

PREVALENCE OF OCCUPATIONAL HAZARDS AMONG OPERATING ROOM PERSONNEL WORKING IN TERTIARY CARE HOSPITALS OF PESHAWAR

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Abstract

Background: Regularly Operating Room (OR) personnel are exposed to a wide range of occupational hazards, still data describing these hazards in Peshawar, remain very limited. This descriptive cross-sectional study was carried out to address that gap.

Objective: This study aimed to find the prevalence, types, factors related to occupational hazards, and related symptoms and conditions, among OR staff employed in tertiary care hospitals of Peshawar (HMC, LRH).

Methods: 235 OR personnel were selected from Lady Reading Hospital and Hayatabad Medical Complex, Peshawar by using simple random sampling technique. Structured, validated questionnaire were used for data collection that was adapted from a previous study in Finland and for analysis SPSS version 22.0 were used by running descriptive statistics, the Mann-Whitney U test, the Kruskal-Wallis test, and the Chi-square test.

Results: Musculoskeletal disorders (MSDs) were the most prevalent health symptoms, with lower back pain affecting 54.5% of participants. Among the Psychological symptoms, highly prevalent were mood swings (65.5%), and almost half of members reported exposure to Hepatitis B (49.8%) and Hepatitis C virus (48.5%). Headache by (69.4%) was the commonest symptom due to chemical exposure. We also analyzed that female staff reported significantly higher exposure to biological, ergonomic, and psychosocial hazards than males ($p < 0.05$), and there was a significant difference to hazard exposure by profession. Awareness of these occupational OR hazards was high (84.3%), but only 52.3% of participants have received formal hazard-related training.

Conclusion: Work related hazards among OR personnel in Peshawar's tertiary care hospitals are highly prevalent and unequally distributed by gender and designation. Formal structured training sessions, biosafety protocols, ergonomic interventions, counseling and psychological support are needed to protect the staff and eventually improve the quality of care they provide.

INTRODUCTION

Occupational hazards are unavoidable, unforeseen work-related events that could result in injury or disease of healthcare professionals. Operating room (OR) personnel also faces these risks because of their close and continuous contact with different patients and the risk of exposure to biological, chemical, ergonomical, psychological and physical factors that can affect well-being of workers and results in health consequences. The National Institute of Occupational Safety and Health describes these hazards as physical, chemical, biological, and psychological factors arising from a mismatch between job demands and worker capacity, making OR staff, a high-risk occupational group (Lebni et al., 2021).

As OR is one of the risky environment of healthcare services, its worker faces different hazards that can affect their working abilities (Bilecen & Bayram, 2024). Routinely, OR staff are exposed: to biological risks such as bloodborne infections and needle-stick injuries, to chemical hazards from different chemicals such as disinfectants, medications and anesthetic gases also to physical hazards such as noise, temperature, and radiations and to ergonomic hazards such as from prolonged standing and awkward posture (Van Den Berg-Dijkmeijer et al., 2011). When these exposures combine with noise, violence and the psychological factors such as patient suffering, these can cause psychological distress and chronic diseases (Dore et al., 2022). Surgical smoke generated by powered instruments such as electrosurgical unit, laser, and ultrasonic devices is biohazard as per Occupational Safety and Health Administration (OSHA) guidelines. These smokes contain more than 80 potentially hazardous and carcinogenic chemicals along with blood and tissue particles (Heroor et al., 2022).

These hazards are more common in developing countries. A systematic review across African countries reported the lifetime prevalence of needle-stick injuries ranging from 22% to 95%, often related to inadequate training and protective equipment (Mossburg et al., 2019). In Ethiopia, more than 64% of OT staff reported musculoskeletal disorders within a single year (Yizengaw et al., 2021). In Pakistan, a study at Mardan Medical Complex revealed that 89.1% of OR staff suffered from work related musculoskeletal pain, with (87.3%) lower back pain (Amin et al., 2023). Globally the prevalence of MSDs among OR staff is noticeably high, a meta-analysis of twelve studies found that lower back pain affects approximately 61.5% of OR workers alongside shoulder pain (55.6%), neck pain (53.7%), and ankle/foot pain (57.1%), confirming musculoskeletal disorders as the leading occupational complaint in this population (Tavakkol et al., 2020).

Every day OR staff is Exposed to contaminated instruments, blood and body fluids such as urine, feces, vomiting and secretions, which make a wide spectrum biological hazards (Carneiro et al., 2019). These hazards are exposing staff to pathogens such as HBV, HCV, HIV, MRSA, and tuberculosis (Lebni et al., 2021). Needle-stick injury prevalence reported internationally ranges from 22% to 95%, with surgeons, OR nurses, and technicians bearing the greatest burden; many such injuries go unreported due to limited awareness of reporting protocols (Lakbala et al., 2014).

Chemical hazards in the OR include exposure to anesthetic gases (nitrous oxide, isoflurane, sevoflurane), formaldehyde, disinfectants, medicines, fumes and vapors. Inhaling the vapors of formaldehyde is carcinogenic (Amin et al.,

2023; Lebni et al., 2021). Although 47% of OR staff received training in chemical risks still exposure related symptoms include irritation (50%), dizziness (40%), headache (30%), remains prevalent (Carneiro et al., 2019; Van Den Berg-Dijkmeijer et al., 2011). Skin problems arising from frequent disinfectant use are most frequent among surgeons, OT technicians and scrubbing nurses (Saleh, 2020).

In ergonomic hazards, MSD is highly prevalent internationally among perioperative staff. It is the leading cause of absenteeism and is common of the main occupational health challenges in today's world and exist in numerous occupation (Dore et al., 2022; Martí-Ejarque et al., 2021). MSDs occur from different factors such as standing for long periods, awkward posture, moving heavy objects, bending neck to focus on the surgical field, lifting heavy patients and many others are causes of ergonomic disorders such as muscle pain, shoulder pain, lower back pain, cervical spondylitis, carpal tunnel syndrome and disc herniation (Seyman & Ayaz, 2016; Zhai et al., 2025). A study from Netherland highlights that 58% of OR personnel have MSDs in which lower back pain is the commonest complaint and these workers report a higher number of MSDs as compared to other department workers (Meijssen & J Knibbe, 2007). A survey of surgeons and trainees in the United States reveals that training on needlestick injuries and bloodborne pathogens is (96.2%), but the formal training on prolonged standing is received only by (7.1%) of participants (Landford et al., 2021). OR personnel in Labia recorded 87% prevalence of lower back pain in which 78% have limitations in performing their duties and 22% were considering resignation due to occupational disorders (Mukhtad et al., 2018). Same study from Saudi Arabia revealed 78% staff experiencing lower back pain (Homaid et al., 2016). A previous Peshawar-based study found that 60.7% of OT staff stand for more than 75% of their shift, with fatigue (48.2%) and back pain (43.8%) as the leading complaints and also reported that institutional support was negligible (Salman1 et al., 2025).

Physical hazards in OR include noise, inadequate lighting, temperature, and ionizing radiation, all of which may have a major impacts on OR personnel working abilities and health conditions (Amin et al., 2023). Exposure to radiation is another risk in OT physical environment and can cause chronic health disabilities. The highest radiation risk is recorded in Orthopedic OT due to rigorous use of fluoroscopy (Saleh, 2020). Pregnant women exposure to radiation in OT is a physical risk, (50-100mGy) at 0-2 weeks pregnancy is an estimated threshold radiation dose for fetal death and a dose of (200-250mGy) at 2-8 weeks can cause congenital abnormalities and growth restriction. International Commission on Radiology Protection recommended that occupational radiation should not exceed (1mSv) for the reminding pregnancy (Anderson & Goldman, 2020). Thermal environment in OT is another physical risk factor. Surgeons perform good at nearly 19°C with 50% relative humidity, while anesthesiologists prefer 21.5°C and Patients require a warmer environment to prevent hypothermia (Katz, 2017). Air in the OR must be aseptic and at constant humidity and temperature. The OR internal air must be maintained within the recommended range to ensure a safer environment, usually desirable OR temperature is (20-24°C) as per standards. Humidity in OR should also be maintained at acceptable levels; high humidity level favors the growth and transfer of microorganisms. Installation of Heating, Ventilation and Air Conditions (HVAC) can control air quality and maintain aseptic condition by securing healthy, safer and suitable environment (Balaras et al., 2007).

Psychological hazards include burnout, traumatic stress from witnessing severe injury and death, and chronic work pressure. Members of surgical team face stressful environment and intense work pressure which can negatively affect both physical and mental health outcomes. Appropriate scheduling of shifts, providing comfortable workplaces and equipment, health support and resources such regular counseling services and health checkups should be provided (Yao &

Zhang, 2024). Work related burnout is a serious health issue that leads to depression, increased risk of suicide and compromised patient care. The operating room is a unique environment and creates more stress (Teymoori et al., 2022).

1.2 Research Gap and Significance

Although significant international literature on occupational hazards exists but the existing literature is concentrated in high- and middle-income countries. Pakistan remains particularly unexplored. In Peshawar tertiary care hospitals only one study is conducted which largely focused on ergonomic hazards and did not access other occupational hazards. Since no comprehensive research on multiple occupational hazards has been conducted in the region leaving a geographical gap.

Methodologically, existing studies address a single hazard category, but the reality is that OT personnel are at the same time exposed to multiple hazards within OR. This isolated approach underrates the true cumulative burden on OT staff. Related to this is a population gap: most studies focus on a single professional group, typically nurses or surgeons, rather than the full OR personnel. The present study addresses these limitations by examining all five hazard categories across all professions; surgeons, anesthetists, OR nurses, and technicians using a comprehensive validated questionnaire adapted from previous study (Gao et al., 2011).

This study is significant on multiple levels, that mutually strengthens the benefits of one another. At primary level finding of this research will promptly advantage OR staff by giving them a transparent image of hazards related to their daily life and will empower them for improved safety in working environment. A solid data on occupational hazards will strengthen their position demand for training and prevention and also benefit the hospitals administration about which hazard or group need immediate attention and will be able to make informed decisions and organizing training workshops.

1.3 Objectives

1. To recognize all occupational hazards among OR personnel working in tertiary care hospitals of Peshawar.
2. To find the prevalence of occupational hazards (biological, chemical, physical, psychological and ergonomics) among operating room personnel working in tertiary care hospitals in Peshawar.
3. To examine differences in perceived occupational hazards by gender and professional designation.

METHODOLOGY

2.1 Study Design and Setting

Descriptive cross-sectional design was used to measure the prevalence of occupational hazards among OR personnel. The study was conducted at two public-sector tertiary care hospitals in Peshawar i.e. Lady Reading Hospital (LRH) and Hayatabad Medical Complex (HMC), both of which routinely perform major elective and emergency surgeries in fully functional operating theatres.

2.2 Study Population and Sampling

The target population consisted of all OR personnel – surgeons, residents, anesthetists, OR nurses, anesthesia technicians/technologists and surgical technicians/technologists with at least six months continuous OR experience and those provided voluntary written informed consent. Internees, students, staff with less than six months' experience, those absent during data collection, and individuals with pre-existing non-occupational illness that could confound hazard assessment were excluded.

By utilizing standard cross-sectional prevalence formula ($Z=1.96$, $p=0.50$, $d=0.05$), an initial sample of 384 was calculated and adjusted for a finite OR population of approximately 600 personnel, calculating a final sample size of 235, and was further confirmed using OpenEpi sample size calculator [https://www.openepi.com/Menu/OE_Menu.htm\(version 3.0\)](https://www.openepi.com/Menu/OE_Menu.htm(version%203.0)) Which is open access epidemiological software, applying the same

statistical parameters. Simple random sampling was applied, and personnel lists were obtained from the OT managers of each hospital, and participants were selected randomly to ensure equal selection probability and minimize selection bias.

2.3 Data Collection

Data were collected using a structured, validated questionnaire in which Section A captured socio-demographic information (age, gender, designation, experience, daily surgical workload); Section B measured exposure frequency across 20 hazard containing five categories (physical, chemical, biological, ergonomic, psychological) using a five-point Likert scale (never, occasionally, sometimes, often, very often); and a final section captured the prevalence of specific work-related symptoms and conditions. English was the initial language, with verbal clarification offered in Urdu or Pashto as needed. Formal institutional permission was obtained from each hospital institutional review boards.

2.4 Data Analysis

All the collected data were coded and analyzed using the Statistical Package for the Social Sciences (SPSS), version 22.0. Descriptive statistical analysis was performed, including calculation of frequencies, percentages, means, and standard deviations. Demographic information and the prevalence of each occupational hazard were summarized using frequency tables. Because the Likert-scale data were ordinal and violated assumptions of normality, the Mann-Whitney U

test was used to compare hazard exposure by gender, and the Kruskal-Wallis test was used to compare exposure across seven professional designations.

2.5 Ethical Considerations

Ethical approval for this research study was issued by the Khyber Medical University (KMU) Ethical Review Committee before the starting data collection. Written institutional permissions were separately obtained from the research cell and Institutional Review Board (IRB) of each participating hospital. All members were informed of volunteer participation and having right to withdraw from the study at any stage without facing any professional or personal consequences. Written informed consent was obtained from each member. Not any personal identifiers (name or any other) were recorded on any questionnaire, and all data was treated as strictly confidential.

RESULTS

3.1 Demographic Characteristics

Among 235 OR personnel, 59.1% (n=139) were male and 40.9% (n=96) female, with a mean age of 33.84 years (SD=9.58; range 19–64). Surgical technicians/technologists formed the largest professional group (24.7%), followed by OT nurses (21.7%), TMOs (19.6%), anesthesia technicians (16.6%), surgeons (8.1%), anesthesiologists (6.8%), and others (2.6%). Most participants had 1–2 years of OT experience (30.6%), and 56.6% performed five or more surgeries daily (Table 1).

Table 1. Demographic Characteristics of Operating Room Personnel (N=235)

Variable	Category	Frequency (n)	Percentage (%)
Gender	Male	139	59.1
	Female	96	40.9
	Total	235	100.0
Professional Designation	Surgeon	19	8.1
	TMO	46	19.6
	Anesthesiologist	16	6.8
	Anesthesia Technician	39	16.6
	Surgical Technician	58	24.7
	OT Nurse	51	21.7
	Other	6	2.6
	Total	235	100.0
Years of Experience in OT	1–2 years	72	30.6
	2–5 years	46	19.6
	6–10 years	49	20.9
	11–15 years	28	11.9
	More than 15 years	40	17.0
	Total	235	100.0
Surgeries Per Day	1–2	23	9.8
	3–4	79	33.6
	5 or more	133	56.6
	Total	235	100.0

3.2 Training and Awareness Regarding OR Hazards

Only 52.3% (n=123) of participants had received formal hazard-related training, yet 84.3% (n=198) reported personal familiarity with OR hazards,

93.6% (n=220) agreed the OR contains multiple hazard factors, and 90.2% (n=212) believed OR personnel are more vulnerable than staff in other hospital departments (Table 2).

Table 2. Training and Awareness Regarding Occupational Hazards Among OR Personnel (N=235)

Variable	Response	n	%
Received Hazards Training	Yes	123	52.3

Variable	Response	n	%
	No	112	47.7
Familiar with OR Hazards	Yes	198	84.3
	No	37	15.7
OR Has Multiple Hazard Factors	Yes	220	93.6
	No	15	6.4
OR Personnel More Vulnerable	Yes	212	90.2
	No	23	9.8

3.3 Frequency of Exposure to Occupational Hazard Factors

Across 20 hazard items rated on a five-point frequency scale, fatigue/musculoskeletal pain was the most frequently reported hazard (40.4% rated 'often' or 'very often'), followed closely by acute

muscle pain from patient handling (40.0%) and psychological stress (34.9%). Exposure to blood and body fluids was reported by 20.8% at high frequency, while the risk of spontaneous miscarriage was reported as 'never' by majority (71.5%) (Table 3).

Table 3. Frequency of Exposure to Occupational Hazard Factors Among OR Personnel (N=235)

Occupational Hazard Factor	Never %	Occasionally %	Sometimes %	Often %	Very Often %
Overall adverse effect of hazards	17.9	23.8	44.7	9.4	4.3
Falling objects / slips	19.1	35.3	37.9	3.8	3.8
Harm by sharp object / needle prick	12.3	31.5	41.3	10.2	4.7
Burn from hot sterilizing equipment	48.5	17.9	21.7	8.5	3.4
Electrical shock from faulty equipment	56.6	17.9	16.6	6.8	2.1
Acute muscle pain (patient handling)	12.8	20.9	26.4	31.5	8.5
Exposure to radiation	29.8	20.9	26.4	15.7	7.2
Exposure to anesthetic drugs / gases	30.6	30.6	23.4	10.6	4.7
Skin problems from chemicals	28.5	25.5	28.5	14.9	2.6
Eye / nose / throat irritation	20.0	23.8	41.3	12.3	2.6

Chronic poisoning from chemicals	43.8	30.6	15.7	9.4	0.4
Latex allergy	37.0	23.0	28.1	8.1	3.8
Exposure to blood and body fluids	27.7	17.9	33.6	15.7	5.1
Nosocomial diseases from needle pricks	40.0	26.4	18.3	9.8	5.5
Risk of spontaneous miscarriages	71.5	11.1	11.5	3.8	2.1
Fatigue / musculoskeletal pain	11.9	15.3	32.3	26.8	13.6
Psychological stress	14.5	22.6	28.1	24.3	10.6
Stress / burnout due to overtime	26.4	22.6	27.2	15.3	8.5
Interpersonal relation problems	49.8	18.7	19.6	8.9	3.0
Exposure to post-traumatic syndrome	23.0	24.7	36.2	13.6	2.6

Note: Frequencies are expressed as valid percentages. Scale: 1=Never, 2=Occasionally, 3=Sometimes, 4=Often, 5=Very Often.

3.4 Prevalence of Work-Related Health

Symptoms and Conditions

Headache was the most common chemical exposure related symptom (69.4%), followed by sleepiness (43.4%), dizziness (33.6%), and nausea (31.5%). Musculoskeletal disorders were reported as lower back pain (54.5%), general muscle pain (46.8%), and shoulder pain (37.0%).

Dermatological complaints included dry skin (29.8%) and allergy/irritation (22.6% each). Nearly half of participants reported exposure to Hepatitis B (49.8%) and Hepatitis C (48.5%), with MRSA (30.6%) and HIV (26.8%) also notable. Psychological symptoms were the highest overall, led by mood swings (65.5%) and restlessness (57.9%) (Table 4).

Table 4. Prevalence of Work-Related Health Symptoms and Conditions Among OR Personnel (N=235)

Hazard Category	Symptom / Condition	n	%
Anesthetic Gas Exposure Symptoms	Headache	163	69.4
	Sleepiness	102	43.4
	Dizziness	79	33.6
	Nausea	74	31.5
	Breathing Difficulty	26	11.1
Musculoskeletal Disorders	Lower Back Pain	128	54.5
	Muscle Pain (any location)	110	46.8

Hazard Category	Symptom / Condition	n	%
	Shoulder Pain	87	37.0
	Lumbar Strain	46	19.6
	Lumbar Disc Protrusion	20	8.5
	Cervical Spondylosis	20	8.5
	Carpal Tunnel Syndrome	16	6.8
Dermatological Problems	Dry Skin	70	29.8
	Any Allergy	53	22.6
	Irritation	53	22.6
	Skin Rashes	37	15.7
Mucosal Irritation	Throat Mucus Irritation	52	22.1
	Nasal Mucus Irritation	51	21.7
	Eye Mucus Irritation	48	20.4
Other Physical Disorders	Eyesight Reduction	53	22.6
	Varicose Vein	20	8.5
	Hemorrhoid	12	5.1
General Health Symptoms	Fatigue	115	48.9
	Frequent Flu	46	19.6
	Gastric Disease	43	18.3
	Endocrine Disturbance	23	9.8
	Constipation	20	8.5
Biological / Infectious Exposure	Hepatitis B Virus	117	49.8
	Hepatitis C Virus	114	48.5
	MRSA	72	30.6
	HIV	63	26.8
	Tuberculosis	50	21.3
	Herpes Virus	45	19.1
Psychological Symptoms	Mood Swings	154	65.5
	Restlessness	136	57.9
	Drowsiness	83	35.3
	Depression	77	32.8
	Insomnia	55	23.4
	Anorexia	23	9.8

Hazard Category	Symptom / Condition	n	%
	Overeating	22	9.4

3.5 Gender Differences in Occupational Hazard Exposure

To check whether statistically significant differences existed between male and female personnel in regarding specific occupational hazards, the Mann-Whitney U test was applied, as the data were ordinal (5-point Likert scale) and neglected the assumption of normality. The analysis finds statistically significant gender differences for seven out of twenty hazard factors at the $p < 0.05$ level. Female personnel reported

significantly higher exposure than males for blood and body fluids ($p = .001$), acute muscle pain during patient handling ($p = .035$), eye/nose/throat irritation ($p = .042$), fatigue and musculoskeletal pain ($p = .014$), stress/burnout due to overtime ($p = .030$), and risk of spontaneous miscarriage ($p = .042$). Males reported significantly higher exposure to burns from hot sterilizing equipment ($p = .009$). No significant gender differences were found for the remaining thirteen factors (Table 5).

Table 5. Mann-Whitney U Test: Statistically Significant Gender Differences in Occupational Hazard Exposure (N=235)

Hazard Factor	Male MR	Female MR	Mann-Whitney U	p-value
Burn from hot sterilizing equipment	126.96	105.03	5427.000	.009*
Acute muscle pain (patient handling)	110.46	128.92	5623.500	.035*
Eye / nose / throat irritation	110.86	128.34	5679.000	.042*
Exposure to blood and body fluids	105.83	135.63	4980.000	.001*
Risk of spontaneous miscarriages	112.04	126.63	5843.500	.042*
Fatigue / musculoskeletal pain	109.19	130.76	5447.500	.014*
Stress / burnout due to overtime	110.22	129.27	5590.000	.030*

Note: MR = Mean Rank. * $p < 0.05$. Only statistically significant factors shown; 13 of 20 factors were not significant. Male $n = 139$, Female $n = 96$.

3.6 Designation-Based Differences in Occupational Hazard Exposure

The Kruskal-Wallis test found significant differences across the seven professional designations for eight hazard factors. Electrical shock risk was highest among surgeons ($p = .009$); radiation exposure was highest among surgical technicians and OT nurses ($p = .009$); and exposure

to anesthetic drugs/gases was, as expected, highest among anesthesiologists ($p = .029$). Significant designation-based variation was also found for burns ($p = .013$), nosocomial needle-prick disease risk ($p = .012$), miscarriage risk ($p = .035$), fatigue/musculoskeletal pain ($p = .025$), and overtime-related burnout ($p = .023$) (Table 6).

Table 6. Kruskal-Wallis Test: Statistically Significant Designation-Based Differences in Occupational Hazard Exposure (N=235)

Hazard Factor	Chi-Square (H)	df	p-value
Burn from hot sterilizing equipment	16.094	6	.013*
Electrical shock from faulty equipment	17.196	6	.009*
Exposure to radiation	17.084	6	.009*
Exposure to anesthetic drugs / gases	14.050	6	.029*
Nosocomial diseases from needle pricks	16.299	6	.012*
Risk of spontaneous miscarriages	13.569	6	.035*
Fatigue / musculoskeletal pain	14.407	6	.025*
Stress / burnout due to overtime	14.680	6	.023*

Note: df=6 for all tests. *p<0.05. Only statistically significant factors shown; 12 of 20 factors were not significant.

3.7 Gender Differences in Hazard Training and Awareness

A Chi-square test found no statistically significant gender association with receipt of hazard training (males 47.5% vs. females 59.4%; $\chi^2=3.220$, $p=.073$) or with hazard familiarity (males 81.3% vs. females 88.5%; $\chi^2=2.248$, $p=.134$), indicating that although female participants showed a slightly higher tendency toward both outcomes, gender did not significantly predict training receipt or awareness in this sample.

DISCUSSION

This research was conducted to find the prevalence, types, and factors associated with occupational hazards among operating room (OR) personnel working in tertiary care hospitals of Peshawar. The findings indicate that OR personnel are facing a widespread, multidimensional occupational burden that has been largely undocumented until now. 59.1% of sample size was consisted of male which represent the general pattern of gender distribution as seen in Pakistan. The average age of respondents was 33.84 years (SD=9.58), indicating that the majority of OR staff were young, this matters because younger workers may sometimes underestimate long-term risks.

One of the most interesting findings from training and awareness section was that although only 52.3% of members had received training on occupational hazards, yet a large number 84.3% recorded that they were personally familiar with OR hazards. This difference is not surprising, but it indicates that workers gain this knowledge through observation, experience, and communication with colleagues. While this kind of informal knowledge is better than no awareness at all, it is not a substitute for proper training. Same pattern, also documented in Iran and Egypt, suggests that awareness is being acquired informally through experience and peer communication rather than training (Lakbala et al., 2014; Saleh, 2020). Tertiary care hospitals in Peshawar need formal, organized, and regularly updated occupational health training programs that cover all five hazard categories and reach all professional groups equally.

MSDs reported as the leading occupational illness, with lower back pain affecting 54.5% of personnel somewhat below the 61.5% reported in international meta-analyses (Tavakkol et al., 2020), possibly due to participants younger age profile, but still a substantial local burden. Female participants reported significantly higher fatigue/musculoskeletal pain ($p=.014$) and acute muscle pain during patient handling ($p=.035$).

than males, pointing to a need for gender-sensitive ergonomic interventions such as adjustable equipment, supportive footwear, and scheduled breaks.

Psychological symptoms were unexpectedly the most prevalent finding overall: mood swings (65.5%) exceeded even lower back pain in frequency, and restlessness (57.9%) and depression (32.8%) were similarly widespread. This represents a largely neglected nature of occupational health. Stress and burnout due to overtime varied significantly by designation ($p=.023$), suggesting that psychological support strategies should be tailored by professional role rather than applied uniformly.

Exposure to biological hazards was high, with almost half of participants reporting exposure to Hepatitis B and C, while these are self-reported exposures rather than confirmed seroconversions. Comparable studies from Iran have documented needle-stick injury prevalence as high as 89.3%, often under-reported to occupational health units (Lakbala et al., 2014). A pattern this study's findings suggest may also apply in Peshawar, highlighting the need for accessible, confidential injury-reporting pathways and routine post-exposure follow-up.

Among Chemical hazard related symptoms, led by headache (69.4%), align with known effects of anesthetic gases, disinfectants, and surgical smoke (Heror et al., 2022). Anesthesiologists recorded significantly higher exposure to anesthetic drugs and gases than other designations ($p=.029$), confirming the role-specific nature of this risk and the need for dedicated scavenging systems and chemical-safety protocols for anesthesia personnel specifically. Similarly, radiation exposure varied significantly by designation ($p=.009$), with surgical technicians and OT nurses who spend extended time in the operative field recording the highest exposure, reinforcing the need for personal dosimetry and protective equipment for these groups (Anderson & Goldman, 2020).

Taken together, the gender- and designation-based analyses indicate that occupational hazard burden in this setting is not evenly distributed: it

concentrates differently depending on who is doing the work and in what role. This has direct implications for how hospital administrations in Peshawar should design protective policy.

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