Research Article

Assessment of Biological, Ergonomic and Psychological Workplace Hazards Among Medical and Paramedical Staff of a Tertiary Care Hospital in Lahore, Pakistan: A Cross-Sectional Study

Momina Idrees,[1] Momina Khaliq,[2] Muhammad Bilal Asad Cheema,[3] Muhammad Daniyal Siddique,[4] Muattar Murtaza,[5] Inshrah Khan,[6] Marina Akhtar[7]

[1-8]*Department of Community Medicine, King Edward Medical University, Lahore*

Abstract

Background: Occupational hazards are defined as unfavorable workplace activities that have the potential to injure or sicken the healthcare personnel. In low- and middle-income countries, a significant percentage of healthcare professionals are subjected to biological, psychological, ergonomic, and chemical hazards.

Objectives: To determine the prevalence of various types of biological, ergonomic and psychological workplace hazards faced by medical and paramedical staff of a tertiary care hospital of Lahore.

Methods: This cross-sectional study, conducted at a tertiary care hospital in Lahore, involved 90 healthcare workers including doctors, nurses and lab technicians. Data were collected using a self-administered questionnaire. Chi square tests and Fisher-Freeman Halton Exact tests were applied to analyze the associations between healthcare profession type and exposure to various hazards.

Results: This study reveals that out of the 90 healthcare professionals, 71.1% of the respondents were exposed to blood-borne pathogens, and needle-stick injuries were highly prevalent (72.2%). Moreover, 81.1% of the respondents had experienced Work-related musculoskeletal disorders WRMSDs, with low back pain being the most prevalent (63.3%). Psychological hazards were also very common as 86.7% of the respondents reported that they often felt stressed at work, particularly due to high workload and long working hours.

Conclusion: This study highlights various biological, ergonomic and psychological hazards faced by healthcare workers. A significant association was found between the type of profession and exposure to biological and psychological hazards. This study emphasizes the importance of measures for reducing occupational hazards.

Keywords | Biological, Ergonomic, Psychological, Medical and Paramedical.

Corresponding Author | Marina Akhtar. **Email:** marinaakhtar88@gmail.com

Received: 01-10-2024 | **Accepted:** 13-10-2024

Introduction

Healthcare workers (HCWs) face serious health hazards as a result of their line of work.[1] Occupational hazards are defined as unfavorable workplace activities that have the potential to injure or sicken the healthcare personnel.[2] In low- and middle-income countries, a significant percentage of healthcare professionals are subjected to biological, psychological, ergonomic, and chemical hazards.[3] These factors compromise the workers' psychological as well as physical health.[4] HCWs frequently provide care in challenging situations like natural catastrophes and man-made conflicts, and are at the forefront of developing disease epidemics.[1]

Healthcare professionals are highly susceptible to communicable diseases due to their close contact with the patients harboring pathogenic organisms. Around 3 million health workers globally are exposed to blood-borne viruses annually,

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https://doi.org/10.21649/jspark.v3i4.716

with 2 million exposed to HBV, 0.9 million to HCV, and 170,000 to HIV. Developing countries account for over 90% of these infections.[5] Reports from India revealed that standing for long periods of time (37%) and lifting heavy objects (42%) posed ergonomic risks to healthcare personnel.[6] According to recent studies, the percentage of Italian healthcare workers with high anxiety (18.7%), high depression symptoms (24.73–32.8%), and high perceived stress (8.27% –27.2%) varies.[7] A survey found that 39.2% of respondents were unaware of occupational dangers, while 60.8% knew a lot. 58% had a positive attitude towards safety measures, while 32% had a negative opinion. Factors like education, marital status, and working experience influenced their awareness.[2]

Compared to workers in other industries, health workers face higher hazards. Although the goal of the health service is to prevent, treat, and safeguard against harm, there is a chance that the hazards that could arise throughout this serving procedure could have a negative impact on the workers' health.[8] It has also been demonstrated that medical professionals who practice healthy habits are more likely to encourage good behavior in their patients.[9] There isn't any separate occupational health and safety law in Pakistan's healthcare sector.[4] Excessive workloads and work hours, a lack of personal protective equipment, overly enthusiastic media coverage, and a sense of inadequate support are some of the factors contributing to these unfavorable results for Pakistani healthcare workers.[10]

It is crucial to identify workplace risks and hazards in order to reduce and eliminate them. Such obstacles and difficulties can prevent the healthcare personnel from functioning effectively and efficiently. The existing literature reveals a lack of sufficient studies that explore the occupational hazards faced by healthcare workers in Lahore, indicating a significant research gap. The safety performance of medical and paramedical personnel can be enhanced by having a thorough grasp of occupational hazards and the risk factors associated with them. The aim of conducting this study is to assess the various types of biological, ergonomic and psychological workplace hazards faced by medical and paramedical staff in a tertiary care hospital of Lahore, Pakistan, so that appropriate initiatives can be taken to enhance their health and productivity.

Methods

A cross-sectional study was conducted at Mayo Hospital Lahore, i.e., a tertiary care hospital of Lahore. Sample size of 90 healthcare workers was estimated by using 95% confidence level, 10% absolute precision with expected prevalence of occupational health hazards as 36.5%.[3] This sample size was estimated by using the software "Sample Size Determination in Health Studies". To select the different categories of healthcare professionals, stratified random sampling technique was used (stratified by profession). Both medical staff (i.e., doctors) and paramedical staff members (i.e., nurses and lab technicians) were chosen after taking informed consent for participation in the study. Healthcare professionals, who were employed at the time of data collection and who had a work experience of at least 6 months, were included. Those, who were on leave or absent at the time of data collection, were excluded.

Data were collected using a self-administered questionnaire. The questionnaire was developed using related literature[4-6, 11-15] and simplified in order to meet the objectives of our study. Section one of the questionnaire collected data on demographic characteristics of the respondents, such as age, gender, marital status, work experience, ward/ department of service and job title. Section two of the questionnaire collected data on the occupational health hazards faced by the respondents. This section was divided into sub-sections such as biological hazards, ergonomic hazards and psychological hazards. The data were collected directly from the departments and units where the medical and paramedical staff worked, including emergency, medicine, surgery, pediatrics, in-patient, and out-patient departments, as well as laboratories. The questionnaire was distributed among the participants in person by the researchers and collected after completion.

Data were entered, cleaned and analyzed using Statistical Package for Social Sciences (SPSS) version 29.0.2.0. Descriptive statistics were presented in the form of frequency tables and bar charts. Chi square and Fisher-Freeman Halton Exact tests were applied to analyze the associations between healthcare profession and exposure to various hazards. p-value of less than 0.05 was considered statistically significant.

Results

A total of 90 responses were obtained during the study. Out of the total 90 respondents, 48 had a work experience of <5 years. Eighteen respondents were from Medicine, Surgery and Pediatrics department each, 24 were from Emergency department and 12 were from laboratory. Fifty-four (60.0%) respondents were doctors, 24 (26.7%) were nurses and 12 (13.3%) were lab technicians. When asked about the availability of Personal Protective Equipment (PPE) in different departments, laboratory had the highest percentage followed by Medicine department, with 83.30% and 66.70% of respondents from these departments, respectively, having access to PPE at work. (Table 1)

More than half of the doctors (79.6%), nurses (54.2%), and lab technicians (66.7%) were exposed to blood-borne patho-

Table 1: *Demographic Characteristics of the Study Population (N=90)*

Variables	Frequency (*f*)	Percentage (%)
Age		
18-25 years	24	26.7
26-35 years	58	64.4
36-45 years	5	5.6
>45 years	3	3.3
Gender		
Male	33	36.7
Female	57	63.3
Marital Status		
Unmarried	53	58.9
Married	36	40.0
Widower / Widowed	1	1.1
Work Experience		
<5 years	48	53.3
5-10 years	28	31.1
10-15 years	10	11.1
15-25 years	2	2.2
>25 years	2	2.2
Ward / Department		
Medicine	18	20.0
Surgery	18	20.0
Pediatrics	18	20.0
Emergency	24	26.7
Laboratory	12	13.3
Professional Profile		
Doctor	54	60.0
Nurse	24	26.7
Lab Technician	12	13.3
Respondents having access to PPE at work		
Medicine	12	66.70
Surgery	10	55.60
Pediatrics	10	55.60
Emergency Department	12	50.00
Laboratory	10	83.30

gens. Doctors and lab technicians were more exposed to airborne pathogens, 81.5% and 58.3% respectively, as compared to nurses (33.3%), with a highly significant p-value of <0.001. Additionally, doctors were more prone to needlestick injuries, with a leading percentage of 81.5%, as compared to nurses and lab technicians. (Table 2)

A high proportion of doctors (61.1%) and half of the nurses (50%) handled biological samples and body fluids without using Personal Protective Equipment (PPE). Only 35.2% doctors had received training about biological hazards safety protocols, with a p-value of 0.015, indicating significant association. Note that most of the variables associated with biological hazards have a p-value of <0.05. This indicates that there exists a significant association between exposure to biological hazards and type of healthcare profession. (Table 2)

A high prevalence of stress was reported among healthcare professionals, with 92.6% doctors, 87.5% nurses, and 58.3% lab technicians often feeling overwhelmed at work. Furthermore, 74.1% doctors and 58.3% nurses had experienced workplace violence, as compared to only 16.7% lab technicians, resulting in a highly significant p-value of < 0.001. Additionally, emotional exhaustion after dealing with patient suffering, trauma, and death on a regular basis was very prevalent among doctors (77.8%). Furthermore, irregular sleep patterns, due to unpredictable schedules, were reported by a substantial proportion of doctors (81.5%) and nurses (83.3%), with a highly significant p-value of <0.001. Note that for all of the variables associated with psychological hazards, p-values are <0.05. This indicates that a significant association exists between exposure to psychological hazards and healthcare profession type. (Table 2)

Among the different causes of stress among healthcare workers, high workload was the most common stress-inducing factor, reported by 73.3% of respondents; followed by long working hours (58.9%) and high patient volumes (57.8%). (Figure 1)

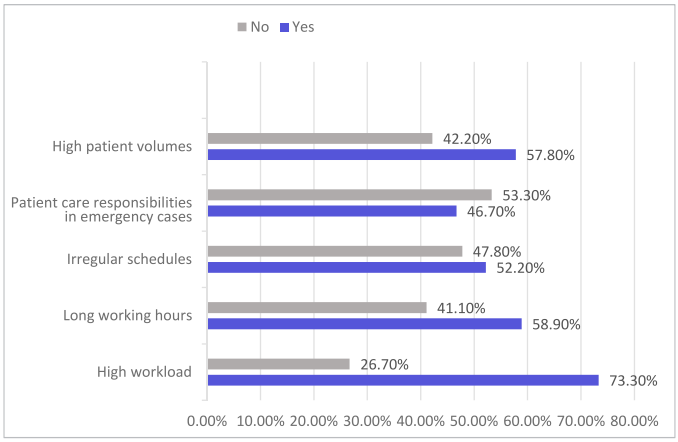

Figure 1: Various Causes of Psychological Hazards among Healthcare Professionals

As far as ergonomic hazards are concerned, 83.3% nurses, 81.5% doctors and 75.0% lab technicians reported working in abnormal body postures. Most of the respondents experienced musculoskeletal disorders (MSDs) due to awkward body postures, with the highest prevalence found among doctors at 79.6%. Additionally, 18.5% doctors and 25.0% nurses had experienced discomfort or injury while transferring patients. However, lab technicians were not exposed to this risk at all. Slips, trips, and falls due to wet or slippery floors and stairs were a notable hazard, with doctors and nurses being significantly more vulnerable, at 42.6% and 41.7%, respectively. Additionally, performing repetitive movements was a significant concern among lab technicians, reported

by 58.3% of them. (Table 3)

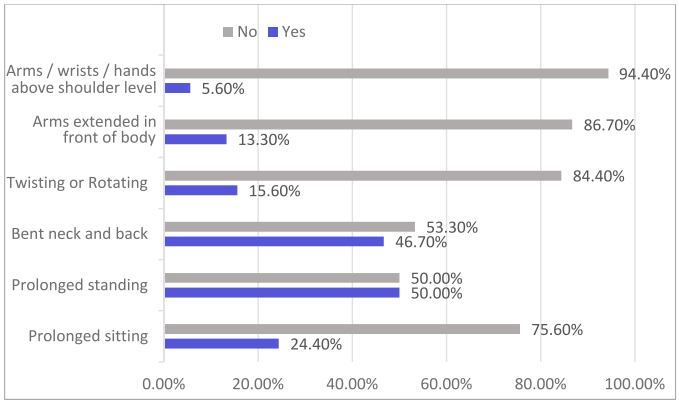

Figure 2: *Various Causes of Ergonomic Hazards Healthcare Professionals*

A large proportion of doctors (77.8%) and nurses (75.0%) and lab technicians (66.7%), experienced headaches or irritability due to overcrowded and noisy premises of the hospital. Due to non-satisfactory temperature and humidity at workplace, 57.8% of the respondents faced difficulty in wearing PPE. Note that all of the variables associated with ergonomic hazards have a p-value of >0.05. (Table 3)

Among the various awkward body postures that the healthcare professionals had to adopt during work, prolonged standing was the most common awkward position, reported by majority of the respondents (50%); followed by bent neck and back (46.7%) and prolonged sitting (24.4%). (Figure 2)

Among all the work related musculoskeletal disorders (WMSDs) experienced by the healthcare workers, low back pain was the most commonly reported (63.3%); followed by neck pain (42.2%), muscle strain (40%) and shoulder pain (35.6%), whereas, elbow pain was the least reported (10%). (Figure 3)

Table 2: *Prevalence of Biological and Psychological Hazards among Healthcare Professionals. (N=90)*

Variables	Healthcare Profession						Total (N=90)		P-value
	Doctor (N=54)		Nurse (N=24)		Lab Technician (N=12)		*f*	(% of N)	
	f	(% of N)	*f*	(% of N)	*f*	(% of N)			
BIOLOGICAL HAZARDS									
Exposed to any kind of pathogen while working at hospital	50	92.6	16	66.7	8	66.7	74	82.2	0.004*
Blood Borne Pathogens (HIV, HBV, HCV, etc.)	43	79.6	13	54.2	8	66.7	64	71.1	0.073
Airborne Pathogens (*Mycobacterium tuberculosis*, Measles, etc.)	44	81.5	8	33.3	7	58.3	59	65.6	<0.001
Fecal-Oral Pathogens (*E.coli*, *Salmonella typh*i, etc.)	29	53.7	8	33.3	8	66.7	45	50.0	0.128
Direct Contact (HSV, Scabies, etc.)	40	74.1	10	41.7	2	16.7	52	57.8	<0.001
Droplets (Influenza virus, Mumps virus, etc.)	40	74.1	11	45.8	6	50.0	57	63.3	0.032
Needle-Stick Injuries	44	81.5	13	54.2	8	66.7	65	72.2	0.045
Handle biological samples / body fluids without PPE	33	61.1	12	50.0	3	25.0	48	53.3	0.071
Received adequate training about biological hazards safety protocols and infection control measures	19	35.2	17	70.8	6	50.0	42	46.7	0.015
PSYCHOLOGICAL HAZARDS									
Often feel overwhelmed or stressed at work	50	92.6	21	87.5	7	58.3	78	86.7	0.010*
Experienced violence at workplace by patients or their attendants	40	74.1	14	58.3	2	16.7	56	62.2	<0.001
Feel emotionally drained and hopeless after dealing with patient suffering, trauma and death on a regular basis (Emotional Exhaustion)	42	77.8	13	54.2	4	33.3	59	65.6	0.005
Becoming emotionally numb or less empathetic towards patients due to continuous exposure to patient suffering on a daily basis (Compassion Fatigue)	41	75.9	9	37.5	5	41.7	55	61.1	0.002
Sleep patterns becoming irregular due to irregular working hours, long shifts and night shifts	44	81.5	20	83.3	3	25.0	67	74.4	<0.001
Experienced bullying or harassment by seniors or supervisors at workplace	30	55.6	12	50.0	2	16.7	44	48.9	0.052

f *= Frequency of data*
(*) *Fisher-Freeman-Halton Exact Test*
(**)*Lab technicians chose "Not Applicable" for this variable.*

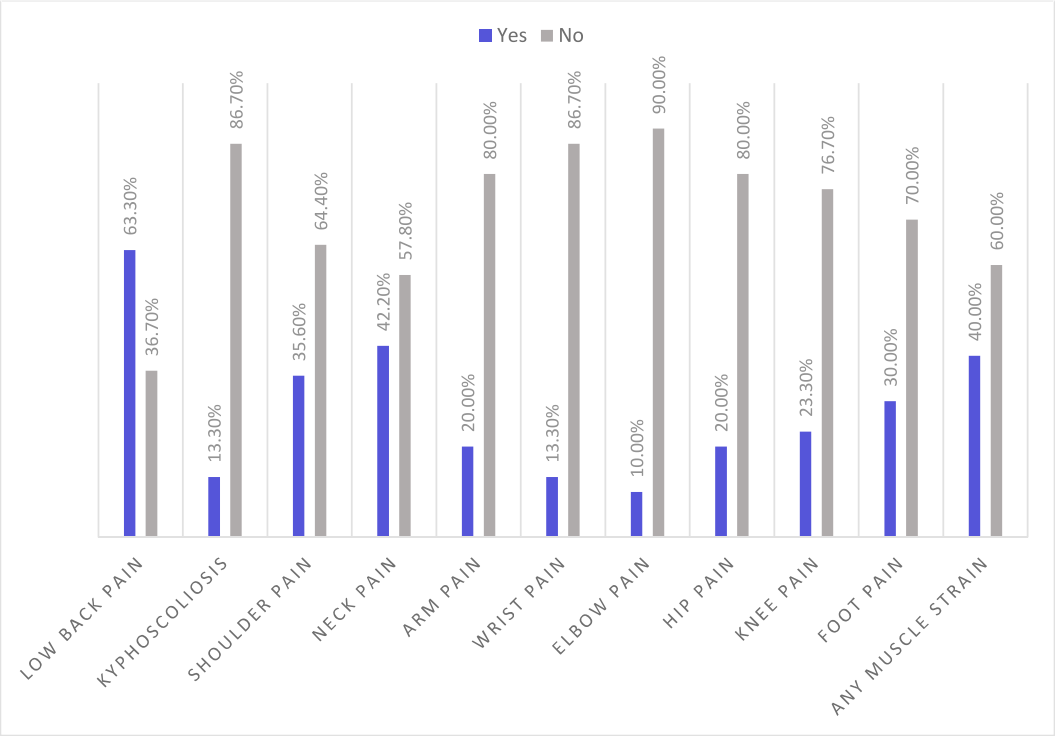

Figure 3: *Prevalence of Work-Related Musculoskeletal Disorders (WRMSDs) among Healthcare Professionals.*

Table 3: *Prevalence of Ergonomic Hazards among Healthcare Professionals. (N=90)*

Variables	Healthcare Profession						Total (N=90)		P-value
	Doctor (N=54)		Nurse (N=24)		Lab Technician (N=12)				
	f	(% of N)	*f*	(% of N)	*f*	(% of N)	*f*	(% of N)	
Work in awkward body postures for most of the time	44	81.5	20	83.3	9	75.0	73	81.1	0.856
Experienced Musculoskeletal Disorders (MSDs) due to awkward body postures while working	43	79.6	18	75.0	8	66.7	69	76.7	0.592
Experienced any discomfort or injury while transferring or lifting patients alone in hospital	10	18.5	6	25.0	**	**	16	20.5	0.552*
Experienced eye fatigue, blurred vision or eye discomfort due to prolonged periods of computer work or due to inadequate lighting at workplace	20	37.0	12	50.0	4	33.3	36	40	0.530
Experienced slips / trips / falls due to wet or slippery floors and stairs	23	42.6	10	41.7	1	8.3	34	37.8	0.089
Prolonged sitting on chair cuts blood supply to legs and makes the legs restless	36	66.7	14	58.3	7	58.3	57	63.3	0.774
Experienced discomfort, pain or fatigue while performing repetitive movements at work (e.g., while using a computer keyboard, handling instruments or equipment, performing surgical procedures, etc.)	28	51.9	13	54.2	7	58.3	48	53.3	0.954
Experienced headaches or irritability due to overcrowded and noisy premises of hospital	42	77.8	18	75.0	8	66.7	68	75.6	0.778
Find difficulty in wearing PPE due to unfavorable temperature and humidity within hospital settings	34	63.0	10	41.7	8	66.7	52	57.8	0.200

f *= Frequency of data*
(*) *Fisher-Freeman-Halton Exact Test*
(**)*Lab technicians chose "Not Applicable" for this variable.*

Discussion

The various workplace hazards faced by medical and paramedical staff of a tertiary care hospital were assessed through a cross-sectional study. The data analysis study highlights significant biological, ergonomic, and psychological risks for healthcare professionals employed in a tertiary care centers. High prevalence of stress was reported, particularly among nurses (87.5%) and doctors (92.6%), with an overwhelming workload being the primary cause. The percentages of emotional exhaustion and compassion fatigue among doctors were much higher (77.8% and 75.9%, respectively). All professions had a high prevalence of musculoskeletal disorders, with doctors having the highest rate (79.6%), which were primarily brought on by bad posture. 77.8% of doctors, 75% of nurses and 66.7% of lab technicians experienced headaches or irritability due to overcrowded and noisy premises of hospital. As far as biological hazards are concerned, a great percentage of doctors (79.6%) and lab technicians (66.7%) were exposed to blood-borne pathogens. In spite of these risks not enough personal protective equipment (PPE) was used, particularly by nurses (50%) and doctors (61.1%). Furthermore, just 35.2% of doctors reported having received sufficient training on biological hazards safety protocols and infection control measures. In order to reduce these risks, the study emphasizes how important it is to have better working environment, more effective stress management techniques, increased safety training and stronger adherence to safety precautions.

This study draws attention to the high stress levels faced by medical professionals, like nurses and doctors, due to irregular schedules and heavy workloads. This highlights how urgent help is needed. Doctors are especially vulnerable to compassion fatigue and emotional exhaustion, which raises the possibility of burnout and its detrimental effects on patient care. Lab technicians face significant biological and ergonomic risks despite having lower levels of psychological stress, which is representative of the diversity of risks found in healthcare settings. Inadequate training of healthcare professionals about biological hazards safety protocols and underuse of personal protective equipment (PPE) by healthcare workers, lead to a high prevalence of blood-borne and air-borne infections as well as needle-stick injuries. This expose grave flaws in workplace safety protocols.

In our study, 72.2 % of the participants reported to be at an increased risk of needle stick injuries which is much higher than the study conducted in Saudi Arabia which reported that at least 22.2% of healthcare workers had at least one needle stick injury incident in the preceding year year.[16] Whereas, in Thailand, a slightly higher prevalence of 27.5% was reported among healthcare professionals working in surgery and anesthesia departments.[6] In contrast, much higher percentage was reported in Ethiopia (60.2%).[17] It is possible that the infection control training programs, sufficient clinical expertise, and workplace safety measures in KSA contribute to the decreased occurrence of NSIs among nurses, dentists, and laboratory technicians.[16]

Our study showed that healthcare workers are at an increased risk of exposure to airborne pathogens like tuberculosis with a high prevalence of 65.6%. This value was much higher as compared to a study conducted in Northern Saudi Arabia according to which the prevalence of infections due to airborne pathogens such as influenza, COVID-19, tuberculosis, etc. was 31.1%.[18]

According to our study, 79.6% of doctors, 75.0% of nurses and 66.7% of lab technicians faced musculoskeletal disorders due to awkward body postures which is line to the study conducted in Iran which states that 76.0% of healthcare workers working in a large-scale public hospital had experienced musculoskeletal disorders in the preceding week.[19] In another study conducted in China, the 12-month prevalence rate of MSDs in any body location that lasted for at least 24 hours was 91.2% which is much higher.[20] However, according to a study conducted in India, 50.7% of the participants reported symptoms of MSDs in at least one area of body, during the previous 12 months.[14]

According to our study, low back pain was the most commonly reported MSD (63.3%); followed by neck pain (42.2%), muscle strain (40%) and shoulder pain (35.6%). Likewise, according to a study conducted in the eastern province of Saudi Arabia, the most common MSD among critical care nurses was lower back pain (92%), followed by upper back pain (56%), shoulder pain (36%) and neck pain (31%).[21] Similarly, according to a study conducted in Chennai, low back pain was the most commonly reported MSD among the participants (45.7%), followed by neck pain (28.5%) and shoulder pain (23.5%).[14]

According to our study, 65.6% of healthcare workers experienced emotional exhaustion due to working long and irregular working hours which also affected their sleep patterns. According to another study, a high prevalence of emotional exhaustion was expressed in 57.1 % of emergency medical staff aged 30–40 years and in 42.0 % of those over 40 years.[22]

According to our research, 62.2% of healthcare workers have experienced some form of violence by the patients or their attendants. This is in accordance with another research which shows that 64% of Emergency Medical Services (EMS) clinicians faced occupational violence in the past 12 months in the form of cursing, punching, spitting, biting, being struck with an object, stabbing and shooting-related violence.[23]

The strength of this study lies in its comprehensive approach to addressing the wide range of occupational hazards that healthcare workers face. To guarantee a representative sample, its process includes stratified random sampling. Comparison of hazard prevalence across different professions and in-depth statistical analysis is beneficial in highlighting areas for targeted interventions.

The study has several significant limitations. The use of small sample size, i.e., 90 healthcare workers can limit the generalizability of results. Because of the use of cross-sectional design, it is not possible to analyze trends over time. Moreover, the use of self-reported data can introduce recall bias, as the participants may provide inaccurate responses based on their ability to remember past events. The study also underrepresents other categories, such as lab workers, and its focus on a single tertiary care hospital in Lahore may limit the generalizability of the findings. Furthermore, the relationships that have been found may be affected by unmeasured confounding variables.

Future research should focus on other categories of healthcare professionals and must include a large sample size, so that the results can be generalized to a larger population. Moreover, other types of occupational hazards, e.g., chemical hazards should also be investigated in future research.

To mitigate the various biological, ergonomic and psychological workplace hazards faced by healthcare professionals, this study recommends prioritizing occupational health and safety of healthcare workers within hospital settings by devising specific policies. Sufficient PPE should be provided to the hospital staff to reduce the prevalence various biological hazards. Special counseling sessions can help the healthcare workers to cope with stress and burnout. More staff should be recruited to reduce the workload on HCWs. To reduce the prevalence of MSDs, the hospital administration should ensure better hospital design by making ergonomic adjustments.

Conclusion

The study highlights various workplace hazards faced by healthcare professionals, including exposure to blood-borne pathogens, needle-stick injuries, MSDs, headaches and irritability due to overcrowded and noisy premises of hospital, stress and irregular sleep patterns due to unpredictable schedules being the most common hazards. It also found a significant association between the type of profession and exposure to biological and psychological hazards, whereas ergonomic hazards affected all healthcare professions almost equally. This study emphasizes the importance of measures for reducing occupational hazards.

Conflict of Interest: Authors do not have conflict of interest.

Source of Funding: No funding was obtained for this study.

Ethical approval: Obtained from IRB of King Edward Medical University.

Authors Contribution:

MA, MI, MK: Involved in conceptualization of study

MBAC, MDS: Involved in data collection

MM, IK: Involved in manuscript writing

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