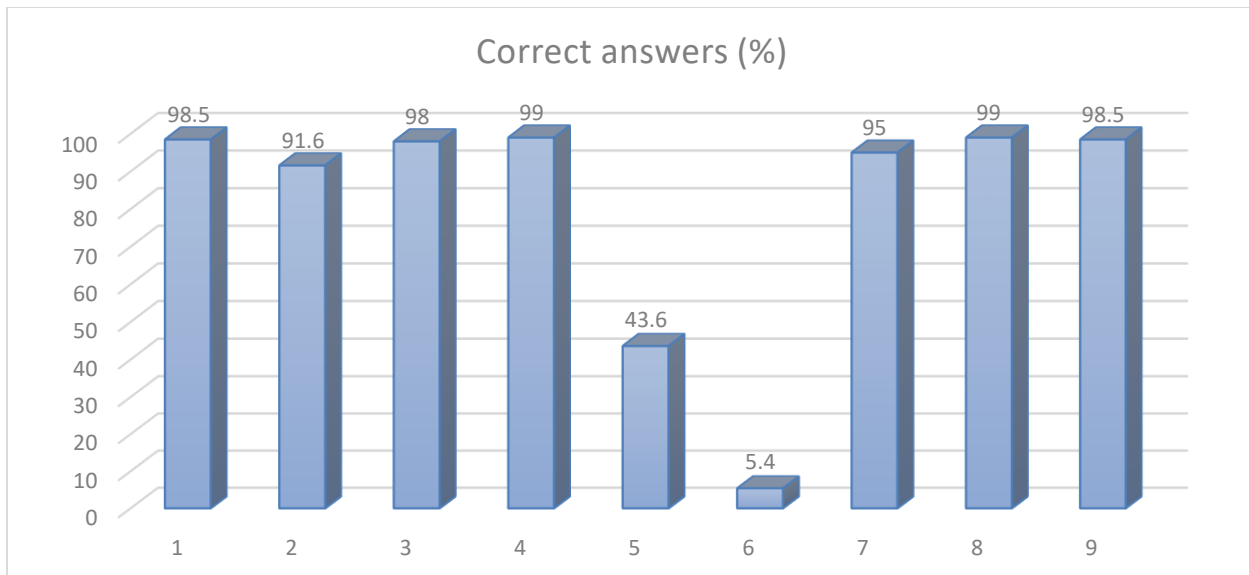
Figure 2: The percentages of correct answers of Stander Precaution in general.

Table (8) reveals healthcare professionals' knowledge regarding Standard Precautions (SP) to prevent blood-borne infections, showcasing their understanding of infection control practices.

It emerged that the large part of participants possessed a knowledgeable understanding of the SP principles. Spreading the idea is critical in this setting. It is really important not only the fact that must be mentioned to each new patient but also the medical personnel should take appropriate measures towards the universal precaution. Well, 98.5% of people responded that indeed the universal precaution such as sterilizing tools is necessary for nursing the each patient. However, the principle of treating every patient as a potential carrier of blood-borne diseases is valued by a massive 91.6% of the group, which can be seen as a way of practicing high a level of a patient care's cautiousness.

Good hand washing practices were highlighted as the most viral, reaching a 98% rate of those who agree that they should wash their hands before possible patient interaction and an even higher 99% who find handwashing after possible interaction is the right practice. This massive support of the mean of hand hygiene as the basis of the epidemic prevention signifies the solid agreement of most people on this issue.

The ability to put on gloves was also very clear, with all knowing 99% of the situations in which it is appropriate to wear gloves when there's a risk of contamination with blood or bodily fluids. This is the indication of the unambiguous knowledge of the function of gloves which ensures safety both for the health professionals and their patients against cross-contamination.

In short, discovered were noticeable knowledgeability holes of some more precautionary ambition measures. Only the 43.6% of people showed that they fully understand that the mask is needed only if there is a risk of spreading the infection through moisture, which means either confusion or inaccuracies in the popularity of the necessity of wearing a mask under the specific conditions of such a threat. In addition, it was also clear from the findings that there was a significant knowledge gap on the importance of wearing protective goggles. Only about 5.3 percent of respondents were able to correctly answer that protective goggles were necessary in situations with a risk of fluids exposure. Thus, it becomes obvious that one of the areas for

improvement and educational implementation is this aspect.
Very clear perception of the usage of the gowns was provided demonstrating 95% of the respondents recognized the need for gowns when there is a possibility of contamination by either mist or fluids, hence confirming that they were well-aware of the gown as a protective barrier

The total mean score of 7.28 (SD=0.8) on a Likert scale of 0-9 indicates that participants have a good understanding Standard Precautions as well. This outstanding average score suggests that about two-thirds of healthcare workers know about the basic principles of infection control well, although there still exist gaps particularly in the use of masks and goggles which can be filled by additional education whereby attenders could better acquire and comply with the SP practices.

C. Distribution of participants regarding their knowledge of Personal Protective Equipment (NSI/SI)

Table 9: Knowledge of Personal Protective Equipment (NSI/SI)

| Item NO.	Items	Correct answers (%)
١	Any injury of the skin by any sharp instrument, scalpel and scissors, can be defined as a sharp injury	16.8
٢	Needlestick injuries are defined as wounds caused by sharp objects such as syringe needles, blood collection needles, cannulae, which are clarified by a vein or needles are used to connect the parts of the venous system.	96
٣	Gloves must be worn when drawing blood and pricking the vein.	99
٤	I must dispose of used needles or sharps into sharps safety boxes immediately.	99
٥	There are sharps disposal boxes in your workplace.	98
٦	The needle should not be separated from the syringe before disposal.	80.2
٧	The needle should not be re-covered after use.	88.1
٨	In the event of an acute injury, the wound site must be allowed to bleed (without applying pressure or sucking it to remove the blood)	83.2
٩	When acute injury occurs, the place of injury must be washed with running water.	97.5
Total Mean (STD)		7.57 (1.10)
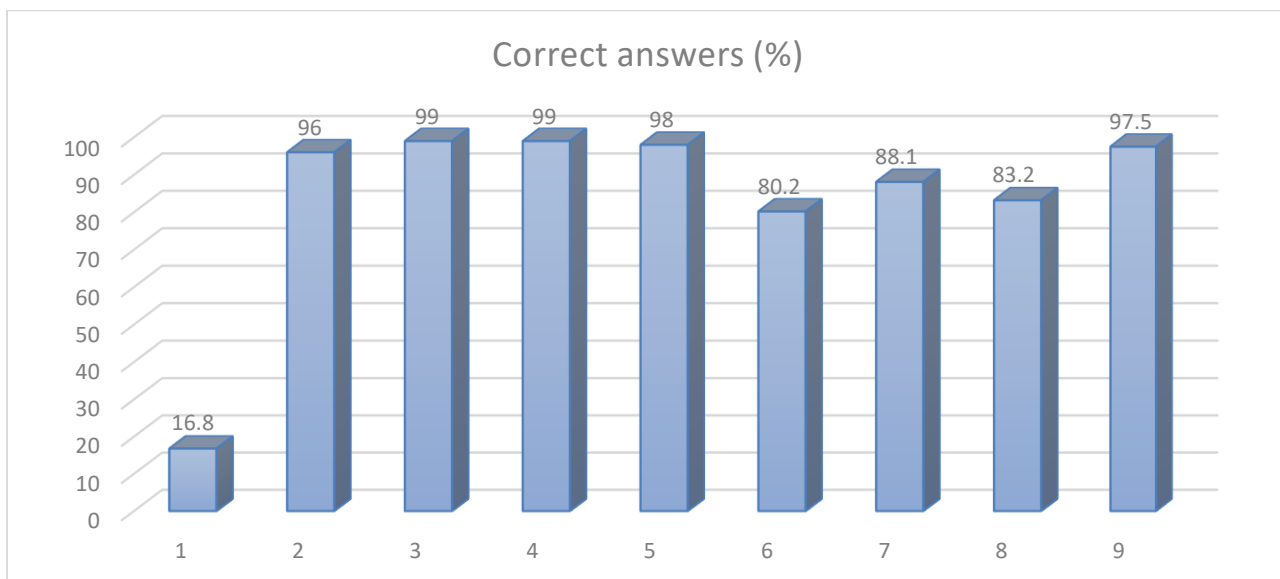
Figure 3: The percentages of correct answers of of Personal Protective Equipment (NSI/SI)
.
Table (9) focuses on healthcare professionals' knowledge regarding the use of Personal Protective Equipment (PPE) and their understanding of needlestick and sharp instrument (NSI/SI) injuries, critical components in maintaining safety and preventing transmission of infections in healthcare settings.
A notable variation in knowledge levels across different areas is evident. A minority of respondents, 16.8%, incorrectly defined any penetration of the skin by sharp instruments such as scalpels and scissors as a blunt injury, highlighting a significant misconception about the nature of sharp injuries.
Alternatively, many participants demonstrated good knowledge of sharp stick injuries, something that was indicated by the 96% who understood them to be as wounds caused by a syringe needle or a cannula. This implies, to a certain extent, on nurses' readiness to anticipate situations in which needlestick injuries can happen easily and their understanding of the nurse specific safety measures.
The participants showed exemplary knowledge as they uniformly agreed, 99%, on the fact that while collecting blood or after pricking a vein one should employ gloves, demonstrating their understanding of the basis principle of the appropriate PPE use

in order to avoid any form of contact with blood and body fluids.
Also, all the participants 99% who got interviewed understood the necessity to dispose used needles or sharps in Sharps disposal boxes and these were readily available to them in their working space. These researches emphasize on the high level of compliance with accumulation safe practices aimed at minimizing risks which is caused due to NSI/SI.

In the wake of needle and syringe disposal following usage, 80.2% were suitable in the fact that the needle should never be separated from the syringe before disposal and 88.1% knew that needles should never be capped after utilization. Such use of practices is necessary for reducing the chance of getting needle-sticks injuries while dealing with handling of the sharp instruments without any need.
Concerning to the urgent treatment of sudden injuries respondents mostly, 83.2%, wanted that the wound area were be permitted to bleed freely and 97.5% answered that the injury site pervious water wash could be the way to do it. These first aid measures that adhere are well enough to the recommended measures for sharp injuries and to help in prevention of infections. The overall mean score of 7.57 (with a standard deviation of 1.10) on a scale of 0-9 reflects a strong foundational knowledge among healthcare professionals about PPE and the management of NSI/SI. However, the misconceptions about the definition of blunt injuries and the somewhat lower scores on certain best practices indicate areas where further education and training could enhance safety and adherence to infection control protocols.

D. Attitude components
: Attuite of Stander Precaution Table10

| Item NO.	Items	Correct answers (%)
١	Any penetration of the skin by any sharp instrument, scalpel and scissors, can be defined as a blunt injury	92.6
٢	Needlestick injuries are defined as wounds caused by sharp objects such as syringe needles, blood collection needles, cannulae, which are clarified by a vein or needles are used to connect the parts of the venous system.	96.5
٣	Gloves must be worn when drawing blood and pricking the vein.	82.7
٤	I must throw used needles or sharps into sharps disposal boxes immediately.	99.5
٥	There are sharps disposal boxes in your workplace.	97.5
٦	The needle should not be separated from the syringe before disposal.	95
٧	The needle should not be re-covered after use.	95.5
٨	In the event of an acute injury, the wound site must be allowed to bleed (without applying pressure or sucking it to remove the blood)	90.1
Total Mean (STD)		7.49 (0.78)
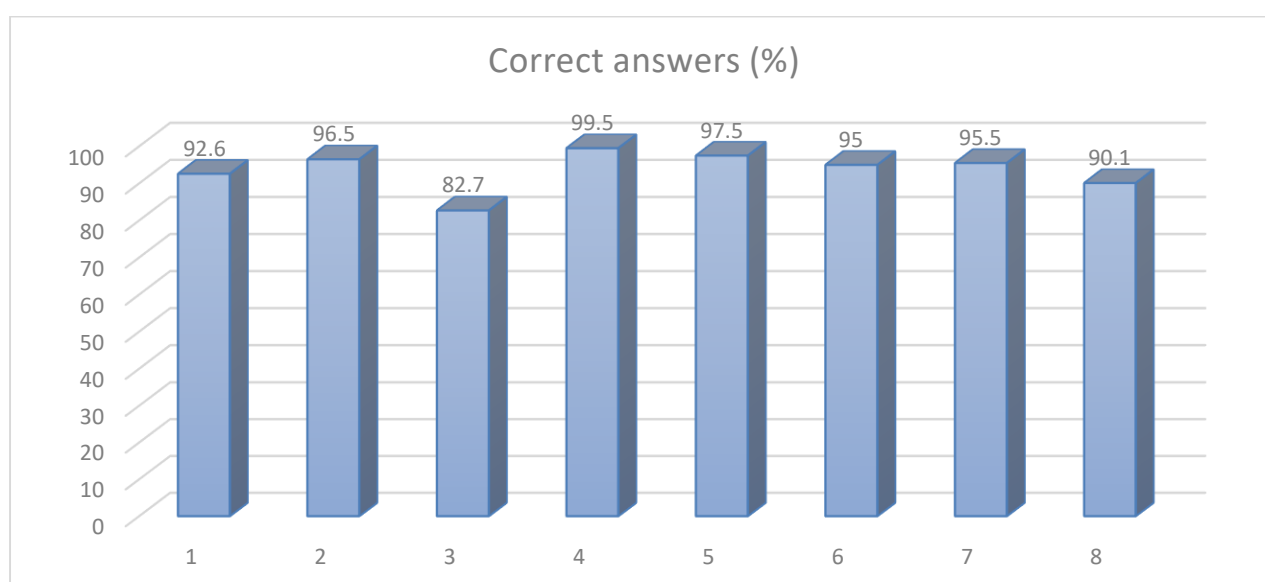
Figure 4: The percentages of correct answers of Attuite of Stander Precaution
The data in table (10) provided highlights the attitudes of healthcare professionals towards various components related to handling sharp instruments and needlestick injuries (NSI), reflecting their perceptions and intended practices within the workplace.
A significant majority, 92.6%, incorrectly identified penetration of the skin by sharp instruments such as scalpels and scissors as a blunt injury. This reflects a common misconception regarding the terminology used to describe injuries caused by sharp objects, which might affect the understanding and reporting of such incidents.

However, on the other end of the spectrum, a staggering 96.5% of participants accurately defined needlestick injuries, displaying a comprehensive understanding about the types and hazardous consequences of injuries inflected by syringe needles, blood collection needles, and cannula, to various users groups. The core of this recognition are the safety precautions and measures that are aimed at avoiding non-suction injuries.

In line with the procedure of blood draw and venipuncture, 82.7% of the respondents came to a conclusion, that protective gloves were very important. It raises the awareness among persons of the importance of PPE as a shield to ward out the probable infections.

Very high commensurability was seen on the prompt disposal of the used needles or sharp objects into the disposal boxes with almost 100 % of the respondents realizing that it is proper. A similar result was given by 97.5% of respondents who mentioned that they had such containers in their workplace, and this means known sharps containers disposal as a norm or standard precautionary measure.

Each using the 95% of them agreed that the needle couldn't be detached from syringe before its disposal, and 95.5% of attendants also agreed that needles should never be re-capped after using. These attitudes evince strong attitude to safety measures that are intended to determine the accidents due to NSI and accomplish the troubles of the soldiers.

In regards to the use of first aid, in the initial stage of a local injury, 90.1 % of the respondents feel safe about not pinching the wound spot or sucking it out to enable the bleeding reduction at the risk of being infected.

A mean score of 7.49 (STDEV 0.78) on a 0-9 scale implies the prevalence of positive attitude towards the non-surgical interventions prevention and management amongst the medical professionals. Though, the real situation is that the general public still applies the term blunt injuries to all kinds of injury. It is now obvious that we need to take further action with aim at helping the public to better recognize different types of injury and thereby improve the overall attitude towards safety.

D. Practices of Stander Precaution

Table (11) discusses the health professionals' everyday practices concerning Standard Precautions (SP), a crucial factor in the prevention of cross-infections in healthcare facilities . These include different approaches for preventing infection, mainly improving the hand washing practices, use of PPE and providing infection prevention services. A majority of the participants, 97.5% the indicated that consistent washing hands after coming in contact with a patient was the standard. The information is key in demonstrating that the participants seriously practiced hand hygiene after interacting with a patient. Moreover, portraying that 95.5% admitted they washed their hands prior to patient contact trends patients to people who care about health, and "with the proposition of contaminating pathogens".

Table1: Practices of Stander Precaution

| Item NO.	Items	Correct practice (%)
١	I wash hands after handling the patient	97.5
٢	I wash hands before handling the patient	95.5
٣	I wash hands after exposure to blood and body fluids	98.5
٤	I wash hands before and after using gloves	91.1
٥	I use gloves to deal with the patient and there is a possibility of a drop of blood or body fluids coming out.	98
٦	I Wear Goggles when dealing with the patient and there is a possibility of splashes of blood or body fluids.	82.7
٧	I wear gown when dealing with the patient, and there is a possibility of spray and liquids coming out	90.1
٨	I Wear Face Shield\ Mask when dealing with the patient and there is a possibility of splashes of blood or body fluids.	81.7
٩	I exercise standard precautions when dealing with all patients	91.6
Total Mean (STD)		8.267 (1.33)
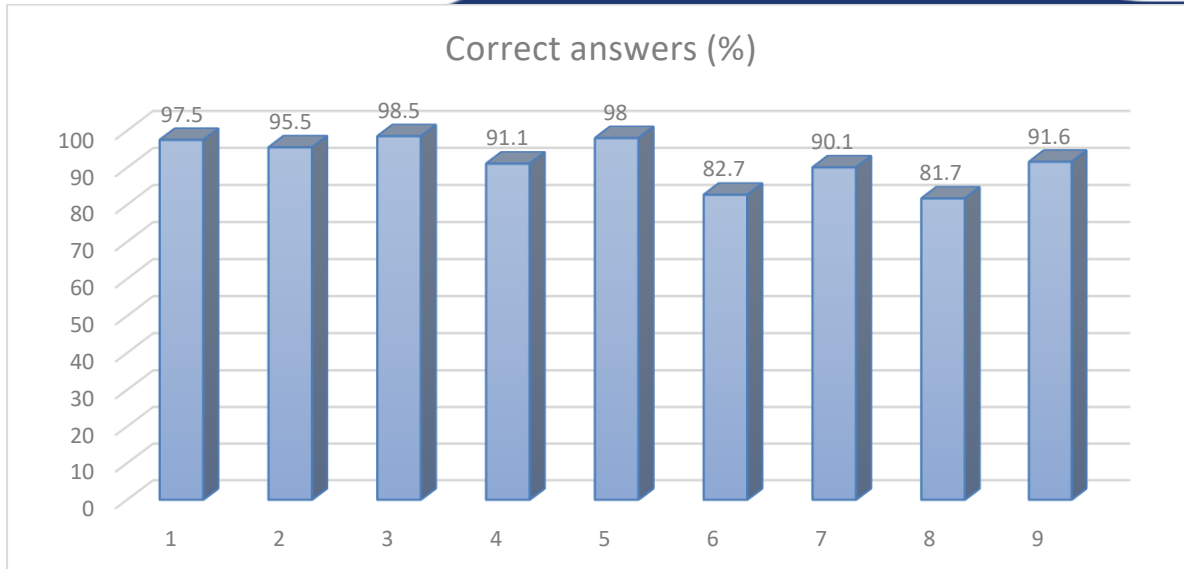
Figure 5: The percentages of correct answers of Practices of Stander Precaution

When contacted with blood or body fluids for the first time, 98.5% of the surveyed participants affirmed that they washed their hands, proving that at this specific situation, the safety measures to minimize the infections spread after exposure become clearly apparent. Moreover, 91.1% also were of the view that they ought to as well cleanse their hands either before or right after using the gloves which clearly implies that they comprehend the essence of hands sanitation together with wearing gloves. Approximately 98% of market participants indicated the application of gloves as a protective measure confronting exposure to blood and body fluids based on the risk of contagion through direct contact with a potentially infectious agent. On the other side, the usage of goggles for avoiding splashes in the face occurred significantly less frequently, as indicated by the 82.7% adherence to eye protection steps, which might be a sign of certain issues with availability or compliance with these steps.

Through the data collected from sixty-eight people working in lab settings protecting the workers from spraying and splash liquids, seventy-tw0 percent of them were wearing their gowns while six out of ten others also relied on their lab gowns, face shields and safety masks during analogous situations. Persisting with the 90% utilization of face masks and the lower-than-desired percentage of perfect face coverages gives an indication that more effort by the society needs to be directed towards this.

The striking statistic, 91.6% of participants reality-checking themselves that they would respect all kinds of precautions with every patient, indicated rather widespread attitude to the need of strict infection prevention for each and every encounter health care workers are supposed to have.

Among the students, the mean engagement level in the standards of practices as one subject in one person was 8.267 with the standard deviation of 1.330 [0-9], which proves that the participants were engaged in the learning process and were highly involved in it. This high median score showed that burdened of the majority of them were already inept but they do possess some decent skills and were basically well acquainted with applying proper SP practices both for their protection and safety as well as the security of their patients. Consequently, but nevertheless, absence of this protection devices will raise the need to plan for the arrangements of such situations with both a compromise on the observance of social distancing and reinforcement of the comprehensiveness of the prevention measures.

E. Practices of Needle stick injury /sharp injury

The dataset outlines healthcare professionals' practices and responses to needlestick and sharp injuries (NSI/SI), essential for preventing infection transmission and managing occupational hazards in healthcare environments.

We are dedicated to adherence to prevention by indicating that 98.5% of respondents wear gloves during the blood drawing and vein wrapping, which is the part that viruses get through the skin. This enables us to provide the first protection line against any infection. In addition, 95.5% of workers who work with such waste also say they put on gloves while disposing of needles or sharp objects, which stresses the rest of the consistent use of personal protective equipment (PPE) in the tasks of a hazardous level.

Table 12: Practices of Needle stick injury /sharp injury

| Item NO.	Items	Correct practice (%)
١	I wear gloves when drawing blood and wrapping the vein	98.5
٢	I wear gloves when disposing of contaminated needles or sharp objects	95.5
٣	Do not separate the needle from the syringe before disposal.	78.7
٤	Throw the used needle or sharps into the sharps disposal boxes immediately	98.5
٥	Do not re-cover the needle after use.	89.1
٦	Do not bend the needle after using it	91.1
٧	When a sharp object/needle stick injury occurs, I will allow the wound to bleed.	81.7
٨	When acute injury/needle injury occurs, wash the area with running water	98.5
٩	When an acute injury occurs, do not apply pressure to the injured area	75.7
Total Mean (STD)		8.07(1.48)
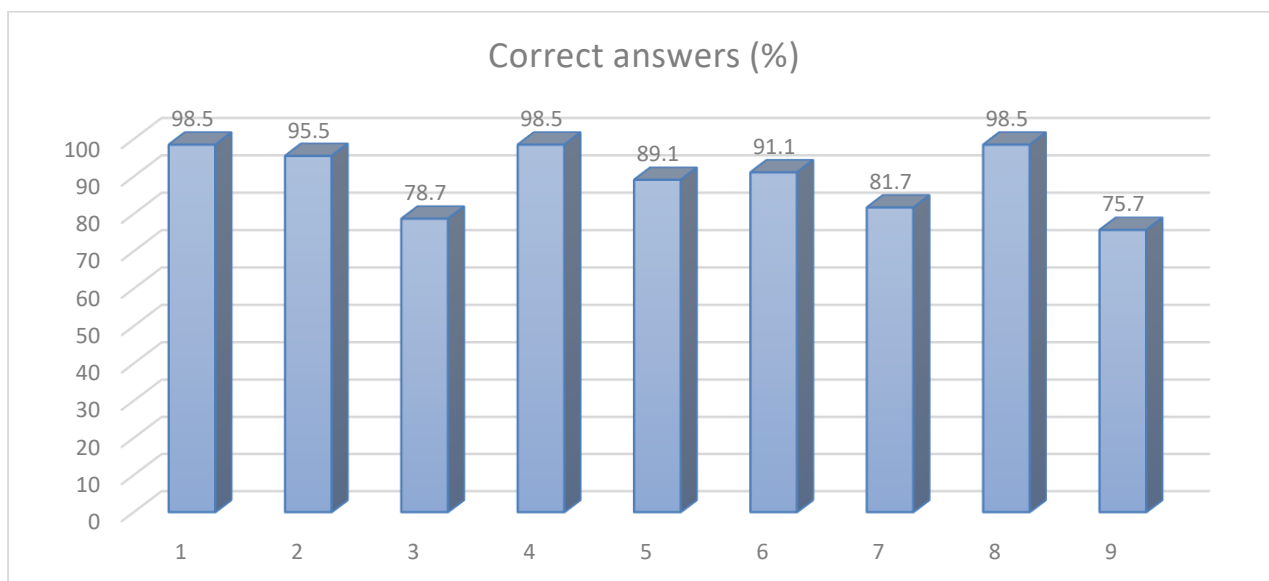
Figure 6: The percentages of correct answers of Practices of Needle stick injury /sharp injury

The realization that other people should practice the use of two separate needles as stipulated by the recommendations meant to address risks of NSI/SI was only marked by 78.7% compliance rate. This goes to demonstrate that there is a possibility for added initiatives to enhance the safety measures worker would use.

Used needles or sharps disposal right away was the only action that was carried by 98.5% of the participants which was an indication of a trait that they followed the recommended practices of handling of the hazardous waste. Furthermore, the study realized that 89.1 % adopted tips such as not recapping needles, after use and 91.1% did not create a curve on needles after the usage, which practices effectively reduce the risk of NSI/SI.

In a case of NSI/SI, 81.7% of them allowed the bleeding for 5 minutes, which is the recommended time apart from the significance that it can flush out the potential infectious agents, cutting back the possibility of infection. The act of handwashing with water that is running and a crucial step to be followed immediately after injury was observed in 98.5%, the highest percentage emphasizing the matter of swift post exposure care.

On the contrary, the attention seems to be less specific when an acute injury occurs, as just 75.7% applicants knew how to respond correctly by saying no to pressing the injured area. In my opinion, education about first-aid responses to NSI/SI is a very important priority because they are currently not prioritized enough.

The overall mean score of 8.07 (with a standard deviation of 1.48) on a scale of 0-9 reflects a commendable level of practice among healthcare professionals regarding NSI/SI prevention and management. Despite this high average score, the variability in adherence across different practices, especially in the correct handling of sharps before disposal and the initial response to injuries, suggests areas where further training and reinforcement could enhance safety measures in healthcare settings.

Discussion:

This study used the SPSS program to analyze data in order to determine the nursing credentials needed to meet the cautious threshold for infection control in Saudi Arabia. The survey found that most healthcare personnel have a good understanding of the routine prevention of blood-transmitted infections, which is good news for specialists. important parts of preventing and controlling infections that spread through blood, and that psychotherapeutic measures work to prevent infections that spread through blood, showing that psychotherapy is widely recognized as important, and that care providers have a nuanced understanding of the risks of infection. Furthermore, focused educational initiatives are necessary to dispel some particular misunderstandings.

It has been demonstrated that healthcare professionals have a limited understanding of the need of personal protective equipment (PPE) and the nature of needlestick and sharps injuries (NSI/SI). One major misconception is that any penetration of the skin by sharp objects like scissors or scalpels constitutes a sharp injury. On the other hand, nurses are well-prepared for potential acupuncture injuries due to their familiarity with PPE and the basic principle of avoiding contact with blood and fluids. In addition to being well-versed in first aid protocols that should be followed for acute injuries and to aid in infection prevention, the body possesses the tools needed to practice reducing the likelihood of needle stick injuries while handling sharps.

Additionally, it reveals how healthcare workers feel about different aspects of needle stick injuries (NSI) and sharps handling, which reflects their views and goals for their work environment. They all showed a thorough knowledge of the various needle, blood collection, and cannula injuries, as well as the severe consequences these incidents have for various user groups, and it turns out that there is a common misunderstanding about the terminology used to describe sharps injuries, which can affect how these incidents are understood and reported.

Additionally, it became evident from observing healthcare workers' daily practices that they comprehend the importance of hand sanitization with gloves on, which is a critical component of Standard Precautions (SP) for preventing cross-infection in healthcare facilities.

Lastly, when it comes to practices and responses to needle and sharp injuries (NSI/SI), which are crucial for preventing infection transmission and managing occupational risks in healthcare settings, it has been demonstrated that healthcare workers wear gloves when drawing blood and wrapping a vein. This confirms the continued use of personal protective equipment (PPE) in dangerous level tasks. Due to its present lack of emphasis, education regarding first aid responses to NSI/SI must be a top concern.

Even though most of them were completely unqualified, they did have a few good talents and knew how to treat patients safely and effectively. Therefore, it will be necessary to make preparations for such situations in the absence of these safeguards, which includes reducing regard for social distance and increasing the thoroughness of preventative actions. Regardless, everybody still uses the word "acute injury" when describing any kind of harm. We must now proceed with the obvious goal of educating the public on the many forms of injuries and fostering a more positive outlook on safety. Nevertheless, there is room for improvement in terms of safety and compliance with infection control methods due to misunderstandings regarding the severity of injuries and relatively poor performance on certain best practices.

Limitation of study :
One of the key limitations of this study is selection bias. As we don't have any control training to assess the effectiveness of BISCL training, our assessment will not show the result we would expect to see under a counterfactual situation. Another limitation is recall bias. Knowing the nature of the study, nurses may pay more attention to the training and pre-assessment question that they wouldn't have done in a normal situation. Asking in KAP regarding infection control to determents the score may sensitive in some participant.

Recommendations:
In general, healthcare workers (HCWs) are more likely to experience job-related stress. The onset of COVID-19 sparked concerns due to the unknown nature of the new virus. The fear was made worse by the high contagiousness and death rates of COVID-19, leading to potential psychological issues like depression, anxiety, and sleep problems, particularly in healthcare workers treating COVID-19 patients.

The BICSL training program emphasizes a theoretical approach to enhance attitude and compliance, while also promoting self-discipline within the course. Supposedly follows a new approach of Teaching nurses emotional stability when facing infectious diseases in the future.

Additionally, nurses healthcare workers reported that increased fear, stress, and anxiety were linked to the number of HCWs affected by COVID-19 and the lack of proper COVID-19 training and protective gear.

Nevertheless, the rate of infection of COVID-19 and the occurrence of psychological effects among nurses and healthcare workers in developed nations were notably less in comparison to developing countries. In contrast to developing nations, the United States possesses a stronger healthcare system.

A worldwide deficit of healthcare workers is said to lead to higher workloads, extended hours, staff burnout, and negative mental health consequences. Hence, it is anticipated that healthcare workers will experience psychological effects like anxiety and depression as a result of the heightened stress caused by the rapid spread of COVID-19 cases in areas with limited healthcare resources(31).

Conclusion:

This review aimed to explore the literature regarding healthcare workers' knowledge of infection prevention and control (IPC) and the factors that influence their compliance with IPC measures. In general, healthcare workers appear to have sufficient knowledge of IPC practices such as standard precautions, hand hygiene, and measures for preventing the spread of infectious diseases like tuberculosis, MRSA, MERS-CoV, and COVID-19, as well as care related to urinary catheters. However, in outbreak of COVID-19 impacted in Nurses more than other health workers this point needs to investigate the factors that influence for gain Covid-19 for one who already training how to do self-protect.

However, there are slight gaps in some healthcare workers' knowledge, particularly regarding occupational vaccinations (such as HBV, varicella, and influenza) and the risk of infection from needlestick and sharp injuries, the importance of following safe practices to prevent bloodborne pathogen transmission.

Various factors can influence healthcare workers' compliance with IPC measures, including their level of knowledge, education and training, experience, availability of necessary supplies (such as hand sanitizer, soap, and paper towels), working in high-risk areas like ICUs or surgical wards, working in different types of hospitals, and caring for patients with potential exposure to blood or body fluids. Barriers to compliance may include heavy workloads, lack of time, professional category, and low patient-to-nurse ratios.

To improve compliance with IPC measures and reduce healthcare-associated infections, it is recommended to implement a comprehensive approach that includes education, training, and access to necessary resources. Adopting such strategies has been shown to be effective in enhancing IPC practices and ultimately improving patient safety.

Reference list:

1. Lam SC. Validation and cross-cultural pilot testing of compliance with standard precautions scale: self-administered instrument for clinical nurses. Infect Control Hosp Epidemiol. 2014;35(5):547-55.

2. Memish ZA. Infection control in Saudi Arabia: meeting the challenge. Am J Infect Control. 2002;30(1):57-65.

3. Ra'awji BAA, Almogbel ES, Alharbi LA, Alotaibi AK, Al-Qazlan FA, Saquib J. Knowledge, attitudes, and practices of health-care workers regarding hand hygiene guidelines in Al-Qassim, Saudi Arabia: A multicenter study. Int J Health Sci (Qassim). 2018;12(2):3-8.

4. Hamid HA, Mustafa MM, Al-Rasheedi M, Balkhi B, Suliman N, Alshaafee W, et al. Assessment of hospital staff knowledge, attitudes and practices (KAPS) on activities related to prevention and control of hospital acquired infections. J Infect Prev. 2019;10.

5. Barry M, AlMohaya A, AlHijji A, Akkielah L, AlRajhi A, Almajid F, et al. Clinical Characteristics and Outcome of Hospitalized COVID-19 Patients in a MERS-CoV Endemic Area. J Epidemiol Glob Health. 2020;10(3):214-21.

6. Australian Government. Infection prevention and control. Retrieved from https://www.amr.gov.au/what-you-can-do/hospitals/infection-prevention-and-control.2017.

7. Australian Commission on Safety and Quality in Health Care. Credentialing health practitioners and defining their scope of clinical practice: A guide for managers and practitioners. Sydney: ACSQHC. 2015.

8. Dunshea, K. J. R. & Morphet, J. Does Australia need credentialed emergency nurse specialists? Australasian Emergency Nursing Journal, 2015; 18(3), 115-117.

9. Mumford, V., Reeve, R., Greenfield, D., Forde, K., Westbrook, J. & Braithwaite, J. Is accreditation linked to hospital infection rates? A 4-year, data linkage study of Staphylococcus aureus rates and accreditation scores in 77 Australian acute hospitals. International Journal for Quality in Health Care, 2015; 27(6), 479-485.

10. Kendall-Gallagher, D., Aiken, L. H., Sloane, D. M. & Cimiotti, J. P. Nurse specialty certification, inpatient mortality, and failure to rescue. Journal of Nursing Scholarship, 2011; 43(2), 188-194.

11. Tam, V., Borrebach, J., Dunn, S. A., Bellon, J., Zeh, H. J. & Hogg, M. E. Proficiency-based training and credentialing can improve patient outcomes and decrease cost to a hospital system. The American Journal of Surgery, 2017; 217(4), 591-596.

12. MacBeth, D., Hall, L., Halton, K., Gardner, A. & Mitchell, B. G. Credentialing of Australian and New Zealand infection control professionals: An exploratory study. American Journal of Infection Control, 2016; 44(8), 886-891.

13. Vandenhouten, C. L., DeVance-Wilson, C. L. & Little, B. B. Credentialing public health nurses: Current issues and next steps forward. Public Health Nursing, 2015; 32(5), 565-576.

14. Boyle, D. K. Nursing specialty certification and patient outcomes: What we know in acute care hospitals and future directions. Journal of the Association for Vascular Access, 2017; 22(3), 137-142.

15. Mumford, V., Reeve, R., Greenfield, D., Forde, K., Westbrook, J. & Braithwaite, J. Is accreditation linked to hospital infection rates? A 4-year, data linkage study of Staphylococcus aureus rates and accreditation scores in 77 Australian acute hospitals. International Journal for Quality in Health Care, 2015; 27(6), 479-485.

16. Hopkins S, Group o. English National Point Prevalence Survey on Healthcare associated infections and Antimicrobial Use, 2011. wwwhpaorguk. 2012.

17. European Centre for Disease Prevention and Control. Annual epidemiological report: Reporting on 2010 surveillance data and 2011 epidemic intelligence data Geneva: ECDC 2013 [Available from: https://www.ecdc.europa.eu/sites/default/files/media/en/publications/Publications/Annual-Epidemiological-Report-2012.pdf.

18. National Audit Office. Reducing Healthcare Associated Infections in Hospitals in England. London: The stationery Office. 2009.

19. Gammon J, Morgan-Samuel H, Gould D. A review of the evidence for suboptimal compliance of healthcare practitioners to standard/universal infection control precautions. J Clin Nurs. 2008;17(2):157-67.

20. Bukhari SZ, Hussain WM, Banjar A, Almaimani WH, Karima TM, Fatani MI. Hand hygiene compliance rate among healthcare professionals. Saudi Med J. 2011;32(5):515-9.

21. Fuller C, Savage J, Besser S, Hayward A, Cookson B, Cooper B, et al. "The dirty hand in the latex glove": a study of hand hygiene compliance when gloves are worn. Infect Control Hosp Epidemiol. 2011;32(12):1194-9.

22. Kuzu N, Ozer F, Aydemir S, Yalcin AN, Zencir M. Compliance with hand hygiene and glove use in a university-affiliated hospital. Infect Control Hosp Epidemiol. 2005;26(3):312-5.

23. Chau JP, Thompson DR, Twinn S, Lee DT, Pang SW. An evaluation of hospital hand hygiene practice and glove use in Hong Kong. J Clin Nurs. 2011;20(9-10):1319-28.

24. Girou E, Chai SH, Oppein F, Legrand P, Ducellier D, Cizeau F, et al. Misuse of gloves: the foundation for poor compliance with hand hygiene and potential for microbial transmission? J Hosp Infect. 2004;57(2):162-9.

25. Flores A, Pevalin DJ. Healthcare workers' compliance with glove use and the effect of glove use on hand hygiene compliance. British Journal of Infection Control. 2006;7(6):15-9.

26. Ary D, Jacobs LC, Razavieh A, Sorensen CK. Introduction to Research in Education: Cengage Learning; 2009.

27. Mash C, Baker J, Foster C, Goldfarb J. Improved infection control compliance using isolation signs that incorporate standardized colors, visual cues, and sequenced instructions. Am J Infect Control. 2011;39(5):445-7.

28. McGaw C, Tennant I, Harding H, Shamir C, Crandon I, Walters C. Healthcare workers' attitudes to and compliance with infection control guidelines in the operating department at the University Hospital in Jamaica. International Journal of Infection Control. 2012;2012:1-9.

30.Fendler EJ, Ali Y, Hammond BS, Lyons MK, Kelley MB, Vowell NA. The impact of alcohol hand sanitizer use on infection rates in an extended care facility. Am J Infect Control. 2002;30(4):226-33.

31-Nelson Chidinma Okpua, Impacts of Covid-19 Pandemic on Frontline Health Care Workers in Africa and Asian Countries: A Systematic Review, Malaysian Journal of Medicine and Health Sciences 2021.