Discover Public Health

RESEARCH Open Access

Prevalence and factors associated with experiencing occupational biological hazards among clinical university students in South Western Uganda

Innocent Ayesiga[1*], Godfrey Wekha[2], Raymond Bernard Kihumuro[3], Racheal Mukisa Nakandi[4], David Tenywa[5], David Muwanga[6], Tom Didimus Ediamu[7], Rebbecca Nabaweera[8], Phillip Musoke[2], Blaise Kiyimba[2] and Isaac Ebiju[2]

*Correspondence:
Innocent Ayesiga
ayesiga49@gmail.com
[1]Department of Community Health, Mbarara University of Science and Technology, Mbarara 40006, Uganda
[2]Department of Internal Medicine, College of Health Sciences, Makerere University, Kampala 10207, Uganda
[3]Department of Research, Way Forward Africa, Kampala 759125, Uganda
[4]Department of Research, Mengo Hospital, Kampala 7161, Uganda
[5]Department of Microbiology, Mbarara University of Science and Technology, Mbarara 40006, Uganda
[6]Department of Surgery, Mbarara University of Science and Technology, Mbarara 40006, Uganda
[7]Department of Research, Moroto Regional Referral Hospital, Moroto 80033, Uganda
[8]Department of Anaesthesia, Faculty of Medicine, Mbarara University of Science and Technology, Mbarara 40006, Uganda

Abstract

Background Clinical students face hazards, such as needlestick injuries and blood spills. While healthcare workers' exposure to such hazards is well-documented, there is limited data on medical students, particularly in Uganda. We explored the prevalence and factors associated with biological occupational hazards among clinical university students.

Methods This cross-sectional study examined biological occupational hazards among 384 randomly selected undergraduate clinical medical students at a university in Southwestern Uganda. Data were collected using a structured self-administered questionnaire. Categorical and numerical data were summarised descriptively using frequencies and means. Multivariable logistic regression identified factors independently associated with hazard exposure. Adjusted odds ratios with 95% confidence intervals were reported, and a $p < 0.05$ was considered statistically significant.

Results A total of 384 participants, with a mean age of 25.1 years and a male predominance of 208 (54.2%), were included; 223 (58.1%) pursued careers in medicine and surgery. 316 (82.3%) reported experiencing a hazard, with 107 (33.9%) reporting experiencing it more than three times. 155 (49.1%) and 102 (32.3%) of the participants had experienced blood spills and needle stick injuries, respectively. Gender (aOR 0.448, CI: 0.24–0.84) and the current ward where the students were placed (aOR 2.94, CI: 1.39–6.22) were significantly associated with exposure to hazards.

Conclusion Clinical students are significantly exposed to occupational hazards, with blood spills and needle stick injuries being the most common. Most students experience multiple exposures in high-risk wards such as Obstetrics. Targeted interventions, such as establishing injury response teams, pinning procedure charts on the ward walls, and providing procedure manuals, are needed to enhance safety and improve clinical training. Future research should also examine safety protocols and gendered risk perceptions to develop effective strategies to mitigate hazards.

Keywords Occupational hazards, Blood spill, Medical students, Needle stick, Biological hazards

1 Introduction

Biological hazards remain a significant public health concern among health workers and clinical students globally. These incidents pose significant risks to their health and safety, potentially leading to the transmission of bloodborne pathogens such as HIV, hepatitis B, and hepatitis C, sprains, and strains, among others [1–3]. According to the World Health Organisation (WHO), over 16,000 Hepatitis C, 66,000 Hepatitis B, and 1000 HIV cases may occur worldwide annually among healthcare workers (HCWs), especially nurses, after their exposure to needle stick injuries [4]. Across the UK, the prevalence of biological hazards among clinical students demonstrated an 82.8% proportion with a 13% incidence of sharps injuries [5]. The survey further showed that the medical (15.3%) and obstetrics and gynaecology (13.3%) wards were the riskiest areas for biological hazard injuries within the hospital. Data from India has varied across different training institutions. For example, research from the medical campus in Sangli, Maharashtra, found a 25.2% prevalence of needlestick and sharps injuries, with these injuries more common among nursing students than among other cadres [6]. Evidence from a 5-year retrospective study in Turkey showed that 554 clinical students had experienced 666 biological injuries, with 86.2% predominance of needle stick injuries [7]. These statistics demonstrate a problem that warrants close attention.

Also, it is estimated that over 85% of these injuries occur in developing countries, including Uganda [8]. The risk is heightened in these settings where proper infection control practices, personal protective equipment, and proper disposal of sharp objects may be lacking or inadequate. For instance, almost 90% of all needlestick injuries that occurred to nurses in third-world countries were due to a lack of knowledge, resources, and adequate training [9]. Interestingly, the lifetime prevalence of needlestick injuries among health workers is estimated at 61.2%, and the one-year prevalence was 38.3% in Ethiopia [10]. Also, the lifetime and one-year prevalence of blood or body fluid splash exposure were 60.2% and 44.9%, respectively. These statistics demonstrate a significant burden of occupational exposures, warranting an intervention.

Among clinical students, literature detailing the incidence and prevalence of these biological hazards is inadequate and fragmented. Countries like Uganda lack substantial information among medical students about these hazards, posing a challenge to implementing the necessary strategies. Two studies conducted across Uganda have specifically explored the prevalence of needle stick injuries among medical students. Ndyamuhaki et al. reported a 55.2% prevalence of needlestick injuries among clinical students in Eastern Uganda.[11] Kamoga found a 42.4% prevalence of needlestick injuries among clinical students in Central Uganda [12]. Sadly, the actual burden of exposure to accidents among medical students in their clinical years in Uganda is also unknown. Other studies conducted in Uganda have explored the prevalence of occupational hazards among qualified health workers, excluding clinical students [13–16]. Also, the factors that contribute to needle stick injuries are not well known and documented, especially from a student perspective in the Ugandan context. Despite the efforts of Uganda's Ministry of Health and respective teaching hospitals to establish universal precautions, standard

operating procedures, and measures, it remains challenging to adhere to or enforce these precautions [17]. The study thus explored the prevalence of occupational hazards among medical students at a teaching hospital in Southwestern Uganda and determined the factors associated with these hazards.

2 Methods

2.1 Study design

We conducted this study using a cross-sectional design and collected quantitative data between January and June 2024.

2.2 Study population

Data were collected among undergraduate clinical students in clinical years at Mbarara University of Science and Technology in western Uganda. Clinical students are those in the later (clinical) phase of their medical education training after completing basic science courses. During this phase, clinical students gain hands-on experience by working directly with patients under the supervision of experienced doctors and healthcare professionals across various clinical settings, including hospitals, clinics, and health centres [18]. In Uganda, Clinical years/exposure to medical students can start as early as the first year and as late as the fourth year of study, depending on one's study program, curriculum type, and institution of study. For example, Bachelor of Medicine and Surgery students begin clinical practice in the third year, while nursing students begin in the second year. By comparison, in Jerusalem, clinical years are the fourth and fifth years for six-year courses and the third and fourth years for four-year courses [19]. This stage is crucial for developing practical skills, clinical reasoning, and professional behaviour necessary for practising medicine. During this phase, the students are at risk of exposure to various biological occupational hazards, including blood spills, unsterile needle pricks, falls, and blade cuts, among others, during their medical training to become professionals [20].

2.3 Study site

The university utilises Mbarara Regional Referral Hospital as its primary training and learning centre for medical students, particularly those in their clinical years [21]. The university offers different study programs, including a Bachelor of Medicine and Surgery (MBChB), Bachelor of Nursing (BSN), Bachelor of Physiotherapy (BPHY), Bachelor of Pharmacy (BPHA), and Bachelor of Medical Laboratory Science (BMLS), among others. The estimated total number of students in undergraduate clinical years at this University during the study period was approximately 800, of whom the majority were pursuing an MBChB. The medical students included in the study were those pursuing MBChB, BSN, and BPHY, as well as Undergraduate Clinical students who were 18 years or older, from MUST, rotating in any MRRH ward, and pursuing one of the above three academic programs. They had to consent to participate in this research. Clinical students who were unable to remain and complete their study activities, as well as those who declined to participate, were excluded.

2.4 Sample size determination

The sample size was determined using the random sample size formula, with a 50% proportion (p) and a z-score of 1.96 at a 95% confidence interval with a margin of error of 0.05. 384 participants were included in this study.

2.5 Sampling and inclusion criteria

A simple random sampling method was used, selecting from a consolidated list of eligible clinical students across departments and ward rotations. We developed papers with "yes" and "no" options, and every participant who met the inclusion criteria would pick one paper from a box. If they picked yes, they would complete the questionnaire; if they picked no, they would be omitted. However, since students were distributed across multiple departments and wards, this approach may not have ensured proportional representation of all departments. Only students in clinical years were included because of their patient interface in ward settings.

2.6 Data collection, variables, and quality control

Data were collected by trained research assistants using a structured self-administered questionnaire. Biological hazards were defined as exposures to the study participant that, at the time of exposure, may involve contact with the patient's internal fluids. Prior to data collection, research assistants received training on the study objectives, participant recruitment, informed consent procedures, and questionnaire administration. Eligible participants were approached during their clinical placements, informed about the study, and invited to participate. After providing informed consent, participants completed the questionnaire independently in a private setting. The exposure mechanisms were defined as the process through which contact between the patient's fluids and the study participant was established. The dependent variable was a binary indicator of whether the individual had ever been exposed to the hazard during their time on the ward. Independent variables included participants' age, year of study, ward placement, and course. The questionnaire collected information on socio-demographic characteristics, academic factors, clinical placement characteristics, and experiences of biological occupational hazards. Each Questionnaire was always prechecked for completeness before its study participant left the interview.

2.7 Questionnaire validity and reliability assessment

The questionnaire was pretested with 10 undergraduate clinical students from Makerere University, and the necessary adjustments were made before it was administered to the final target participants at MUST. A Cronbach's alpha of 0.689 was obtained, indicating the questionnaire's reliability in addressing the research question.

2.8 Ethical consideration and confidentiality

Ethical approval was obtained from the Mulago Hospital Research and Ethics Committee (MHREC) under approval number *MHREC 2470*. Furthermore, local administrative clearance was sought from MUST and MRRH to proceed with the study. Written informed consent was obtained from each participant before recruitment.

2.9 Data management and analysis

Raw data from hardcopy questionnaires were entered into Microsoft Excel 2016, cleaned, and then exported to Stata 15 for analysis. Categorical data were summarised as frequencies and percentages, while numerical data were summarised as means and medians. Some variables were visualised using bar charts and line graphs. Bivariable and Multivariable logistic regression were used to identify factors independently associated with occupational hazards among clinical students. Variables with a p-value < 0.20 at bivariable analysis and those identified a priori based on existing literature were included in the multivariable model. Adjusted odds ratios (aORs) with 95% confidence intervals (CIs) were reported to quantify the strength of associations. Statistical significance was set at $p < 0.05$. Variables such as gender and age were retained in the multivariable model, regardless of statistical significance, to control for confounding. In this study, we had no missing data because quality control was maintained during field data collection.

3 Results

A total of 384 responses were considered, with more than half of the participants male (208, 54.2%) and the majority (255, 66.4%) aged 20–24 years. 223 (58.1%) of the participants were pursuing a bachelor's in medicine and surgery (MBChB), 139 (36.2%) were pursuing a bachelor's in nursing (BScN), and the remaining participants were pursuing a bachelor's in physiotherapy. A detailed description of the demographic characteristics is provided in Table 1.

Table 1 Demographic characteristics of the participants ($n = 384$)

Variable	Frequency (*n*)	Percentage (%)
Age mean (SD) 25.1(4.4)		
20_24 years	255	66.4
25_29 years	79	20.6
30_34 years	22	5.7
35_39 years	16	4.2
40_44 years	9	2.3
45_49 years	3	0.8
Sex		
Female	176	45.8
Male	208	54.2
Program		
BScN	139	36.2
MB ChB	223	58.1
Physiotherapy	22	5.7
Year of study		
1	11	2.9
2	39	10.2
3	123	32.0
4	135	35.1
5	76	19.8
Ward of clinical rotation		
Medicine	112	29.2
Obs & Gyn	110	28.6
Pediatrics	89	23.2
Surgery	73	19.0

Table 2 Biological occupational hazard-related characteristics of the study participants ($n = 384$)

Prevalence of the biological occupational hazard	Frequency (*n*)	Percentage (%)
Exposed to hazard		
No	68	17.7
Yes	316	82.3
Frequency of hazards (For the Yes)		
Once	93	29.4
Twice	76	24.1
Thrice	40	12.6
More than 3	107	33.9
Availability of PPEs		
Were you wearing PPE like gloves?		
No	51	16.1
Yes	265	83.9

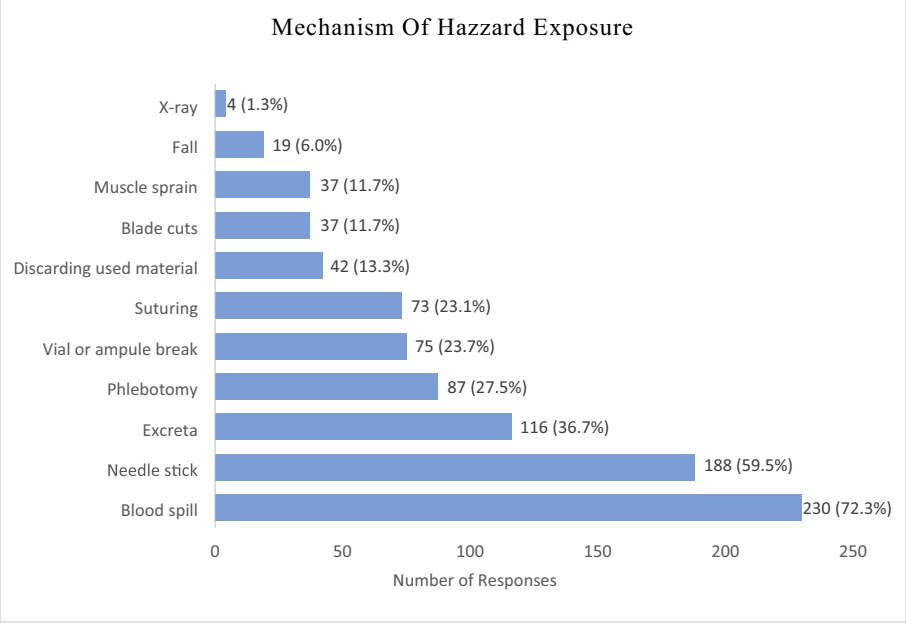

Fig. 1 Mechanisms of occupational hazard exposure among clinical students (multiple responses, $n = 316$). Cumulative percentages exceed 100% due to multiple responses

3.1 Prevalence of exposure to hazards

The majority, 316 (82.3%) of all participants reported exposure to a hazard, injury, or cut during their clinical rotations. 107 (33.9%) of the 316 were exposed to the hazard more than 3 times. 265 (83.9%) of those who were exposed wore PPE at the time of exposure, as shown in Table 2.

Among participants who reported exposure to occupational hazards (n=316), blood spills and needle-stick injuries were the most commonly reported mechanisms of exposure, with 155 (49.1%) and 102 (32.3%) participants reporting these experiences, respectively. From multiple responses, 230 (72.3%) participants had experienced blood spills, while 188 (59.5%) reported needle sticks. Since participants could report more than one type of exposure, the total number of responses exceeded the number of participants. The least commonly reported exposure mechanism was X-ray exposure, with 4 responses, as demonstrated in Figure 1.

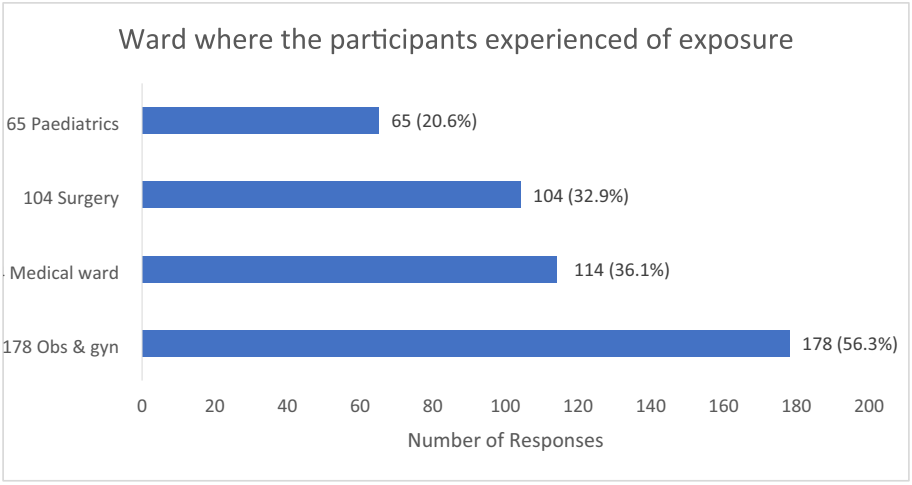

Fig. 2 Multiple responses concerning the distribution of occupational according to wards of rotation ($n=316$). Cumulative percentages exceed 100% due to multiple responses

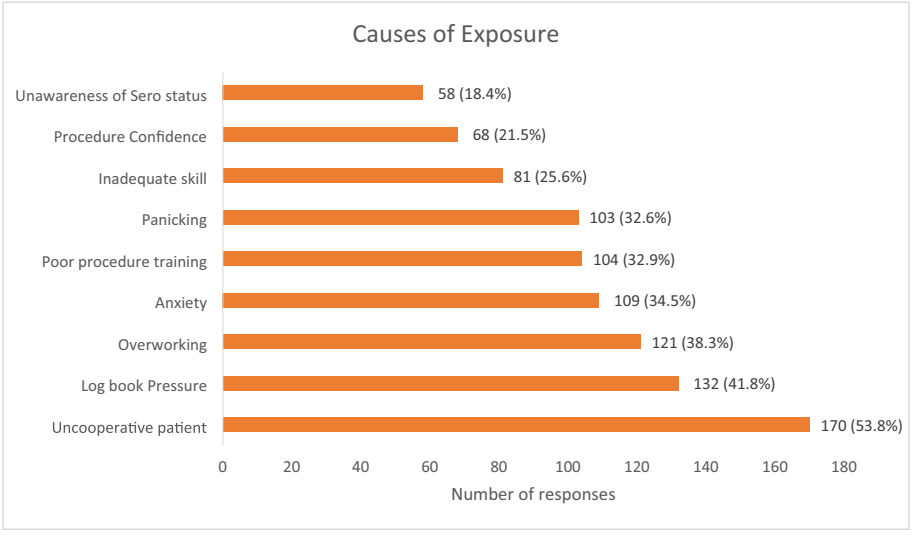

Fig. 3 Multiple responses about the common causes to biological hazard exposure as reported by the participants ($n=316$). Cumulative percentages exceed 100% due to multiple responses

Most of the exposure occurred while rotating in the Obstetrics and Gynaecology (Obs & Gyn) wards, followed by the medical wards, with the least in the Pediatric wards, as shown in Fig. 2.

The majority of participants noted that an uncooperative patient (170, 53.8%), logbook pressure (132, 41.8%), and overworking (121, 38.3%) were the most common causes of the biological hazard. Other reasons for the hazard exposure included inadequate procedural skills, panic, and a lack of confidence in performing the procedure, as demonstrated in Fig. 3.

In response to the biological hazard exposure, participants washed the site of exposure (247, 78.2%), while others applied alcohol sanitiser (152) and panicked (66), as in Fig. 4.

As part of the response to occupational hazards, most participants ($n=232$, 73.4%) suggested establishing injury response teams and providing procedure manuals, as shown in Fig. 5.

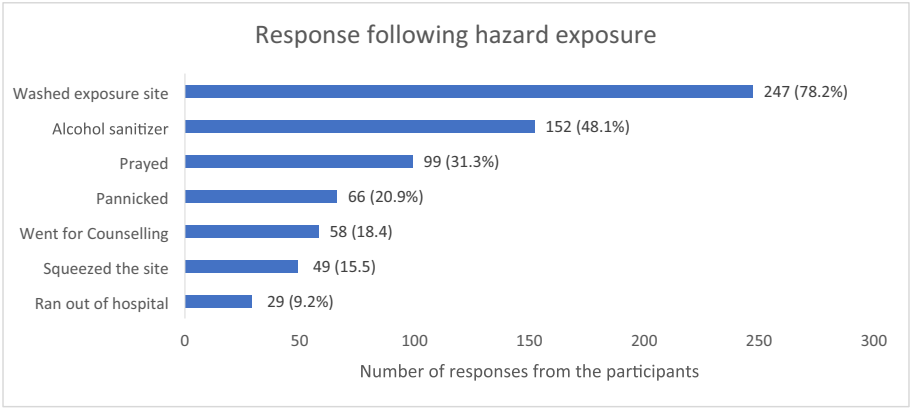

Fig. 4 Multiple responses from the study participants following exposure to the biological hazard ($n = 316$). Cumulative percentages exceed 100% due to multiple responses

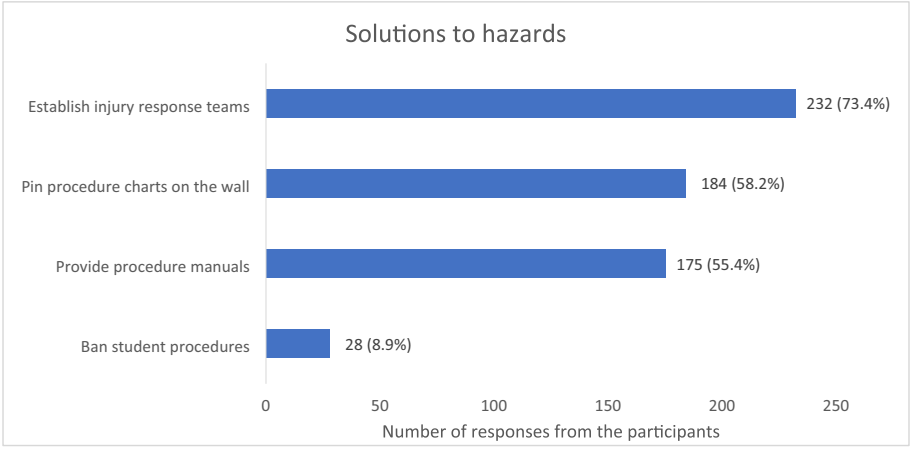

Fig. 5 Multiple responses of the proposed solutions to occupational hazards ($n = 384$). Cumulative percentages exceed 100% due to multiple responses

3.2 Factors associated with exposure to occupational hazards

At the bivariable level, gender and the ward where the student was placed were significantly associated with exposure to hazards. Notably, the male participants were 44% less likely to be exposed to occupational hazards [Odds Ratio (OR) 0.56, 95% Confidence Interval (CI) (0.33–0.97), $p = 0.041$] compared with the females. Students rotating in the Obs & Gyn wards were 3 times more likely to be exposed to hazards when compared to those in the medical ward [OR 3.0, 95% CI (1.50–2.93), $p = 0.002$], Those rotating in the surgery ward were 2 times more likely to be exposed to hazards when compared to those in the medical ward, however, did not reach a statistical significance P-Value of 0.47 as demonstrated in Table 3.

3.3 Multivariable logistic regression

After adjusting for other variables, Male participants were 55% less likely to be exposed to occupational hazards than female participants [aOR 0.45, 95% CI (0.24–0.84)], $P = 0.012$. Those rotating in the Obstetrics and Gynaecology (Obs & Gyn) ward were 2.9 times more likely to be exposed to occupational hazards than those in the medical ward [aOR 2.93, 95%CI (1.39–6.2)], $P = 0.005$.

Table 3 Bivariate and multivariable logistic regression of factors associated with exposure to occupational hazards

Logistic regression Variable	Bivariable				Multivariable			
	Crude odds ratio	95% Confidence interval		*P*-Value	Adjusted (aOR)	95% Confidence interval		*P* Value
Age								
18_24 years	Ref.*							
25_29 years	1.36	0.69	2.71	0.38	1.22	0.56	2.68	0.62
30_34 years	5.12	0.67	38.99	0.12	4.88	0.52	45.65	0.16
35_39 years	3.66	0.47	28.35	0.21	1.22	0.11	13.81	0.87
40_44 years	0.49	0.112	2.02	0.32	0.06	0.00	1.00	0.05
45_49 years	1.01	0.56	2.62	0.36	1.00	0.417	6.842	0.83
Gender								
Female	Ref.*							
Male	0.56	0.33	0.98	0.04	0.45	0.24	0.84	0.01
Course								
BScN	Ref.*							
MB ChB	0.70	0.39	1.27	0.24	0.59	0.27	1.30	0.18
Physiotherapy	0.32	0.11	0.89	0.03	0.41	0.12	1.35	0.14
Year of study								
1	Ref.*							
2	3.00	0.43	21.00	0.27	16.13	0.32	18.14	0.14
3	0.85	0.17	4.22	0.84	3.60	0.66	3.87	0.72
4	1.10	0.22	5.49	0.91	5.36	0.24	7.30	0.87
5	1.86	0.34	10.17	0.47	9.52	0.39	11.34	0.08
Ward								
Medicine	Ref.*							
Obs & Gyn	3.00	1.50	6.03	0.002	2.94	1.39	6.22	0.005
Pediatrics	1.00	0.53	3.54	0.339	1.00	0.49	3.49	0.243
Surgery	1.25	0.67	2.33	0.577	1.23	0.62	2.44	0.53

*Ref: Reference; aOR: Adjusted Odds Ratio

4 Discussion

This study examined the occurrence of biological occupational hazards among medical students across clinical years. Some previous studies have studied occupational hazards among health workers, but very few have explored these among medical students in their clinical disciplines [13, 14]. The study demonstrated that most medical clinical students had been exposed to an occupational hazard during their study time on the wards, with more than half having multiple exposures. From the study's evaluation, blood spills and needle stick injuries were the most common mechanisms of occupational hazard exposure among clinical students. These findings align with another study, which reported that approximately 68.9% of clinical students had experienced multiple Needle Stick Injuries (NSIs) at a tertiary hospital in Uganda [22]. However, in this study, we report a lower prevalence of NSIs at 32.3% compared to that reported by Elisa et al. of 46.6% still in Uganda [22]. While both studies took place in the same country, the different tertiary hospitals might have varying safety practices, patient volumes, supervision levels, and availability of protective equipment, all of which may impact exposure rates.

Globally, evidence has demonstrated variable prevalence of occupational hazards with a focus on needle stick injuries among clinical students. For example, Xu et al. demonstrated a 35% pooled prevalence of NSIs among nursing students, while Huang et al. showed a 44% pooled prevalence among dental students [23, 24]. Notably, NSIs among

medical students worldwide have been estimated to range from 11% to 95% in different settings [25]. Huang et al. further align with the WHO findings, which demonstrated an approximate 43% global incidence of NSIs, with over 51% of the occurrences in Africa [7, 24]. Thus, this study provides a prevalence proportion, especially from this setting, necessitating targeted intervention. Also, our findings on the proportion of clinical students who had experienced blood spills (49.05%) were higher than those reported in other studies; for example, a study by Amare et al. reported a proportion of 19.9% among nursing and midwifery students who had experienced blood spills [20]. The mismatch could have been due to the inclusion of multiple clinical student groups, such as medicine, nursing, and physiotherapy, in this study, compared to the one group of nursing and midwifery in that study. However, a systematic review and meta-analysis found a pooled prevalence of 54.9% for blood-spill exposure among health workers in Ethiopia [26]. Further, an evaluation by Zhang et al. among nurses in China found a 52.1% proportion of nurses who had experienced biological exposure to blood spills, with other studies reporting variable proportions [27–30].

Notably, the exposure distribution among clinical students increased with advancing study years, but declined in the final year. This phenomenon, characterised by a decrease in the exposure distribution, could be attributed to the increment in expertise among these clinical students in the final year. Additionally, the pattern in which exposure to occupational hazards peaks in the earlier clinical years and declines in the final year likely reflects increases in skill confidence and adherence to safety protocols that accumulate as students progress through their training. However, our study did not assess the presence and implementation of safety protocols for occupational hazards in this setting, a gap that warrants further research. Additionally, the decline in exposure patterns could be explained by a transition from routine, high-risk hands-on tasks to more supervisory roles, such as observing or assisting more advanced procedures alongside senior staff. This shift can reduce their direct exposure to NSI-prone tasks, thus lowering the risk of occupational hazards. Yet, evaluating these concepts in future studies can offer concrete evidence. Notably, our study agrees with a German study that found reduced NSI exposure among final-year medicine students [31]. However, adjusting for the clinical year in our study was not significantly associated with exposure to occupational hazards among the medical students. The study differs from the findings of Elisa et al. [22], which showed that NSIs increased among finalist students and were more likely to experience this hazard than in other clinical years [22]. Importantly, examining these exposures across a single clinical group over time would provide a comprehensive understanding of their trends.

Significantly, sex, year of study, and the ward where a student is attached were associated with exposure to an occupational hazard. Compared to females, males had a lower likelihood of exposure to the occupational hazard. Multiple studies have demonstrated that being female increases the risk of exposure to NSIs [18, 32, 33]. However, other studies have found that males have a higher risk of experiencing NSI, which contradicts our study [33–36]. The observed sex differences in occupational exposure to NSIs may reflect a variety of factors rooted in social, behavioural, and occupational aspects within clinical settings. For example, there may be a difference in how NSIs and other hazards are reported between males and females. Female students may be more likely to report injuries due to heightened risk awareness or precaution. In contrast, male students might

underreport due to social factors like stigma or fear of being perceived as less competent. However, there is limited research on gendered willingness to report among clinical students, especially from a Ugandan perspective, offering opportunities for future research. This reporting bias could skew findings, leading to higher female NSI rates in studies where reporting practices are not controlled. Additionally, variability across genders in clinical settings may be attributed to presumed gender roles, risk perceptions, and attitudes toward safety practices. For example, female students might approach certain tasks cautiously, potentially leading them to undertake riskier procedures more often to ensure a thorough experience, albeit at greater risk [17]. Conversely, male students may prioritise efficiency or feel pressured to avoid any perception of vulnerability, potentially avoiding or rushing through procedures involving sharps. Still, further research is needed to evaluate concepts such as gendered roles in clinical settings, risk perceptions, and safety attitudes among clinical students. These could provide concrete information to guide interventions to mitigate occupational hazards in this category.

Due to their higher risk of exposure, the students experienced more exposure to occupational hazards in the Obstetrics and Gynaecology and medical wards than in other wards. In Obs & Gyn wards, students may frequently perform or assist with invasive procedures like deliveries, suturing, and cesarean sections, all of which present a significant risk for blood exposure and needle stick injuries (NSIs). Similarly, medical wards involve regular blood draws, intravenous line placements, and injections. These tasks increase exposure to bodily fluids and sharp instruments, making these wards high-risk areas for occupational hazards. Notably, the obstetrics and gynaecology ward was significantly associated with exposure to an occupational hazard. Our findings align with a UK survey of healthcare students, which showed that medical and obs and Gyn wards had the highest frequency of occupational hazards, at 15.3% and 12.3%, respectively [5]. However, Elisa et al. reported that the causality and emergency wards were the most common wards for exposure to hazards [22]. Emergency room settings often involve acute trauma care, emergency surgical procedures, and immediate life-saving interventions, which are associated with high-risk exposure for healthcare workers, including experienced staff. The fast-paced, unpredictable environment of the ER may lead to high exposure to blood and body fluids. Nonetheless, medical students in the ER may have an observational role and are typically closely supervised during procedures, which may reduce their direct exposure compared to settings like Obs & Gyn and medical wards, where they engage more independently [37, 38]. Further research is warranted to explore these avenues, such as ward settings and their implications for hazard exposure among medical students.

4.1 Existing limitations

Our study was a single-site study, which could have introduced potential selection and sampling biases and limited its generalizability. However, we attempted to mitigate this by ensuring randomness during the selection of study participants and by ensuring representativeness from students across all clinical years. Also, we acknowledge that there may have been a misallocation of sample sizes across the different cadres, as this study included population categories from different wards and departments and did not use proportionate allocation.

5 Conclusion

There is a significant exposure of clinical medical students to occupational hazards, with blood spills and needle stick injuries identified as the most common mechanisms. The findings indicate that many students experience multiple exposures during their training. Notably, these findings highlight the importance of establishing targeted interventions to improve the learning experience and enhance safety in the clinical learning environment. Gender differences in this study may reflect reporting practices and gendered perceptions of risk within clinical settings. Further studies could explore the different gendered perceptions among medical students in these clinical settings to inform protective strategies for this population. Additional research is warranted to examine the impact of safety protocols, reporting practices, and gendered risk perceptions in clinical environments. By addressing these factors, institutions can enhance occupational safety, optimise clinical training experiences, and better protect medical students from the hazards inherent to their professional preparation.

5.1 Implications for future research

Our study reveals a high incidence of occupational hazards, with blood spills and needlesticks among the most common mechanisms of exposure. Sex, year of study, and ward of rotation were significantly associated with exposure to hazards. Perhaps future studies could explore in detail the factors that predispose individuals to hazards across different wards. The findings could offer targeted interventions to minimise hazard exposures among medical students, thereby protecting their quality of life and that of the patients they serve. Additionally, this study explored all medical disciplines from a clinical perspective. Future studies can investigate the individual disciplines within this setting to identify program-specific exposures that may help establish targeted interventions, such as developing hazard manuals and ensuring the presence of hazard response teams.

Abbreviations

MBChB	Bachelor of Medicine and Bachelor of Surgery
BScN	Bachelor of Nursing Science
OBGYN	Obstetrics and Gynaecology
MHREC	Mulago Hospital Research and Ethics Committee
WHO	World Health Organisation
NSIs	Needle Stick Injuries
HIV	Human Immunodeficiency Virus
HBV	Hepatitis B Virus

Acknowledgements

We would like to thank the various study coordinators and research assistants who were involved in the data collection process. Special thanks are rendered to Dr Francis Ssengoba, Dr Evas Muhumuza, Dr Shillah Ankunda, Dr Joseph Labalpiny, Ms Florence Bonabana, and Mr Grant Kijana for their tremendous efforts during data collection.

Author contributions

IA and RMN conceptualised the studyRBK and IA developed the study protocolDM, DT, GW, RN, BK, and IE oversaw data collectionIE, GW, BK, and PM conducted data analysisIA and IE developed the initial draft of the manuscript.TDE and BK reviewed the final manuscript draftAll authors reviewed and approved the final manuscript draft for publication consideration.

Funding

No funding was received for this project.

Data availability

Data is available upon reasonable request from the authors.

Declarations

Ethics approval and consent to participate

Ethical approval was obtained from the Mulago Hospital Research and Ethics Committee (MHREC) under approval number *MHREC 2470*. Furthermore, local administrative clearance was obtained from MUST and MRRH to proceed with

the study. The remaining study activities were conducted in accordance with the principles outlined in the Declaration of Helsinki. Written informed consent was obtained from each participant before their recruitment.

Consent for publication
No personal information for the study participants, such as photos, was presented in this manuscript. All authors consented to the submission of this manuscript for publication.

Competing interests
The authors declare no competing interests.

Received: 4 March 2026 / Accepted: 25 August 2026
Published online: 04 September 2026

References

1. Abere G, Yenealem DG, Wami SD. Occupational exposure to blood and body fluids among health care workers in Gondar Town, Northwest Ethiopia: a result from a cross-sectional study. J Environ Public Health. 2020;1(2020):3640247.
2. Lyakurwa DM, Khalfan SS, Mugisha J, Yao W. Occupational hazards among healthcare workers in Tanzania: a scoping review. Discover Public Health. 2024;21(1):32.
3. Rai R, El-Zaemey S, Dorji N, et al. Exposure to occupational hazards among health care workers in low-and middle-income countries: a scoping review. Int J Environ Res Public Health. 2021;18(5):2603.
4. Hosseinipalangi Z, Golmohammadi Z, Ghashghaee A, et al. Global, regional and national incidence and causes of needle-stick injuries: a systematic review and meta-analysi. East Mediterr Health J. 2022;28(3):233–41.
5. Hambridge K, Burt W, Bettache G, Keshishian M, Walvin T, Cozma E. An exploration of sharps injuries within healthcare students at a UK university. J Infect Prev. 2024;25(4):110–9.
6. Datar UV, Kamat M, Khairnar M, Wadgave U, Desai KM. Needlestick and sharps' injury in healthcare students: prevalence, knowledge, attitude and practice. J Family Med Prim Care. 2022;11(10):6327–33.
7. Güllü M, Türkkan A. Frequency and characteristics of occupational injuries and infections in senior medical students: a 5-year retrospective study. Discover Public Health. 2025;22(1):239.
8. Bin-Ghouth AS, Al-Ammary SS, Alsheikh GY, et al. Occupational hazards among health workers in hospitals of Mukalla City, Yemen. J Community Med Health Care. 2021;6(1):1045.
9. El-Sawy NA, Mosa OF. Journal of Clinical and Biomedical Sciences. J Clin Biomed Sci. 2020;10(3):80–6.
10. Zenbaba D, Sahiledengle B, Bogale D. Practices of healthcare workers regarding infection prevention in Bale Zone Hospitals, Southeast Ethiopia. Adv Public Health. 2020. https://doi.org/10.1155/2020/4198081.
11. Ndyamuhakyi E, Ssenyonga L, Iramiot JS, Nuwasiima D, Nekaka R. Prevalence and risk factors of sharp/needlestick injuries among clinical students in a tertiary hospital in eastern Uganda. J Infect Prev. 2026;27(2):66–77.
12. Kamoga L. Needlestick injuries among clinical students at the College of Health Science, Makerere University. A cross-sectional study (Doctoral dissertation, Makerere University). https://dissertations.mak.ac.ug/items/206dfb3c-657c-46ed-bebf-7039a2c30d65. Accessed on 30 April 2026.
13. Aleku M, Nelson K, Abio A, et al. Lower back pain as an occupational hazard among Ugandan health workers. Front public health. 2021;2021(9):761765.
14. Basaza R, Otieno E, Haddock CK. Assessment of needle stick injuries among healthcare workers: A cross-sectional study from Kakiri military and SOS hospitals, Uganda. Int J Healthc. 2021;8(1):5410–30.
15. Ndejjo R, Musinguzi G, Yu X, et al. Occupational health hazards among healthcare workers in Kampala, Uganda. J Environ public health. 2015;2015(1):913741.
16. Odongkara BM, Mulongo G, Mwetwale C, et al. Prevalence of occupational exposure to HIV among health workers in Northern Uganda. Int J Risk Saf Med. 2012;24(2):103–13.
17. Kasa AS, Temesgen WA, Workineh Y, et al. Knowledge towards standard precautions among healthcare providers of hospitals in Amhara region, Ethiopia, 2017: a cross sectional study. Archives Public Health. 2020;2020(78):1–8.
18. Iliyasu BZ, Amole TG, Galadanci HS, et al. Occupational exposure to blood and body fluids and knowledge of HIV post-exposure prophylaxis among medical and allied health students in Northern Nigeria. Int J Occup Environ Med. 2020;11(4):196.
19. Weissman C, Zisk-Rony RY, Schroeder JE, et al. Medical specialty considerations by medical students early in their clinical experience. Isr J Health Policy Res. 2012;1(13):1–10.
20. Amare TG, Tesfaye TT, Girmay B, Gebreagziabher TT. Exposure to occupational health hazards among nursing and midwifery students during clinical practice. Risk Manag Healthc Policy. 2021;14(2021):2211–20.
21. Tibaijuka L, Kajjimu J, Atimango L, et al. Impact of the Mbarara University of Science and Technology residency training on increasing access to specialty care workforce. PLOS Global Public Health. 2024;4(3):e0003021.
22. Elisa N, Ssenyonga L, Iramiot JS et al. Sharp/needlestick injuries among clinical students at a tertiary hospital in Eastern Uganda. medRxiv. 2023;23285330.
23. Xu X, Yin Y, Wang H, Wang F. Prevalence of needle-stick injury among nursing students: a systematic review and meta-analysis. Front Public Health. 2022(10). https://doi.org/10.3389/fpubh.2022.937887.
24. Huang J, Li N, Xu H, et al. Global prevalence, risk factors, and reporting practice of needlestick and sharps injuries among dental students: a systematic review and meta-analysis. J Hosp Infect. 2022;2022(129):89–101.
25. Hambridge K. The psychological impact of sharps injuries sustained by medical students. Br J Hosp Med. 2022;83(1):1–7.
26. Sahiledengle B, Tekalegn Y, Woldeyohannes D, Quisido BJ. Occupational exposures to blood and body fluids among healthcare workers in Ethiopia: a systematic review and meta-analysis. Environ Health Prev Med. 2020;25(58):1–4.
27. Zhang L, Li Q, Guan L, et al. Prevalence and influence factors of occupational exposure to blood and body fluids in registered Chinese nurses: a national cross-sectional study. BMC Nurs. 2022;21(1):298.
28. Nouetchognou JS, Ateudjieu J, Jemea B, Mbanya D. Accidental exposures to blood and body fluids among health care workers in a Referral Hospital of Cameroon. BMC Res Notes. 2016;9(94):1–6.

29. Yasin J, Fisseha R, Mekonnen F, Yirdaw K. Occupational exposure to blood and body fluids and associated factors among health care workers at the University of Gondar Hospital, Northwest Ethiopia. Environ Health Prev Med. 2019;24(18):1–9.
30. Reda S, Gebrehiwot M, Lingerew M, et al. Occupational blood exposure beyond needle stick injuries: hospital-based cross-sectional study among healthcare workers in governmental hospitals of Northern Ethiopia. BMC Health Serv Res. 2021;21(1136):1–10.
31. Keicher F, Zirkel J, Leutritz T, König S. Combatting the occurrence of needle-stick injuries in a medical school: why is it still an issue? BMC Med Educ. 2024;24(1):312.
32. Gabr HM, El-Badry AS, Younis FE. Risk factors associated with needlestick injuries among health care workers in Menoufia governorate, Egypt. Int J Occup Environ Med. 2018;9(2):63–8.
33. El Bouazzi O, Toujami Z, Raoui SM, et al. Occupational exposure to blood and body fluids among nursing students in clinical internship. J Public Health Afr. 2023;14(6):2336.
34. Belachew YB, Lema TB, Germossa GN, Adinew YM. Blood/body fluid exposure and needle stick/sharp injury among nurses working in public hospitals; Southwest Ethiopia. Front Public Health. 2017;2017(5):299.
35. Dilie A, Amare D, Gualu T. Occupational exposure to needle stick and sharp injuries and associated factors among health care workers in Awi Zone, Amhara Regional State, Northwest Ethiopia, 2016. J Environ Public Health. 2016. https://doi.org/10.1155/2017/2438713.
36. Berhan Z, Malede A, Gizeyatu A, et al. Prevalence and associated factors of needle stick and sharps injuries among healthcare workers in northwestern Ethiopia. PLoS ONE. 2021;16(9):e0252039.
37. Mengistu DA, Tolera ST. Prevalence of occupational exposure to needle-stick injury and associated factors among healthcare workers of developing countries: systematic review. J Occup Health. 2020;62(1):e12179.
38. Iliyasu Z, Babashani M, Dantata K, et al. Blood and body fluids exposure, post-exposure prophylaxis, and HIV self-testing among healthcare workers in northern Nigeria. HIV Res Clin Pract. 2023;24(1):2256063.

Publisher's Note