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Prevalence and Predictors of Occupational Health Hazards among Nurses Working in Health Care Facilities at Moshi Municipal, Kilimanjaro, Tanzania

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Abstract

Background
Health care workers in sub-Saharan Africa have higher exposure to disease causing pathogens than those working in high income countries. Occupational health hazards remain one of the under looked challenges in low-income countries. Nurses carry out most of the hazardous activities since they spend more time with patients than any other medical personnel.

Aim
To assess the prevalence and predictors of occupational health hazards faced by nurses working at Moshi municipal.

Methods
This study was a hospital based descriptive cross-sectional study done at four health facilities of different levels at Moshi municipal. The study population was 215 nurses who were interviewed face to face using questionnaire. Obtained data was processed using SPSS version 20. For analysis of predictors for occupational health hazards the crude odds ratio, adjusted odds ratio and P-value with their corresponding 95% Confidence Intervals were calculated by comparing with exposures to occupational health hazards.

Results
Out of 215 participants, 169 (78.6%) reported to have experienced biological hazards. 171 (79.5%) experienced non-biological hazards. The key exposures to biological hazards were needle stick injuries (prevalence of 43, 20%), and blood drop and splash exposure (prevalence of 122, 56.7%). The most prevalent non – biological hazards were low back pain (132, 61.4%), and work-related stress which included verbal abuse (118, 54.9%) and physical abuse (27, 12.5%). 116 (54%) reported shortage of personal protective equipment in their facilities. The key predictors of experiencing biological hazards were hours of working per week (p=0.03), type of facility one is working (p=0.01), number of years at work (p=0.02) and age of the participant (p=0.03). Predictors of experiencing non-biological hazards were carrying the patient (p=0.01) and standing for more than 3 hours (p=0.01)

Conclusion
Prevalence of occupational health hazards among nurses in Moshi municipal is high. This is influenced by many working hours per week, shortage of personal protective equipment, inadequate training on occupational health hazard prevention, and working at higher level health facility. Younger nurses and nurses with few years at work are at higher risk of experiencing needle stick injuries.

Key words*: Occupational health hazards, biological hazards, non – biological hazards, nurses.*

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Introduction

An occupational health hazard is the potential risk to the health of the person emerging from unhealthy environment, which is a significant public health issue (24). There are about 2.78 million work-related deaths each year globally, where by 2.4 million deaths are directly linked to occupational diseases (12).

Most of the world health care attrition occurs in Africa and Asia. This is attributed to the large workload assigned to the nurses (11). An estimated 600,000 to 800,000 percutaneous injuries occur annually to health care workers. Nurses practising in the perioperative environment are at distinct risk of percutaneous injury due to prolonged exposure to open surgical sites and frequent handling of sharp instruments. 37% of hepatitis B infection among health care workers is the result of occupational exposure and about 10% of HIV among health care workers is the result of occupational exposure (10). Overexertion, specifically from lifting, is a major contributing factor to non – biological hazards (5).

From the studies conducted in Asia, there was limited access to personal protective equipment such as facemasks, gloves, and disinfectants, contributing to poor adherence to standard precautions when caring for patients (9). Study conducted in Israel showed that there is correlation between confidence on personal protective equipment and self-perceived knowledge (19). Studies done in Africa reveal limited supply of personal protective equipment, perception of low risk to hazards, high workload, and the belief that personal protective equipment could interfere with patient care (3).

In Asia, the predictors for experiencing needle stick injury include use of a hollow-bore needle during venous sampling or intravenous injection, wound suturing and needles recapping (30). In sub-Saharan Africa they include lack of training on such injuries, working for more than 40 hours per week, recapping of needles and not using gloves while handling needles (22).

Another study done in Asia showed that reasons for experiencing musculoskeletal injuries among nurses were positioning, transportation and assisting patients (13).

Nurses and attendants perform more hazardous activities compared to other cadres of health care workers (17). This study aimed at providing information on occupational exposures encountered by nurses in their daily activities. It focused on assessing the prevalence of biological and non–biological occupational health hazards, activities potential to cause these hazards, and accessibility of personal protective equipment.

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Methodology

Study design and setting

This was a hospital based descriptive cross-sectional study, conducted in August to September, 2020. It was conducted in Moshi municipal, one of the seven councils in Kilimanjaro region, North – eastern part of Tanzania. Moshi municipal has 57 health facilities, which include 5 hospitals, 10 health centres, 29 dispensaries and 13 specialized clinics.

Registered nurses and who work at the selected health facilities in Moshi municipal. A multi-stage sampling technique was used where one health centre, one designated district hospital, one regional referral hospital, and one zonal referral hospital were selected at random. Using a probability proportionate to size (PPS) method, the required number of nurses was selected from each level of the selected public health care facility which offers at least obstetric services i.e. referral, regional, district and one primary health care facility in Moshi Municipal. 215 registered nurses working at the selected heath facilities of different levels in the Moshi municipal council were interviewed face to face; 136 at KCMC (a zonal referral hospital), 41 at Mawenzi regional referral hospital, 26 at St. Joseph designated district hospital and 12 at Majengo health centre.

Independent variables were age, sex, marital status, level of education, type of facility, blood and body fluids, needle stick injuries, cuts and wounds, airborne diseases, hazardous drugs such as antineoplastic drugs, work related stress, physical, psychological, sexual and or verbal abuse, musculoskeletal injuries, slips, trips and or falls, fractures, chemical spills, noise, burns and radiations. Dependent variables were prevalence and predictors of occupational health hazards.

Data collection and analysis

An electronic questionnaire with closed and open – ended questions was used to assess the prevalence and predictors of occupational health hazards. The questionnaire had five parts; demographic data, biological injuries, non-biological injuries, use of PPE, and factors leading to occupational health hazards. The data obtained were cleaned, processed and analyzed using SPSS version 20 where categorical variables were summarized using frequencies and percentages while for numerical variables, measure of central tendency and variability were used. For analysis of predictors for occupational health hazards the crude odds ratio,

adjusted odds ratio and P-value with their corresponding 95% Confidence Intervals were calculated by comparing with exposures to occupational health hazards.

Ethical considerations

Ethical clearance and permission to conduct the study were obtained from Kilimanjaro Christian Medical University College Ethical Committee, and was given research ethical clearance certificate number UG061/2020. The permission was obtained from Kilimanjaro Christian Medical Centre (KCMC), Moshi Municipal council, and Mawenzi Regional Referral Hospital. The written informed consent was handled to the study participants. Then the participants were assured that they may leave the study at any point they feel to do so.

Results

A total of 215 participants were enrolled with a response rate of 87%. Socio-demographic characteristics are summarized in Table 1 below;

Table 1: Socio-demographic characteristics of the participants N=215

Variable	Frequency	Percentage (%)
Age		
20-34	155	72.1
>35	60	27.9
Sex		
Male	72	34
Female	143	66
Marital status		
Single	129	60
Married	86	40
Residence		
Urban	171	79.5
Semi-urban	35	16.3
Rural	9	4.2
Education level		
Certificate	54	25
Diploma	134	62
Degree	27	13
Type of facility		
KCMC	136	69
Mawenzi	41	19
St. Joseph	26	12
Majengo	12	6

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Prevalence of biological hazards

The prevalence of biological hazards, obtained by considering needle stick injury and contamination with patients' specimen was 78.6%. Out of all participants 42 (20%) had needle stick injuries, 146 (67.9%) reported to have encountered hepatitis patient, and 42 (20%) reported to have experienced direct cough from TB patient. The distribution of each biological hazard among study participants is as shown in figure 1 below.

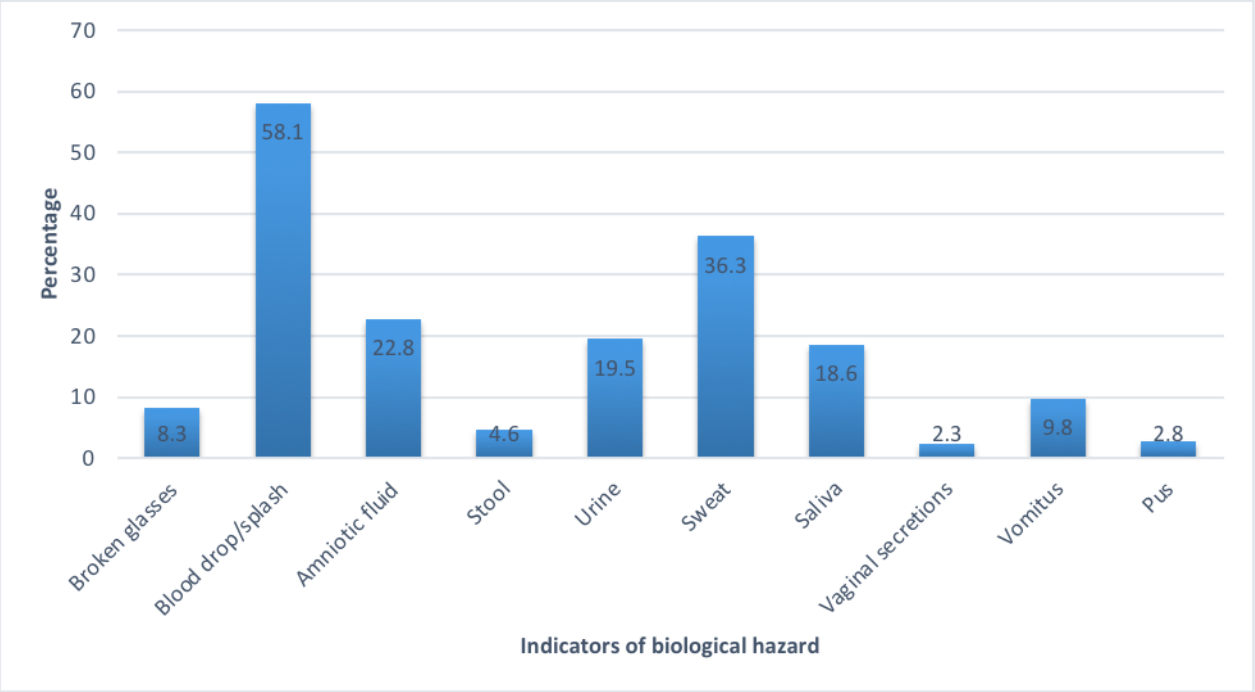

Figure 1: Bar chart showing percentages of each indicator of biological hazard

Prevalence of non-biological health hazards

The prevalence of non-biological hazards was 79.5%. Non-biological hazards were taken by considering musculoskeletal injuries, physical accidents such as spills of different chemicals, contact with medicines and vaccines and psychological stressors.

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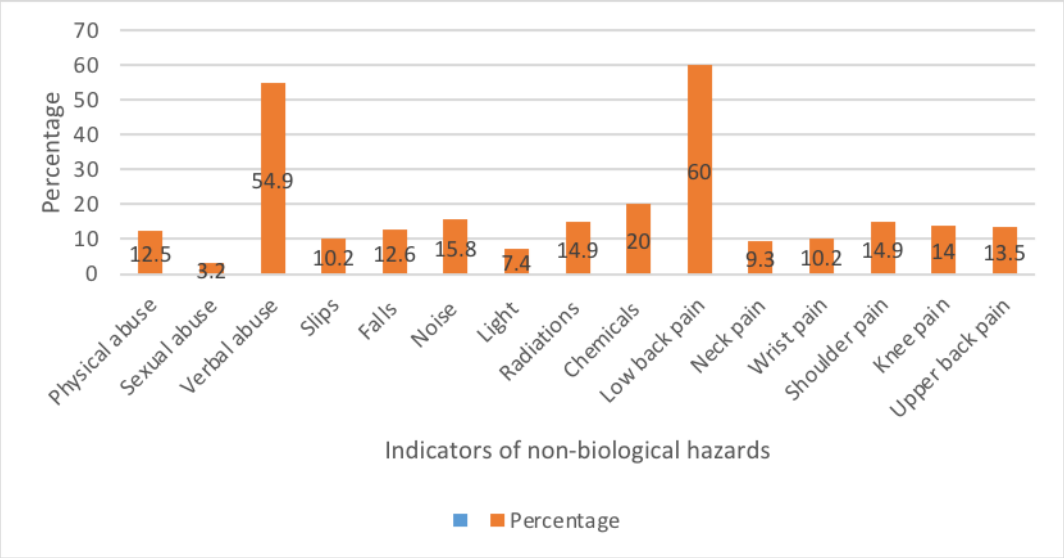

Figure 2: Bar chart showing percentage of each indicator of non-biological hazard

Accessibility of personal protective equipment (PPE)

Most of the participants reported to use PPE while handling the sample in the past six months. Out of all 215, 98.1% of the participants reported that gloves were accessible, 90.2% reported that masks were accessible, 89.3% reported that aprons were accessible and 66.5% reported that head covers were accessible. However, 54% reported to have shortage of PPE in their respective facilities. 63.7% of the nurses reported to have not received formal training on occupational health hazards prevention.

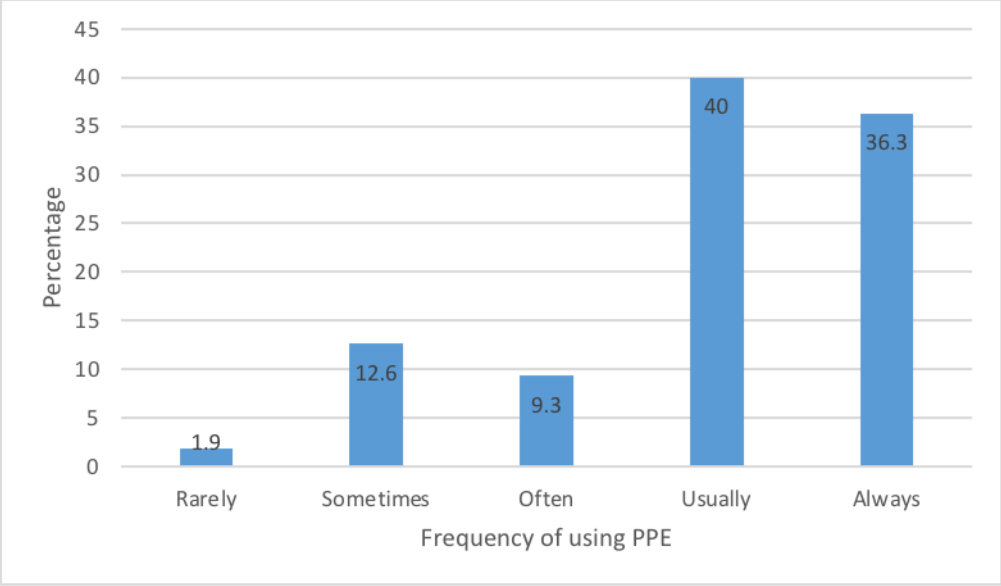

Figure 3: Bar charts showing the frequency of the usage of PPE N=215

Activities leading to potential occupational hazards

The factors leading to needle stick injuries, which were statistically significant, were age of the participants (P=0.03), hours of working per week (P=0.03), number of years at work (P=0.02) and type of facility one is working at (P=0.01); (Table 2).

Table 2: The distribution of reported needle stick injuries by study population characteristics

Variable	N	Experiencing needle stick injury n (%)	Not experiencing needle stick injury n (%)	P-value
Age of the participants				
20-34	155	36(23.2)	119(76.8)	0.03**
≥35	60	6(10)	54(90)	
Hours of working per week				
30-49	121	15(12.5)	106(87.5)	0.03**
≥50	94	27(28.7)	67(61.3)	
Number of years at work				
0.5-10	172	39(22.7)	133(77.3)	0.02**
≥10.5	43	3(7.0)	40(93.0)	
Type of facility				
Mawenzi	41	5(12.2)	36(87.8)	0.01*
KCMC	136	37(27.2)	99(72.8)	
Level of education				
Certificate	54	8(14.8)	46(85.2)	0.40**
Diploma	134	30(22.4)	104(77.6)	
Degree	27	4(14.8)	23(85.2)	

**P-value from Fisher exact test*

***P-value from Pearson exact test*

Out of all participants, 48.8% (105), 61.4% (132), 20.9% (45) and 40.9% (88) reported that carrying the patient, standing for more than 3 hours, handling violent patient and turning the patient predisposed them to musculoskeletal injuries.

The factors leading to low back pain, which were statistically significant were carrying the patient (P-value of 0.01) and standing for more than three hours (P value of 0.01), as shown in table 3.

Table 3: Predictors of low back pain

Variable	N	Experiencing low back pain n (%)	Not experiencing low back pain n (%)	P-value
Activities leading to low back pain				
Carrying the patient	107	54(50.5)	53(49.5)	0.01**
Standing for ≥ 3 hours	81	38(46.9)	43(53.1)	0.01**
Handling violent patient	165	97(58.8)	68(41.2)	0.16**

***P-value from Pearson exact test*

The factors associated with experiencing needle stick injuries were hours of working per week, (Table 4). Experiencing needle stick injuries was statistically significant among those working more than 50 hours per week, compared to those working 30-49 hours per week [(cOR=0.11) P=<0.001].

In the adjusted analysis the factors that remained significantly associated with needle stick injuries were also working for more than 50 hours per week, compared to those working 30-49 hours per week [(aOR=0.39(0.2,0.8), P=0.01]

Table: 4 Predictors of experiencing needle stick injuries

Variable	cOR*	P-value	aOR**(95% CI)	P-value
Hours of working per week				
30-49	1.00		1.00	
≥50	0.11	<0.001	0.39(0.2-0.8)	0.01
Number of years at work				
0.5-10	1.00		1.00	
≥10.5	0.40	<0.001	3.06(0.5,17.37)	0.21
Age of the participants				
20-34	1.00		1.00	
≥35	0.11	<0.001	1.09(0.3,4.15)	0.9
Activities leading to NSI				
Recapping of the needle	1.00		1.00	
Accidental prick	0.42(0.2,0.8)	0.01	0.42(0.2,0.9)	0.002
Unexpected patient movement	0.96(0.5,1.9)	0.90	1.01(0.5,2.1)	0.97

cOR*: Crude Odds Ratio, aOR: Adjusted Odds Ratio; adjusted for hours of working per week, number of years at work, age of the participant and activities leading to needle stick injuries.

The factors associated with low back pain were standing for more than 3 hours (Table 5). Low back pain was statistically significant among those who stood for more than 3 hours at work, compared to those who carried the patient, (aOR=2.8, 95%CI, 1.5,5.2) with P-value of 0.001, and in crude analysis the same factor remained statistically significant (cOR=2.6, 95%CI, 1.5,4.8) with P-value of 0.001.

Table: 5 Predictors to low back pain

Variable	cOR*	P-value	aOR**(95% CI)	P-value
Hours of working per week				
30-49	1.00		1.00	0.88
≥50	1.06(0.6,1.9)	0.83	0.96(0.5,1.7)	
Number of years at work				
0.5-10	1.00		1.00	
≥10.5	0.55(0.3,1.1)	0.11	0.71(0.2,2.34)	0.58
Age of the participants				
20-34	1.00		1.00	
≥35	0.58(0.3,1.1)	0.09	0.72(0.5,1.26)	0.12
Activities leading to low back pain				
Carrying the patient	1.00		1.00	
Standing for ≥3 hrs	2.6(1.5,4.8)	0.01	2.8(1.5,5.2)	0.001
Handling violent patient	0.60(0.3,1.2)	0.16	0.89(0.4,2.0)	0.78
Turning patient	3.2(1.7,6.0)	<0.001	2.6(1.3,5.3)	0.07

cOR*: Crude Odds Ratio, aOR: Adjusted Odds Ratio; adjusted for hours of working per week, number of years at work, age of the participant and activities leading to low back pain.

Discussion

The prevalence of biological hazards was found to be 78.6%, which is high, but it is comparable to other studies done in the region. One which was done at Singida, reported a prevalence of 68.6% (14). However in other systematic reviews the prevalence of needle-stick injuries in sub-Saharan Africa was reported to be as high as 57% among nurses (22). In another study done in Kampala, Uganda the prevalence of biological hazards was 39.5%, with sharps related injuries contributing the largest per cent (21.5%) followed by direct contact with contaminated specimen 10.5% (21).

One of the key exposures to biological hazards was needle stick injuries which had the prevalence of 20%. A study done in Uganda reported the prevalence of 21.5% (21). In the study done in Ethiopia, the prevalence of needle stick injuries was 18.7% within a period of

one year (7). Another study in Ghana reported the prevalence of needle stick injuries to be 28.9% within twelve months period (15). In one US study the prevalence of needle stick injuries among newly registered nurses was 26% (29). From this study the prevalence of needle stick injuries is comparable to other studies done elsewhere in the region and outside the region.

The other key exposures to biological hazards were blood drop and splash exposure, which had the prevalence of 56.7%. This is slightly high compared to other studies. A study done at Singida reported the prevalence of 47.1% of the exposure to blood splash. Another study which was done among health care workers in 14 different health facilities in Tanzania reported the prevalence of blood splash of 27.1% (17). In a study done in Lebanon, the occupational exposure to blood and body fluids was 30%. The difference in prevalence of exposure can be explained by the difference in population studied where, in this study, it only involved nurses but in the other two mentioned studies, it involved wider study population, which were nurses and other health care workers such as physiotherapists, radiographers, optometrists.

The prevalence of non-biological hazards was 79.5%. This prevalence is higher compared to the study done at Kampala, Uganda which reported the prevalence of 31.5% (21). The higher prevalence of non-biological hazards can be explained by the wider scope of non-biological hazards considered in this study, which involved low back pain, neck pain, wrist pain, shoulder pain, knee pain, and upper back pain, falls, slips, fractures and exposure to harmful radiations while at work.

The most prevalent non – biological hazards were low back pain, and work-related stress. The prevalence of low back pain among nurses was 61.4%, this is small compared to the study done in Nigeria that reported the prevalence of low back pain to be 73.53% (28). In studies done in Asia, the prevalence of low back pain ranged from 44.4% to 72.9% (16, 25). Small study population that involved only nurses compared to other studies, which involved all health care providers, explains the small prevalence of low back pain in this study.

In this study, work related stress, which included verbal abuse and physical abuse was 54.9% and 12.5% respectively. In one study done in Nigeria, the prevalence of work related stress was 83.3% among health care workers (23). While in another study in USA it was reported that 70% of the nurses had experienced verbal violence (29). This difference can be explained by difference in exposure to patients as nurses from different departments had different encounters when serving patients.

From the study, 54% of the participants reported to experience shortage of personal protective equipment. The key personal protective equipment, which was scarce, was clean gloves and they had to use sterile gloves, which are expensive, and not easily accessible. In this study, 63.7% of the nurses reported to have received training on occupational health hazards prevention. In another study in Nigeria 59% of the participants reported personal protective equipment were available at their working areas (8). In the other study done in Saudi Arabia 93% of the participants were aware of the importance of using personal protective equipment (2). The shortage of PPE observed in this study can be accounted for, by the rise in demand for PPE following the outbreak of COVID-19, but also this facilitated increase in training on occupational health hazards prevention.

In this study the leading predictors to experiencing biological hazards were hours of working per week, type of facility one is working, number of years at work and age of the participant. This is comparable to the findings obtained in one study done in Uganda, where researchers reported that the predictors, for biological hazards were working in multiple facilities, working overtime and number of years in the service. Most of the nurses who reported to work overtime, it was due to shortage of staff and larger workloads in their facilities.

From the study, 48.8% of the nurses reported that carrying the patient leads them to experience musculoskeletal injuries, while 40.9% reported to experience musculoskeletal injuries from turning the patient. This can be compared to one study done in North America, which reported that of all the occupational strains and sprains suffered by workers at seven hospitals, 17.8% were caused by repositioning patients in bed. The number two causative activity was lifting an object and number three was lifting a patient (5). The difference observed in the percentage of nurses who reported musculoskeletal injuries, from turning the patient can be explained by methodological difference, which arises from study designs used, where in this study it was a descriptive cross-sectional study whereas the other study was a systematic review.

In another study conducted at Bangladesh, multiple logistic regression analyses indicated that insufficient supporting staffs, overtime working hours and manual lifting in a working environment were associated with low back pain (25) . This is comparable to what has been found in this study, where nurses who reported to stand for more than 3 hours during serving patient reported to experience low back pain, with [cOR=2.6(4.5,6.8) P=0.01], this influenced their exposure to non-biological hazards particularly low back pain.

Conclusion

The prevalence of occupational health hazards among nurses in Moshi municipal council is high. This is influenced by many working hours per week, not receiving proper training on occupational health hazard prevention and management and working at higher level health facility. Younger nurses and nurses with few years at work are at higher risk of experiencing needle stick injuries. Carrying the patient and standing for more than 3 hours per day are the major contributors to low back pain. In addition, there is shortage of personal protective equipment, which also influenced exposure to occupational hazards.

Recommendations

Education on occupational health hazards prevention should be given at colleges and at work regularly to all nurses working at all levels of facilities.

The hours of working per week should be regulated to not more than 40 hours per week as recommended by International labour organization (ILO). This should go hand in hand with recruiting sufficient number of nurses to reduce the workload.

There should be improved, constant supply of personal protective equipment especially in the lower levels of health care system.

Authors' contribution

JM, FN and SM contributed to conception and design of the study, acquisition of ethical clearance, data collection and analysis, and writing the final report. ER participated in data analysis and preparing the manuscript for publication. NM was the principal supervisor throughout all steps in preparing this work.

Abbreviations

COVID-19	Corona Virus Disease 2019
ILO	International Labour Organization
KCMC	Kilimanjaro Christian Medical Centre
KCMUCo	Kilimanjaro Christian Medical University College
PPE	Personal Protective Equipment
SPSS	Statistical Package for the Social Sciences
TB	Tuberculosis
US	United States

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