RISK PERCEPTION ON NEEDLESTICK INJURY AND EFFECTIVENESS OF THE NEEDLESTICK PREVENTION MODULE AMONG HOUSE OFFICERS IN KELANTAN

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UNIVERSITI SAINS MALAYSIA

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BY

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LIST OF PAPERS AND CONFERENCES

Throughout my Doctor of Public Health (DrPH) program, I had the privilege of having several articles and conference abstracts accepted for publication and presentation. As a result, this thesis encompasses three distinct papers that align with the four specific objectives of my study.

Publication

1. Kutubudin AFM, Wan Mohammad WMZ, Md Noor SS, Shafei MN. Risk Factors Associated with Defaulted Follow-Up and Sharp Injury Management among Health Care Workers in a Teaching Hospital in Northeastern Malaysia. Int J Environ Res Public Health. 2022 May 29;19(11):6641. doi: 10.3390/ijerph19116641. PMID: 35682226; PMCID: PMC9180157.

Conferences

1. 2nd International INTERACT Symposium on One Health and One Medicine at Oklahoma State University 10-11 July 2023 (Poster Presentation)
   Needlestick Injury Prevention Module Development (N-SIP):
   A Comprehensive Approach to Education and Prevention
2. 3rd National Epidemiology Conference 2023 (NEC 2023) at Hospital Universiti Sains Malaysia (Oral Presentation)
   Factors Associated with Perception of Risk of Needlestick Injury Among House Officers in Kelantan.

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LIST OF ABBREVIATIONS

A&E	Accident and Emergency
HBV	Hepatitis B Virus
HCV	Hepatitis C Virus
HCWs	Healthcare Workers
HIV	Human Immunodeficiency Virus
HO	House officer
HRPZ II	Hospital Raja Perempuan Zainab II
MOH	Ministry of Health
HSIP	Hospital Sultan Ismail Petra
HTM	Hospital Tanah Merah
NSI	Needlestick Injury
N-SIP	Needlestick Injury Prevention
SD	Standard Deviation
SPSS	Statistical Package for Social Science
UP	Universal Precautions
SP	Standard Precaution
WHO	World Health Organization
RM ANOVA	Repeated measure ANOVA

LIST OF SYMBOLS

>	More than
<	Less than
=	Equal to
A	Alpha
B	Beta
%	Percentage

ABSTRAK

Persepsi Risiko Terhadap Kecederaan Tusukan Jarum dan Keberkesanan Modul Pencegahan Kecederaan Tusukan Jarum dalam Kalangan Pegawai Perubatan Siswazah di Kelantan

Latar belakang: Pegawai perubatan siswazah (HOs) menghadapi ancaman pekerjaan yang signifikan daripada kecederaan tusukan jarum (NSIs), yang berpotensi mendedahkan mereka kepada patogen bawaan darah. Memahami faktor-faktor yang mempengaruhi persepsi risiko NSI dan membangunkan modul latihan yang berkesan adalah penting untuk melaksanakan langkah pencegahan yang kukuh. Penyelidikan ini meneroka faktor - faktor yang mempengaruhi persepsi risiko NSI di kalangan HOs dan menilai keberkesanan Modul Pencegahan Kecederaan Tusukan Jarum (N-SIP) dalam meningkatkan pengetahuan dan persepsi risiko berkaitan NSI.

Objektif: Objektif kajian ini adalah untuk menentukan skor purata persepsi mengenai risiko NSI, faktor-faktor yang berkaitan dengan skor purata persepsi, pembangunan dan pengesahan modul, serta keberkesanan modul yang baru dibangunkan.

Metodologi: Kajian ini bermula dengan kajian irisan lintang yang melibatkan 176 HOs, yang melengkapkan soal selidik kendiri. Regresi linear digunakan untuk mengenal pasti faktor - faktor skor persepsi risiko NSI. Selain itu, modul N-SIP dibangunkan menggunakan model ADDIE dan menjalani pengesahan kandungan oleh pakar dan pengesahan muka oleh HOs. Reka bentuk intervensi tidak rawak menugaskan HOs sama ada ke kumpulan intervensi yang menerima modul N-SIP atau kumpulan kawalan, dengan skor persepsi risiko NSI dinilai pada garis asas, tiga

minggu, dan enam minggu selepas intervensi menggunakan ukuran yang sah. Analisis statistik, termasuk ANOVA ukuran berulang, menilai perubahan dalam skor persepsi. ***Keputusan***: Kajian keratan rentas menunjukkan bahawa jantina ($b = 1.96$; $p = 0.002$), pengalaman kerja ($b = 2.93$; $p < 0.001$), menghadiri pendidikan kesihatan mengenai NSI ($b = 4.42$; $p < 0.001$), dan sejarah NSI ($b = 4.96$; $p < 0.001$) mempengaruhi persepsi risiko NSI secara signifikan. Kajian mendapati skor purata keseluruhan persepsi risiko adalah 47.63, menunjukkan skor positif di kalangan HOs. Modul N-SIP menunjukkan kesahan kandungan yang tinggi dan kesahan muka yang positif di kalangan HOs. Kajian intervensi menunjukkan peningkatan yang signifikan dalam skor persepsi risiko NSI di kalangan kumpulan intervensi berbanding kumpulan kawalan, dengan peningkatan yang signifikan secara statistik diperhatikan dari garis asas hingga tiga minggu dan enam minggu selepas intervensi. Tiada perubahan ketara yang diperhatikan dalam kumpulan kawalan sepanjang tempoh yang sama.

Kesimpulan: Kajian ini mengenal pasti faktor-faktor utama yang mempengaruhi persepsi risiko NSI di kalangan HOs, dengan skor purata keseluruhan persepsi risiko adalah 47.63, menunjukkan persepsi yang umumnya positif di kalangan HOs. Keberkesanan modul N-SIP dalam meningkatkan persepsi risiko NSI telah ditunjukkan, dengan peningkatan yang ketara diperhatikan dalam kumpulan intervensi. Program latihan yang disasarkan, seperti N-SIP, mempunyai kesan yang signifikan terhadap persepsi risiko dan mempromosikan keselamatan pekerjaan di kalangan HOs. Penemuan ini menekankan kepentingan usaha berterusan untuk melaksanakan dan menilai intervensi pendidikan yang disesuaikan untuk mengurangkan risiko NSI dan memperbaiki amalan keselamatan dalam persekitaran penjagaan kesihatan.

Kata Kunci: cedera tusukan jarum, persepsi risiko, modul pendidikan, pembangunan modul, pencegahan NSI, keberkesanan intervensi.

ABSTRACT

Risk Perception on Needlestick Injury and Effectiveness of The Needlestick Prevention Module Among House Officers in Kelantan

Introduction: House officers (HOs) face a significant occupational threat from needlestick injuries (NSIs), posing potential risks of exposure to bloodborne pathogens. Understanding the factors influencing NSI risk perception and developing effective training modules are essential for implementing robust preventive measures. This research explores factors influencing NSI risk perception among HOs and evaluates the effectiveness of the Needlestick Injury Prevention Module (N-SIP) in enhancing NSI-related knowledge and risk perception.

Objectives: The objectives of this study is to determine the mean perception score on risk of NSI, factors associated with mean the perception score, module development and validation, and effectiveness of the newly developed module.

Methodology: This study utilized a cross-sectional design involving 176 HOs, who completed a self administered questionnaire. Linear regression identified associated factors of NSI risk perception scores. Additionally, the N-SIP module was developed using the ADDIE model and underwent content validation by experts and face validation by HOs. A non-randomised interventional design assigned HOs to either the intervention group receiving the N-SIP module or a control group, with NSI risk perception scores assessed at baseline, three weeks, and six weeks post-intervention

using validated measures. Statistical analysis, including repeated-measures ANOVA, evaluated changes in perception scores.

Results: The study found an overall mean risk perception score of 47.63, indicating a positive score among HOs. The cross-sectional study revealed that gender ($b = 1.96$; $p = 0.002$), work experience ($b = 2.93$; $p < 0.001$), attending health education on NSI ($b = 4.42$; $p < 0.001$), and history of NSI ($b = 4.96$; $p < 0.001$) significantly influenced NSI risk perception. The N-SIP module demonstrated high content validity and positive face validity among HOs. The interventional study showed a significant improvement in NSI risk perception scores among the intervention group compared to the control group, with statistically significant increases observed from baseline to three weeks and six weeks post-intervention. No significant changes were observed in the control group over the same period.

Conclusion: The study identified key factors influencing HOs' perception of NSI risk, with an overall mean risk perception score of 47.63 indicating a generally positive perception among HOs. The effectiveness of the N-SIP module in enhancing NSI risk perception was demonstrated, with significant improvements observed in the intervention group. Targeted training programs, such as the N-SIP, significantly impact risk perception and promote occupational safety among HOs. These findings underscore the importance of continued efforts to implement and evaluate tailored educational interventions to mitigate NSI risks and improve safety practices in healthcare settings.

Keywords: needlestick injury, risk perception, educational module, module development, NSI prevention, intervention effectiveness.

CHAPTER 1

INTRODUCTION

1.1 Background of NSI

1.1.1 Hazards in the Healthcare Facilities

Healthcare workers (HCWs) dealt with various workplace risks and hazards. HCWs were highly susceptible to occupational hazards such as NSI and splash during their everyday working lives. This was intimately tied to how they worked, which involved handling and working with sharp objects, including needles, sutures, scalpels, syringes, and sharps. Bloodborne viruses such as the Hepatitis B virus (HBV), Hepatitis C virus (HCV), and Acute Immunodeficiency Syndrome (AIDS) may be transmitted as a result of the injury.

Surprisingly, more than 50 different infections, including Diphtheria, Gonorrhea, Herpes, Malaria, Leptospirosis, Ebola, Tuberculosis, Syphilis, Scrub typhus, HCV, HBV, and HIV, can be spread by NSI. These viruses were the most frequently related, transmitted, and harmful for the HCWs among those mentioned. The likelihood of getting those viruses after suffering an NSI is 0.3% for HCV, 3.0% for HIV, and 30.0% for HBV (Feleke, 2013; Mf *et al.*, 2018). According to Prüss-üstün *et al.* (2003), the estimated risk of seroconversion for HIV, HBV, and HCV after an NSI is 0.3%, 30.0%, and 1.8 to 3.0 %, respectively.

It is widely acknowledged that hepatitis B, hepatitis C, and HIV significantly impact global health, with approximately 350 million, 150 million, and 33 million individuals affected by each disease, respectively (Feleke, 2013). According to research from the World Health Organization (WHO), the proportion of HCWs exposed to bloodborne pathogens worldwide each year was 2.6% for HCV, 5.9% for HBV, and 0.5% for HIV (Prüss-üstün *et al.*, 2003).

NSI also impacts healthcare services and HCWs' health. This was related to alterations in behaviour and employment brought on by anxiety, mental stress, and distress brought on by the NSI (Feleke, 2013). NSIs were the main contributor to 74.9% of injuries among Malaysian HCWs, according to the Occupational Health Unit of the Ministry of Health (MOH). When compared to other HCWs, nurses suffered the greatest number of NSI (MOH Malaysia, 2007).

In addition to NSI, HCWs also confronted numerous other risks and hazards, including TB infection, toxic exposure to chemicals and medications, allergy to chlorhexidine, nosocomial infection, asthma, latex allergy, accidents, falls, and numerous others. But out of all of them, NSI was the most significant because it generally affected all HCWs in a healthcare context. This resulted from the likelihood that practically all HCWs would experience NSI. For instance, with TB, only individuals who cared for and managed TB patients were susceptible to contracting the disease. Nosocomial TB will be a possibility as long as people with active TB can receive medical attention. However, according to a previous study, the proportion of HCWs who had nosocomial TB infection was rather low (Krüüner *et al.*, 2001).

The goal of eliminating risk among HCWs was unattainable. The goal was to limit this risk to the smallest amount possible. To further limit the risk of blood-borne infection among HCWs in healthcare institutions, a mix of administrative, engineering, and personal control measures must be used. Even though it was possible to prevent or decrease HCWs' exposure to these hazards, injuries and illnesses continue to occur in healthcare settings (Bajwa *et al.*, 2014). Of all industry sectors, HCWs experience the highest prevalence of non-fatal occupational sickness and injury. This illustrated the importance of studying NSI, especially in addressing how they perceived the risk of NSI. The ultimate objective is to reduce the frequency of NSIs and the number of

HCWs affected (Delclos *et al.*, 2007; Wicker *et al.*, 2008; Wittczak *et al.*, 2013; Hefzy *et al.*, 2016; Tudor *et al.*, 2016).

1.1.2 NSI and Its Implications

HCWs are required to follow up on NSI incidence using several steps. This was done to ensure they were being observed for any health problems following the occurrence. However, it was shown that there was a significant amount of defaulted follow-up for NSI among HCWs. The prevalence of defaulting follow-up for NSI varied considerably worldwide, from 28.0% to 53.0% (Miceli *et al.*, 2005; Fadhli *et al.*, 2018). In a study conducted in Germany by Schmid *et al.* (2007), it was discovered that the prevalence was extremely high, at 35.0%. It was much higher in Brazil, where 46.0% of defaulters were reported (Escudero *et al.*, 2015). Higher than that recorded in Brazil, a study from Argentina found a frequency of 53.0% (Miceli *et al.*, 2005). Looking closer, neighbouring Brunei recently conducted research and reported a prevalence of 36.0%, which is greater than Malaysia's 25.9% (Win *et al.*, 2020; Adib *et al.*, 2022).

HCWs may have anxiety, depression, and other morbidities because of NSI, and the health system may experience decreased revenue, increased hospital expenses, and lawsuits because of such injuries. HCWs in Japan reported 40 to 50 new HCV cases annually because of infection at the workplace. Despite widespread usage of an international reporting system, Japan's NSI reporting rate is still considered poor, at less than 21.0% (Kunishima *et al.*, 2019). Each year, between 600,000 and 800,000 NSIs took place in the USA, and many HCWs end up with serious bloodborne virus infections as a result. HCWs were still at high occupational risk for NSI (Joukar *et al.*, 2018).

The emotional impact of NSI can endure for a very long period, and the dread and danger of HCV, HBV, and HIV infection were significant. It was estimated that the annual cost burden in the USA would range from $118 million to $591 million (Kunishima *et al.*, 2019). A study conducted in the US revealed that at least one NSI had been experienced by 110 nurses, with 73 incidents occurring during blood withdrawals. In the USA, indirect costs comprised between 44% and 62% of the total budget. Average short-term expenses per NSI ranged from $145 to $201, while average short-term expenses per hurt nurse ranged from $235 to $328 (Kunishima *et al.*, 2019).

According to research conducted in Britain, treating these severe injuries costs close to £600,000. However, this was believed to be a significant underestimate due to under-reporting and cautious assumptions regarding the cost of injury management (Trueman *et al.*, 2008). In Japan, the national cost burden of NSI in hospitals is estimated to be 33.4 billion yen (US$302 million) per year based on an average cost per NSI of 63,711 yen (US$577) and a number of sharp injuries of 525,000 annually. Efficiency loss costs 20.0% more than initial laboratory tests, which account for 70.0% of the overall cost. Only 5.0% of the total cost was attributable to an infective NSI. Variations in the incidence of NSIs significantly impacted the results.

1.1.3 The Burden of NSI Among HCWs in Malaysia

From January 2010 to January 2011, the MOH's Occupational Health Unit in Malaysia received notifications of 1231 NSI cases. In the following year, from January 2011 to January 2012, the reported instances of NSI increased to 1405, reflecting an increase of 174 cases compared to the previous year. For two years in a row, Selangor, Perak, and Johor were the top three states with the most instances reported; Selangor was the leader in both years.

According to the NSI Surveillance Database, there was a rise in cases from 2016 to 2017, with 1,587 cases reported in 2016 and 1,655 cases in 2017 (MOH, 2011). From the above, we can conclude that NSI cases in Malaysia increased steadily from 2010 to 2017 (Fadhli *et al.*, 2018). Around 67.7% of HCWs who were injured were women, which is greater than it was for men. The prevalence of NSI decreased as people aged, with 1006 cases occurring most frequently in the 20 to 29 age group (71.6%). The next age range, 30 to 39 years, has 237 cases (16.9%). In conclusion, it was observed that the majority of HCWs who sustained injuries were under the age of 30.

In Malaysia, on average, HCWs begin their careers at 25. Thus, people with less than five years of job experience were more likely to sustain injuries. Most cases, 763 (54.3%), occurred in the ward, while 155 cases (11.0%) occurred in the operating room. Staff nurses came in second with 245 (17.4%) cases, but HOs scored the most overall with 445 cases (31.7%). Surprisingly, with 301 occurrences, injection cases predominated over intravenous, intramuscular, and subcutaneous cases (21.4%), followed by blood sample withdrawal with 242 cases (17.2%). A massive number of 1,097 cases (78.1%) were caused only by needles (Fadhli *et al.*, 2018).

1.1.4 Quality Assurance Programme and National Indicator Approach

Around the world, most, if not all, nations had created and implemented policies to lower the incidence of NSI. Each nation had a unique system to address the scope of its issues. Many countries have included the prevalence of NSI as one of the Quality Assurance Indicators to highlight the significance of this issue. This is done to encourage and guarantee that HCWs work safely in a healthcare environment.

In Malaysia, the National Indicator Approach aims for zero new case occurrence. These indicators were crucial because they let us evaluate the program's efficiency while lowering the risk of seroconversion, bloodborne transmission, and prevalence. According to the Quality Assurance Manual, NSI was still common in 2002, showing that HCWs were not adhering to Universal Precautions (UP). The main reason Malaysian HCWs failed to meet the Quality Assurance Indicator, although having the necessary knowledge, was insufficient UP practice, according to a related study by Lee and Noor Hassim (2005).

The Centers for Disease Control and Prevention (CDC) recommended that HCWs practice UP in 1987 to stop the spread of bloodborne infections. Gloves, goggles, and other protective clothing were needed for handling specimens and collecting blood or bodily fluids from patients. According to Thakur *et al.* (2015), if the workers had adhered to the UP protocol, roughly three-quarters of the NSI exposure might have been avoided. Promoting awareness of UP rules and compliance was crucial to prevent HCWs from being exposed to bloodborne pathogens and contracting an infection. Recently, UP had been replaced by Standard Precaution (SD), which is used to prevent the spread of infection via contact, airborne, and not only blood transmission like UP.

1.1.5 Post Exposure Management for NSI Among HCWs

HCWs like doctors, nurses, physicians, paramedics, and laboratory technicians were particularly at risk from sharp tools while at work. Over 20 illnesses can be spread by even a tiny wound made by a sharp object that causes little blood loss. The most common and dangerous bloodborne illnesses include HBV, HCV, and HIV.

Aside from the strain on this profession, occupational contact with sharp objects may lead to other problems, like prejudice against HIV-positive patients who are terrified of getting the virus. This demonstrated that NSI has a wide range of outcomes. Simple treatments like immunisation, post-exposure prophylaxis (PEP), education, and the availability of sharp instrument containers can significantly reduce sharp instrument exposure and its effects (Merchant & Keshavarz, 2003; Varghese *et al.*, 2003; Goniewicz *et al.*, 2012; Chakravarthy *et al.*, 2015).

For HCWs, post-exposure NSI care was crucial. Those who have suffered NSI will be provided intramuscular tetanus toxoid and private counselling on the injury and post-exposure care within 24 hours of the injury. After a thorough risk assessment, those at a high risk of contracting a bloodborne infection will be given PEP. However, not all HCWs who experience NSIs adhere to post-exposure management protocols and receive the necessary treatment. A study conducted in Malaysia found that most HCWs (51.4%) defaulted on follow-up appointments at some point during the treatment process (Kutubudin *et al.*, 2022). Another study conducted in Malaysia reported a slightly lower percentage of defaults, with 35.0% of HCWs failing to adhere to post-exposure management at some point during treatment. Although this percentage is lower, it is still considered high (Adib *et al.*, 2022).

The supply of sharp bins, HIV and HBV PEP, HBV immunisation for HCWs, knowledge, insight, and awareness were all critical components of proper therapy to prevent NSI and its effects (Prüss-üstün *et al.*, 2003). As stated in the Occupational Safety and Health Act of 1994, NSIs are avoidable because everyone is responsible for their health and not others (MOH Malaysia, 2007).

1.1.6 Determinants and Risk Perception of NSI

NSIs are among the most dangerous occupational hazards in medical settings, with blood identified as the primary source of exposure in nearly all occupational diseases. Exposures occur when contaminated needles or a patient's blood come into contact with the eyes, nose, or mouth (Kebede & Gerensea, 2018). In Japan, HCWs report 40 to 50 new HCV cases annually due to workplace accidents. The risk of NSI in the workplace significantly impacts HCWs' safety, well-being, and the standard of care delivered. HCWs working in operating rooms, labor and delivery rooms, emergency rooms, and laboratories are more likely to be exposed. Similarly, cleaners, waste handlers, and other workers who come into contact with blood-contaminated items face greater NSI risks (Amira & Awobusuyi, 2014). NSIs are critical threats that HCWs must manage, yet these dangers are often accepted as part of the job. Employers must prioritize employees' health and safety by creating safe work practices and providing suitable tools, such as safer needle devices, finger shields, and sharps containers (Kunishima *et al.*, 2019).

Risk perception is a fundamental aspect of decision-making and behavior, crucial in how individuals assess and respond to potential hazards and threats to their well-being. It involves subjective judgments and evaluations of risks, encompassing both immediate and long-term considerations that impact health and safety. Perception, in cognitive psychology, refers to the mental processes by which individuals intake, process, and evaluate information from their environment through their senses (Renn, 2004). Each person's perception constitutes a unique reality, similar to characters in animated films who remain suspended in mid-air until they realize their situation and react. Individuals construct their reality and assess risks based on subjective perceptions. This intuitive perception of risk is influenced by factors such

as information about the risk source, psychological mechanisms for processing uncertainty, and prior experiences with danger (Finkenstadt & Handfield, 2023).

In the context of NSIs, risk perception among HCWs is critical. NSIs present significant occupational hazards that can result in transmitting bloodborne pathogens, such as HIV and viral hepatitis. Research indicates that perceiving NSIs as low risk can lead to the occurrence and underreporting of these incidents (Kermode *et al.*, 2005; Jahangiri *et al.*, 2016). This underreporting poses a significant challenge in healthcare systems, impeding the implementation of effective preventive measures. Awareness of NSI and its consequences among HCWs is vital to preventing NSIs and the transmission of bloodborne diseases. Despite available preventive measures and protocols, many HCWs lack adequate knowledge about NSIs and their associated risks (Sardesai *et al.*, 2018). The lack of awareness and inadequate training can lead to the occurrence and underreporting of NSI incidents, a significant concern in the healthcare industry (Mathew *et al.*, 2021). Educational interventions and training programs are crucial in improving HCWs' knowledge and risk perception of NSIs. These programs enhance knowledge and promote adopting safe behaviors and adherence to SOP to prevent NSI incidents.

The Health Belief Model (HBM) is instrumental in understanding NSI risk perception. The HBM stated that health-related behavior is influenced by an individual's perception of the threat posed by a health problem (perceived susceptibility and severity), the benefits of avoiding the threat, and factors influencing the decision to act (barriers, cues to action, and self-efficacy). Applying the HBM to NSIs involves several components.

Firstly, perceived susceptibility refers to an individual's assessment of their risk of experiencing a health issue. For example, HCWs who frequently handle sharp

instruments may perceive a higher susceptibility to NSIs, recognizing their increased exposure to potential injuries. Secondly, perceived severity involves the belief about the seriousness of contracting an illness or suffering an injury. HCWs who understand the severe consequences of bloodborne infections, such as HIV or hepatitis, will likely perceive NSIs as severe threats. Thirdly, perceived benefits consider the positive outcomes of taking preventive actions. HCWs may recognize that using safer needle devices and adhering to proper disposal protocols significantly reduce their risk of NSIs and subsequent infections. Fourthly, perceived barriers are the obstacles that hinder individuals from adopting preventive behaviors. HCWs might identify barriers such as lack of access to safety devices, time constraints, or inadequate training as significant impediments to safe practices. Fifthly, cues to action are triggers that prompt individuals to take action. For instance, regular safety training sessions, reminders about proper needle disposal, or witnessing a colleague's NSI can act as cues that reinforce safe practices. Lastly, self-efficacy refers to an individual's confidence in their ability to perform a behavior. HCWs with high self-efficacy believe they can effectively use safety devices and follow protocols to prevent NSIs.

Our study aimed to address the main outcome: the perception of risk of NSI among HCWs by incorporating these HBM components into intervention program. By targeting changes in this perception, we sought to improve HCWs' adherence to safety protocols and reduce NSI incidents. For example, by enhancing perceived susceptibility and severity through detailed education on the risks and consequences of NSIs, HCWs can better appreciate the importance of preventive measures. Similarly, addressing perceived barriers by ensuring easy access to safety devices and providing comprehensive training can improve adherence to safe practices.

The module's development and implementation were driven by the need to shift HCWs' risk perception, as understanding and modifying this perception are crucial in mitigating NSI risks. By comprehensively addressing the factors associated with risk perception and implementing tailored educational interventions, we aim to create a safer work environment for HCWs, ultimately enhancing the overall standard of care and occupational safety.

1.2 Problem Statements

The prevalence of NSIs in Malaysia remains alarmingly high, showing no significant reduction over time and posing a persistent risk to HCWs across various sectors. HOs, nurses, and medical officers (MOs) are particularly vulnerable to these injuries, underscoring the urgent need for more effective preventive measures (MOH Malaysia, 2007). NSIs represent significant occupational hazards for HCWs, especially for HOs who are often on the frontline of patient care. In Kelantan, as in other regions, the risk of NSIs is a critical concern due to the potential transmission of bloodborne pathogens such as HIV, HBV, and HCV, contributing to a substantial disease burden both globally and within Malaysia (Kermode *et al.*, 2005; Jahangiri *et al.*, 2016).

Despite the implementation of various preventive measures, the incidence of NSIs among HOs remains significantly high, suggesting potential gaps in awareness and the effective application of safety protocols. Efforts to promote healthy practices among HCWs have not achieved the desired outcomes, as evidenced by the unattained Quality Assurance Indicator, particularly the National Indicator Approach (NIA). This indicates ongoing challenges in reaching optimal healthcare safety standards. Furthermore, NSIs sustained by HCWs not only result in physical injury or infection but also lead to anxiety, stress, and distress, ultimately impacting work quality and patient care.

One key issue is the underreporting of NSIs, which compromises the accuracy of data on NSI incidence and the effectiveness of existing measures. Factors contributing to underreporting include fear of stigmatization, perceived complexity of reporting procedures, and a lack of immediate symptoms post-injury, which can lead HCWs to underestimate the severity of the exposure. Additionally, the persistence of NSIs highlights potential deficiencies in the design and enforcement of current preventive strategies. For instance, while protective equipment and safer needle devices are available, their inconsistent use and inadequate training on their proper utilization diminish their effectiveness. Moreover, the lack of a robust safety culture in some healthcare settings may lead to complacency and lower adherence to safety protocols.

HOs, typically less experienced, may not fully appreciate the severity of the risks associated with NSIs in their job. Their risk perceptions are likely influenced by several factors, including their level of training, experiences with NSIs, working conditions, and the effectiveness of existing preventive measures and safety protocols. If these perceptions are not accurately aligned with the actual risks, HOs may be less diligent in adhering to safety protocols, increasing their vulnerability to NSIs.

In addition to these factors, the organizational structure and culture of healthcare settings play a significant role in shaping NSI risk perception. A hierarchical organizational structure might hinder open communication about NSIs, while a collaborative culture that promotes safety can enhance awareness and adherence to preventive measures. Leadership support is another crucial factor; leaders who prioritize and actively support safety initiatives can foster an environment where NSI risks are taken seriously and addressed effectively. Individual characteristics, such as personal attitudes towards risk, previous experiences with NSIs, and overall health

literacy, also influence risk perception. HOs with a proactive attitude towards learning and safety are more likely to engage in preventive behaviors compared to those who are less concerned about the risks.

The NSI prevention module, a critical component of safety training for HCWs, is designed to mitigate the risk of NSIs. However, the effectiveness of this module in real-world settings, particularly in the specific context of Kelantan, remains under-researched. It is crucial to assess whether the preventive module adequately prepares HOs to handle situations that might lead to NSIs and whether it effectively changes their behaviour and perception towards these risks.

Understanding the factors associated with NSI risk perception among HOs is crucial as it provides valuable insights into how these HCWs assess their vulnerability and the protective measures they undertake. Identifying factors such as previous NSI experiences, the quality of training received, workplace culture, and the availability of safety equipment can significantly influence their perception of risk. For instance, HOs with prior NSI incidents might be more vigilant and cautious, while those with comprehensive training might better understand the importance of adhering to safety protocols. Additionally, a supportive workplace culture that prioritizes safety and the availability of necessary protective equipment can enhance risk perception and encourage safer practices among HOs.

Evaluating the effectiveness of the NSI prevention module is essential in identifying strengths and areas needing improvement in current training and preventive strategies. By assessing how well the module prepares HOs to handle NSI risks, healthcare facilities can ensure that the training is comprehensive and practical. This evaluation can reveal whether the module effectively changes HOs' behaviour

and perception towards these risks, leading to improved compliance with safety protocols. Identifying gaps or weaknesses in the module allows for targeted enhancements, ensuring that HOs are adequately equipped to prevent NSIs and ultimately contributing to a safer healthcare environment.

1.3 Rationale of Study

NSIs remain a prevalent issue among HCWs, particularly HOs who frequently engage in high-risk procedures. Despite established preventive measures, the ongoing incidence highlights a significant gap in awareness or the effective implementation of safety protocols. Addressing this issue is crucial for mitigating occupational health risks associated with bloodborne pathogens (Kutubudin *et al.*, 2022).

HOs are often newly graduated and may lack extensive practical experience, making them particularly vulnerable to NSIs. Their training and familiarity with safety protocols might not be as comprehensive as that of more experienced HCws. Understanding their unique challenges and perceptions is essential to tailor preventive measures effectively.

Perception of NSI risk significantly influences HOs' behaviour and adherence to safety protocols. Mismatched perceptions may lead to overestimation or underestimation of the necessity of preventive measures. Identifying associated factors of risk perception can inform targeted interventions to correct misperceptions and enhance compliance with safety protocols.

The NSI prevention module is a critical component of the safety training provided to HCWs. The effectiveness of the NSI prevention module warrants evaluation, especially in Kelantan's context. Assessing how well the module prepares

HOs to prevent NSIs and influences their behaviour and risk perception provides insights into current training program strengths and weaknesses.

The study's findings can potentially guide the development of more efficient training programs and safety protocols. By grasping the factors influencing risk perception and assessing the effectiveness of existing preventive measures, healthcare administrators can enact evidence-based enhancements. Ultimately, this will bolster the safety and welfare of HOs and other healthcare staff. The knowledge and feedback regarding the degree of risk perception and its associated factors among HOs will be significantly updated by the proposed research. The findings of this study could assist stakeholders in creating successful preventative policies and changes in current policies to improve NSI prevention programs.

There exists a notable gap in comprehensive research on the associated factors of risk perception and the efficacy of preventive modules among HOs, particularly within Malaysia. This study aims to fill this void and contribute to the broader domain of occupational health by furnishing region-specific data and insights. Such insights have the potential to enhance healthcare practices not only in Kelantan but also in similar settings elsewhere.

Overall, conducting research on the perception of NSI risk among HOs in Malaysia is essential for informing evidence-based interventions and policy initiatives to reduce NSIs and promote a safer working environment for HCWs.

1.4 Research Questions, Hypothesis, and Objectives

1.4.1 Research Questions

Phase 1:

1. What is the mean perception score on risk of NSI among House Officers in Kelantan?
2. What are the associated factors of perception score on risk of NSI among House Officers in Kelantan?

Phase 2:

Is the Needlestick Injuries Prevention Module a valid tool for improvement of risk perception of NSI?

Phase 3:

Is the Needlestick Injuries Prevention Module effective in improving the mean perception score on the risk of NSI among House Officers in Kelantan?

1.4.2 General Objective

To study the associated factors of perception score on the risk of needlestick injury and the effectiveness of the newly developed Needlestick Injury Prevention (N-SIP) Module in improving the perception scores on the risk of NSI among House Officers in Kelantan.

1.4.3 Specific Objectives

1.4.3.1 Phase 1

1. To determine the mean perception score on the risk of NSI among House Officers in Kelantan.
2. To determine the associated factors of perception score on risk of NSI among House Officers in Kelantan.

1.4.3.2 Phase 2

To develop and validate the NSI Prevention module

1.4.3.3 Phase 3

To determine the effectiveness of the NSI Prevention module on perception on risk of NSI among House Officers in Kelantan

1.4.4 Research Hypothesis

1. There are significant associations between sociodemographics, history of attending NSI related health education, history of NSI, and perception score on the risk of NSI among HOs in Kelantan.
2. NSI Prevention Module is valid and reliable to be used for improving the NSI risk perception scores.
3. The Needlestick Injury Prevention (N-SIP) Module significantly improves the mean perception score among House Officers in Kelantan.

CHAPTER 2

LITERATURE REVIEW

The literature surrounding NSIs among HCWs encompasses various facets, from assessing perception scores regarding NSI risk to identifying factors influencing these perceptions. Understanding the level of perception scores on NSI risk among HCWs is crucial for devising effective preventive measures and interventions. Moreover, exploring the associated factors of perception scores on NSI risk can provide valuable insights into the factors influencing HCWs' perceptions and behaviours concerning NSI prevention. Additionally, NSI prevention strategies are pivotal in reducing the incidence of NSIs and minimizing the associated risks to HCWs. As such, developing comprehensive module content models tailored to NSI prevention is essential for guiding healthcare facilities in implementing standardized protocols and procedures.

Furthermore, the availability of reliable and validated NSI risk perception measuring tools is imperative for accurately assessing HCWs' perceptions and attitudes toward NSI risk. In this literature review, we delve into these critical areas to understand the factors influencing NSI risk perception among HCWs and the strategies aimed at mitigating NSI incidence. This review aims to examine existing research on NSIs among HCWs critically, elucidating key findings and implications for practice and policy while synthesizing evidence from diverse sources. Through this exploration, we seek to contribute to the ongoing dialogue on NSI prevention and promote a culture of safety and well-being in healthcare settings.

2.1 Incidence of NSI

NSI was defined as the introduction of blood or other potentially hazardous material into the body of a healthcare practitioner while they were performing their regular activities using a hollow bore needle or other sharp objects, such as needles, lancets, or contaminated broken glass (Waqar *et al.*, 2011). Since needles and other sharp objects were frequently used in hospitals, NSI was a significant occupational hazard that posed a threat to HCWs who work in these or other settings (Al Johani Abdulrahman *et al.*, 2016).

Due to their frequent interaction with sharp medical equipment and patients, HCWs and HOs face the risk of NSIs and potential exposure to blood-borne pathogens such as HIV, HBV, or HCV, which can have severe implications for their health and well-being, and in some cases, even pose a threat to their lives (Apisarnthanarak *et al.*, 2006). Their limited experience in handling needles and other sharp objects makes HOs more likely to engage in risky behaviour, increasing their susceptibility to suffering an NSI or other sharp injury (Juni *et al.*, 2015).

Healthcare professionals were exposed to the occupational hazards of NSIs since hospitals functioned as continuous workplaces for various processes and outcomes. Several factors increased the risk of needlesticks and other sharp injuries among HCWs and HOs working in hospitals. Common causes of NSI among HCWs and HOs during routine procedures include re-capping used needles, failing to use needle-disposing containers, stress from the job, inexperience, and mental discomfort. Due to their inexperience, lack of ability, desire to acquire new things and information, and negative perceptions about NSI, HOs were more susceptible to NSI and other sharp injuries. These put HOs and HCWs at risk for occupational transmission of blood-borne infections (Masih, 2017). According to (Kebede & Wabe, 2012), over 30 known

harmful blood-borne viruses can be transmitted to HCWs through an NSI. Furthermore, more than 80% of NSIs were preventable by taking the appropriate safety steps.

NSIs have long been recognized as a significant occupational hazard, putting HCWs and support staff at risk of exposure to bloodborne pathogens. In response to these risks, the Needlestick Safety and Prevention Act was enacted in the USA in November 2000 following prominent advocacy campaigns. Consequently, the Occupational Health and Safety Administration (OSHA) revised its Bloodborne Pathogens Standard, which became effective in April 2001. This revision mandated that healthcare employers maintain records of NSIs, consult non-managerial HCWs regarding needle safety measures, and implement these safety measures (Pugliese *et al.*, 2001; Trim & Elliott, 2003; Vol *et al.*, 2010).

Similarly, in the UK, increased attention to NSIs and the occupational transmission of bloodborne pathogens was driven by efforts from the Royal College of Nursing and UNISON. This led to the establishment of the "Safer Needles Network" and heightened NSI awareness among healthcare professionals. The UK Department of Health further recommended the consideration of needle protection devices and the minimization of sharp object use whenever possible (UK Health Department, 1998; Trim & Elliott, 2003).

Despite these efforts, accurately estimating the rate of sharps injuries remains challenging, primarily due to underreporting. Various researchers have attempted to quantify the frequency of reported NSIs; however, underreporting continues to obscure the true extent of the problem. Estimates of NSI rates per 10,000 HCWs per year have ranged from 113 (1.0%) to 623 (6.2%), with an average of 405 (4%). Discrepancies in

study methodologies and timeframes make it difficult to draw strict comparisons between studies.

The lack of a globally accepted method for NSI data collection and calculation further complicates the assessment. While some countries like the USA, Canada, Italy, and Japan have extensively utilized the Exposure Prevention Information Network (EPINet), a standardized system for documenting mucocutaneous and percutaneous injuries, the applicability of these findings across different settings remains uncertain. EPINet provides healthcare facilities with a pre-programmed form for documenting injuries, enabling customized reports, statistical analysis, and injury tracking. However, variations in data collection practices and reporting standards can influence the results, limiting the generalizability of findings from EPINet-based studies (UK Health Departments, 1998; Trim & Elliott, 2003).

Local healthcare practices, available resources, and cultural factors can significantly impact the applicability of NSI findings across different settings. For instance, differences in healthcare infrastructure, safety protocols, and staff training can affect both the incidence of NSIs and the reporting rates. Cultural attitudes towards safety practices and the perceived importance of reporting injuries may also vary, influencing the reliability of data.

To critically analyze these differences, it is essential to consider how local contexts shape the effectiveness of NSI prevention measures. For example, a study conducted in a well-resourced hospital with robust safety protocols and high reporting compliance may yield different findings compared to a study in a resource-limited setting with less stringent safety measures and lower reporting rates. Understanding

these contextual factors is crucial for interpreting NSI data and developing targeted interventions that are effective in diverse healthcare environments.

2.2 The Level of Perception score on the Risk of NSI among HCWs

The level of risk perception of HCWs and HOs toward NSI was still insufficient, especially in developed nations, despite thorough guidelines for prevention in UP (Reddy & Emery, 2001). Apart from looking at the perception score, it can also be divided into appropriate and inappropriate scores. Respondents in the category scoring above the median for perception of NSI risk have an appropriate perception. In contrast, respondents in the category scoring below the median have an inappropriate perception of the risk of NSI.

According to research conducted in Malaysia, most respondents, particularly medical students, exhibited an appropriate level of perception regarding the risk of NSIs, accounting for 51.0%. However, at 49.0%, the proportion of having inappropriate perceptions was also considered high. This was owing to a few questions that were not answered poorly, which led to inappropriate perception. In perceived severity, 39.0% of those surveyed said that NSI was not significant enough to warrant reporting. Regarding perceived susceptibility, the respondents said they were not susceptible to NSI (59.5%), while 38.7% believed they were not susceptible to blood-borne illnesses. According to perceived benefit, wearing gloves was not considered significant when performing minor procedures like phlebotomy (51.0%), and recapping needles was standard practice among HCWs (49.5%) (Juni *et al.*, 2015). The cross-sectional study targeted clinical year medical students from a Malaysian public university, utilizing a sampling frame comprising a list of such students. The sample size, determined via the single proportion formula, amounted to 320 students spanning the third, fourth, and fifth years of study, selected through stratified random sampling.

A researcher-developed questionnaire with four sections covering socio-demographic characteristics, perception of NSI, knowledge about NSI, and attitude towards NSI was employed. However, the study's categorization of perception levels into appropriate and inappropriate categories based on median scores warrants critical examination. While this approach simplifies the analysis, it overlooks the nuances within perceptions and may fail to capture the full spectrum of responses. Additionally, the questionnaire's development process and validation methods, though briefly mentioned, lack sufficient detail for assessing the tool's reliability and validity. Further clarification on these aspects would enhance the study's methodological robustness.

Kable *et al.* (2011) found that more than one-third of respondents in their research said they recap needles. Even though the WHO guidelines prohibit needle recapping since 1987, it is still commonly used. This demonstrates unequivocally that NSI's perception of risk was flawed (Nagandla *et al.*, 2015). The CDC recommendations for precautions to prevent the spread of BBV in the healthcare setting include using gloves and personal protective equipment (PPE), washing hands if contaminated, refraining from recapping needles, and disposing of all sharp objects in a sharp's container as soon as possible after use (Kable *et al.*, 2011). They discovered that the primary causes of underreporting NSI were a poor impression of the risk of NSI and an underestimated risk of potential patient blood-borne transmission. This was presumably connected to self-evaluation of risk based on the patient's social and medical history. This was troubling because studies show that one's assessment of the danger of transmission following NSI almost certainly underestimates the actual risk (Nagandla *et al.*, 2015).

Based on the study by Nawafleh *et al.* (2017), 80.0% of responders gave a very favourable response to using gloves during phlebotomy procedures. Most survey participants (67.0%) put on gloves when discarding contaminated needles. Respondents who gave negative responses knew that needles shouldn't be bent after use, and 78% of them quickly threw the used needle into the sharp container. Most respondents, however, preferred to recap the needle after use and to detach the needle from the syringe before disposal (86.0% and 72.0%), respectively. Among all respondents, 73.0% said that a heavy workload could result in NSI, and 88.0% of the participants concur that careless handling of needles and sharp objects could lead to NSI. Nagandla *et al.* (2015) mentioned that 52.6% claimed that being in a rush caused the NSI, while 10.5% reported that it was due to fatigue. The majority of respondents (64.0%) disagreed that those infected with HIV had to be excluded from the work. At 98.0% of respondents, a large majority, felt that using safe needle handling techniques will help lower the frequency of NSI. The mean perception score of risk on NSI range from 1.24 to 1.96 which considered positive perception (Nawafleh *et al.*, 2017). This cross-sectional study was suitable for assessing the prevalence of NSIs and understanding students' perceptions and knowledge. However, there were limitations in establishing causality or temporal relationships due to the study's cross-sectional nature. The sample size of 162 students appeared adequate for the study's objectives, allowing for meaningful analysis and generalizability to the undergraduate nursing student population. Additionally, the inclusion of both male and female students enhanced the study's representativeness.

Based on the study done by Debark *et al.* (2022), they found that 20.3% had a low perception of the risk of NSI, and those who had a low-risk perception had the highest percentage of NSI compared to those with a moderate level (68.8%) and high