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Original article

Needlestick Injuries During Nursing Student Practice: A Cross-sectional Study

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Abstract

Needle-stick injuries remain one of the most significant occupational hazards for nursing students during clinical practice, increasing the risk of blood-borne infections. Despite existing preventive measures, gaps in practical skills and incident reporting culture persist worldwide.

The aim of the study: To assess the level of knowledge and practice among nursing students of medical educational institutions in the city of Karaganda regarding needlestick injuries.

Methods. A cross-sectional study was conducted with the participation of 247 nursing students from medical educational institutions in Karaganda. Data were collected using an adapted questionnaire in Kazakh and Russian languages. Descriptive statistics were applied to calculate absolute and relative frequencies, proportions, and percentages. To test hypotheses for statistical significance of differences between two independent samples, the nonparametric Mann-Whitney test was used.

Results. Most students (99.6%) reported being informed about safety rules; 7.3% had experienced needle-stick injuries, mainly during injections and waste disposal. Despite a high level of knowledge (52.6%), practical gaps persisted: nearly half considered needle recapping acceptable, 23.9% were unfamiliar with the full post-exposure protocol, and 91.5% did not report incidents. However, only 76.1% of students know the procedure for dealing with an accidental needlestick injury and can apply it in practice. This means that almost a quarter of future professionals lack sufficient confidence in their actions in an emergency. Statistical analysis revealed a significant difference between groups ($U = 401.5$, $Z = -2.38$, $p = 0.017$), indicating a higher adherence to safety measures among undergraduate students.

Conclusion. Nursing students demonstrate adequate theoretical knowledge but show deficiencies in practical skills and reporting culture. Although the prevalence of needle-stick injuries was lower compared to international data, unsafe practices remain a pressing issue.

Keywords: needle-stick injury, nursing, infection safety, risks.

1. Introduction

A needle-stick injury (NSI) is the unintentional penetration of a needle into the skin [1,2]. Among all healthcare workers, nurses are at the highest risk due to the specific nature of their professional activities [3-5]. Needle-stick injuries pose the greatest danger to medical students during clinical practice due to accidental contact with biological fluids and infected blood [6,7]. The problem of professional safety of healthcare workers and students of medical specialties remains one of the most pressing in modern healthcare. According to the World Health Organization (WHO), more than two million cases of contact of medical personnel with sharp instruments are registered annually among thirty-five million healthcare workers. Such situations increase the risk of developing more than 20 types of infectious diseases, leading to infection of tens of thousands of patients, specialists, and nursing students with viral hepatitis B and C, as well as the human immunodeficiency virus [8-11]. Nurses and nursing students occupy a special place in the risk group, since they most often perform manipulations associated with the use of injection equipment and contact with biological fluids of patients [3,12,13]. The risk of transmission of infections through needlesticks is highest for HBV (6–30%), somewhat lower for HIV (4.4–10%), and minimal for HCV (1.8%) [4,11,14-16]. The incidence of infection in healthcare workers is 4 times higher than in individuals not working or studying in hospitals. Of the 35 million healthcare workers working worldwide, approximately 3 million are occupationally exposed to hepatitis B virus infection annually, resulting in 66 thousand cases of infection with this virus (261 deaths) [11,16-19].

According to Al-Mugheed et al. (2023), 14.1% of nursing students in Saudi Arabia reported needlestick injuries. The main causes of injuries were recapping the needle (74.1%) and performing injection procedures without following safety rules (22.3%). The authors also emphasize that most students (77.4%) did not report the incidents due to anxiety and fear (91.2%) [6]. Research confirms that failure to comply with safety rules, insufficient knowledge and practical skills, and a poor culture of reporting emergency situations significantly increase the likelihood of occupational infections [20-22]. Students are especially vulnerable during industrial and professional practice, when they are just beginning to master clinical skills and often lack sufficient confidence in actions in emergency situations [3-7].

Today, the issue of nurses' safety is also significant in the Republic of Kazakhstan. For example, in the ProInCa project (2019) the issues of nurses' well-being and safety, including sharp instrument injuries, were identified as a priority on nursing research in Kazakhstan [23,24]. Despite the development of nursing education and the training of nurses and healthcare professionals, the problem of needless-stick injuries and their prevention among students has not yet received sufficient attention. In this regard, conducting research aimed at identifying the level of knowledge, attitudes, and practical skills of students, as well as determining the prevalence and characteristics of injuries in real-life clinical practice conditions is of particular importance [25]. Despite the prevalence of the topic and the successes achieved in the occupational safety of healthcare workers, the issue of ensuring the professional safety of nurses and its further study in the context of the reformed nursing in Kazakhstan remains relevant [26].

The aim of the study was to examine the level of knowledge, attitudes, and practical skills of nursing students regarding safety precautions when working with sharp medical instruments, as well as to determine the frequency and characteristics of needlestick injuries during industrial practice in the city of Karaganda.

2. Materials and methods

Study design. This cross-sectional study was conducted in February 2025 among students enrolled in the four-year Nursing program at Karaganda Medical University, the Medical College of Karaganda Medical University, the Regional Higher Nursing College, and the Higher Medical Intercollege. Participants were students aged 18 years and older, pursuing their first degree in Nursing. The study included students from their second through senior years, as it is during clinical practice that they are most at risk of infection from injection procedures.

Data collection tool. To achieve the set objectives, a questionnaire based on the research of Al-Mugheed et al., 2023 [6] was adapted as a tool. The questionnaire was translated into Kazakh and Russian. It consists of four sections. The first section consists of two parts, the first part asking for demographic data, the second part related to prevalence. The second section consists of eight questions related to general information about needlestick injuries, such as definitions, common causes, and knowledge of blood-borne diseases. The third section consists of seven statements related to attitudes towards needlestick injuries on a five-point Likert scale, where a higher score represents a higher level of self-preservation. The fourth section contains five items about the practical skills students currently apply in their practice. These statements also used a

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five-point Likert scale, where a higher score represents a higher level of practice.

Data collection. The survey was conducted online between April and May 2025 using Google Forms and a link to the questionnaire was distributed in student WhatsApp groups. Responses did not request personal information (names or dates of birth), and the questionnaire was anonymous. To prevent duplicate submissions, participants were only allowed to complete the survey once.

Sample. The study population included 786 students. The actual sample size was 247 students who responded to the survey. Inclusion criteria were students enrolled in the Nursing program, aged 18 years and older, and in their second year of study and pursuing their first medical degree. Exclusion criteria included those studying and working as nurses or those who did not meet the inclusion criteria.

Data analysis. Descriptive statistics were used to process and analyze the data obtained. In the first stage, absolute values (frequencies) were calculated, allowing us to determine the actual number of respondents for each of the studied characteristics. Next, relative values—proportions and percentages—were calculated, reflecting the sample structure and the ratio of different response categories. For clarity, the results were systematized and visualized in tables and diagrams, providing a more complete and accessible understanding of the identified patterns.

To test hypotheses for statistical significance of differences between two independent samples, the nonparametric Mann-Whitney test was used, using Statistica software, version 13.

Ethical aspects. The study was conducted in accordance with relevant ethical guidelines, including an oral explanation and written informed consent from the participants. Studies were approved by the local bioethical committee (Bioethics Committee of Karaganda Medical University, Karaganda, Kazakhstan; Act No 10 from 20.05.2025).

3. Results

This study was conducted to assess students' knowledge, attitudes, and practical skills regarding infection control, as well as to determine the frequency and characteristics of needlestick injuries during internships. The study was conducted among students enrolled in the Nursing program at medical educational institutions. The total sample consisted of 247 students, primarily enrolled in secondary technical vocational education programs.

Demographic characteristics. The majority of respondents were female (92.7%), consistent with the overall gender distribution in the profession. Participants ranged in age from 18 to 26 years and older, with the majority of those aged 18–20 (70.5%). The largest proportion of students were in their second year of study (44.9%), indicating a high level of involvement of junior students in clinical practice. The majority of students were enrolled in technical and vocational education (92.3%), and only a small proportion had completed a bachelor's degree. This is important to consider when interpreting the data, as academic preparation can directly impact knowledge and skills.

Needlestick injury prevalence. Nearly all students (99.6%) reported being informed about safety regulations. However, the risk of injury remains: 7.3% of respondents experienced at least one accidental needlestick injury during their final year of practice. Of these, 2.4% reported a single incident, another 2.4% reported two incidents, and 2.0% reported three or more.

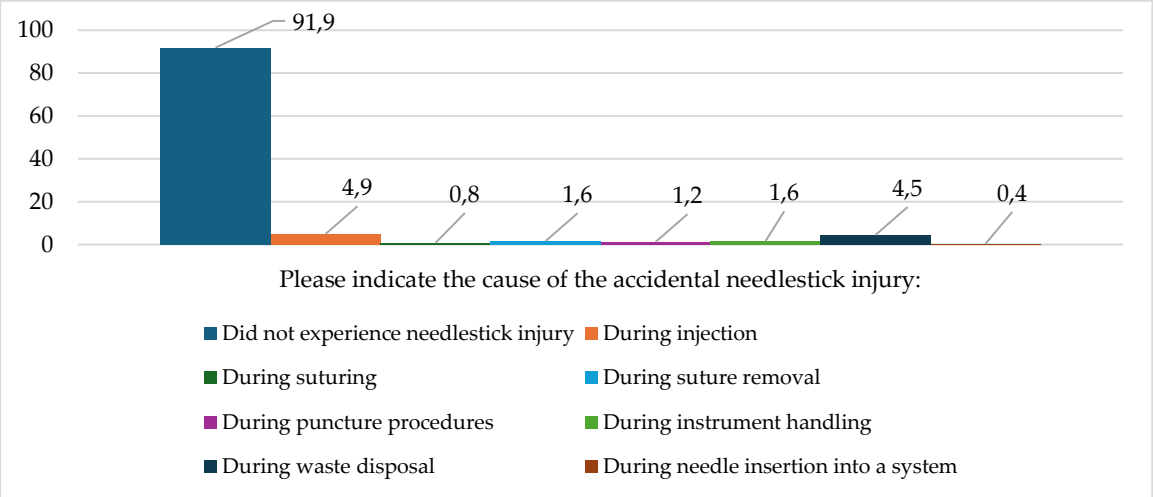

Figure 1 - Distribution of causes of needlestick injuries in relative terms

The causes of injuries were distributed as follows: the most common were during injections (4.9%) and waste disposal (4.5%). Less common were injections during the application and removal of sutures, punctures, or instrument handling. These data highlight that even with knowledge of safety rules, routine procedures performed by students on a daily basis remain the most risky. The data are presented in Figure 1.

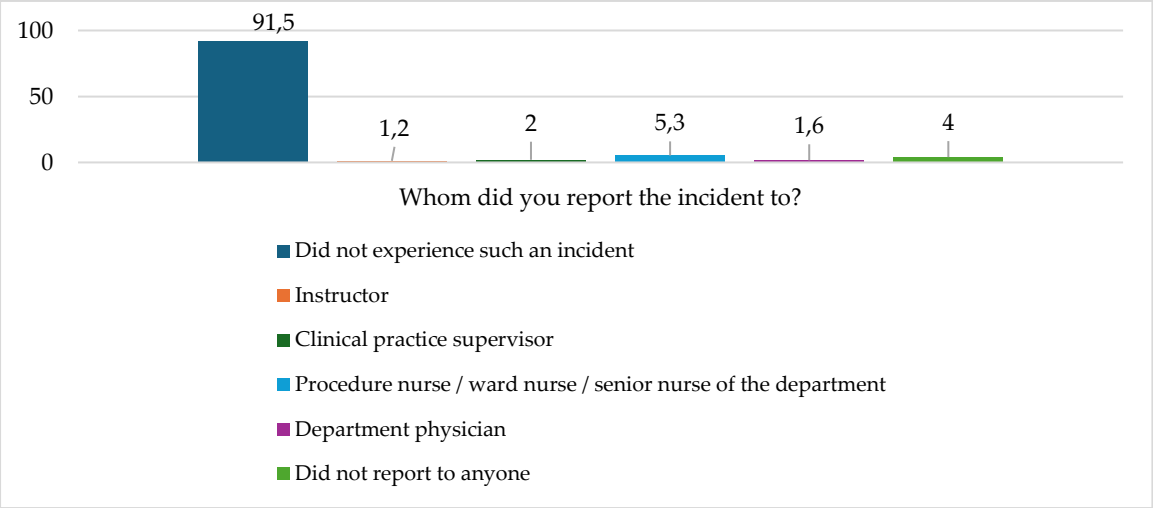

Figure 2 - Relative distribution of recipients of reports on needlestick injuries

Regarding incident reporting, the majority of students (91.5%) did not encounter the need to report. Among those who experienced an injury, some informed the nurse in charge (5.3%), while 4% admitted not reporting the incident to anyone. The main reasons for not reporting were confusion (2.8%) and fear (1.6%). This indicates a weak safety culture and the need for awareness-raising among students. The data are presented in Figures 2 and 3.

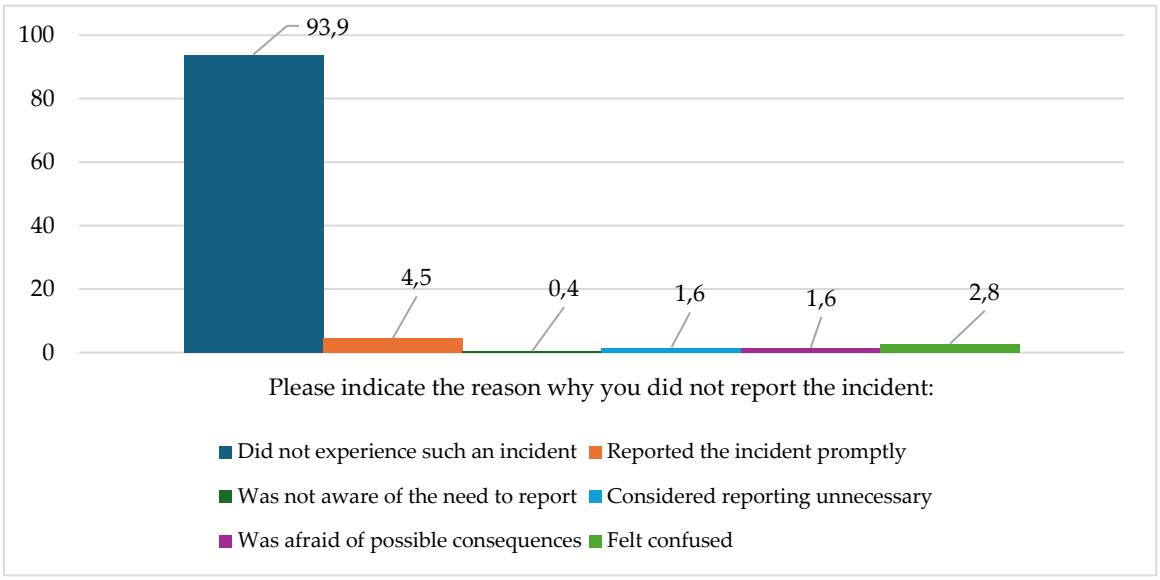

Figure 3 - Relative distribution of reasons for non-reporting of the incident

Student Knowledge. The test questions revealed heterogeneity in knowledge levels. For example, 91.5% of students correctly defined the concept of an "emergency situation", 92.7% knew the rules for disposal of sharp objects, and 84.6% understood the preventive role of hepatitis B vaccination. However, almost half (50.6%) incorrectly believed that recapping needles reduces the risk of injury, and 46.2% believed that wearing properly sized gloves is unnecessary.

Thus, despite a high level of basic awareness, critical gaps in specific aspects of infection safety were identified. Overall, according to the integrated assessment, 52.6% of students demonstrated a high

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level of knowledge, 45.3% a moderate level, and only 2.0% a low level.

We also tested the hypothesis about the different levels of knowledge on this topic among students of different educational levels using the nonparametric Mann-Whitney test. The analysis revealed a statistically significant difference between the groups (U = 412.5, Z = –2.47, p = 0.013), confirming the higher level of knowledge among undergraduate students and demonstrating heterogeneity in their preparation.

Student attitudes toward needlestick injuries. Most students expressed concern about the risk of accidental needlestick injuries: 52.6% strongly agreed with this statement, while 24.7% partially agreed. Furthermore, 45.3% consider needlestick injuries a common problem.

However, it is alarming that 18.6% of students admitted to a tendency to ignore thoughts about the risk of injury and infection. This may indicate a certain psychological defense mechanism, but in practical terms, it increases the likelihood of risky behavior.

On a positive note, 81.8% of respondents believe that needlestick injuries can be prevented by following safety precautions, and the same number of students (81.8%) noted the need to immediately report an injury to their supervisors. This indicates a high level of responsibility and an adequate attitude among most students, although a minority continues to engage in risky behavior. The data are presented in Figure 4.

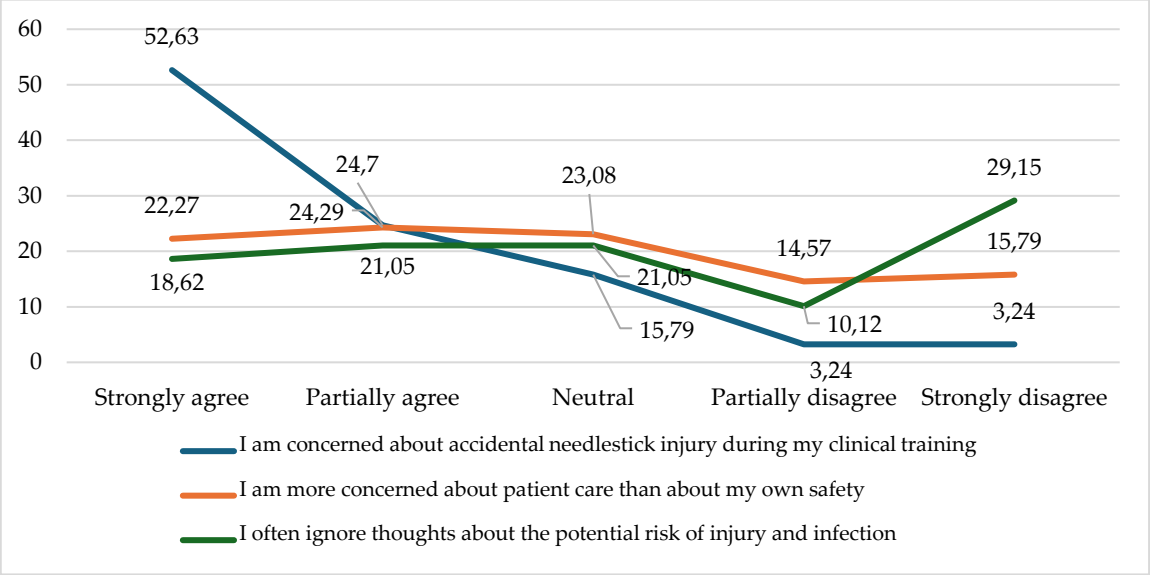

Figure 4 - Indicators of students' attitudes toward the risk of needlestick injuries

To assess differences in attitudes toward injury risk between undergraduate and vocational education students, the nonparametric Mann–Whitney U-test was also used. The results revealed statistically significant differences between the groups (U = 389.0, Z = –2.61, p = 0.009), indicating a higher level of concern about the risk of accidental needlestick injuries among undergraduate students. Furthermore, vocational education students were more likely to ignore thoughts about the risk of injury and infection, confirming the heterogeneity of their behavioral attitudes and the presence of risky behavior among some respondents.

Students' practical skills. The analysis revealed that not all students consistently adhere to safety precautions. For example, 36% of respondents admitted to sometimes replacing the cap on a syringe after use, which is contrary to safety principles. Meanwhile, 73.7% always use gloves when interacting with patients, and 76.1% don full personal protective equipment before administering injections.

However, only 76.1% of students know the procedure for dealing with an accidental needlestick injury and can apply it in practice. This means that almost a quarter of future professionals lack sufficient confidence in their actions in an emergency. Statistical analysis revealed a significant difference between groups (U = 401.5, Z = –2.38, p = 0.017), indicating a higher adherence to safety measures among undergraduate students. College students were more likely to engage in risky behavior, such as recapping a needle, and were also less likely to demonstrate confident knowledge of the procedure for dealing with an accidental injury, highlighting the heterogeneity in practical preparedness. The data are presented in Figure 5.

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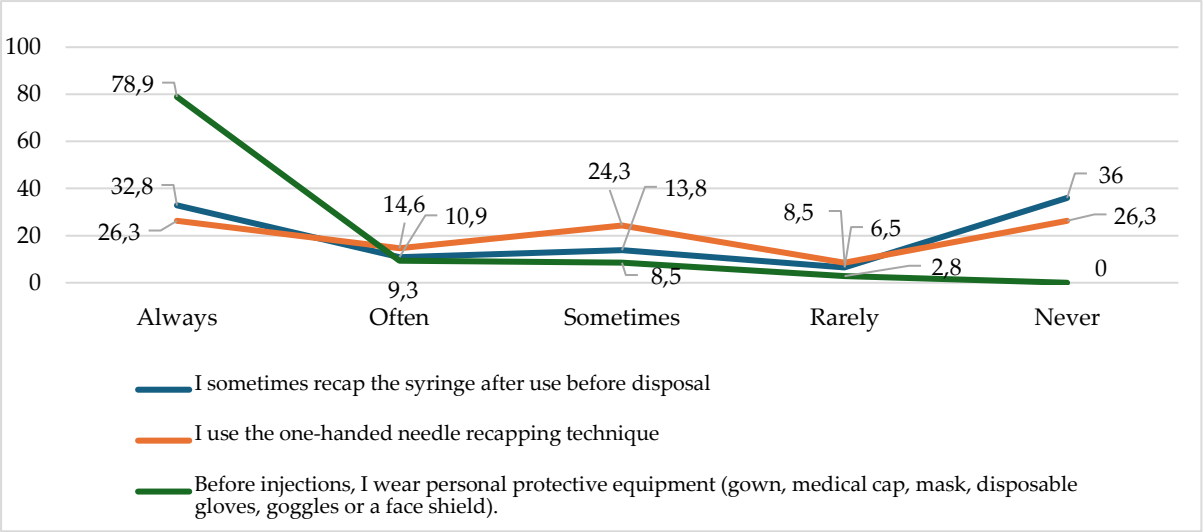

Figure 5 - Relative distribution of students' practical skills during clinical training

The study found that nursing students have a high level of general awareness of safety regulations, but gaps remain in certain areas of knowledge and practical skills. Despite the rarity of injuries, the risk remains significant, and needlestick injuries are often underreported. These findings highlight the need for additional educational programs aimed at developing sustainable safety skills, fostering a culture of incident reporting, and strengthening occupational risk prevention among students. Implementing such measures will improve the safety of future professionals and reduce the risk of occupational infections.

4. Discussion

The results of a study conducted among students of the Nursing educational programs showed that the rate of needlestick injuries during the internship period was 7.3%. The highest proportion of incidents occurred during the injection and waste disposal stages, which emphasizes the importance of strict adherence to safety rules during these procedures. The data are comparable with the results of studies conducted in Saudi Arabia, where the injury rate was 14.1% among nursing students [6], and according to the results of a study by Yao et al. (2010) in China, it was 11.8% [27]. Somewhat higher rates (up to 24–35%) were recorded in India and Pakistan [14,28,29], which can be explained both by the peculiarities of the organization of clinical practice and differences in the level of control over compliance with standard precautions. Thus, the injury rate in our sample was lower than in many international studies, which may reflect both some progress in student training in Kazakhstan and an underreporting of cases due to underreporting.

An important observation was that 91.5% of students did not report an injury. This result is consistent with the data of Al-Mugheed et al. (2023), where 77.4% of students did not report injuries due to fear and guilt [6]. Similar trends were described by Yao et al. (2010) in China and Datar et al. (2022) in India, where underreporting and underreporting of incidents were considered factors hindering prevention [4,27]. The low trauma reporting culture identified in our study also points to the need to strengthen educational programs and implement clear algorithms for supporting students in such situations.

The respondents' knowledge level can be characterized as relatively high: over 90% of students knew the rules for instrument disposal and the role of vaccinations, but half of the students had misconceptions about the safety of recapping. Similar gaps were identified in Palestine and China, where students demonstrated a general level of awareness but did not always know the details of safe practices [30, 31]. Studies by Abuduxike et al. (2021) and Yasmin et al. (2022) emphasize that even among practicing nurses, inaccuracies in knowledge of standard precautions persist [32, 33]. Therefore, the problem is systemic and requires targeted training not only for students but also for existing professionals.

Regarding attitudes toward injuries, most students expressed concern about the risk of needlestick injuries and recognized the need for immediate reporting. This finding is consistent with the studies by Prasuna et al. (2015) and Siddiq et al. (2008), which also found a discrepancy between high levels of awareness and

actual willingness to report incidents [28,29]. This discrepancy may be explained by psychological factors, in particular defensive reactions, as well as a lack of confidence in the support of practice managers.

Students' practical skills showed heterogeneity: although the majority use gloves and personal protective equipment, about a third of respondents continued to recap used needles. Similar findings were obtained by Hussein et al. (2012) in India, where recapping and needle disposal errors remained the leading causes of injuries [14]. Comparison with other studies confirms that knowledge does not always translate into safe behavior, and the development of sustainable practical skills should be a key goal of educational programs.

Our study has several limitations. First, it was conducted in a single region of Kazakhstan, which limits the generalizability of the results to the entire country. Second, the data were collected through self-reporting, which may underestimate the true incidence of injuries. Third, the study was cross-sectional, limiting the ability to analyze the dynamics of changes in students' knowledge and skills.

Nevertheless, the results obtained have significant practical implications. They confirm that nursing students in Kazakhstan face similar challenges to their colleagues in other countries: high awareness combines with critical gaps in knowledge and practical skills, and the culture of injury reporting remains insufficient. These findings align with the results of numerous international studies and highlight the need for targeted educational programs aimed at addressing knowledge gaps, developing robust practical skills, and fostering a culture of safety. Only a systematic approach will reduce students' professional risks and ensure a high level of infection safety in medical practice.

5. Conclusion

The study highlights that ensuring infection safety for nursing students remains a pressing issue requiring a comprehensive approach. Further improvement of needlestick training and the development of a positive attitude toward safety can reduce the risk of occupational infections and improve the safety of future professionals.

These findings have important practical implications. While the injury rate is lower than in some international studies, it is possible that actual rates are underestimated or incidents are underreported. The study's findings support the need for improved educational programs aimed not only at developing theoretical knowledge but also at reinforcing robust practical skills in the safe handling of sharp instruments. Developing a culture of emergency reporting and a supportive environment for students that helps reduce fear and uncertainty are particularly important.

Conflicts of Interest. There are no conflicts of interest.

Author Contributions. Concept development, research methodology, data collection, and manuscript writing – R.B.; concept development, research methodology, validation, and scientific supervision – F.S.; data visualization, verification – Zh.K.; statistical data analysis, text editing and critical review of content – A.V. The final version of the manuscript has been reviewed and approved by all authors, who have also completed the copyright transfer.

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Мейіргер ісі студенттерінің тәжірибесіндегі кездейсоқ инемен жарақат алу жағдайлары: Бір реттік көлденең зерттеу

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Түйіндеме

Ине жарақаттары клиникалық тәжірибе кезінде мейіргер ісі студенттері үшін қан арқылы берілетін инфекцияларды жұқтыру қаупін арттыратын ең маңызды кәсіптік қауіптердің бірі болып қала береді. Қолданыстағы алдын алу шараларына қарамастан, дүние жүзінде мұндай оқиғалардың тәжірибелік дағдылары мен хабардарлық мәдениетіндегі кемшіліктер сақталуда.

Зерттеудің мақсаты: Қарағанды қаласы медициналық оқу орындарының мейіргер ісі студенттері арасында ине шаншылып жарақат алу бойынша білімі мен тәжірибе деңгейін бағалау.

Әдістері. Қарағанды қаласының медициналық оқу орындарының мейіргер ісі мамандығының студенттері арасында жалпы саны 247 респондент қатысқан бір реттік көлденең зерттеу жүргізілді. Мәліметтер қазақ және орыс тілдеріндегі бейімделген сауалнама арқылы жиналды. Талдау үшін сипаттамалық статистика әдістері қолданылды: абсолюттік және салыстырмалы жиіліктер, үлестер мен пайыздар есептелді. Екі тәуелсіз үлгі арасындағы айырмашылықтардың статистикалық маңыздылығы туралы гипотезаларды тексеру үшін параметрлік емес Манн-Уитни сынағы қолданылды.

Нәтижесі. Студенттердің көпшілігі (99,6%) қауіпсіздік ережелерімен таныс екенін көрсетті, алайда 7,3%-ы инемен шаншылып жарақат алған және жарақат инъекция жасау немесе қалдықтарды жою кезінде орын алған. Жоғары білім деңгейіне (52,6%) қарамастан, тәжірибелік дағдыларда олқылықтар анықталды: студенттердің жартысына жуығы инеге қалпақшаны қайта кигізуді дұрыс деп есептейді, 23,9%-ы толық постэкспозициялық іс-шаралар алгоритмімен таныс емес, ал 91,5%-ы жарақаттың орын алғаны туралы туралы хабарламағаны анықталды. Дегенмен, студенттердің тек 76,1%-ы ғана кездейсоқ инемен жарақат алу кезіндегі іс-қимыл тәртібін біледі және оны іс жүзінде қолдана алады. Бұл болашақ мамандардың төрттен бір бөлігі төтенше жағдайда өз әрекеттеріне жеткілікті сенімді емес екенін білдіреді. Статистикалық талдау топтар арасында айтарлықтай айырмашылықты анықтады ($U = 401,5$, $Z = -2,38$, $p = 0,017$), бұл студенттер арасында қауіпсіздік шараларын сақтаудың жоғары екенін көрсетеді.

Қорытынды. Мейіргер ісі студенттері теориялық тұрғыдан жеткілікті білімге ие болғанымен, тәжірибелік дағдыларда және инемен шанжылған жарақаттар туралы хабарлау мәдениетінде кемшіліктер бар. Шетелдік деректермен салыстырғанда инемен шаншылып жарақат алу жиілігі төмен болғанына қарамастан, қауіпті тәжірибелер әлі де өзекті мәселе болып табылады.

Түйін сөздер: ине шаншылып жарақат алу, мейіргер ісі, инфекциялық қауіпсіздік, тәуекелдер.

Травмы от уколов иглой в практике студента сестринского дела: Одномоментное поперечное исследование

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Резюме

Травмы от уколов иглой остаются одной из наиболее значимых профессиональных угроз для студентов сестринского дела во время клинической практики, повышая риск заражения инфекциями, передающимися через кровь. Несмотря на существующие меры профилактики, во всем мире сохраняются пробелы в практических навыках и культуре сообщения о таких инцидентах.

Цель исследования: оценить уровень знаний и практики среди студентов сестринского дела медицинских образовательных учреждений города Караганды в отношении травм от уколов иглой.

Методы. Проведено одномоментное поперечное исследование с участием 247 студентов сестринского дела в медицинских учебных заведениях города Караганды. Сбор данных осуществлялся с помощью адаптированного опросника на казахском и русском языках. Для анализа использовались методы описательной статистики: абсолютные и относительные частоты, доли и проценты. Для проверки гипотез о статистической значимости различий между двумя независимыми выборками использовался непараметрический критерий Манна-Уитни.

Результаты. Большинство студентов (99,6%) были информированы о правилах безопасности, однако 7,3% сталкивались с уколами иглой, чаще всего при инъекциях и утилизации отходов. Несмотря на высокий уровень знаний (52,6%), сохраняются пробелы в практике: почти половина допускает повторное надевание колпачка, 23,9% не знают алгоритма, а 91,5% не сообщают о случившихся травмах от уколов иглой. Однако лишь 76,1% студентов знают порядок действий при случайном уколе иглой и могут применять его на практике. Это означает, что почти четверть будущих специалистов не обладают достаточной уверенностью в своих

действиях в чрезвычайной ситуации. Статистический анализ выявил значительную разницу между группами (U = 401,5, Z = –2,38, p = 0,017), что указывает на более высокую приверженность мерам безопасности среди студентов.

Выводы. Студенты сестринского дела демонстрируют достаточный уровень теоретических знаний, но имеются пробелы в практических навыках и культуре сообщения о травмах от уколов иглой. Несмотря на более низкую частоту травм от уколов иглой по сравнению с зарубежными данными, проблема рискованных практик сохраняется.

Ключевые слова: травма от укола иглой, сестринское дело, инфекционная безопасность, риски.

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