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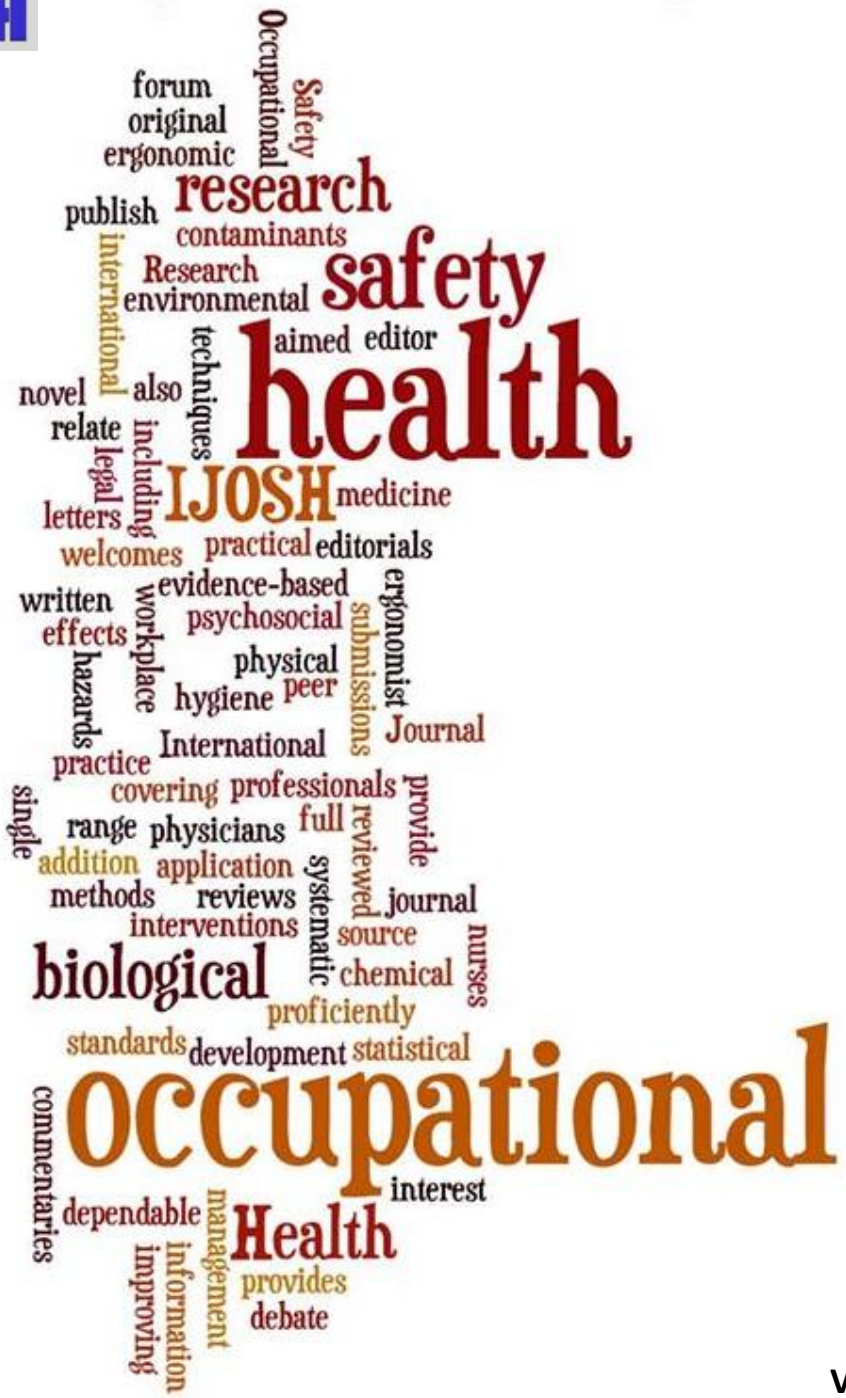

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Original Articles

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Short Communication

Lassa Fever Infection among Healthcare Workers during the 2018 Outbreak in Nigeria

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ABSTRACT

Introduction: Healthcare workers (HCWs) are potentially exposed to infection during viral hemorrhagic fever outbreaks. In the wake of 2018, Nigeria experienced an unprecedented surge in cases of Lassa fever (LF), which affected HCWs. To guide infection prevention and control (IPC) strategies in similar settings, we characterize HCWs' infection and describe the gaps in IPC standards and practices during the outbreak.

Methods: Data was collected using a structured questionnaire, interview, and review of case notes of 21 HCWs with laboratory-confirmed Lassa fever who were treated at the Irrua Specialist Teaching Hospital (ISTH) Irrua and the Alex-Ekwemen Federal Teaching Hospital, Abakaliki (AEFETHA), between 1st January and 27th May 2018. Information collected was the patients' socio-demographic characteristics, date of potential exposure and onset of illness, nature and type of exposure, clinical features, outcome, use of personal protective equipment (PPE), and personnel IPC training. The obtained data were analyzed using descriptive statistics with Microsoft Excel.

Results: The study included 21 HCWs, and 12 (57.14%) were doctors. The case fatality rate was 23%. Nearly two-thirds (62%) of the HCWs could describe a likely procedure leading to their exposure and infection. Among 13 HCWs, 85% had multiple blood and body fluids exposure, while 15% had needle stick injury or scalpel cut. About one-fifth of the participants had received some IPC training.

Conclusion: Limited IPC adherence and inappropriate risk assessment were identified as factors leading to Lassa fever exposure and infection among HCWs. There is an urgent need to provide IPC training for all HCWs and to ensure an adequate supply of IPC materials to all healthcare facilities as part of emergency preparedness, especially in LF endemic areas.

Keywords: Healthcare workers, Lassa fever infection, Nigeria, Preventable calamity, 2018 outbreak

Introduction

Lassa fever (LF), an acute viral hemorrhagic disease caused by the Lassa virus, remains a public health challenge in West Africa, with an estimated 100,000–3,000,000 new infections and approximately 5000 deaths per year.[1] Since 1969, when the disease was first reported in the Lassa community in North Eastern Nigeria, among two missionary nurses who became ill and died, several outbreaks and sporadic cases have been reported with the increasing incidence among healthcare workers.[1–4]

The reservoir for the Lassa virus is the multimammate rat of the genus *Mastomys natalensis. This peri-domestic r*at is ubiquitous in many households in the endemic area of sub-Sahara Africa.[5] Two modes of transmission have been recognized, namely primary and secondary transmission. Primary transmission is via consuming contaminated food, inhaling aerosolized droplets from the rat, direct contact with rat excreta with broken skin or mucous membrane, and hunting and consuming rats as food in endemic areas.[6,7]

Secondary transmission from human–to–human may occur through direct contact with blood and body fluids or inhalation of droplets from infected patients at the community level or in healthcare settings. Nosocomial outbreaks involving transmission between patients and healthcare workers are associated with high mortality and are driven by poor understanding and compliance with standard precautions and other infection prevention and control measures.[4,8,9]

In Lassa fever endemic areas, it is difficult to distinguish between cases of primary and secondary infections acquired through occupational exposure. Also, direct estimation of the Lassa fever infection rate and risk factors among healthcare workers is cumbersome because about 80% of infections are asymptomatic, and some symptomatic infections occurring in healthcare workers may be self-limiting and mimic other febrile illnesses in endemic areas and, therefore, may not be recognized or reported.[1,5] A mathematical modeling research suggests that while outbreaks are primarily fuelled by independent zoonotic transmission events from infected rodent hosts, approximately 20% of cases may result from the secondary human-to-human transmission, typically in hospital settings.[3] Most available literature on Lassa fever in HCWs is based on serologic surveys conducted during outbreaks, and therefore the causal relationship between exposure and infection was challenging to establish.

This study described cases of Lassa fever infection among HCWs during the 2018 outbreak in Nigeria, with specific reference to laboratory-confirmed cases that were treated at the Irrua Specialist Teaching Hospital (ISTH) and the Alex Ekwemen Federal Teaching Hospital Abakaliki (AEFETHA) - two major Lassa fever treatment centers in Nigeria.

Methods

We conducted a review of all cases of infected healthcare workers in Nigeria during the 2018 Lassa fever outbreak between 1st January and 27th May 2018. A total of 21 HCWs who had laboratory-confirmed cases, treated either at Irrua Specialist Teaching Hospital (ISTH), Irrua, or Alex Ekwemen Federal Teaching Hospital, Abakiliki (AEFETHA) were interviewed using a structured questionnaire, and their case notes were reviewed. The data collected included socio-demographics, date of likely exposure and onset of illness, nature, and type of exposure, clinical features and outcome, infection prevention and control (IPC) practices at the point of care, and personnel IPC training. Data collected were analyzed using descriptive statistics with Microsoft Excel to identify exposure risk and gaps in infection prevention and control (IPC) measures during patient care in their various healthcare facilities.

Results

A total of 21 HCWs were treated in the two treatment centers, and about three-fifths (57.14%) of them were doctors, while one-fifth (19.0%) were nurses, and the other two were one laboratory technologist and one dental technologist. Male to female ratio was 1.6: 1, and the mean age of respondents was 37.76 ± 9.45 years. Fourteen cases

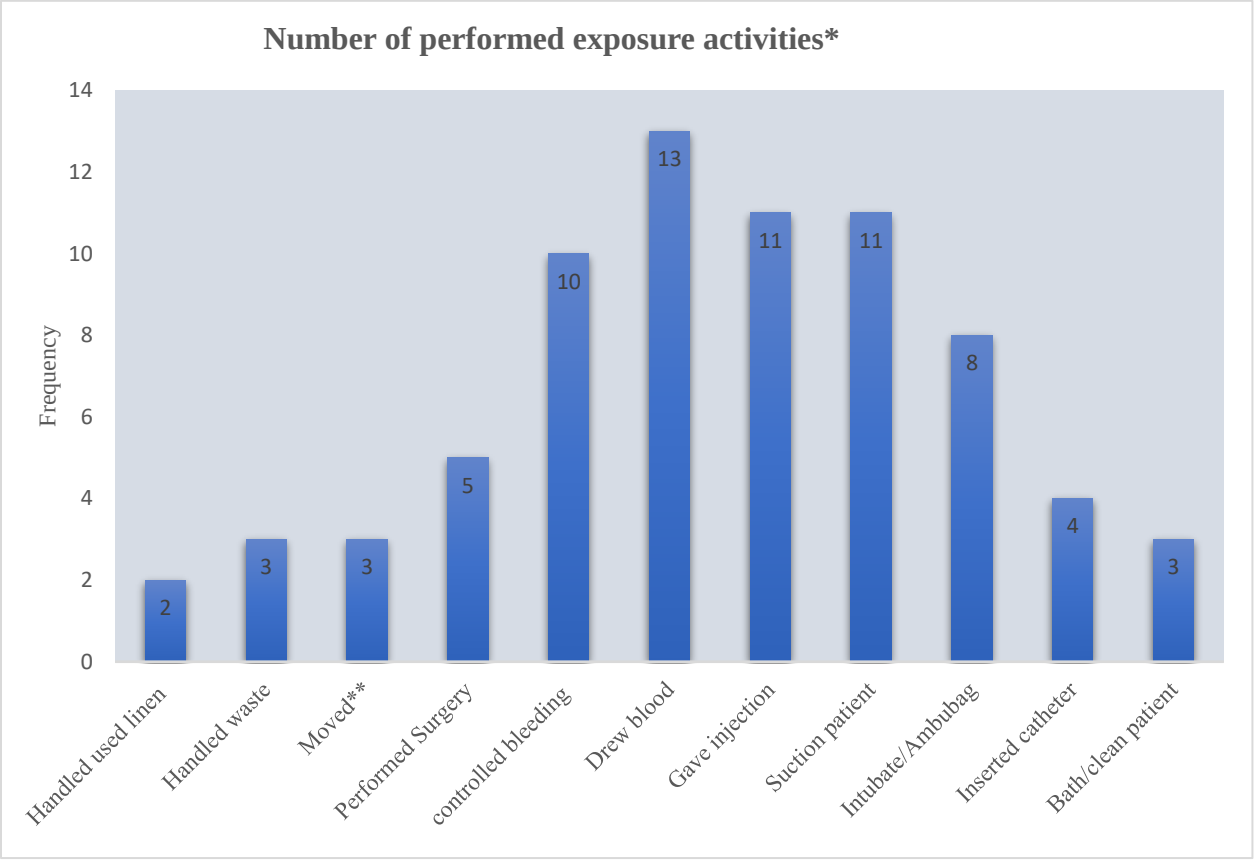
were treated at AEFETHA (eight doctors, five nurses, and one Laboratory technologist), while seven received treatments at ISTHI (four doctors, two nurses, and one dental technologist).

All the respondents were staff of tertiary healthcare facilities located in the Lassa fever endemic States of Edo, Ebonyi, Ondo, Nasarawa, and Kogi (Table 1). More than two-thirds (71.43%) were from FETHA/AEFETHA (Alex Ekwemen Federal Teaching Hospital, Abakaliki), three (14.29%) from ISTH (Irrua Specialist Teaching Hospital), Irrua, while other health facilities recorded one case each.

Table 1: The distribution of Lassa fever-infected HCWs by their health facility and state in Nigeria.

Institution	Frequency	Percentage
AEFETHA, Ebonyi State	15	71.43
ISTHI, Edo State	3	14.29
FMCK, Nasarawa State	1	4.76
FMCL, Kogi State	1	4.76
FMCO, Ondo State	1	4.76
Total	**21**	**100**

Key: AEFETHA (Alex Ekwemen Federal Teaching Hospital, Abakaliki), ISTHI (Irrua Specialist Teaching Hospital, Irrua), FMCK (Federal Medical Centre, Keffi), FMCL (Federal Medical Centre, Lokoja) and FMCO (Federal Medical Centre Owo).



Key: *Multiple responses reported, **patient/dead body.

Figure 1: The various exposure-prone activities performed by respondents

Nearly two-thirds (61.90%) of the HCWs were able to describe a likely procedure leading to exposure and infection. Exposure to blood through the drawing of blood from the patient(s)

they managed was recorded in all those whose possible source of exposure could be identified. Also, there were multiple sources of exposure in these respondents. Another exposure to blood and body fluids was experienced by 11 (84.62%) of the HCWs who were able to describe the likely exposure-related procedure, while two (15.38%) reported exposure through needle stick injury or scalpel cut.

In terms of infection prevention and control capacity, about one-fifth of the respondents had received IPC training, which did not include practical demonstrations. Amongst them, one respondent received one-day training while others got a maximum of three days. More than two-thirds (71.4%) of the respondents reported regular use of PPE when attending patients.

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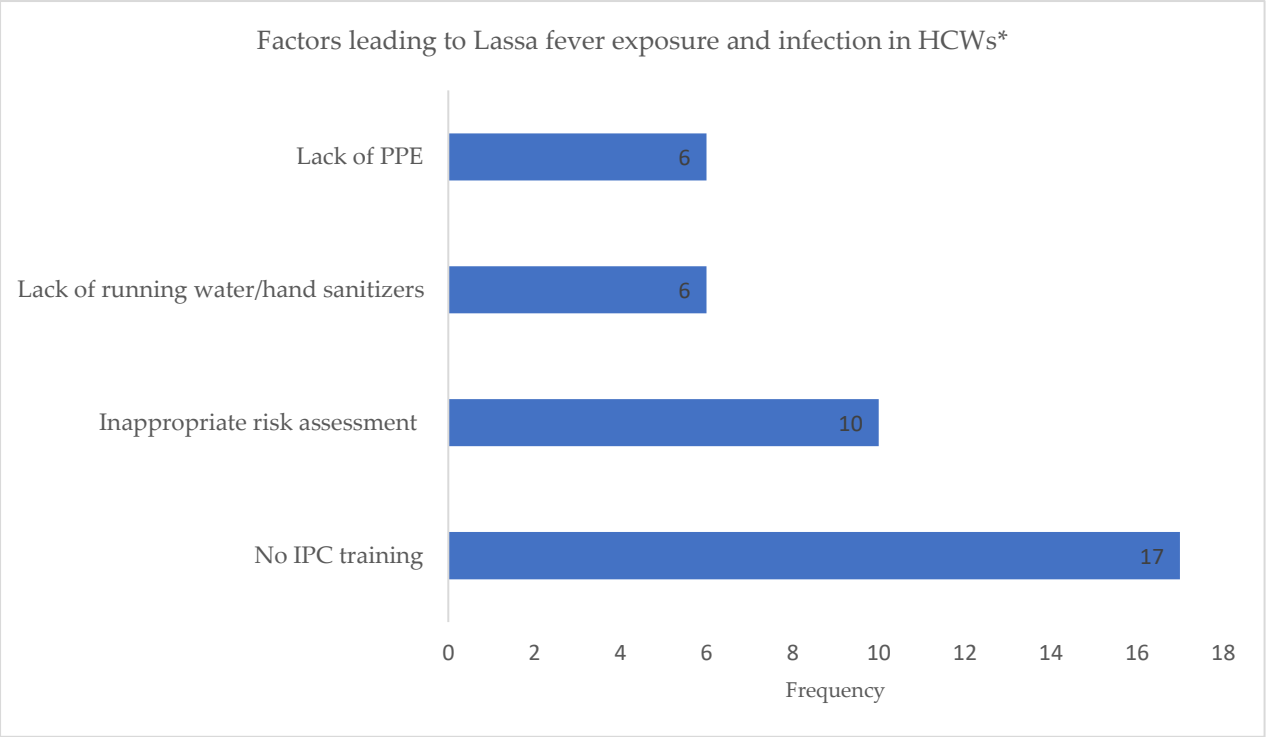
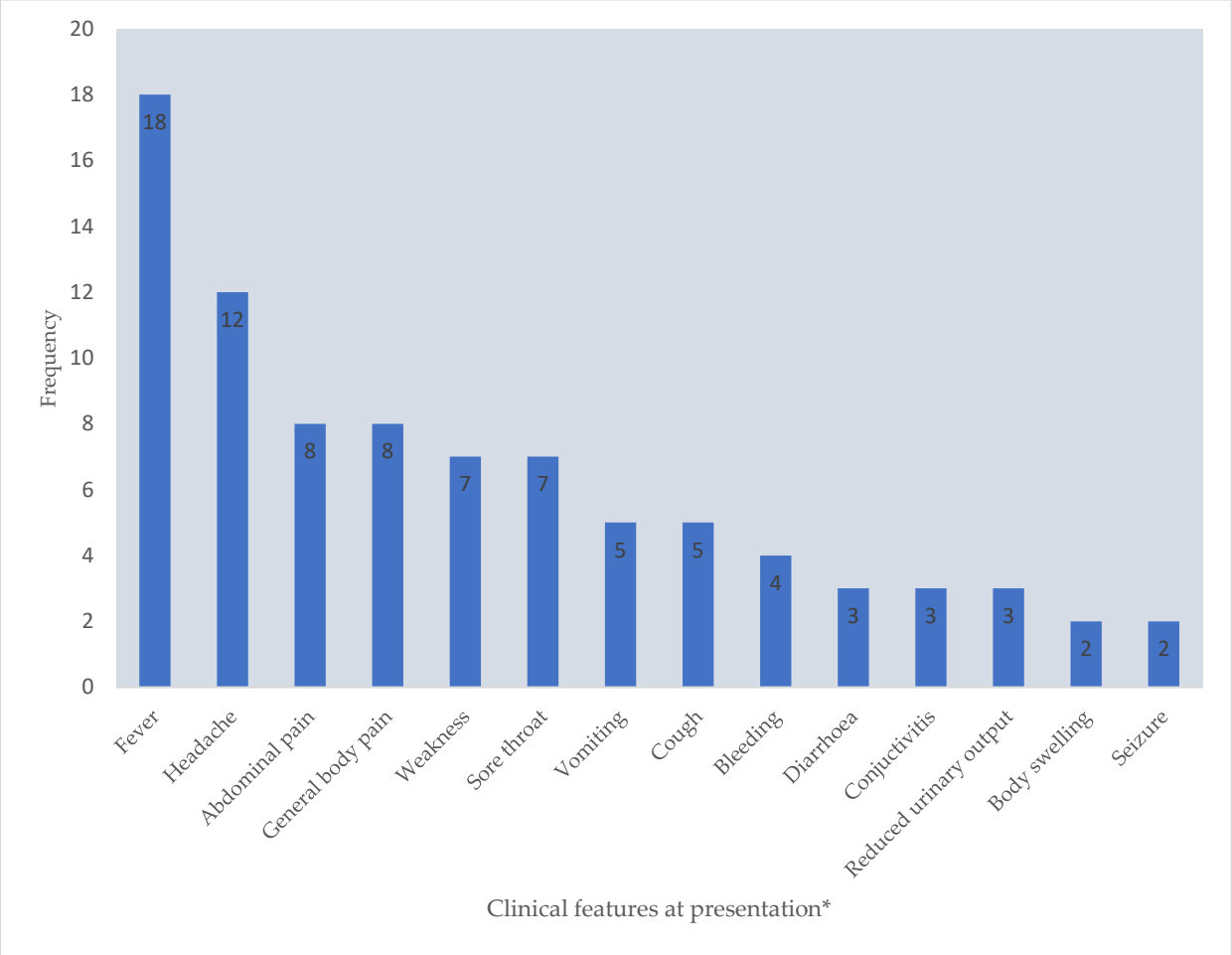


Key: **Multiple responses reported.*

Figure 2: Factors leading to Lassa fever exposure and infection in HCWs.

Overall, the challenges and gaps identified by respondents as contributory factors to exposure and infection at the place of work were lack of IPC training, inappropriate risk assessment when attending to patients, lack of PPE, and lack of running water/hand sanitizer.

The commonest clinical feature at the time of presentation by the respondents was fever (85.71%). Others were headache (57.14%), abdominal pain and general body pain (38.1%), weakness and sore throat (33.33%), vomiting and cough (23.81%). The least common clinical features were body swelling and seizure (9.52%). The mean incubation period estimated as the period between the time of likely exposure to the time of onset of illness was ten days, while the median number of days between the onset of symptoms and testing for Lassa fever was 12 days. The case fatality rate was 23.8%.



Key: *Multiple responses applicable.

Figure 3: Clinical features of respondents at the time of presentation.

Discussion

This study, to our knowledge, is the first, in recent times, to interrogate and characterize HCWs infected with Lassa fever during an outbreak situation and analyze the gap to guide infection prevention and control strategies in this population. The number of Lassa fever-infected HCWs described in this study represents about half [21(47.0%)] of the 45 HCWs infected nationwide in 2018, as reported by the Nigeria Centre for Disease Control (NCDC).[3] The infected HCWs represented 7(2.4%) of the 291 and 14(23.3%) of the 60 confirmed Lassa fever cases treated at ISTH and AEFETHA, respectively, during the year. The proportion of infected HCWs among the confirmed cases treated at AEFETHA was higher than that of ISTH because, in January 2018, there was a nosocomial outbreak of LF at AEFETHA with the death of 3 HCWs (2 doctors and a nurse). A similar situation of a nosocomial outbreak of LF was reported in South-Eastern Nigeria in 1989.[2] The proportion of infected HCWs among confirmed cases in this report is also similar to what was reported during the 2013-2016 Ebola virus disease (EVD) outbreak in West Africa.[10,11] Both Lassa and Ebola viruses are transmissible from human to human in healthcare settings where HCWs are under-protected.

The most affected healthcare professionals in this study are the medical doctors, followed by the nurses and laboratory technologists. The higher rate of infections among these professionals probably reflects their greater involvement in invasive procedures compared with other HCWs. For instance, the majority of the respondents reported drawing blood as one of the performed activities. Venepuncture is a procedure mainly performed by medical doctors, nurses, and laboratory technologists in many Nigerian hospitals, and 85% of those who recalled a likely exposure incidence leading to infection stated having direct contact with blood or body

fluids.[12,13]

The clinical profile of the infected HCWs in this study is expected and in keeping with the non-specific nature of the disease. Likely, Lassa fever was not suspected early, which may account for the delay in requesting laboratory tests, as observed in this study. In practice, most febrile illnesses are presumptively treated with anti-malaria and antibiotics as the first line of treatment, and LF is considered only after treatment failure.[14] It is, however, worrisome that physicians would not request LF testing early enough, especially in outbreak settings when a high index of suspicion is expected of them. The case fatality rate would probably have been lower if diagnosis and treatment with ribavirin were initiated early, as the clinical outcome of LF is known to depend on the stage of the disease at presentation.[15,16]

Nevertheless, this study's case fatality rate among infected HCWs is lower than in previous experiences.[4] In the past, there was no laboratory diagnostic capacity in Nigeria, and samples were transported outside the country with a delay in the return of laboratory results. Recent improvements in LF diagnostics in Nigeria, through the establishment of molecular diagnostic laboratories, development of testing algorithms, and guidelines for case management, through the collaborative efforts of the NCDC and ISTH, might have contributed to a reduction in mortality.

This study also identified risk situations and factors contributing to HCW exposure to LF infection. The most frequently cited deficiency was the lack of or inadequate training on IPC. Previous studies in Nigeria and other countries have recorded similar perceptions among health workers.[17–20] Education and training is one of the core components of the WHO National Guidelines for Implementation of IPC programme.[21] Pre-service and in-service training of healthcare workers in multidisciplinary sessions that would encourage collaboration across health professionals have been recommended. Whenever possible such training should be integrated to leverage existing programmes such as orientation programmes for new staff and regular hospital seminars and workshops. Several studies have demonstrated that compliance with standard precautions was improved significantly after training programs.[22,23]

Risk assessment is important in determining whether a febrile patient may have LF infection and deciding on the need for isolation and the level of personal protective equipment to be worn. Inappropriate risk assessment of potential LF patients was the second most cited contributory factor to HCWs exposure in this study. A high index of suspicion is required to quickly identify, triage, and isolate suspected LF cases, pending definitive diagnosis. This is especially important because the initial manifestations of LF may be non-specific. During outbreaks, exposure to unrecognized patients has been reduced by the use of standard precautions and is thus recommended.[24–27]

Effective implementation of infection control is at the core of breaking a chain of transmission during outbreaks of viral hemorrhagic fevers and cannot be performed without the required IPC supplies and equipment. This study revealed that lack of running water, hand hygiene products, and PPE contributed equally to HCWs' exposure, and in most situations, both were lacking or inadequate at the point of patient care. Overall, these findings are consistent with previous studies and still pose a challenge to VHF outbreak response in Africa.[17,28,29]

Strong health systems rely on a well-equipped, protected, and capable workforce to respond to outbreaks and emergencies. In previous outbreaks of VHFs in Africa, including the 2013-2016 Ebola outbreak in West Africa, many healthcare workers paid the supreme price while providing care for patients under grossly inadequate work conditions of weak infrastructure, lack of training, and deficient supply of PPE. There is a critical need to recognize that health worker protection and support is key to the capability of health systems to respond to outbreaks, and emergencies, and to meet the routine health need of the population. Capacity building of the health workforce, strengthening health infrastructure, the supply of IPC commodities, and the

institutionalization of IPC practices and standards across all levels of healthcare should be considered as an essential component of emergency preparedness, particularly in Lassa endemic areas. Thankfully, since 2017, the ISTH, in collaboration with the NCDC, has embarked on yearly training programmes on IPC and case management of LF for all categories of HCWs in Nigeria. The NCDC recently issued national Guidelines for Lassa Fever Case Management and Infection Prevention and Control.[30] Put together, these are laudable initiatives to guide the management and control of Lassa fever at the healthcare facility level and to reduce nosocomial transmission, including health workers' infections. Beyond the direct occupational risks described in this study, other factors such as psycho-social stress, fatigue due to long hours of work or excessive workload, workplace disharmony, and poor remunerations are all potential indirect determinants of exposure to harm in the workplace which should be addressed.

This study has some limitations. First, it assumed that HCWs infections occurred in the workplace without excluding the possibility of non-occupational exposure, particularly rodent-to-human transmission at the community level. Second, there was difficulty in obtaining good-quality data on exposure history and IPC practices from patients who were seriously ill or had died. In such cases, some information was obtained from co-workers and proxies in addition to what was documented on the patient case notes. Third, data on IPC practices were based on patient interviews and might have been affected by recall bias. Studies involving direct observation of the practice of standard precautions among healthcare workers in their workplaces, including an on-site survey of the infection prevention and control materials available to workers, are warranted to provide a more precise assessment. Despite these limitations, this study uniquely draws a direct connection between exposure and infection in healthcare settings where IPC infrastructure and supplies are deficient and HCWs training is neglected.

Preventing occupational LF infection places responsibilities on both HCW and the employer. HCWs at all levels in the health system (hospitals, clinics, laboratories, etc.) should mandatorily be taught the basics of LF and other highly infectious diseases, including practical training on IPC - hand hygiene, use of PPE, prevention of needle sticks and sharp injury, safe blood collection, environmental cleaning and decontamination of surfaces and equipment, safe management of linens and medical waste.

They should report any risky exposure forthwith in the workplace to their immediate supervisor or employer for appropriate post-exposure prophylaxis. All HCWs who develop febrile illness in Lassa fever endemic areas or living in an area of Lassa fever outbreak should seek immediate medical attention. IPC programmes and governance structures, such as IPC teams and committees, should be constituted at all healthcare system levels to provide leadership for IPC implementation and ensure compliance with recommended standards. Employers are responsible for ensuring employees are well-trained and equipped with the required preventive measures. Administrative controls (such as guidelines, standard operating procedures, and policies) and engineering controls (such as the provision of running water, isolation areas, and waste management facilities), and provisions of PPEs must be in place to minimize occupational risk.

It is gladdening that healthcare worker protection and security is beginning to receive global attention following the recent EVD outbreak in West Africa, which prompted WHO and ILO to recommend that HCWs with EVD resulting from workplace activities should have the right to compensation, as well as free rehabilitation and access to curative services.[31] Implementing similar strategies for LF and cementing them into the national policy for IPC and emergency preparedness will go a long way to strengthen and increase the health workforce's confidence and immortalize all those who lost their lives for the patients under their care.

Conclusion

This study reported limited IPC adherence

practices and inappropriate risk assessments among HCWs who cared for LF patients during the outbreak. These were some of the factors that led to their LF exposure and subsequent high infections. It is, therefore, of urgent importance to provide IPC training for all HCWs. The relevant IPC materials should be made available to all healthcare facilities, especially in LF endemic areas, as part of emergency preparedness in Nigeria.

Availability of data and material

The datasets used and analyzed during the current study are available from the corresponding author upon reasonable request.

Acknowledgments

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Original Article

Ethical Sensitivity and its Association with Caring Behavior among Healthcare Workers in Delta State, Nigeria: A Cross-Sectional Study

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ABSTRACT

Introduction: Caring behavior is a unique behavior that can promote patients' well-being, the performance of healthcare workers, and the general effectiveness of healthcare institutions. The mechanism and possible predictors of caring behavior are under-researched in health and organizational behavior literature. Based on the aforementioned, this study examined the predictive effect of ethical sensitivity (dimensions included) on caring behavior, and gender differences in caring behavior and ethical sensitivity among public healthcare workers in Delta State, Nigeria.

Methods: A cross-sectional research design and a quantitative approach for data collection were adopted. Simple random sampling was adopted for selecting the participating hospitals while the convenience sampling technique was utilized for selecting the healthcare workers. Two instruments with good psychometric properties were used for the data collection. The simple linear regression and independent sample t-test were used for testing the hypotheses via the IBM-SPSS v.25.

Results: The participants comprised 150 healthcare workers from public-owned hospitals consisting of 73(48.7%) males and 77(51.3%) females with a mean age of 40.60 years and a standard deviation of 9.30. The results of the study indicated that ethical sensitivity positively and significantly predicted caring behavior. Also, two dimensions of ethical sensitivity, moral strength, and moral responsibility positively and significantly predicted caring behavior while a sense of moral burden did not. Finally, there was no significant gender difference in caring behavior and ethical sensitivity.

Conclusion: This study highlights the role of ethical sensitivity, moral strength, and moral responsibility in predicting higher levels of caring behavior among healthcare workers. Thus, it was recommended that hospital administrators, health policymakers, and practitioners seeking to boost the caring behavior of healthcare workers should focus on enhancing factors such as sensitivity to ethical standards. Also, administrators of medical education can nurture intending healthcare workers (medical students) on the importance of ethics in the medical profession.

Keywords: Caring behavior, Ethical sensitivity, Gender, Healthcare workers, Moral responsibility, Moral strength, Sense of moral burden

Introduction

Healthcare workers are crucial to nations around the world and they represent about 12% of the working population worldwide.[1] Healthcare workers work long hours and their job is usually challenging since they have to deal with human suffering daily. Despite this, it is their professional duty to ensure that the health of a patient is well managed.[2] Caring behavior is regarded as an essential attribute in the healthcare profession because of the salient role it plays in the caregiver-patient relationship.

Achieving an efficient and optimum healthcare delivery largely relies on the service process and the interaction between healthcare workers and patients.[3] Caring behavior is crucial in establishing and maintaining a sound therapeutic alliance, and it fosters the efficacy of the treatment process.[4]

Therefore, the relevance of the interaction between healthcare workers and health seekers cannot be overemphasized because it has been observed to aid the treatment process.[5] This relationship is built on effective care, interpersonal communication, information disclosure, and caring behavior which are important in ensuring and maintaining quality therapeutic relationships between healthcare workers and health seekers.[6,7] At a minimum, quality healthcare is built on the availability of necessary resources as well as a health workforce that is capable and well-motivated. Caring behavior is an interpersonal process that is built on sensitivity to the need of others and involves highly practical behaviors such as assuring humanistic presence, general respect for patients' needs, positive communication, providing professional skill and knowledge where necessary, and most importantly paying attention to the need of the patient.[8]

Caring behavior in the healthcare profession conveys concern for the safety and well-being of the patient and ensures that significant attention is given to the patient's needs during the treatment process.[9] Caring behavior is very important largely because healthcare professionals are constantly in direct contact with patients. The absence of caring behavior in the healthcare profession has detrimental effects on health seekers. In the Nigerian public healthcare system, workplace attitude marked by emotional incompetence, reduced interpersonal communication, and caring behavior has been major contributors to the reported challenges within the health sector.[10,11] These attitudes (emotional incompetence, reduce interpersonal communication, and caring behavior) can impact the quality of healthcare services, hence, discouraging patients from seeking care in public-owned health institutions. However, caring behavior has not been given as much attention in health and organizational literature as it should be, especially in the Nigerian context where there exists evidence of reduced care among healthcare workers.[11] On reviewing various kinds of literature it shows that researchers are recognizing its perceived importance in quality healthcare delivery still its antecedents and predictors have not been fully established in the global workspace, especially in Nigerian health organizations. A few gaps in the literature necessitated this study.

First, with recent reports in the literature indicating a shift from the regular sample utilized for studying caring behavior in the population of healthcare workers,[12] it becomes pertinent to examine other core healthcare units and possible variables that contribute to caring behavior in a bid to promoting the health and well-being of health seekers. The extant literature indicates that a significant number of studies have been focused on the caring behavior of nurses and other nursing caregivers with less attention given to other core healthcare personnel that have direct contact with patients.[3,6,8] In most Nigerian hospitals, health seekers have to meet record personnel who takes their record on behalf of the hospital, medical doctors responsible for drug prescription, a pharmacist in charge of giving the prescribed drugs or medications, and nurses who administer the drugs.[12] These processes are likely the same all over the world as the healthcare professional is highly regulated and controlled because of its essence to humanity. The inclusiveness of other core professionals in the healthcare sector reflects the caring behavior within the hospital. Second, studies examining the dimensionality of the ethical sensitivity scale (moral burden, strength, and responsibility) and its effects on caring behavior are lacking in the literature. Finally, the impact of gender on ethical sensitivity and caring behavior is also lacking in the Nigerian healthcare literature. The existence of these gaps in knowledge, if unattended can disempower health and hospital administrators in taking the right proactive and reactive steps in promoting caring behavior and ethical sensitivity. Based on this, the present study assessed caring behavior among healthcare workers and how it was influenced by ethical sensitivity, and its dimensions (moral burden, moral strength, and moral responsibility). The study also examines the likely differential effect of gender on caring behavior and ethical sensitivity. Studies on caring behavior are lacking in Nigeria, especially concerning the selected individual and demographic variables.

Ethics are the foundation on which the medical profession is built providing the basis for ethical patient care.[13] Therefore, the role of ethical sensitivity in the management and delivery of quality healthcare services cannot be undermined. Ethical sensitivity refers to the attentiveness to the moral values involved in a conflict-laden situation and self-awareness of one's personal role and obligation in a given situation e.g., during patient care.[14] It is the personal predisposition that guides healthcare workers in making an ethical decision which entails using their skills, feelings, cognitive capacity, and ethical knowledge.[14] Healthcare professionals face a variety of challenges that require ethical knowledge and a critical step to

take in increasing the ethical sensitivity of healthcare professionals is to increase their awareness and recognition of ethical issues especially those that have direct implications for patient care. [13] It has also been observed that personal disposition can influence care-related behavior among healthcare workers. [15] Healthcare workers need to understand basic ethical principles related to healthcare and integrate these principles with their moral values to deal with ethical problems. Reduced ethical sensitivity may bring about ethically inappropriate behavior and conflicts with the obligations of the healthcare profession. Hence, the abundance of ethical sensitivity may promote favorable workplace behavior that may have a positive impact on patients and colleagues at work. Consequently, it is hypothesized that ethical sensitivity is likely to have a positive impact on caring behavior. Previous studies have reported that higher levels of ethical sensitivity significantly contribute to compassion levels,[16] perceptions and quality of nursing,[17] occupational professionalism,[18] and greater empathetic behavior.[19] Also, the literature indicates that incompetency in ethical sensitivity threatens patient care and desensitizes healthcare workers when they are confronted with ethical situations or challenges.[20,21] Thus, there is a strong ground to believe that ethical sensitivity and its dimensions have the potential of predicting caring behavior among healthcare workers.

Gender has also been shown to influence varieties of workplace variables in healthcare institutions. Although there are inconsistent findings regarding gender influence on caring behavior, the role it plays cannot be overlooked. Previous studies outside Nigeria have shown that gender influences the caring behavior of healthcare workers.[22] Individuals who reported higher masculinity and femininity have been shown to have higher caring behavior. [23] Shmilovitz, Itzhaki and Koton found a significant gender difference in caring behavior with females reporting more caring behavior than males. [24] Similarly, a study found that gender is not a significant factor in understanding and dealing with the need of patients in Nigerian public hospitals.[25] These inconsistencies necessitated further examination of the observed difference between gender and caring behavior. Sensitivity to ethical practices might also be influenced by gender. This is based on the notion that males are more prone to assertiveness and rule-breaking compared to their female counterparts using the gender role theory.[26] Males are usually pushier and hence more likely to break ethical standards. Hence, females are more likely to be ethically sensitive than their male counterparts. Recent literature gives support for this proposition.[27,28] Consequent to the salient literature reviewed and the bid to fill the gaps earlier identified in the literature, this study is guided by the following hypotheses:

H_1: Ethical sensitivity will positively and significantly predict caring behavior.

H_{1a}: Sense moral burden will positively and significantly predict caring behavior.

H_{1b}: Moral strength will positively and significantly predict caring behavior.

H_{1c}: Moral responsibility will positively and significantly predict caring behavior.

H_2: There will be a significant gender difference in caring behavior.

H_3: There will be a significant gender difference in ethical sensitivity.

Methods

A cross-sectional study was adopted using a quantitative approach to data collection. The cross-sectional research design is appropriate because the sample was drawn from all participating public-owned hospitals in Delta State, Nigeria. This design was also deemed appropriate because of its capacity and flexibility in measuring several variables and testing multiple research questions and hypotheses at a single point in time. Also, the time constraint, the size of the sample, and the resource available at the time led to the selection of this method. A required sample size to test for statistical power and inference was adopted. This was estimated using the G*power software.[29] Using the adequate number of predictors outlined in the research hypotheses, a standardized alpha of 0.01, with a medium effect size (f^2) of 0.15, and a power level of 0.97. The G*power analysis suggested a required sample size of 101 participants.

As recommended by Bartlett, Kotrlik, and Higgins, it is advisable to increase the required sample size by 50% to enhance statistical inference.[30] Based on this recommendation, an additional sixty (60) participants were added to the overall sample totaling 161. This was evenly distributed across all the participating public owned hospitals. After the data collection, the researchers discovered that some questionnaires were not properly filled out by some of the respondents. This was attributed to the unwillingness of the participants to continue participation after giving their consent or merely a lack of motivation to respond to the items on the questionnaires. As a result, 150 questionnaires

were used for the final statistical data analysis and test of hypotheses. The questionnaire contained two psychometrically standardized instruments and questions eliciting sociodemographic information from the participants. The socio-demographics include gender, age, marital status, medical experience, current organizational tenure, and educational qualification. Item coding and mean scores of the participants' responses were used for the data analysis.

Ethical clearance was obtained from the institutional ethical committee of Delta State University before the commencement of the study. Confidentiality was maintained throughout the process of data collection. The researchers sought the permission of the participating hospitals (through a formal written letter stating the essence of the research and why health workers should participate in it) before administering the questionnaires. Verbal consent was taken from healthcare workers for participating in the study. Considering the constraint of resources, probability sampling was used for selecting the participating public-owned institutions via the use of random numbers assigned to hospitals to give some form of randomization to the process. The hospitals assigned to the random numbers selected were utilized for the study. Also, the convenience sampling technique was used for selecting the healthcare workers from the selected hospitals. The researchers ensured that participants were selected from the core units of the healthcare profession. One hundred and seventy (170) questionnaires were distributed, and one hundred and sixty-two (162) questionnaires were retrieved. The return rate was 95.29% and among them, 150 responses were used for the analysis.

Two instruments were used for assessing the two major variables in the study. One for caring behavior and the other for ethical sensitivity. Caring behavior was assessed with the instrument developed by Wu et al.[31] The inventory measures healthcare workers caring behavior toward patients. The caring behavior inventory was adapted to accommodate all participating healthcare workers such as doctors, nurses, and others within the field with direct contact with patient care. The inventory comprises 24 items that yielded four factors with each constituting a specific and significant domain of caring behavior: assurance (measured with 8 items), knowledge and skill (measured with 5 items), respectfulness (measured with 6 items), and connectedness (measured with 5 items). According to Nwanzu and Babalola, the assurance domain entails giving time to the need and security of patients, knowledge, and skill has to do with information and proficiency in the healthcare profession, with regard to patient's well-being, respectfulness entails the act of having courteous regard for patients, while connectedness covered optimistic and constant readiness on the part of the healthcare worker to help patients. [9] Examples of the items include: "I attentively listen to my patient"; "I allow the patients to express feelings about his/her disease and treatment"; "I am usually patient and tireless with the patients". The scale was measured on a five-point Likert format ranging from strongly disagree (1), disagree (2), neutral (3), agree (4), and strongly agree (5). The overall scores for each of the dimensions represent the composite construct of caring behavior. A reliability coefficient alpha of .96 was reported for the overall scale.

Ethical sensitivity was assessed with the index of ethical sensitivity questionnaire developed by Lutzen et al.[14] The scale was specifically developed for measuring ethical sensitivity during ethical decision-making among healthcare professionals working in a variety of healthcare settings. The ethical/moral sensitivity questionnaire comprises 9-item that yielded three factors each constituting a specific and significant domain of ethical sensitivity in healthcare settings: sense of moral burden (measured with 4 items), moral strength (measured by 3 items), and moral responsibility (measured with 2 items). Examples of the items include: "I always feel a responsibility that the patient receives good care even if the resources are inadequate"; "I have a very good ability to sense when the patient is not receiving good care"; "my ability to sense a patient's needs means that I often find myself in a situation in which I feel inadequate", representing each of the significant domain respectively. A Likert-type response was adopted for the instrument. Specifically, a 5-point Likert format was adopted ranging from strongly disagree (1) to strongly agree (5). Since the present study was focused on ethical sensitivity as a composite and the specifics, the mean scores reflecting the whole and the dimensional construct were utilized such that higher scores indicate high ethical sensitivity and lower scores indicate low ethical sensitivity. The same applies to the dimensions. The scale has been found to possess good psychometric properties.

Preliminary statistical analyses such as the normality test, Cronbach's alpha, correlation, and common method bias tests were conducted to

check the suitability of the data and see if it meets the assumptions of the parametric statistical test. The first groups of hypotheses (H_1, H_{1a}, H_{2b}, and H_{1c}) were tested with the simple linear regression analysis while Hypotheses two (H_2) and three (H_3) were tested with the independent sample t-test. The decision rule to be used in testing the hypotheses is, if the critical value (p) > 0.05 for a two-tailed test, reject the null hypothesis, if not accept the null hypothesis. The data were analyzed with the IBM-SPSS Statistics v.25.

Results

The sociodemographic profiles of the respondents are given in Table 1. The participants had a mean age of 40.60 years (*SD*= ±9.30). The study sample comprised 77(51.3%) females and 73(48.7%) males and a majority of the participants were married.

Table 1.: Sociodemographic characteristics of the respondents

	n	Frequency	Percent
Gender	150		
Male		73	48.7
Female		77	51.3
Age	150		
Under 31years		22	14.7
31-40years		61	40.7
41-50years		53	35.3
51 years and above		14	9.3
Marital Status	150		
Married		88	58.6
Single		51	34.0
Separated/Divorced		7	4.7
Widowed		4	2.7
Medical Experience	145		
Less than 5years		40	27.5
6-10years		49	33.8
11-20years		31	21.4
21-30years		11	7.6
31 years and above		14	9.7
Organizational Tenure	150		
Under 12years		100	66.7
12-22years		29	19.3
23 years and above		21	14.0
Educational Qualification	149		
Bachelor's degree/Equivalent Certificate		115	77.1
Postgraduate		34	22.9

Participants between 31-40, 60(40.7%) years of age, and those who have spent below 12 years (66.7%) in their various hospitals made up a significant proportion of the research sample. All the participants reported that they have received formal education with most of them having bachelor's degrees or an equivalent certificate at a descriptive value of 115(77.1%). The correlation analysis shown in Table 2 indicates that age (r = .284, p <.01), organizational tenure (r = .174, p <.05), and educational qualification (r = .288, p <.01) were all associated with the caring behavior of healthcare workers. The demographic characteristics of the participants have no association with ethical sensitivity.

Table 2.: Association between sociodemographic characteristics and the scores on caring behavior and ethical sensitivity

	Descriptive statistics		**Caring behavior**		**Ethical sensitivity**	
	Mean	SD	correlation	p-value	Correlation	p-value
Gender	1.513	.501	.033	.689	.004	.959
Age	40.606	9.302	.284**	.000	.009	.917
Marital status	1.513	.711	.060	.465	-.035	.670
Medical experience	2.379	1.236	.148	.075	.109	.191
Organizational tenure	1.460	9.126	.174*	.033	.104	.206
Educational qualification	2.973	.993	.288**	.000	-.096	.243

Note: *Correlation is significant at .05 level (2-tailed); **correlation is significant at .01 level (2-tailed); Gender, marital status, and educational qualification were collected at nominal levels while age, medical experience, and organizational tenure were coded in years (continuous level) and later categorized.

The Cronbach's alpha, a test of normality, and multicollinearity (for the predictors) for the pre-statistical tests were all within the normal range. The internal consistency of the instruments was largely satisfactory as they met the literature requirement for a reliable scale. Specifically, Cronbach's alpha values for the sense of moral burden, moral strength, moral responsibility, and caring behavior were .65, .74, .70, .67, and .91 which were considered satisfactory. The values for the variance inflation factor (<10) and tolerance (>0.40) were also within normal range. The descriptive statistics and normality test were within the acceptable range for a regression-based model. Table 3 also shows the descriptive statistics and the correlation coefficient of the research variables. A modest value was attained for the mean and standard deviation of all the variables. The table also shows a significant relationship for most of the key study variables. Specifically, moral strength ($r = .20$, $p < .05$), moral responsibility ($r = .19$, $p < .05$), and the composite value for ethical sensitivity ($r = .21$, $p < .05$) were significantly related to caring behavior among healthcare workers while the sense of moral burden did not ($r = .10$, $p > .05$). It is also important to know that the observed correlation values were below .80 indicating that common method variance and multicollinearity did not affect the results of the analysis.

Table 3.: Mean, standard deviation, and correlation coefficient of research variables

		M	**SD**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
1	Sense of moral burden	3.94	.81	[.65]								
2	Moral strength	4.59	.59	.15	[.74]							
3	Moral responsibility	4.60	.67	.17*	.67**	[.70]						
4	Ethical sensitivity	4.30	.52	.80*	.68**	.66**	[.67]					
5	Assurance	4.39	.60	.10	.13	.15	.16*	[.87]				
6	knowledge and skill	4.50	.49	-.04	.16*	.13	.07	.36**	[.86]			
7	Respectfulness	4.50	.57	.10	.14	.10	.16	.26**	.47**	[.85]		
8	Connectedness	4.53	.46	.09	.19*	.18*	.19*	.24**	.41**	.50**	[.73]	
9	Caring behavior	4.47	.39	.10	.20*	.19*	.21*	.76**	.71**	.73**	.65**	[.91]

Note: *Correlation is significant at .05 level (2-tailed); **correlation is significant at .01 level (2-tailed); The Cronbach's alpha for each variable is placed in parentheses.

A simple linear regression was performed to examine the effect of ethical sensitivity on caring behavior among healthcare workers and the results are presented in table 4. The statistics in the table offered support for the hypothesis: ethical sensitivity positively and significantly predicted caring behavior, (B= .20, 95% CI [.03, .27], t = 2.58, p= .011). The observed B value suggests that for every unit increase in ethical sensitivity, a .20 increase in caring behavior is expected and the R^2 of .04 indicates that ethical sensitivity accounts for 4% of the variation in caring behavior. The analysis of variance (ANOVA) test, $F(1, 148) = 6.68$, $p= .011$, indicates that the regression was statistically significant, meaning caring behavior can be predicted from ethical sensitivity. Hence, the first hypothesis was accepted. There was no

support for hypothesis H_{1a} as the regression analysis indicates that a sense of moral burden did not significantly predict caring behavior (B= .10, 95% CI [-.02, .13], t = 1.29, p > .05).

The results also indicated that moral strength significantly predicts caring behavior (B= .21, 95% CI [.03, .24], t = 2.60, p= .010). The B value suggests that for every unit increase in moral strength, a .21 increase in caring behavior occurs while the R^2 of .04 indicates that moral strength accounts for 4% of the variation in caring behavior. The test for ANOVA, F(1, 148) = 6.77, p= .010, indicates that the regression is statistically significant, meaning caring behavior can be predicted from the moral strength of healthcare workers. Therefore, we did not fail to accept hypothesis H_{1b}.

Finally, the results in Table 4 showed that the moral responsibility of healthcare workers significantly predicts caring behavior (B= .19, 95% CI [.02, .20], t = 2.40, p= .018). The B value suggests that every unit's increase in moral responsibility leads to a .19 increase in caring behavior. Also, the R^2 of .03 indicates that moral responsibility accounts for 3% of the variation in caring behavior. The test for ANOVA, F(1, 148) = 5.75, p= .018, indicates that the regression is statistically significant, meaning that the caring behavior of healthcare workers can be predicted from moral responsibility. Therefore, hypothesis H_{1c} was accepted.

Table 4.: Simple regression analysis showing ethical sensitivity, and its dimensions predicting caring behavior

	B	SE	t	R^2	Adj R^2	F	P	95% CI	
								Lower	Upper
Ethical sensitivity	.20*	.06	2.58	.043	.037	6.68	.011	.03	.27
Sense of moral burden	.10	.04	1.29	.011	.005	1.68	.196	-.02	.13
Moral strength	.21*	.05	2.60	.044	.038	6.77	.010	.03	.24
Moral responsibility	.19*	.05	2.40	.037	.031	5.75	.018	.02	.20

Note: *p < .05 level (2-tailed).

An independent sample t-test was conducted to check for gender differences in the caring behavior and ethical sensitivity of healthcare workers. For the first condition (gender difference in caring behavior) as seen in Table 5, there was no significant difference in the scores for males (M = 4.461, SD = 0.405) and the scores for females (M = 4.488, SD = .392) on caring behavior, t(148) = -.405, p = .686. Hence, the hypothesis (H_2) which stated that there will be a significant gender difference in caring behavior was rejected. For the second test of difference (gender difference in ethical sensitivity) as displayed in Table 5, there was no significant difference in the scores for males (M = 4.304, SD = .523) and females (M = 4.309, SD =.528) on ethical sensitivity, t(148) = -.051, p = .959. Therefore, the hypothesis (H_3) which stated that there will be a significant gender difference in ethical sensitivity was rejected.

Table 5.: Independent sample t-test for gender difference in caring behavior and ethical sensitivity

	N	M	SD	t-value	p-value	Mean difference	95% CI		Cohen's d
							Lower	Upper	
Caring Behavior									
Male	73	4.461	.405	-.405	.686	-.027	-.155	.102	-.066
Female	77	4.488	.392						
Ethical Sensitivity									
Male	73	4.304	.523	-.051	.959	-.005	-.174	.165	-.008
Female	77	4.309	.528						

Discussion

This study examined the predictive relationship between ethical sensitivity and caring behavior among public healthcare workers in Delta State, Nigeria. Specifically, the study explored the composite concept of ethical sensitivity, its dimensions which include a sense of moral burden, moral strength, and moral responsibility,

and how they impact the caring behavior of healthcare workers. Also, the study examined gender differences in caring behavior and ethical sensitivity. Three research hypotheses were developed (with the first having three other hypothetical statements to further explore the dimensions of ethical sensitivity). The descriptive statistics, normality and reliability tests were within the normal range for a regression-based model.[32,33] The correlation analysis of the demographic variables on caring behavior and ethical sensitivity revealed that the age, number of years spent in the hospital (organizational tenure), and educational qualification of a healthcare worker were all associated with the caring behavior while the demographic characteristics of the participants have no association with ethical sensitivity.

The first hypothesis which stated that ethical sensitivity will positively and significantly predict caring behavior was supported. Ethical sensitivity was found to be a positive and significant predictor of caring behavior among healthcare workers. This implies that an increase in ethical sensitivity will necessitate an increase in the caring behavior of healthcare workers. The finding is in line with similar studies in the literature. Previous studies have reported that sensitivity to ethical practices is significantly related to empathy, general compassion levels, and the occupational professionalism of healthcare workers.[16,18,19] Thus, ethical sensitivity fosters the caring behavior of healthcare workers. Further analysis of the dimensions of ethical sensitivity showed that of the three dimensions, two significantly predicted caring behavior. Specifically, moral strength and moral responsibility showed predictive abilities i.e., they both predicted caring behavior. This indicates that moral strength and moral responsibility are two defining factors in ethical sensitivity. Hence, the feeling of responsibility to the patient and the moral capacity to carry out assigned tasks, especially those that deal primarily with patient care are necessary factors for caring behavior.

The second hypothesis which stated that there will be a significant gender difference in caring behavior was not supported as the results of the study did not offer support for this proposition. Male and female healthcare workers do not differ in their levels of caring behavior. The finding is consistent and also inconsistent with previous literature. Consistent with the current finding is the work of Onuoha and Idemudia who found that gender is not a significant factor when it comes to comprehending and handling the need of patients in the hospital. [25] The current finding is not consistent with previous literature such as the work carried out by Liu et al. on gender role orientation and its impact on caring behavior and the ability to think critically. [23] The researchers reported a significant gender difference in caring behavior. The finding is in line with that of Talebian et al. and Shmilovitz, Itzhaki and Koton.[22, 24] The researchers reported a significant gender difference in caring behavior with females reporting more caring behavior than males. The third hypothesis which stated that there will be a significant gender difference in ethical sensitivity was also not supported as the results were not in line with the research hypothesis. The finding was not consistent with studies outside the current context (Nigeria). Studies show that gender could be a factor in sensitivity to ethical practices.[27,28] The reason for the current findings can be attributed to individual and organizational factors, and possibly issues prevalent in the Nigerian healthcare sector. Hence, factors such as uniform education and training for male and female healthcare workers, support from their supervisors, workload, job satisfaction levels, and cultural and emotional intelligence are to be considered. These factors should be investigated alongside the current variable to get more stable and robust results on gender differences in caring behavior.

This study provides valuable insight into the circumstances under which healthcare workers will care more for their patients which will further inform policies developed by hospital administrators, medical educators, and healthcare practitioners. Like many studies of this nature, this study has some limitations. First, the cross-sectional nature of the study restricted the findings to correlation rather than the establishment of causal relationships. Perhaps, longitudinal studies to test the causal direction between the various dimensions of ethical sensitivity and caring behavior are needed. Second, all the variables were obtained through self-report measures. Data on a variable like caring behavior can be obtained via supervisor rating or possibly through coworker reports in order to have a true picture of the behavior.

Conclusion

This study has successfully examined the empirical link between the ethical sensitivity of healthcare workers and their caring behavior toward patients. In conclusion, ethical sensitivity fosters caring behavior. Also, the dimensions of

ethical sensitivity (moral strength and moral responsibility) promote caring behavior. Through this study, new knowledge has been added to the healthcare literature on caring behavior and ethical sensitivity which are the foundations of treatment and professionalism.

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Original Article

Areas of Work Life as Burnout Predictors in Dentists of Denpasar, Indonesia

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ABSTRACT

Introduction: Burnout is most common among healthcare workers and is characterized by emotional fatigue, depersonalization and low personal accomplishment impacting behaviors also the work environment. This study aimed to analyze areas of work-life and burnout among dentists in dental hospitals.

Methods: A cross-sectional survey study was conducted on 72 dentists in a dental hospital in Denpasar. An online questionnaire containing the Maslach Burnout Inventory and the Areas of Work Life Survey by Michael Leiter and Christina Maslach to estimate burnout and work life was used for data collection from April-May 2022. Multiple linear regression was used to evaluate the association.

Results: The work-life area category had a score of 3.45, while the dentist's average score for burnout had a mean value of 4.15. Workload, control, rewards, community, fairness, and values were associated with burnout. The control dimension showed the strongest correlation to burnout. The reward dimension had the most significant role in burnout. All dimensions of the work-life area are predictors of dentist burnout.

Conclusion: Based on the finding of this study, all of the dimensions of work life can potentially cause burnout in dentists. A reward is the most dominant variable in the emergence of burnout. Management needs to set policies to reduce burnout for dentists at work.

Keywords: Areas of work life, Burnout, Dentists, Indonesia

Introduction

Dentistry is an occupation that provides compassionate care and an excellent opportunity to meet new people regularly, which may result in burnout.[1] Burnout is a psychological disorder present among professionals that involves a stressful condition, especially in people who carry out care social activities and is characterized by a range of symptoms including fatigue, sleeplessness, headaches, low immunity, irritation, suspicion, overconfidence, drug abuse, negative attitude, boredom and lack of motivation. All due to continuous interpersonal stresses at work.[2,3] According to Maslach et al.[4], burnout is most common among healthcare workers and is characterized by emotional fatigue, depersonalization and low personal accomplishment impacting behaviors also the work environment.[5] In a study of service personnel, including dentists, burnout was associated with depression, anxiety, alcohol consumption, sleep and cognitive problems and musculoskeletal problems. Dentists have

extremely high levels of burnout, with 21% at particular risk, 13% having high levels of burnout, and 2.5% highly burned out and still working. Additionally, 26% of dentists reported having high emotional exhaustion and depersonalization.[6,7]

The high burnout levels among dentists may be attributed to the profession's interpersonal dynamics. The etiology of burnout in dentists is impacted by various psychosocial variables, including work-related stresses, dentist-patient relationships, stress perceptions, and the clinician's personality traits.[8,9] The following reasons contribute to occupational burnout in dentists' everyday lives: confinement, patient anxiety, compromised treatment, the stress of perfectionism, economic demands and low self-esteem. Furthermore, Cooper et al. reported time and schedule difficulties, pay-related stresses, patients' negative perceptions of the dentist, personnel and technological challenges, and difficulty dealing with patients were all stressors in dentistry. Some dentists described frustration with their patients, issues with their physical environment, uncomfortable working postures, and unhappy marriages as contributing factors to burnout.[10,11] There have been many studies on burnout among medical professionals but relatively little on burnout in dentistry. This study aims to investigate the area of work-life and burnout among practicing dentists in dental hospitals.

Methods

This study used a cross-sectional analytic observational design. The study population comprised dentists with a minimum of one year's working experience, and a sample was gathered using consecutive sampling. In this study, 72 participants (dentists and dentist specialists) were from the Saraswati Dental and Oral Educational Hospital (RSGMP) in Denpasar. The study was carried out between April and May of 2022. Since the hospital had respondents with similar qualities of education, it was selected as the study site. To be eligible, respondents must have had at least one year of work experience as a qualified dentist at the hospital.

The survey was distributed to respondents via Google Forms, and the participation was voluntary and anonymous. Participants gave their informed consent to participate and were informed about the study's objectives and procedures.

Christina Maslach and Michael Leiter's Mind Garden website provided the survey, which employed the standard Maslach Burnout Inventory (MBI) and Area of Work Life Survey (AWS) questionnaires. The validity test of the MBI and AWS was conducted on thirty respondents at dental clinic X in Denpasar, using the Pearson Correlation Product moment score total of more than the correlation table 0.235. Also, the reliability test using Cronbach's Alpha gave a result of more than 0.6. Permission was obtained from Mind Garden, (Mind Garden Inc., Menlo Park, CA) to use an Indonesian version of MBI and AWS. Individual characteristics such as age, gender, education, employment status and years of service as a hospital dentist were also included. All statistical computations were carried out using SPSS 23 (IBM SPSS Statistics for Windows, Version 23.0. Armonk, NY) and Excel 2013 spreadsheets, where variables were displayed as sums and percentages, as well as averages and standard deviations. The Kolmogorov-Smirnov test was used to assess customarily distributed data. After the data had been distributed, the Rank Spearman Correlation was used to determine the relationship between the strength and direction variables. Furthermore, Multiple linear regression analysis was used to predict and investigate the impact of various parameters, (independent variables). In all calculations, the significance level was set at $p < 0.05$.

Results

Table 1 shows the demographic characteristics of the respondents. Age, employment status, the number of years employed, and education level are not all significant factors in burnout symptoms. The respondents were of age 51-60 (31.9%), 34.7% were male and 65.3% were female.

Most respondents (67 individuals, or 93.1%) had non-government employment status, with undergraduates and postgraduates amounting to 51 respondents (71%). Furthermore, there were 33 respondents (45.8%) with less than ten years of working experience.

Table 1: The demographic characteristics of the respondents

Demographic	N (%)
Gender	
Male	25 (34.7%)
Female	47 (65.3%)
Age group (years)	
21-30	18 (25%)
31-40	20 (27.8%)
41-50	9 (12.5%)
51-60	23 (31.9%)
>60	2 (2.8%)
Education	
Dentist certification	16 (22%)
Specialist/Master	51 (71%)
Consultant/Doctoral	5 (7%)
Employment Status	
Government	5 (6.9%)
Non-government	67 (93.1%)
Working experience	
<10 years	33 (45.8%)
11-20 years	14 (19.4%)
21-30 years	22 (30.6%)
>30 years	3 (4.2%)

The work-life factor statement had an average total score of 3.45. The numbers correspond to the compatibility or fitness categories (>3) in respondents with work-life factors of high workload 3.79 (>3.5); moderate control 3.49 (2.67-4.0); medium reward 3.62 (2.76-3.8); medium community 3.85 (2.81-4.0); medium fairness 3.25 (>3.33); and medium values 3.5 (2.78-3.375).

The responses from 72 dentists revealed that 22% claimed to experience moderate burnout and 76.4%, or 55 respondents experienced high burnout. Figure 1 depicts each burnout description. Only one respondent, or 1.4%, had low burnout, while 22.2%, or 16 respondents, experienced moderate burnout. The findings indicate that most respondents suffer emotional fatigue at least once a week (mean=4.19), depersonalization or cynicism at least several times a month (mean=3.6), diminished self-achievement at least once a week (mean=4.43), and burnout once a week on average (mean=4.15).

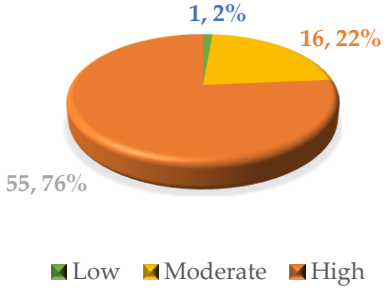

Figure 1: Emotional fatigue among subjects

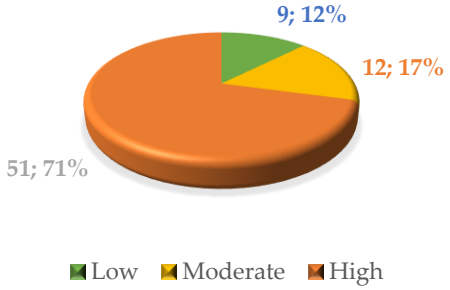

Figure 2: Depersonalization among subjects

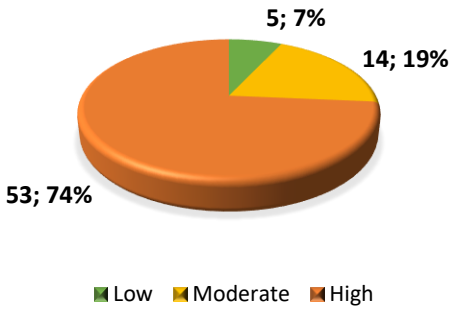

Figure 3: Personal accomplishment among subjects

The study also investigated the association between participants' work-related fatigue levels and elements such as workload, control, community, reward, fairness, and value. Table 2 demonstrated a robust association, particularly for the AWS control factors to burnout. Burnout worsens when the respondent's level of control, community, respect, fairness, values and workload increases.

Table 2: Areas of Work Life to Burnout

AWS	Burnout	
	r	p
Workload	0,636	<0.001
Control	0,949	<0.001
Rewards	-0,890	<0.001
Community	-0,941	<0.001
Fairness	-0,851	<0.001
Values	-0,820	<0.001

r = correlation coefficient; p = significance level.

A regression model was created using the Multiple Linear Regression Analysis Backward approach. The determination coefficient (R squared) was 0.91, indicating that the regression model can explain 91% of the variation in burnout symptom variables. It can also be deduced that the six independent variables of work-life area factors can account for 91% of the variation in the burnout parameter. P (sig) = 0.000 can be seen in the F-test results. This demonstrates that the 5% alpha of the regression model matches the existing data or that the variable can predict burnout significantly. The significance test revealed a substantial link between burnout and workload, rewards, community and values. The reward factor has the most significant impact on the emergence of burnout. An analysis of the results can be seen in Table 3.

Table 3: Regression analysis area of work life to burnout

Model 1	Unstandardized Coefficients		Standardized Coefficients		
	B	Std. Error	Beta	t	Significance
Constant	136.143	19.414	-	7.013	0.000
Workload	1.193	0.353	0.173	3.379	0.001
Control	0.695	0.524	0.124	1.326	0.189
Reward	-1.528	0.426	-0.276	-3.589	0.001
Community	-1.027	0.412	-0.209	-2.459	0.015
Fairness	-0.494	0.286	-0.108	-1.726	0.089
Values	-1.687	0.532	-0.200	-3.173	0.002

Model 2	Unstandardized Coefficients		Standardized Coefficients		
	B	Std. Error	Beta	t	Significance
Constant	158.918	9.109	-	17.446	0.000
Workload	1.117	0.350	0.162	3.189	0.002
Reward	-1.759	0.391	-0.317	-4.503	0.000
Community	-1.364	0.326	-0.278	-4.186	0.000
Fairness	-0.541	0.286	-0.118	-1.894	0.063
Values	-1.780	0.530	-0.211	-3.358	0.001

Discussion

Burnout in the medical profession is a problem that often occurs and requires in-depth examination. Burnout affects includes doctors and nurses and is also found in dentists and dental nurses. Risk factors for dentist burnout include work pressure, working time, anxiety, finances, complex patients and problems with colleagues and closest staff.[12,13]

Burnout in dentists causes physical and psychological damage[14,15,16] such as emotional exhaustion, anxiety, irritability, depression and decreased motivation and self-esteem. Furthermore, burnout also has negative impacts on physical health in the form of lower back pain, musculoskeletal issues, headaches and digestive disorders.[17,18,19]

The relationship between dentists and patients is regarded as one of the primary sources of stress and fatigue. Interaction among employees and the perception of a safe working environment contribute significantly to employee productivity. Long-term fatigue in the workplace will lead to high turnover, absenteeism, a lack of work dedication, and job dissatisfaction, all of which will influence organizational productivity.[20,13]

Most research on stress and burnout in health care has focused on physicians and nurses. Even fewer studies have been conducted on dentists in Indonesia than elsewhere. A low number of studies were conducted on dentist stress and associated causes, as well as dentistry student burnout. No research has been conducted on dentist burnout in Indonesia.[21,22,23] According to one study, non-specialist dentists are more likely to experience burnout than specialist dentists.[11]

The relationship between years of work and work life with burnout symptoms was discovered among dentists who had 5-10 years of practice. However, the prevalence of burnout dropped for practitioners with more than ten years of experience.[24] Practitioners may learn to manage work stress as they gain experience. Senior and younger doctors participated in the study, where the researchers found a substantial difference in emotional fatigue. After ten years of employment, senior doctors had higher emotional exhaustion.[25]

A working dentist with a practicing license can provide services in three locations. Several respondents performed several service activities, not just at one location. This is consistent with a study on burnout symptoms, which discovered that dentists who worked in many locations had a higher percentage of burnout symptoms (depersonalization) than dentists who exclusively operated in one location.[26,27]

Workload and job control are critical in improving the working environment. The improved working environment is indicated by a lower workload, which reduces fatigue and can also be related to increased work control. Someone who can regulate her/his work is thought to protect himself from workplace errors, yet the symptoms of burnout are severe. According to the study of health practitioners working in Italian hospitals, a high workload does not constitute a severe problem when workers have substantial involvement in making decisions. In order to reduce worker stress, a systemic review of stress management controls is essential.[28,29]

In this study, it was determined that rewards have the most significant impact on burnout. According to a study, there is a correlation between

appreciation, emotional exhaustion, and depersonalization.[5] The provision of rewards commensurate with work accomplishment is a measure that can be taken to reduce burnout.[30]

Community in the area of work life is defined as social support in the workplace and individual relationships. Conflict, support, intimacy and teamwork are workplace social interaction attributes that majorly impact work life. Ties between leaders and subordinates and relationships among coworkers can help workers feel a sense of belonging. This study's findings are consistent with the work environment study, which demonstrates the relevance of community points in supporting work life in hospitals.[31] Burnout can be efficiently managed by combining individual and organizational strategies, with engagement as a positive intervention objective.

Individual treatments such as stress management, cognitive-behavioral training, mindfulness-based stress reduction, meditation, rapid relaxation, recognition of daily stressors, narrative counseling and technology may be helpful in burnout management.[32]

Conclusions

According to this study, high emotional exhaustion was the most significant cause of burnout among dentists. Furthermore, job control is vital in forming a favorable treatment for burnout. This study shows that rewards are the primary influence on the probability of burnout. All areas of work-life characteristics, (workload, control, community, reward, fairness, and values) could predict burnout in dentists.

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Original Article

Covid-19 Prevention Practices And Associated Factors Among Workers in Yirgalem Agro-Industry Park, Sidama Regional State, Ethiopia: A Cross-Sectional Study

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ABSTRACT

Introduction: The COVID-19 outbreak resulted in millions of cases and deaths with an incredible pace of spread. It has been a global public health crisis since December 2019. Though the work behaviors of some organizations can facilitate more ways for the mode of transmission, the potential work areas for the risk of infection are not identified yet. Designing intervention strategies based on the risky assessment findings of a specific population or organization is better. The problem is more significant in developing countries. This study aimed to assess the prevention practices and associated factors of COVID-19 among workers in Yirgalem Agro-Industrial Park, Sidama Regional State; Ethiopia, 2020

Methods: Cross-sectional study was conducted from June 15th to August 15th, 2020. Yirgalem Agro-Industrial Park had 233 workers during the study period and data were collected from all of them. Collected data were entered into Epi Data 3.1 and exported to SPSS 22 for analysis. Factors associated with the practice of prevention were then analyzed.

Results: Among the respondents, 91.8%, 75.1%, and 48.9% had good knowledge, positive attitudes, and good practice toward COVID-19 prevention strategies respectively. Multivariate regression revealed that age, spiritual or sin, training, knowledge, attitude, opposition to wearing, ordinary residents, and hoping leaders can win against COVID-19 were predicted practices of COVID-19 prevention strategies

Conclusion: The practice of COVID-19 prevention strategies was so poor and needed adequate attention. Age, spiritual/sin as a cause, prior training, knowledge, attitude, opposing mask-wearing, and belief in whether to defeat COVID-19 or not were identified as the predictors. It is so important to revamp the current practices and assure the implementation of the standard as expected.

Keywords: Attitude, COVID-19, Ethiopia, Knowledge, Practice, Yirgalem agro-industry

Introduction

Coronaviruses are viruses of a large family that is known for resulting in illness ranging from the common cold to more severe disease like Middle East Respiratory Syndrome (MERS) and Severe Acute Respiratory Syndrome (SARS).[1,2] The most aggressive human coronavirus is the one that causes fatal lung disease, Severe Acute Respiratory Syndrome (SARS), and it is called SARS-CoV. World Health Organization called the current coronavirus "2019 nCoV" i.e. 2019 novel coronavirus or COVID-19. Globally, it resulted in more than three million attacks and closer to a million deaths within a short period with incredible spread. Its recent outbreak occurred in Wuhan,

China for the first time.[3]

According to the 2020 World Health Organization data, it is a global pandemic disease resulting in enormous public health impact and tremendous economic and social crisis which is generating stress throughout the population. Everybody in the population is susceptible to this disease. However, some factors increase susceptibility. Since there is no identified treatment yet, delaying transmission or reducing the risk of the outbreak is paramount important in decreasing its diversified impacts on different sectors. Various modes of prevention like wearing masks, hand hygiene practices, social (physical) distancing, case detection, contact tracing, and quarantines have been recommended to reduce its risk of transmission.[4]

During the first week of the COVID-19 pandemic attack, the prevention methods were misperceived in the USA. There was also, unawareness, not engaging in social distancing, and negligence in practicing protective behaviors.[5] This may be due to unawareness as finding from China evidenced peoples' knowledge, attitude, and practice towards COVID-19 positively affects adherence to control measures. In this region, most Chinese of high economic status especially women were knowledgeable about COVID-19, hold an optimistic attitude and have appropriate practices for its prevention.[6] Since its emerging time, the world has been striving to find a solution to tackling the infection. Nevertheless, all trials and efforts brought no solution for this pandemic infection to date. Though developed countries are found to be the unique victim of the problem, developing countries including Ethiopia are significantly vulnerable to the disease. The spread of the infection is escalating vigorously and COVID-19-related deaths have been reported in 52 African countries.[7]

The potential work areas for the spread of the infection are not clearly stated. On top of this, many things including the mode of transmission, the reservoir, and sources of infection remain unclear about Covid-19. Due to the gap in data, risk assessment of the infection is still vague.[8] Thus, this study aims to assess the risky behaviors of COVID-19 infection that will serve as input for the reduction of the infection in the organization, particularly in manufacturing companies.

The COVID-19 infection does have various modes of transmission. The work behaviors of some organizations can facilitate more ways for this mode of transmission. Thus, any prevention and intervention strategies shall base on these correspondent risky behaviors to bear effective results.

In Yirgalem Agro-Industry Park, different categories of people in terms of educational status, socio-economic differences, and cultural practices were involved in the job. The foreigners who might have traveled to their home country where there is a high epidemiologic distribution of the disease were also part of the workers in this industrial park. Besides, it is believed that behaviors (practices) like overcrowding in a certain place, transportation of many passengers in a single bus, daily traveling of workers with a possible risk of contact, and greeting practices like hugging each other and hand-shaking are common among the workers. Again, nothing is known concerning the knowledge, attitude, and practice towards the infection prevention of COVID-19 in the area.

This study aimed to assess the prevention practices and associated factors of COVID-19 among workers in Yirgalem Agro-Industrial Park, Sidama Regional State; Ethiopia. The finding of this study will also be inferred for a similar organization like other factories and an interventional project will be designed with Hawassa University and Yirgalem Hospital Medical College to tackle the spread of the infection. Other government and non-government organizations that are concerned with the subject matter can use the result of this study to design their intervention strategies. Moreover, as there is a significant gap concerning this disease, the study finding will serve as baseline information for the country as well as other parts of the world and other researchers interested in the related issues can use it as scientific literature.

Methods

An Institutional based Cross-sectional study was conducted in Yirgalem Agro-Industrial Park, southern Ethiopia to assess risky behavior for COVID-19 at the workplace. The Yirgalem Industrial Park is found in Abosto kebele, Dale

Woreda, Sidama Regional State; about 320 Kilometers far from the capital of Ethiopia. It had many sheds from which few of them engaged in active work. The functioning sheds were involved in producing juices and other manufacturing. The study period was from June 15th to August 15th, 2020. All workers of Yirgalem Agro-Industrial Park were taken as the source population and all active workers during the study period were the study population.

The data extraction tool was developed after reviewing various literature and WHO protocols that were developed for the assessment of potential risk factors for the 2019 novel coronavirus. The tool incorporated the Knowledge, attitude and practice questions. The consistency of the tool was checked by translating the tool to the local language and then back to English as well as through conducting a pretest on 5% of the sample size. The training was given on the objective of the project, how to approach participants, handle the information and keep confidentiality. Data collectors used personal protective equipment and kept recommended COVID-19 protocols during interviews. In this study, workplace behavior was measured as "risky" if industry park workers did not adhere to all covid-19 prevention protocols. Completeness and clarity of the collected data were assured daily by the supervisor.

The outcome variable was Covid-19 prevention Practice. Potential risk factors were selected based on different literature. Accordingly; suspected risk factors include Age, sex, mask utilization, place of residence, Religion, educational status, marital status, Droplet, smoking, isolation, crowd ness, Distancing, prickling nose/eyes, touching the mouth, workers health status, etc. The overall assessment was based on the primary data collected from the eligible participants involved in the study. The census method was used for data collection.

Yirgalem Agro-industrial Park had 233 workers during the study period which was an addressable population size

The collected data were cleaned, coded and entered into Epi data version 3.1. Then, it was exported to SPSS version 22 software packages for analysis. Any errors identified during analysis were corrected using the assigned code numbers. Presence of missing values and outliers were checked through descriptive analysis. The knowledge, attitude and practice score of the respondents were analyzed based on their respective questions. Then their score was analyzed as Good or adequate knowledge, poor or inadequate knowledge, Favorable/unfavorable attitude, and good or poor practices based on their average mean score. Factors associated with the practice of COVID-19 prevention were primarily analyzed using binary logistic regression and then variables with p-value <0.25 were analyzed in multivariable logistic regression analysis with a 95% confidence interval and finally p-value <0.05 was considered statistically significant. The odds ratios together with their corresponding 95% confidence intervals were interpreted accordingly

To ensure the quality of the data to be collected; a pretest was done on 5% (12 Industrial workers) before the actual study and followed by required modification. Supervision was done by the principal investigator during the whole process of data collection. Daily evaluation of the data for completeness was undertaken accordingly. Then, all the collected data were checked for completeness and consistency during the data management, storage and analysis.

Ethical clearance was received from the Institutional Review Board of Hawassa University, College of Medicine and Health Science. A consent format was distributed and informed consent was obtained from each respondent before data collection. The confidentiality of the study participants was not disclosed. All collected data were first coded and then locked in a separate room before undertaking data entry. No personal identifier was included in the data collection formats

Results

A total of 233 study populations participated; giving a response rate of 100%. The majorities 143 (61.4%) of the study participants were males and more than half (56.2%) of them were unmarried. The minimum and maximum ages of the study participants were 18 and 80 with a mean and standard deviation of 28.25 ± 7.4 years. More than

three fourth (81.5%) of the study participants live in Yirgalem town and the majority (55.8%) were followers of the protestant Religion. Other religions indicated in the table include apostles, Wakefata and Pagan. Around one-third (38.2%) of the study, participants had the educational status of attending college and above while few (4.7%) of them had no formal education. Primary, secondary and College and above level education in Ethiopia represents grades 1-8, Grades 9-10 and profession-specific education respectively (Table 1).

Table 1: Socio-demographic Characteristics of the respondents by Sex, age, marital status, Religion and Residents, Yirgalem, Sidama Region, Ethiopia 2020 (n = 233)

Characteristics		Frequency (%)
Sex	Male	143(61.4)
	Female	90(38.6)
Age	15-24	63(27)
	25-34	116(49.8)
	35-44	34(14.6)
	≥45	20(8.6)
Marital status	Unmarried	131(56.2)
	Married	102(43.8)
Religion	Protestant	130(55.8)
	Orthodox	51(21.9)
	Muslim	17(7.3)
	Catholic	14(6)
	Others	21(9)
Residence	Yirgalem	191(82)
	Hawassa	23(9.9)
	Other	19(8.2)
Education	No formal education	11(4.7)
	Primary education	61(26.2)
	Secondary education	72(30.9)
	College & above	89(38.2)

According to the finding of the knowledge assessment; almost all (91.8%) participants had good knowledge and about three fourth (72.5%) of the study participants did not know as children need to take measures to prevent COVID-19. The mean knowledge score of the participants was 20.23±1.46. More than 6% of the study participants did not consider crowdedness as one way of COVID-19 transmission (Table 2).

Table 2: Knowledge of the participants towards COVID-19 Prevention, Yirgalem, Sidama Region, Ethiopia, 2020 (n=233)

Characteristics		Frequency (%)
Spread via droplet	Yes	206(88.4)
	No	27(11.6)
Smokers are at risk	Yes	210(90.1)
	No	23(9.9)
Isolation is effective way	Yes	211(90.6)
	No	22(9.4)
Ordinary resident should wear mask	Yes	220(94.4)
	No	13(5.6)
Children not need to take measure	Yes	64(27.5)
	No	169 (72.5)
Individuals needs to void crowded place	Yes	218 (93.6)
	No	15(6.4)
Contacted person need to be isolated	Yes	222(95.3)
	No	11(4.7)
Washing hand is advised	Yes	222 (95.3)
	No	11(4.7)
Distancing	Yes	227(97.4)
	No	6(2.6)
Avoid prickling eyes, nose and touching the mouth	Yes	218(93.6)
	No	15(6.4)
All develop severe disease	Yes	161(69.1)
	No	72(30.9)

According to the findings of the attitude assessment; the majority (75.1%) of the study participants had a positive attitude on COVID-19 prevention strategies and about 24.5% of the study participants did not think that COVID-19 will be controlled. The mean attitude score of the study participants was 20.89±5.45. More than half (54.1%) of the respondents said that the cause of COVID-19 is sin while about half (42.9%) of the study respondents said that traditional medicine can cure this disease. More than one-third (52.8%) of the study participants said that the WHO can win the challenges of attitude (Table 3).

About half (48.9%) of the respondents were not practicing COVID-19 prevention strategies. For instance, 24.3% of the study participants were not wearing personal protective equipment while 39.9% of them occasionally wear their protective equipment. Only 29.6% and 31.3% of the study participants always use alcohol/water and soap after touching a man and a product respectively as per the recommendations. One-third (33%) of the study respondents always practice recommended hand hygiene and 25.5% of the study respondents use alcohol/water and soap before touching a man as per the recommendation (Table 4).

Table 3: Attitude of the participants towards COVID-19 Prevention, Yirgalem, Sidama Region, Ethiopia, 2020 (n=233)

Characteristics		Frequency (%)
Do you think COVID-19 will be controlled	Disagree	57(24.5)
	Neutral	29(12.4)
	Agree	147(63.1)
WHO@ can win	Disagree	82(35.2)
	Neutral	28(12)
	Agree	123(52.8)
The cause of COVID-19 is Sin	Disagree	77(33)
	Neutral	30(12.9)
	Agree	126(54.1)
You oppose wearing a mask	Disagree	58(24.9)
	Neutral	26(11.2)
	Agree	149(63.9)
Affected by COVID-19 information	Disagree	88(37.8)
	Neutral	27(11.6)
	Agree	118(50.6)
Traditional medicine cures COVID-19	Disagree	90(38.6)
	Neutral	43(18.5)
	Agree	100(42.9)

Table 4: Practice of the participants towards COVID-19 Prevention, Yirgalem, Sidama Region, Ethiopia, 2020 (n=233)

Characteristics	Rarely	Occasionally	Most of the time	Always as recommended
Practice recommended hand-hygiene	10 (4.3%)	25(10.7%)	121(51.9%)	77(33%)
Use alcohol/water & soap before touching a man	19 (8.2%)	65(27.9%)	90(38.6%)	59(25.3%)
Use alcohol/water & soap after touching a man	17(7.3%)	61(26.2%)	86(36.9%)	69(29.6%)
Use alcohol/water & soap after touching the product	24(10.3%)	61(26.2%)	75(32.2%)	73(31.3%)
Wear PPE	57(24.5%)	93(39.9%)	33(14.2%)	50(21.5%)

According to the findings of bivariate analysis sex, Age, Marital status, educational status, spiritual cause or sin, training, Good knowledge, positive attitude, Mask wearing, and Traditional Medicine as a cure were significantly associated with COVID-19 prevention practices. But, after running a multivariate analysis, Age, spiritual cause or sin, training, knowledge, attitude, mask-wearing, ordinary residents mask wearing and winning chance of COVID battle were remain significantly associated with the COVID-19 prevention practices at 95% confidence interval and p-value <0.05.

The odds of practicing COVID-19 prevention strategies among workers of age 45 years or more was about 7 times (AOR=6.86; 95% CI: 1.51-31.21) compared to workers aged 15 years to 24 years. There were 75% fewer odds of practicing COVID-19 prevention strategies among workers who agree that the cause of COVID-19 is spiritual or sin (AOR=0.25; 95% CI: 0.11-0.56) compare to Workers who disagree that the cause is spiritual or sin.

The odds of Practicing COVID-19 prevention strategies were 55% less among trained workers (AOR=0.45; 95% CI: 0.22-0.92) compared to the workers who hadn't taken COVID-19-related training. There were 97% fewer odds of practicing COVID-19 prevention strategies among workers who had poor knowledge (AOR=0.03, 95% CI: 0.01-0.27) compared to workers who had good knowledge. Similarly, there were 88% fewer odds of practicing COVID-19 prevention strategies among workers who had negative attitudes (AOR=0.12; 95% CI: 0.05-0.34) compared to industrial park workers who had a positive attitude toward COVID-19.

The odds of practicing COVID-19 prevention strategies among Industrial park workers who were neutral to opposing mask-wearing were reduced by 78% compared to workers who disagree to oppose mask-wearing (AOR=0.22; 95% CI: 0.06-0.85). There were 90% fewer odds of practicing COVID-19 prevention strategies among workers who said ordinary residents should wear masks compared to their counterparts (AOR=0.10; 95% CI: 0.01-0.79). The odds of practicing COVID-19 prevention strategies among workers who said leaders can win the COVID-19 battle was three times (AOR=3.03, 95% CI: 1.30-7.07) more compared to their counterparts (Table 5).

Table 5: Multivariate Logistic Regression analysis results for practicing COVID 19 prevention strategies, Yirgalem, Sidama Region, 2020 (n = 233)

Variables	Categories	Practice		Crude OR (95% CI)	Adjusted OR (95% CI)
		Good N (%)	Poor N (%)		
sex	Female	36(40)	54(60)	0.56(0.33-0.95)*	0.53(0.26-1.08)
	Male	78(54.5)	65(45.5)	1	1
Age	15-24	21(33.3)	42(66.7)	1	1
	25-34	60(51.7)	56(48.3)	2.14(1.13-4.06)*	2.07(0.86-4.98)
	35-44	20(58.8)	14(41.2)	2.86(1.21-6.76)*	2.19(0.69-6.91)
	≥45	13(65)	7(35)	3.71(1.29-10.69)*	6.86(1.51-31.21)*
Residence	Yirgalem	97(50.8)	92(49.2)	1	1
	Hawassa	11(47.8)	12(52.2)	0.89(0.37-2.11)	1.43 (0.45-4.53)
	Other	6(31.6)	13(68.4)	0.45(0.16-1.23)	0.51(0.44-1.79)
Marital status	Unmarried	55(42)	76(58)	0.53(0.32-0.89)*	0.62(0.30-1.28)
	Married	59(57.8)	43(42.2)	1	1
Educational status	No formal	5(45.5)	6(54.5)	0.59(0.17-2.09)	2.15(0.30-15.28)

	Below college	57(42.9)	76(57.1)	0.53(0.31-0.92)*	1.36(0.66-2.81)
	College/above	52(58.4)	37(41.6)	1	1
Caused by Spiritual or sin	Disagree	52(67.5)	25(32.5)	1	1
	Neutral	18(60)	12(40)	0.72(0.30-1.73)	0.85(0.27-2.67)
	Agree	44(34.9)	81(65.1)	0.26(0.14-0.47)***	0.25(0.11-0.56)**
Get Trained	Yes	66(55.9)	52(44.1)	1	1
	No	48(41.7)	67(58.3)	0.56(0.34-0.95)*	0.45(0.22-0.92)*
Knowledge	Poor	2(10.5)	17(89.5)	0.12(0.02-0.48)**	0.03(0.01-0.27)***
	Good	112(52.3)	102(47.7)	1	1
Attitude	Negative	17(29.3)	41(70.7)	0.33(0.18-0.63)**	0.12(0.05-0.34)***
	Positive	97(55.4)	78(44.6)	1	1
oppose mask wearing	Disagree	37(63.8)	21(36.2)	1	1
	Neutral	10(38.5)	16(61.5)	0.36(0.14-0.92)*	0.22(0.06-0.85)*
	Agree	67(45)	82(55)	0.46(0.25-0.87)*	0.42(0.17-1.01)
Residents should wear mask	Yes	105(47.7)	115(52.3)	0.41(0.12-1.36)	0.10(0.01-0.79)*
	No	9(69.2)	4(30.8)	1	1
Leaders can win COVID battle	Disagree	45(54.9)	37(45.1)	1.50(0.86-2.64)	3.03(1.30-7.07)*
	Neutral	14(50)	14(50)	1.24(0.54-2.81)	0.99(0.32-3.05)
	Agree	55(44.7)	68(55.3)	1	1
Isolation & Treatment Reduce spread	Yes	100(47.4)	111(52.6)	1	1
	No	14(63.6)	8(39.4)	1.94(1.78-4.82)	1.79(0.47-6.78)
Traditional medicine can cure COVID	Disagree	53(58.9)	37(41.1)	1	1
	Neutral	27(62.8)	16(37.2)	1.18(0.56-2.49)	2.49(0.86-7.20)
	Agree	34(34)	66(66)	0.36(0.20-0.65)*	0.58(0.27-1.25)

Discussion

An Institutional based cross-sectional study was conducted to examine the status of preventive practices and associated factors at Yirgalem Agro-Industrial Park. According to the findings of this study, 91.8% of the study participants had good knowledge, 75.1% had a positive attitude, and about half (48.9%) of them had good preventive practices for the prevention of COVID-19. Having good knowledge (91.8%) was higher than the studies conducted in Jimma University Medical Center (41.3%), Amhara region (70%), Gondar 82.8%, Uganda (82.4%), China (89%), and Pakistan (90.7%) (41.3%).[6,9-13] The reason behind the variations might be the time difference at which those studies were conducted. The studies in Jimma, Gondar, and Amhara were conducted in the early stage of the pandemic, thus, the awareness of the disease had not this much disseminated in the early stage. The study in Pakistan was almost similar and its study time could also justify it. The finding was lower than the study conducted in Pakistan 93.2% and Nigeria 99.5%.[14,15] The possible reasons for this variation might be due to changes in the study period, settings, population, and data collection mechanism. The major stated COVID-19 prevention strategies by the study participants were distancing, isolation of suspected individuals, wearing a mask, hand washing, and avoiding touching the nose/mouth before washing hands which was consistent with the recommended strategies for COVID-19 prevention.[4,5] This could be taken as the existence of better awareness of COVID-19 prevention strategies among the Industry park workers. Majorities (88.4%) of the participants stated as COVID-19 spreads through respiratory droplets which was almost in line with findings

from Jimma University medical center (95.1%).[9] The report that indicated all individuals infected by novel coronavirus can develop the severe disease (69.1%) was supportive of the findings from Bangladesh where young children can even develop the complication to the extent of getting died of it.[16]

The proportion of people believing that the COVID-19 pandemic will be controlled at the end (63.1%) was slightly higher compared with the proportion of people believing the same in the Bangladesh Study (41.7%).[16] Changes in the study period, settings, and variations in study participants might be the justification for the differences. More than three fourth (75.1%) of the study participants had a positive attitude towards COVID 19 which was almost in line with the study conducted in Pakistan (82.16%), (90%), but it was lower than the study finding in Ethiopia (94.7%).[10,14,17] The justification for this variation might be due to the study population and setting. A study from Nigeria reported as a significant number of the participants (25.06%) had shown poor attitudes toward COVID-19.[18] However, the majority of the respondents in this study had a positive attitude toward the COVID-19 pandemic and this is higher than those having a moderate attitude in Iran.[19] Unlike the current study, Study in Nigeria was conducted in the early stage of the Pandemic when lack of awareness may be the reason for having a poor attitude. In addition, the reason for the variation from a study in Iran may be the category of attitude classification which was in the Likert scale while this study only dichotomized the Attitude, thus, the percentage distribution may be less when the class of the category is increased Attitude, thus, the percentage distribution may be less when the class of the category is increased.

There were differences in proportion between practices of COVID-19 prevention strategies in this study (48.9%) and findings from Northern Ethiopia, and Addis Ababa where 62%, 67%, and 49% of the respondents had good practice of prevention strategies respectively.[11,20,21] The reason for the difference can be the variation in profession that the study in Amhara was conducted on health professionals who have direct professional linkage with that issue and this may support them to have relatively better practices. On the other hand, respondents in Addis Ababa were an urban population that might have good access to information and technology. Late nationwide training on COVID-19 prevention strategies following its spread could be considered as the reason for almost closer proportion with the findings of Addis Ababa.

Practicing COVID-19 prevention strategies was significantly associated with age, belief in the spiritual cause, prior training, knowledge, attitude, Opposing mask-wearing, and belief in defeating COVID-19. The odds of practicing COVID-19 prevention strategies among workers of age 45 years or more was about 7 times compared to workers aged 15 years to 24 years (AOR=6.86; 95% CI: 1.51-31.21). This finding was consistent with the study conducted in Northwestern Ethiopia and Uganda.[12, 13] This might be since chronic medical illness increases with age and the existence of those chronic illnesses increase the severity of COVID-19. Adherence to COVID-19 prevention strategies might be due to the fear related to this fact.

There were 75% fewer odds of practicing COVID-19 prevention strategies among workers who agree that the cause of COVID-19 is spiritual or sin (AOR=0.25; 95% CI: 0.11-0.56) compare to Industrial workers who disagree that the cause is spiritual or sin. COVID-19 is zoonotic and tends to be transmitted between animals to humans and humans to humans through droplets, close contact, or other means, and as stated those study participants who didn't know this reality was not practicing COVID-19 prevention strategies.[17]

The odds of Practicing COVID-19 prevention strategies were 55% less among untrained Industrial park workers (AOR=0.45; 95% CI: 0.22-0.92) compared to the workers who took COVID-19-related training. This finding was consistent with the finding of a study conducted in Zambia.[22] It is also logical to believe that having prior COVID-19 training increases workers' awareness and is basic for practicing COVID-19 prevention strategies. There were 97% fewer odds of practicing COVID-19 prevention strategies among workers who had poor knowledge (AOR=0.03, 95% CI: 0.01-0.27) compared

to workers who had good knowledge. This study finding was in line with the study conducted in northern Ethiopia.[13] This might be since getting awareness or knowledge on COVID-19 prevention strategies precedes the practice of COVID-19 prevention strategies.

The attitude of a human being is the result of his or her judgment towards something.[23] The majority of people who judged something as positively could practice the event better and the reverse is true for the majority of people who judged something negatively.[24] Our study supported such facts and reported that the odds of practicing COVID-19 prevention strategies among workers who had negative attitudes were 88% less compared to industrial park workers who had a positive attitude toward COVID-19. This finding was consistent with various studies conducted in Ethiopia, Egypt, China, and Saudi Arabia and all studies revealed that favorable attitudes towards COVID-19 preventive measures were significantly associated with good adherence to COVID-19 mitigation measures.[20,25-27]

The odds of practicing COVID-19 prevention strategies among Industrial park workers who were neutral to opposing mask-wearing were reduced by 78% compared to workers who disagree to oppose mask-wearing (AOR=0.22; 95% CI: 0.06-0.85). This might be due to the reason that mask-wearing is among the first line of COVID-19 prevention strategies and being neutral for mask-wearing means that those industrial workers had less likely to implement or practice other COVID-19 prevention strategies. There were 90% fewer odds of practicing COVID-19 prevention strategies among workers who said ordinary residents should wear masks compared to their counterparts (AOR=0.10; 95% CI: 0.01-0.79). This indicates the awareness gap among the respondents because ordinary people are expected to have less risk of exposure compared to those people around risk-prone areas. The odds of practicing COVID-19 prevention strategies among workers who said leaders can win the COVID-19 battle was three times (AOR=3.03, 95% CI: 1.30-7.07) more compare to their counterparts. This indicates that the hope in world leaders and technology motivated those people to adequately practice COVID-19 Prevention Strategies.

Limitations of the Study

This study has its limitation. Generalization of the study findings to other Agro-industrial workers in the country is impossible since this study was conducted only in one institution (i.e. Yirgalem Agro-Industrial Park). Some degree of selection bias may not be ruled out since the participation was voluntary and the chance of participating is high among those who had a better understanding or attitude towards the practice of COVID-19 prevention strategies. This could lead to an overestimation of the practice.

As this is an institutional-based cross-sectional study, the limitations that come up with this type of study design need to be taken into consideration in interpreting the results/findings.

Conclusions

According to the findings of this study, 91.8% of the study participants had good knowledge, 75.1% had a positive attitude and about half of them (48.9%) had good preventive practices for the prevention of COVID-19. Practicing COVID-19 prevention strategies was significantly associated with age, belief in spiritual/sin as a cause, prior training, knowledge, attitude, Opposing mask wearing and belief in whether to defeat COVID-19 or not. The top management of the Yirgalem Agro Industry is better to conduct awareness creation/intensive training activities on COVID-19 prevention strategies and then enforce policies for effective implementation.

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Original Article

Gender-Based Violence Against Female Sex Workers in Nigeria, How Helpful Are Grassroots Interventions?

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ABSTRACT

Introduction: Gender-based violence (GBV) against female sex workers (FSWs) increases their risk of unwanted pregnancies, abortion, HIV, and other sexually transmitted infections (STIs). Hence, this study aims to assess the impacts of grassroots interventions on GBV against FSW in Benue State, Nigeria.

Methods: The study is a cross-sectional baseline-post-intervention survey using a randomized cluster sampling technique. It was carried out in six local governments of the State using structured questionnaires to collect data from the respondents. Data were analyzed using IBM Statistical Package for the Social Science (SPSS) version 25.0.

Results: This study comprised 446 FSWs with 223 from each baseline and intervention survey. The prevalence of GBV was 48.0% in the baseline and 59.2% in the intervention (P<0.001). The most common GBV were being beaten/battered/kicked (26.0%) in the baseline and 30.9% in the intervention (P>0.05). Paying partners (65.6%), the police (53.0%), and vigilantes (30.3%) were the top perpetrators of GBV in the post-intervention study, higher than 41.3%, 17.5%, and 3.9% in the baseline (P<0.001). Access to health care services after GBV was 43.0% in the baseline and 72.7% in the intervention (P<0.001). Only 24.2% of post-intervention respondents would keep cases of GBV to themselves instead of reporting them to appropriate authorities, compared to 53.3% in baseline (P<0.001).

Conclusion: The study recorded higher reports of GBV among the FSWs after the intervention than at the baseline, in which most cases of GBV were underreported. The increased ability to report cases among FSWs after intervention helped to improve the boldness of the victims in reporting the GBV.

Keywords: Gender-based violence, Female sex workers, Interventions, Rape

Introduction

The use of violence by men is a common occurrence in sexual relationships in most sub-Saharan African societies, particularly with female sex workers (FSWs).[1,2] Gender-based violence against FSWs has been a persistent problem in this part of the world. Violence toward FSWs has resulted in physical, sexual and mental damage, contributing to discrimination in accessing health care, insecurity and other health risks.[3] The most common attacks on FSWs are beating, rape and social injustice, which in turn leads to physical injury, trauma and inaccessibility to sexual and

reproductive health (SRH) services and basic human rights, respectively.[4]

FSWs in Nigeria often face violence and harassment, increasing their risk of HIV infection and sexually transmitted infections (STIs).[2] Those with lower educational status are at higher risk of HIV.[2] FSWs suffer economic, physical, sexual and psychological violence from clients, brothel managers, and police.[5–7] Consequently, FSWs continue to be exploited by pimps. Most have been unable to establish a working relationship with hotel and brothel owners to gain a better working environment or obtain their workers' rights.[6] Besides, most of those who indulge in the daily experience of prostitution continue to face violence, stigma and discrimination.[7] Thus, the sex workers' situation remains fragile. Investing in their well-being and care appears difficult, and their sexual and reproductive health needs have been widely neglected.

Restricted access to contraception for FSWs, challenges negotiating condom usage, and exposure to gender-based violence (GBV) often result in an unplanned pregnancy,[8] making access to safe abortion and post-abortion treatment an urgent sexual and reproductive health need. If abortion is banned, it is possible to use illegal care providers, raising the risk of death and long-term health problems.

While there is very little knowledge on the gender-based violence faced by FSWs, a study to understand the incidence and causes of violence against FSWs in Abuja, Nigeria, indicates that 52.5 percent of FSWs had encountered violence in the six months preceding the study.[9] The study further revealed that 63.8% of the sexual violence reported was committed by their clients, which was the most prevalent.

With support from the Kingdom of the Netherlands, HAI is implementing a two-year initiative in Nigeria called "Sexual and Reproductive Rights for All (SARRA)." Which are inclusive, intersectional human rights and movement-building interventions with reproductive health knowledge and resources to cover eight thousand relegated women and girls.[10] The grassroots intervention programs are supported in Nigeria by Heartland Alliance International (HAI) in collaboration with the Kingdom of the Netherlands. This project empowers vulnerable women, regardless of social status, sexual orientation and gender identity, to secure their sexual and reproductive health and rights (SRHR). The goal of Heartland Alliance International is to ensure the protection of individuals whose rights are violated and to encourage them to participate actively in their communities and foster social change. Heartland Alliance International supports progressive, creative approaches to defending human rights and gender equality in all programmes.[10] Since the project's inception, about 500 formerly disadvantaged women and girls in the states of Benue and Lagos have voluntarily begun using family planning options, safeguarding them from unwanted pregnancies and the challenges that come with them, as well as societal shame and stigma. Some program graduates have reported increasing their knowledge of human rights violations such as Gender-Based Violence and other forms of injustice that they had previously neglected. Sexual and Reproductive Rights for All (SARRA) has organized support group sessions for survivors of sexual and intimate partner abuse so that they may feel safe discussing their sexual, reproductive, mental, and emotional health with people they know and trust. Finally, a significant number of victims are coming forward due to their increasing participation in public health services, health-seeking behavior and narrative have gained confidence and agency. This study will address the GBV against FSWs in Benue state Nigeria before and after grassroots interventions.

Methods

This is a cross-sectional quantitative study that evaluates gender-based violence among FSWs in Benue State, both before grassroots interventions and after the interventions, using a randomized cluster sampling technique, the clusters chosen were brothels in the six LGA of the states, random number generation was used to randomly select some brothels for the study. From the selected clusters the sample size within the brothels was

determined and participants (FSWs) were randomly selected from each cluster (brothel). All FSWs who gave informed consent when the interviewers visited their sites were included in the study.

The study was carried out in six local government areas (LGAs), including Makurdi, Gboko, Ukum, Katsina-Ala, Konshisha, and Buruku in the Benue State, Nigeria. The study population comprised FSWs in the six LGAs selected. These were selected because they are a good representative of FSWs in Benue state since the six LGAs have a high concentration of FSWs from various parts of the country.

The sample size was calculated based on the 15,000 estimated population of female sex workers in the State. A 7% marginal error was used, and Alpha α was taken as P=0.05 at 95% confidence. Using the formula

$$\text{Sample size n} = N \frac{\frac{Z^2 x\ P\ (1-P)}{e^2}}{N-1+\frac{Z^2 x\ P\ (1-P)}{e^2}} \qquad 11$$

N= 15000 – population of FSWs in Benue State, Z^2 = 1.96 at 95% confidence interval, a response proportion (P) of 50% was used and this is = 0.5, 1-P = 1-0.5 = 0.5, and e = marginal error = 7% = 0.07. The sample size N was calculated as 446, comprising 223 participants at baseline and 223 at post-intervention surveys. The sample size was grouped because the study is a randomized controlled trial with a continuous outcome measure.

All FSWs 15 years old or above who were willing to be part of the study were included. Non-female sex workers, FSWs younger than 15 years old, and those unwilling to participate in the study were excluded. FSWs younger than 15 years old were excluded because they are very scarce to find compared to other age groups and can affect the overall outcome of the study.

Ethical approval was obtained from the National Health Research Ethics Committee of Nigeria (NHREC) with approval number NHREC Protocol Number NHREC/01/01/2007-08/03/2019. Approval was also obtained from Heartland Alliance International to use its baseline data, based on past experiences of violence experienced by FSWs. The data collected from the participants were kept private and only used for the analysis. The research protocol was explained to each respondent, and informed consent was obtained before conducting the questionnaire. There is no set of data that can be used to identify the respondents.

A structured questionnaire with questions on socio-demographic characteristics, sexual lifestyle, knowledge of sexual health and rights issues and sources of information, health-seeking behavior, observations on the attitude of service providers in both the private and public sectors, questions on sexual choices and practices for female sex workers, and drug-use habits for female drug users was developed. There were also questions about mental health and whether the intervention program could reduce their stress level and preferences for different types of sexual and reproductive health and rights services. The questionnaire used in this study was adapted from a programming tool developed by Heartland Alliance Nigeria, which has been previously validated and used in similar research studies. The original tool was developed based on established theories and concepts in the field of sexual and reproductive health and rights, as well as the experiences and perspectives of individuals and communities affected by these issues. Additionally, the instrument has been piloted and validated by Heartland Alliance, Nigeria, to ensure its reliability and validity in the context of our research objectives and target population. The questionnaire was written in English and translated to the local dialect, after which it was cross-checked to assure context. Research assistants were employed to administer questionnaires after training for two days. The questionnaire was pre-tested in the Federal Capital Territory (FCT), Abuja and corrections and observations were dully addressed before data collection.

The data collected were cleaned and analyzed using IBM-Statistical Package for Social Sciences (IBM-SPSS) version 25.0 for Windows *IBM* Corp., Armonk, N.Y., USA. Descriptive statistics were performed, the association between categorical

variables was established using the Chi-square analysis, and the statistical significance level was set as $P<0.05$.

Results

This study comprised 446 FSWs, of which 223 (50.0%) were interviewed at the baseline study (before intervention) in 2018 and another 223 (50.0%) in 2020 after two years of Sexual and Reproductive Rights for All (SARRA) intervention programs. Two years were selected for the interventional assessment period because SARRA programs last for this time. The minimum age of all respondents was 15 years and a maximum of 45 years for baseline and 49 years for intervention, respectively. The mean age was 26.6 ± 6.30 years. Slightly above half (53.6%) of all respondents had experienced Gender-Based Violence, as shown in Table 1. Forty-eight percent (48.0%) of respondents in the baseline had experienced Gender-Based Violence compared to 59.2% of their colleagues in the intervention. About one-quarter (26.0%) of the participants in the baseline experienced being beaten/battered/kicked as the most prevalent Gender-Based Violence compared to 30.9% of respondents in the intervention. However, 8.1% of the baseline experienced rape as the least prevalent Gender-Based Violence compared to 15.2 % of respondents in the intervention (Table 1).

Table 1: Prevalence of Gender-Based Violence Among FSWs at Baseline and Intervention

		Baseline	Intervention	Total	X^2	P-value
Have experienced GBV	Yes	107 (48.0)	132 (59.2)	239 (53.6)	12.535	<0.001*
Kind of GBV (n_r = 446)	Beaten/battered/ kicked	58 (26.0)	64 (28.7)	122 (27.4)	0.406	0.524
	Verbal abuse/ insulted	60 (26.9)	69 (30.9)	129 (28.9)	0.883	0.347
	Unwanted touch	20 (9.0)	54 (24.2)	74 (16.6)	18.729	<0.001*
	Rape	18 (8.1)	34 (15.2)	52 (11.7)	5.573	0.018*
	Arrest/raid	24 (10.8)	59 (26.5)	83 (18.6)	18.134	<0.001*
	Exploitation	17 (7.6)	43 (19.3)	60 (13.5)	13.018	<0.001*
Perpetrator (n_r = 235)	Paying partner(s)	43 (41.3)	86 (65.6)	129 (54.9)	13.829	<0.001*
	Non-Paying partner(s)	15 (14.6)	20 (15.2)	35 (14.9)	0.016	0.900
	Bunk/Brothel mate(s)	15 (14.6)	5 (3.8)	20 (8.5)	8.627	0.003*
	Bunk/Brothel manager	8 (7.8)	10 (7.6)	18 (7.7)	0.003	0.956
	Police	18 (17.5)	70 (53.0)	88 (37.4)	31.223	<0.001*
	Vigilante	4 (3.9)	40 (30.3)	44 (18.7)	26.536	<0.001*

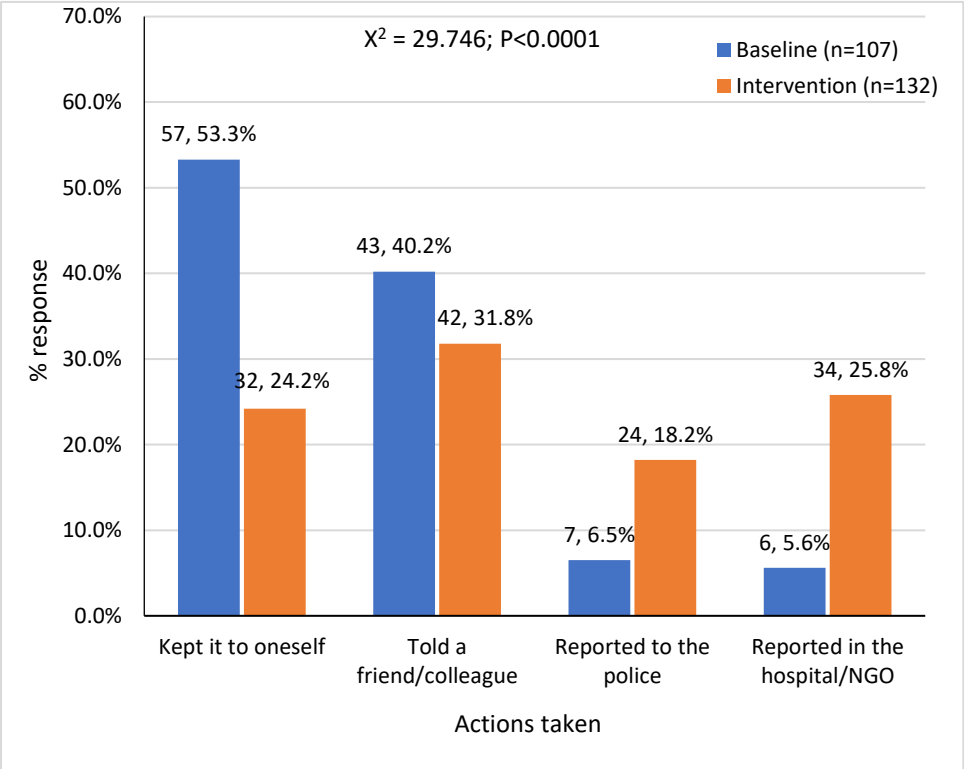
As shown in Table 1, about half (54.9%) of all the participants have experienced Gender-Based Violence through their paying partners as major perpetrators. Paying partners (65.6%), the police (53.0%), and vigilantes (30.3%) were the top perpetrators of Gender-Based Violence against FSWs, as found in the post-intervention study. These values are higher than what was obtained in the baseline 41.3% for paying partners, 17.5% for police and 3.9% for vigilantes

About 2 of 5 (43.0%) respondents in the baseline had access to care after experiencing GBV, in contrast to 72.7% of respondents in the intervention ($P<0.001$). About 20.6% of the respondents in the baseline were given post-exposure prophylaxis, which is slightly lower compared to 28.8% of their counterparts in the intervention, as shown in Table 2.

Table 2: Access to Care After Experiencing Gender-Based Violence

	Baseline (n=107)	Intervention (n = 132)	Total (n=239)	X^2	P-value
Able to receive the needed care	46 (43)	96 (72.7)	142 (59.4)	30.613	<0.001*
Given post-exposure prophylaxis	22 (20.6)	38 (28.8)	60 (25.1)	7.428	0.006*

Figure 1 shows various actions taken by respondents on gender-based violence. About half (53.3%) of respondents in the baseline prefer to keep the abuse to themselves compared to about one-quarter (24.2%) in the intervention. However, only about 1 of 20 (5.6%) respondents in the baseline reported in the hospital/NGO compared to about 1 out of 4 respondents (25.8%) in the intervention.



n_r = number of responses; * significant at P-value <0.05.

Figure 1: Actions taken by respondents about GBV

Discussion

This study found that more respondents in the post-intervention study had experienced gender-based violence than the participants at the baseline. The higher rate of gender-based violence against FSWs recorded in the intervention study might be because of the ability to speak out, which might have been gained through Sexual and Reproductive Rights for All (SARRA) programs. When FSWs know where to seek redress or reliable assistance, they will be willing and able to report cases of gender-based violence than when there are no reliable places to go.[12,13] In the case of the FSWs, sometimes, the perpetrators are even the law enforcement agents, which might be why the number of those who reported gender-based violence in the baseline study was lower than after post-interventions. The common gender-based violence against FSWs found in this study includes being beaten/battered/kicked, raped, verbal abuse, unwanted touch, arrest/raid, and exploitation. Studies have reported a high rate of gender-based violence among FSWs.[4] Seib (2007) in a study conducted in the Queensland sex

industry, reported that within 12 months, 35% of FSWs reported that someone had attempted to forcefully have sex with them, while 31% were forced to have sex.

Paying partners were the top perpetrators of gender-based violence against FSWs in both the baseline and intervention studies. However, a very high proportion of the respondents in the intervention study mentioned the police and vigilantes as the major perpetrators of gender-based violence after paying partners. These findings show that more of the FSWs were able to speak out as a result of the interventions. A similar study conducted in Abuja, Nigeria, to determine the rate of violence against FSWs also reported that more than half of the FSWs experienced gender-based violence within six months; sexual violence was the most common type, while other forms of violence include physical and psychological violence.[9] Similar to this study, they also reported that the main perpetrators of gender-based violence have clients, brothel staff, and policemen.[14]

Studies have shown that violence against FSWs is very common worldwide.[7,9,12,15–17] studies from Pakistan,[18] India,[19] and Kenya [20] revealed that FSWs workers experienced verbal abuse, stoning, and physical and sexual violence, mainly from religious leaders, clients, and the police, and intimate and non-paying partners. Studies have also shown that in cases where there are no interventions, they are not brave enough to speak out, and most violence against FSWs often goes unreported,[9] which buttresses the fact that more cases of gender-based violence were reported in the post-intervention study due to the interventions, unlike the baseline.

More than twice the number of FSWs who accessed care at the baseline study doubled after the interventions. Although this study assesses the impacts of intervention, considering FSWs' perspectives, the interventions were not limited to the FSWs alone. Still, they were also extended to all health facilities and health workers in the State. The fact that only a few baseline FSWs had access to care or sexual and reproductive health services compared to post-intervention study participants could be attributed to, first and foremost, increased knowledge of sexual and reproductive health and awareness of where to receive care, provision and accessibility of sexual and reproductive health services as a result of interventions that reached all FSWs in Benue State. Secondly, intervention programs in health facilities and healthcare providers improved support for FSWs' right to sexual and reproductive services.

This study revealed that most baseline study participants would rather keep the experience of gender-based violence to themselves or only tell their friends/colleagues. In contrast, most intervention study participants reported to the NGOs or the police in addition to informing their friends. This shows a great impact of the intervention programs as more FSWs in the intervention study knew the appropriate steps to take and had more confidence to talk about their experiences rather than remaining numb, as seen in the baseline. Sexual and Reproductive Rights for All grassroots intervention aims to improve the FSWs' awareness of their right and access to sexual and reproductive health, improve self-esteem, and build their confidence in the system enough to direct them to the appropriate channels for assistance. Previous studies have reported that FSWs (without sexual and reproductive health interventions) cannot often speak out when they experience gender-based violence or molestation due to penalization of sex work, criminalization, and stigmatization against sex workers, depriving them of their rights to sexual and reproductive health services. [21–24]

Conclusions

The study recorded higher reports of gender-based violence among the FSWs after the intervention than at the baseline, in which most cases of gender-based violence were underreported. The increased ability to report cases among FSWs after intervention helped improve the boldness of the victims of gender-based violence More grassroots interventions are necessary to reduce discrimination, stigmatization

and violence against female sex workers in the community.

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Original Article

Heat Stress Vulnerability among Small-Scale Factory Workers and Adaptive Strategies in Ahmedabad: A Cross-Sectional Study

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ABSTRACT

Introduction: Global warming is likely to affect certain groups such as workers in heat-producing industries. With limited research exploring such an important area, this study aimed to explore the heat stress vulnerability and adaptive strategies of indoor small-scale factory workers.

Methods: This was a cross-sectional study and a mixed-method approach was used. The study setting was small-scale factory units. The quantitative component included environmental and biological monitoring from six units of steel rolling mills and foundry in the summer and winter seasons. The study was conducted during the period of November-2018 and May 2019. Heat stress was measured among workers using a portable Wet Bulb Globe Temperature (WBGT) meter. The physiological parameters of workers were also measured. The qualitative component included in-depth interviews of workers and supervisors from eleven units.

Results: The maximum temperatures recorded at steel rolling mills and foundry crossed Occupational Safety and Health Administration (OSHA) threshold (27.5℃) in summer as well as winter. The mean WBGT at the steel rolling mill recorded 31.5℃. The physiological measurements of workers also crossed the threshold level for heart rate and oral temperature in steel rolling and foundry units. The units had mechanisms to dissipate heat but lack a temperature monitoring mechanism inside the units. The workers wore lighter or fewer clothes as an adaptive measure but uncomfortable PPEs in foundry units were avoided.

Conclusion: Heat stress in small-scale industry units was found high and there is a high need to develop specific strategies for such vulnerably high heat-exposed groups.

Keywords: Foundry, Heat Stress, OSHA, Steel rolling mill, Wet Bulb Globe Temperature (WBGT)

Introduction

Global climate change has been one of the greatest challenges in the world in this century and much of this is anthropogenic. Human modifications of the environment have increased greenhouse gases and are a major process fueling global warming which is a key component of global climate change. The world is already witnessing record-breaking temperatures across several geographies and the heat waves have become frequent events in many regions. The Intergovernmental Panel on Climate Change 5th Assessment report also indicates an increase in frequency, length and intensity of heatwaves over most land areas in the future. [1,2]

The effects of global climate change on humans can be devastating. During the past two decades, the number of people exposed to heat waves has

increased dramatically and consequently, heat-related health events and hazards have also increased.[3,4] The workplaces especially those of high heat-inducing nature (steel rolling mill, foundry) can compound risks posed by heat stress and the potential consequences of heat stress on workers are substantial.[5] Occupational heat stress risk is projected to become particularly high in middle and low-income tropical and subtropical regions.[6]

India is prone to climate and weather-sensitive health events and heat-related illnesses significant problems in India.[7] The study on analysis of summer temperature, frequency, severity, and duration of heatwaves and heat-related mortality between 1960 and 2009 showed that mean temperature across India has risen more than 0.5℃ over that period with the increase in heatwaves and increase of probability of heat-related mortality in India by 146%.[8,9] The western region of India is most susceptible to heatwaves and showed rising mortality due to extreme heatwaves in the months of summer over the years The changing trend in heat-related mortality was also observed across several years -1972, 1988, 1998 and 2003 in which there were more than 10 heat waves days on average across India, with a corresponding surge in heat-related mass mortality of between 650 and 1500 people.[10] However, the impacts of such heat stress on occupational safety and health remain understudied.[5,11]

Occupational heat stress is the net load to which a worker is exposed from the combined contributions of metabolic heat, environmental factors, and clothing which results in an increase in heat storage in the body.[12] Therefore, Occupational heat stress in industries especially those that have high heat-inducing nature of the environment is critical to understand as workers who are working in such an environment are vulnerable to heat stress and the economic burden is substantial.[13] In India, despite widespread recognition of this problem, a limited attempt has been made to estimate health impacts related to occupational heat stress. This has been reflected in the least control over reducing heat exposure at the workplace.[14] Heat stress due to climate change can compound heat exposures at the workplace, especially in vulnerable occupational settings.

In India, several small-scale industries produce heat and can be particularly vulnerable during the summer months. However, these industries operate in resource-constrained settings with minimal resources for occupational safety and health. Studies on the effects of heat stress on the workers working in these small-scale industries are limited and warrant more evidence.[15] This paper empirically measures the exposure to heat stress among the workers in a foundry, steel rolling mill units in the city of Ahmedabad, one of the metropolises badly affected by heat waves in the past decade[10]. Therefore, the objective of the study was to explore the heat stress vulnerability of indoor small-scale factory workers of foundry and steel rolling units and their adaptive strategies in Ahmedabad.

Methods

Ahmedabad, a city with more than 5 million residents is prone to extreme weather from heat waves (45℃) in summer and cold waves (8℃) in winter. Heatwaves are very common, and the night temperature also remains high during the heat waves. With more than 250,000 workers in about 65,000 small-scale industrial units, Ahmedabad is a busy manufacturing hub. Foundry, steel rolling and ceramic are the most common types of small-scale industries which usually employ 5 to 50 workers. The study adopted a mixed methods design.

The qualitative component of the study included in-depth interviews of workers and managers of small-scale industries which explored the vulnerabilities faced by workers and adaptive strategies employed by them. For this qualitative component, a purposive sampling technique was employed. A total of 30 workers and 7 supervisors from 11 units of steel rolling mill and foundry were purposively selected for in-depth interviews to provide insights into heat stress and adaptive strategies.

All the units sampled in our study were visited and physical observation of the nature of the

working environment, working and living conditions of workers was conducted. In addition, areas covered by units for production, space for working, ventilation mechanism of units, and other factory-level facilities and measures for heat coping mechanisms were also observed. The workers' practices and behavior for heat coping and use of protective equipment (like gloves, shoes, and protective goggles) were also captured in observation.

The quantitative component included ambient temperature measurement of sample units and vital physiological parameters of the workers. For the assessment of ambient heat inside small-scale units, six units (three units each of the foundry and steel rolling mill) were selected. The reasons for selecting a smaller number of units for quantitative components than qualitative components include challenges in getting approval by the concerned authority for ambient temperature measurement inside units during that period as well as not feasible to cover more units during that limited period. The ambient heat of these units was measured using a portable heat stress WBGT meter. The measurements included the Globe Temperature (Tg), Air Temperature (Ta) and Relative Humidity (RH) and the combined index as the Wet Bulb Globe Temperature. The measurements were recorded in all six units between 2 PM and 6 PM and at regular intervals during those working hours. To understand the effect of heat waves on the same, the readings were done in two seasons; once in May (Summer) and once in December (Winter) months. The Foundry units had two dedicated areas and hence the measurements were done in both these areas separately.

The physiological measurement of 30 workers (16 workers in a steel rolling mill and 14 workers in a foundry) were taken. The smaller sample size for quantitative components is due to resource constraints, organizational level barriers such as approval to conduct the study at those small-scale units as well as a smaller number of workers available in the units of steel rolling mill and foundry during the summer months largely due to migration to hometown. The physiological parameters of workers are also measured between 2 PM and 6 PM while they are actively involved in work which included heart rate using a pulse oximeter, skin temperature using an infrared thermometer, and oral temperature using a digital thermometer.

The study approval was taken from the Institutional Review Board of Tata Institute of Social Sciences (TISS) by giving undertaking of all ethical guidelines. The study followed ethical principles as laid down in the Declaration of Helsinki. Being an observational study, the risks posed were minimal. All participants were informed about the purpose and process of the research and the role of the researcher. They were explained that their participation was voluntary and they had the right to leave the study at any time before the transcripts were analyzed. In addition, prior consent for the permission of audio recording for interviews was taken. The transcripts were anonymized to protect the identity of the units as well as the participants. Written informed consent was obtained before they participated in the study.

The qualitative data was transcribed and the transcripts were read and re-read. The data were analyzed using a thematic approach which helped draw codes and themes related to the perceptions of heat stress and the mechanisms employed to adapt to it and cope with it. The respondents were asked clearly defined open-ended questions and were open and free to not answer any of the questions.

The maximum and minimum temperature along with the Mean and Standard Deviation (SD) of WBGT were measured for May and December months and have been tabulated. Since both types of units included heavy work, the OSHA threshold of temperature above 27.5℃ on WBGT has been used for defining heat stress. For workers, minimum and maximum physiological parameter readings and Mean and Standard Deviation (SD) were calculated and presented for both types of units in both seasons (Summer and Winter). A heart rate of 110/minute and an oral temperature of 37.6℃ were considered as the threshold for these biological measurements in

line with OSHA recommendations.

Results

The heat stress in the form of WBGT and its three components is presented in Table 1 to Table 4. It is important to note that the mean ambient temperatures inside the units during work hours of 2:00 PM-6:00 PM were higher than the maximum recorded temperatures for the city on the same day.

(Ahmedabad's Minimum and Maximum temperature was 16.3℃ - 31.0℃ respectively in winter (1-2 Dec 2018) and 26.0℃ - 41.8℃ in summer (1st May to 4th May 2019) on the day of ambient and physiological measurement).

Table 1: Measurement of Wet Bulb Globe Temperature (WBGT) in two types of industrial units, Ahmedabad

Wet Bulb Globe Temperature in Steel Rolling and Foundry Units					
Type of Industrial Unit	Season	Maximum WBGT Recorded (℃)	Minimum WBGT Recorded (℃)	Mean (WBGT) (℃)	Standard Deviation (WBGT)
Steel Rolling Mill (n=3)	Winter	28.3	24.3	26.5	1.04
	Summer	32.9	30.3	31.5	0.66
Foundry Mill (General area) (n=3)	Winter	24.8	20.4	21.8	1.36
	Summer	27.4	25.7	24.1	0.38
Foundry Mill (Furnace area) (n=3)	Winter	28.7	20.6	26.5	3.81
	Summer	28.5	26.2	27.4	0.92

The heat stress (WBGT) was more in the summer for both types of units. In the steel rolling mill, the heat stress in summer was in the hazardous range. The heat stress (WBGT) in the foundry was not high in the summer or winter months. However, within the foundry unit, the heat stress was significantly higher (3.9℃) near the heating furnace than in a general area in the winter season. There was also a Standard Deviation of 3.81 between the maximum and minimum WBGT recorded near the furnace area of the foundry. It is important to note that the furnace did not operate for the whole day. Instead, the units were starting the furnace only after 3.30-4:00 PM. This explains the readings are lower than the steel rolling units in both Summer and Winter seasons.

The difference in maximum WBGT recorded in the steel rolling mill between summer and winter was 4.6℃ while the difference in minimum WBGT recorded in the foundry between summer and winter was 2.6℃ in the general area and 0.2℃ near the furnace area (Table 1).

Table 2: Measurement of Ambient Air Temperature (T_a) in two types of industrial units, Ahmedabad

Ambient Air Temperature in Steel Rolling and Foundry Units					
Type of Industrial Unit	Season	Maximum Ambient (Air) Temp. Recorded (℃)	Minimum Ambient (Air) Temp. Recorded (℃)	Mean Ambient (Air) temperature (℃)	Standard Deviation (Ambient Temp.)
Steel Rolling Mill (n=3)	Winter	40.6	30.2	37	2.24
	Summer	49.4	42.6	46.5	1.88
Foundry Mill (General area) (n=3)	Winter	36.4	27.8	31.05	2.59
	Summer	41.4	36.9	39.7	1.21

Foundry Mill (Furnace area) (n=3)	Winter	44.1	28.7	35.6	7.38
	Summer	41.7	39.8	40.7	0.69

Table 3: Measurement of Globe Temperature (T_g) in two types of industrial units, Ahmedabad

Globe Temperature in Steel Rolling and Foundry Units					
Type of Industrial Unit	Season	Maximum Globe Temp. Recorded (℃)	Minimum Globe Temp. Recorded (℃)	Mean Globe Temperature (℃)	Standard Deviation Globe Temperature
Steel Rolling Mill (n=3)	Winter	45.2	33.1	40.6	2.6
	Summer	53.8	46.5	50.6	1.81
Foundry Mill (General area) (n=3)	Winter	36.8	27.5	31.7	2.75
	Summer	42.3	36.8	39.9	1.33
Foundry Mill (Furnace area) (n=3)	Winter	39.3	31.4	35.1	2.78
	Summer	46.9	40	43.5	2.49

Table 4: Measurement of Relative Humidity (RH)in two types of industrial units, Ahmedabad

Relative Humidity in Steel Rolling and Foundry Units					
Type of Industrial Unit	Season	Maximum Relative Humidity (%) Recorded (℃)	Minimum Relative Humidity (%) Recorded (℃)	Mean Relative Humidity (%)	Standard Deviation Relative Humidity (%)
Steel Rolling Mill (n=3)	Winter	37.9	11.6	23.1	5.71
	Summer	24.4	10.5	15	3.57
Foundry Mill (General area) (n=3)	Winter	32.5	18.5	25.4	4.49
	Summer	25.3	12.4	16.9	3.78
Foundry Mill (Furnace area) (n=3)	Winter	29.4	16.1	23.05	6
	Summer	18.1	13.6	15.2	1.91

The maximum and minimum ambient air temperature (Ta) along with mean ambient air temperature was higher in steel rolling mills than in foundry units in both winter and summer (Table 2).

The maximum and minimum globe temperature (Tg), as well as the mean globe temperature, was higher in the steel rolling mill than in foundry units in both winter and summer (Table 3).

The mean relative humidity (RH) was higher in foundry units than in steel rolling mills in both winter and summer (Table 4). However, within foundry units, relative humidity was higher in the winter season than in the summer. The standard deviation (SD) of relative humidity is on the higher side in the winter season for both types of units [Steel rolling mill - 5.71; foundry (furnace area) - 6.0].

Table 5: Physiological measurements of Workers in industrial units, Ahmedabad

Physiological Measurements of Workers in Steel Rolling and Foundry Units						
Type of Industrial Unit	Season	Heart Rate	Oxygen saturation SPO2	Oral temperature (℃)	Skin temperature (Forearm) (℃)	Skin temperature (Trunk) (℃)
		Min-Max Recorded	Min- Max Recorded	Min- Max Recorded	Min- Max Recorded	Min- Max Recorded
Steel rolling Mill (n=16)	Winter	70-129	95-99	35.2-39.3	32.5-34.8	33.4-35.5
	Summer	68-134	97-99	36.3-39.9	31.3-36.5	32.1-37.9
Foundry Mill (n=14)	Winter	97-120	96-99	35.8-36.8	31.7-35.7	31.4-35.0
	Summer	88-131	98-99	36.4-39.3	30.4-34.9	31.2-37.3

Table 6: Mean and Standard Deviation (SD) of Physiological measurements of Workers in industrial units, Ahmedabad

Physiological Measurements of Workers in Steel Rolling and Foundry Units											
Type of Industrial Unit	**Season**	**Heart Rate**		**Oxygen saturation SPO2**		**Oral temperature (℃)**		**Skin temperature (Forearm) (℃)**		**Skin temperature (Trunk) (℃)**	
		Mean	**SD**	**Mean**	**SD**	**Mean**	**SD**	**Mean**	**SD**	**Mean**	**SD**
Steel rolling Mill (n=16)	Winter	91	15.41	97.5	1.62	37.1	0.93	33.75	0.75	34.3	0.51
	Summer	103.6	21.63	98.3	0.67	37.5	1.15	34.4	1.45	35.05	1.95
Foundry Mill (n=14)	Winter	107.2	7.02	98.2	0.97	36.4	0.34	34.1	1.3	33.1	1.16
	Summer	109.2	12.5	98.3	0.48	37.2	0.68	32.5	1.41	34.4	1.87

Table 5 and Table 6 show the maximum and minimum recorded physiological parameters of workers along with mean and Standard Deviation (SD).

The maximum heart rates of workers crossed the OSHA threshold (>110 /minute) in both units in both seasons. The maximum oral temperatures also crossed the OSHA threshold (> 37.5℃) in workers of both steel rolling and foundry units. The oxygen saturations of workers were all above 95% in both seasons in sample units (Table 5).

The mean heart rate of foundry workers in the winter season was significantly higher than steel rolling mill workers during the working hours between 2:00 PM- 6:00 PM. The mean oral temperature in foundry units was higher than the OSHA threshold (> 37.5℃) in the winter season (Table 6).

Organizational level ambient heat controlling mechanism and facilities for workers:

The units were of medium size appx. 4000 to 5000 sq. ft. and had fans, exhaust fans, vents and ventilation in the unit. However, there were no systems to record/monitor the temperature inside them. The mechanisms at the organization level to dissipate heat included fans and ventilation. The heat furnaces in foundry units were started only after 4 PM. Water facilities were present in the units and units had a water cooler for drinking water purposes. There was an adequate water supply for workers to cleanse themselves during or at the end of duty. One of the units, a foundry

also was providing glucose water to employees during the summer months. The factories provided personal protective equipment such as gloves and shoes. Foundries that had electric furnaces also had given protective eyewear to the workers who would work near the electric furnace. Factories were registered with the Employees State Insurance Corporation; a state-run health protection scheme for the employees and thereby the workers had some financial health protection.

Heat Coping and Adaptive Strategies of Workers: The workers had their coping strategies to cope with high heat and controlling body temperature. Workers used to consume more water and could take small breaks from work during work hours which were allowed by the factory managers. Almost all of the workers were men. Only in one foundry unit, four women were working which too was away from the heating furnace to carry sand toward the molding area. The nature of work for women in foundry units involves lifting sand and moving towards the molding area which is away from the heating furnace. Men were found using a piece of cotton cloth or napkin (Gamcha) to wrap around the head and face as protective measures to control head temperature and prevent burn against excessive heat. The usual clothes at work included a shirt and trousers. Men workers often used to remove their shirts and work in undershirts and fold the trouser up to the knees. There were their mechanisms to cope with excessive heat.

Protective Gear and Usage among Workers: Provisions of safety gear and protective equipment were poor from the organizational level although in some units despite the provision and availability of protective gear the utilization of safety gear among workers was generally poor. There were no specific protective gears to protect against the heat wave. Rather the protective gear of gloves and shoes became uncomfortable to wear during summer months and practically no one in the foundry units was found using the gloves or shoes. One of the workers quoted,

"We are being provided gloves, masks, shoes from factory owner but we are using gloves sometimes only as those protective aids are not useful or comfortable to work with."

The Foundry workers mentioned that the gloves made their hands sweaty which made it difficult to hold on to the equipment. Hardly anyone in the foundry used shoes because they felt that barefoot would be better than using shoes to prevent injury. A worker in the foundry unit explained for non-use of protective shoes,

"If we wear shoes in a foundry there are high chances of burn injury if the hot melted iron falls on shoes. If hot iron falls onto shoes, by the time we react and remove the shoes the melted iron will make a hole in the shoe and penetrate the skin and cause severe burn injury. On the other hand, chappals (Slippers) are relatively safe as we can quickly remove them in case of hot iron accidentally falling on the foot."

The workers in steel rolling mills however were found using gloves throughout to protect themselves from handling hot metals. Difficulty in breathing and suffocation was the chief barrier to using a protective mask.

Discussion

The hazardous working environment, poor ventilation, heat as well as a poor standard of protective equipment contribute to an adverse working environment and high perceived heat among small-scale industrial workers.[16] The study shows that the atmospheric temperature significantly affects the working environment and ambient temperature inside high heat-inducing working units. The steel rolling mills had very high heat stress in the summer months. Heat stress was also high in the furnace area of the Foundry units. The lower heat stress in the furnace area of foundry units compared to the steel rolling mills could be because the furnaces did not operate throughout the day but only after 4 pm which can affect the average temperature. The heat stress in ambient air starts reducing after 4 pm. The effects of heat stress were also evident in the biological monitoring of the workers as the maximum heart rate and an oral temperature of workers crossed the OSHA threshold level in both foundry and steel rolling units in the winter and summer

seasons. Further, mean oral temperature also crossed the threshold (>37.5℃) in foundry units in the winter season. Heart rate along with body temperature has been recommended by the American Conference of Governmental Industrial Hygienists (ACGIH) as a possible measure of heat stress. Heart rate monitors with alarm systems could be developed to notify workers of slowing down their activities or taking a break from work which contribute to preventing heat-related illness.[17]

The mitigation strategies included timing of using the furnace, ventilation, water coolers, etc. at the industrial unit level. However, there has been no measurement of temperature within the units. The personal protective equipment (PPEs) used to protect workers against injury and other hazards were found to complicate the heat stress and workers did not want to use PPEs because of the discomfort and inconvenience caused due to them, especially during the summer months.

Mitigation strategies employed by individual workers included drinking water, taking small breaks, use of cotton gear (*Gamcha*) to reduce the effects of excess heat. These strategies have been in use across several occupational settings in India.[18] However, the workers also did not use PPEs to reduce heat stress but this step could make them more prone to injuries. Literature shows that the use of PPE was much better in colder places such as Nepal than in the hot and humid city of Visakhapatnam.[18,19] Hence, the use of PPEs may be related to heat waves and heat waves can potentially change the behavior of workers.

The PPEs' use was lower in foundry units than in a steel rolling mill. Workers in steel rolling mills could not perform the work without the PPEs (gloves) as they had to handle hot material continuously and for a longer time and therefore used the PPEs more frequently. In contrast, the foundry workers could perform their work without gloves as they had to handle hot items intermittently. The use of PPEs was much lower among them and they resorted to cotton cloth for holding hot objects to avoid the inconvenience and discomfort associated with the use of PPEs. The quality of PPE determines its use; heavy PPEs were cited as a major reason for its non-use in Saudi Arabia.[20]

The National Policy on Safety, Health, and Environment at the Workplace of the Government of India provides a framework for developing and maintaining a safety culture and environment at the workplace.[21] The major legal provisions for the protection of health and safety includes the Factories Act, of 1948 which has provisioned for the structure and layout of the industry to maintain a proper temperature.[22] Despite that, many industries have an inadequate provision of cooling systems, natural shades, or shed with fans in the working place which is due to the poor regulatory framework. Although, this was not the case for this study's units; there are other units that operate in congested areas and can potentially get severely affected by heat waves. There is a need to record heat stress in these industries as a self-regulatory mechanism and a need to invest in engineering interventions to protect workers from occupational heat stress.

Ahmedabad Municipal Corporation (AMC) with a partner organization has rolled out a Heat Action Plan (HAP) for protection against high heat and heatwaves. The plan focuses largely on the general population and outdoor workers.[23] Recent evidence highlights the plight of those who live/work indoors in urban areas where the heat stress could be higher and most heat-health warning systems are based upon outdoor climate only.[24] Response to climate change also needs multi-faceted interventions including adaptation measures. Structure of industrial units, ventilation, scheduling of heat generating processes at a time of day when a heat wave is not at peak, breaks during work, monitoring heat stress through simple gadgets, availability of drinking water, and appropriate and comfortable PPEs will help address the issue.[25] The intervention could be a mix of educative, regulatory, and internal control mechanisms to reduce the effect of heat waves on workers.

This study has a few limitations. It is an exploratory study that documents heat stress in small-scale industrial units. However, it is limited to measurements in fewer settings. The sample

size for workers was also small and generalizations are not possible. However, the study is among the first to explore the high heat stress in small-scale units which do not have their setup for occupational safety and overall regulatory governance is weaker. It is important that most of these units do not have any environmental monitoring and there are hardly any occupational safety and health measures apart from ESIS-linked insurance and the provision of PPEs.

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Original Article

HPLC analysis of biomarkers of Toluene and Xylene in human urine samples

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ABSTRACT

Introduction: Urinary Hippuric acid (HA) and Methylhippuric acid (MHA) are considered reliable biomarkers for monitoring exposure to toluene and xylenes. A simple and robust HPLC method for simultaneous determination of HA and MHA in urine samples was developed and validated as per Internation Conference on Harmonization (ICH) Q2 guidelines.

Methods: Mobile phase consisting of two solvents A & B, solvent A was 0.1% TFA in water, and solvent B was 0.1% TFA in acetonitrile. Separation was performed in gradient elution mode and the time program was as follows - Time (min)/%B: 0/20, 4/20, 11/80, 11.1/90, 16/90, 16.1/20, 25/20. The detection wavelength was 205 nm.

Results: The limits of detection (LOD) and quantification (LOQ) of HA in urine were 0.3 and 1.0 mg/L, and for MHA were 0.25 mg/L and 1.0 mg/L respectively and the recovery for HA and MHA were 95% and 98.9% respectively.

Conclusion: The developed method was successfully applied for the analysis of urine samples.

Keywords: Biomarker, Hippuric acid, HPLC, Methylhippuric acid, Method validation

Introduction

Smoking and combustion of fossil fuels are well-established sources of volatile organic compounds (VOCs) containing benzene and substituted benzenes such as toluene and xylenes (have three isomers (m-/p-/o-xylenes). Agency for Toxic Substances and Disease Registry (ATSDR) of the U.S. Department of Health and Human Services published toxicological profiles of toluene and xylenes. VOC exposure is associated with toxic effects on human health and may lead to various diseases but respiratory problems in the case of xylenes and central nervous system (CNS) problems in the case of toluene are most prevalent.[1-4]

Xylenes exposure may happen due to skin permeation as well as inhalation, whereas toluene exposure happens mainly by inhalation. Post-exposure xylene and toluene are absorbed into the blood. In humans major metabolic pathway of toluene proceeds primarily by oxidation to benzyl alcohol catalyzed by Cytochrome P450 enzymes followed by benzoic acid which further converts to hippuric acid (HA) whereas, in the case of xylenes oxidation to methyl benzoic acids followed by methyl hippuric acids (MHA) in liver. HA and MHA are considered primary exposure

biomarkers of toluene and xylenes which are excreted from the body in urine.[3-5] According to the American Conference of Governmental Industrial Hygienists (ACGIH), the permissible exposure limit in workers after 1-day exposure is 1.6 w/w creatinine for urinary HA and 1.5 w/w creatinine for urinary MHA, respectively.[6]

Many chromatographic methods are reported for the determination of HA and MHA in urine samples such as gas chromatography (GC),[7] capillary zone electrophoresis (CZE),[8] ion chromatography (IC),[9] liquid chromatography and each has its own merits and demerits.

There are various efforts to develop novel methods for HA and MHA. Recently, Takeuchi et. al. developed Direct methyl esterification with 2,2-dimethoxy propane for the simultaneous determination of urinary metabolites of toluene, xylene, styrene, and ethylbenzene by gas chromatography-mass spectrometry.[7] Chiu et. al. reported the use of urinary hippuric acid and methyl hippuric acid to evaluate surgical smoke exposure in operating room healthcare personnel.[10] Here we tried to develop and validate a simple high-performance liquid chromatography (HPLC) for analysis of HA and MHA as per ICH Q2 R(1) guidelines in human urine samples because HPLC methods are convenient as it is cost-effective and derivatization is not required.[11]

Methods

Standards of urinary metabolites, HA and MHA were procured from Sigma Aldrich USA. Trifluoroacetic acid (TFA), HPLC grade acetonitrile was purchased from Merck. Ultrapure water obtained by Merck Synergy water purification system.

The HPLC system consists of two LC-10AT vp pumps, a diode array detector (SPD-M10A vp), a column oven (CTO-10AS vp) and a system controller (SLC-10A vp) (all from Shimadzu, Kyoto, Japan), was used. Reversed-phase Thermo ODS-2 Hypersil, 250 x 4.6 mm, particle size: 5 µm column was used for analysis. The chromatographic and the integrated data were recorded using the LG computer system using LC-Solution data acquiring software (Shimadzu, Kyoto, Japan). The mobile phase consisted of two solvents A & B, solvent A was 0.1% TFA in water and solvent B was 0.1% TFA in acetonitrile. Separation was performed in gradient elution mode and the time program was as follows –Time (min)/%B: 0/20, 4/20, 11/80, 11.1/90, 16/90, 16.1/20, 25/20. The detection wavelength was 205 nm.

Water and methanol were mixed (1:1) to form a diluent solution. solution: 10.0 mg of HA and MHA standard were taken separately into a 100.0 mL volumetric flask and dissolved in methanol up to mark to prepare 100ppm Stock HA and MHA individually. Working standard solutions of HA and MHA of concentration 1, 2, 3, 5, and 10 mg/L were prepared respectively by diluting 100 µL, 200 µL, 300 µL, 500 µL and 1000 µL of the 100 mg/L stock solution of HA and MHA to 10.0 mL with diluent. The reference solution of HA and MHA was prepared by diluting 500 µL of the 100 mg/L stock solution of HA and MHA to 10.0 mL with diluent. 2.5 g of disodium hydrogen orthophosphate, 2.5 g of sodium dihydrogen orthophosphate and 8.2 g of sodium chloride was dissolved in 950 mL of water. pH of the solution was adjusted to 6.4 with 1 M sodium hydroxide or 1 M hydrochloride acid, if necessary and diluted to 1000.0 mL to prepare phosphate buffer at pH 6.4.

This study was part of our previous "Consortium on Vulnerability to Externalizing Disorders and Addictions (cVEDA)" study and the HPLC method was developed for the analysis of volatile organic compounds (VOCs) in urine samples, is incorporated in cVEDA as a measure of exposure to environmental neurotoxins.[12] Details of sample size and study recruitment centers can be found in this reference However, only three samples were selected randomly and used for method development purposes. Spot urine samples were collected from all subjects after washing their hands to avoid any contamination and collect the mid-stream urine sample in polythene bottles and samples were brought to the laboratory and kept under refrigerated conditions and preserved in a deep fridge at -20°C. All urine samples were obtained after approval from the Human Ethics Committee of the Institute. Before analysis, urine

samples were cleaned up by solid phase extraction (SPE) for removing matrix interferences. Strong anion exchange (SAX) SPE cartridges from Whatman (500 mg per 3 mL cartridge) were used for this purpose., A vac-Elute vacuum elution system was used for SPE. SAX cartridges are a quaternary ammonium bonded phase of the silica matrix, positively charged in the full pH range, and have a strong anion exchange capacity. SAX cartridges are mainly used for extracting weakly acidic compounds such as carboxylic acids. Matrix interferences with strong negative charge bind strongly on SAX cartridges and thus help in eliminating matrix interferences. First, for conditioning, the SAX cartridge was washed with methanol (3 times), followed by washing with pH 6.4 phosphate buffer solution (elution rate was adjusted to between 2 to 3 mL. 5 mL urine sample and 5 mL of phosphate buffer solution was mixed thoroughly and passed through SAX column. The SAX column was washed by 1 mL water, followed by 1 mL phosphate buffer and 1 mL of 1.0% aqueous acetic acid. The column was dried in air and analytes were eluted with 5 mL of 10% aqueous acetic acid.[2]

Results

During HPLC Method Validation following parameters were evaluated:

Selectivity, Calibration Curve and Linearity, Accuracy and Precision, Limit of Detection (LOD) and Quantitation (LOQ), Robustness, and Application of the method to real samples.

During Selectivity evaluation, no endogenous components extracted from blank urine were eluted at the retention time of the peak of HA and MHA (**Fig.1 and 2**). The developed method was found to be selective for the determination of HA and MHA without interference from the endogenous constituents of urine.

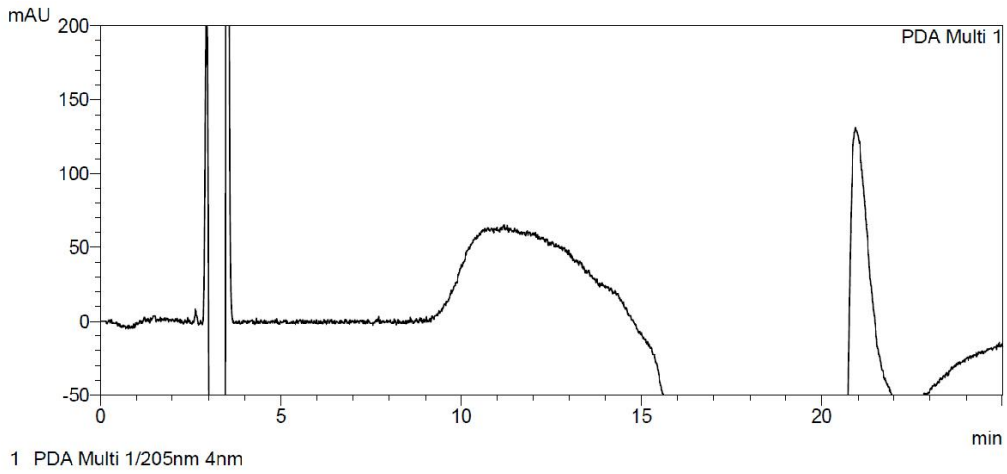

Figure 1: Chromatogram for Blank (Diluent)

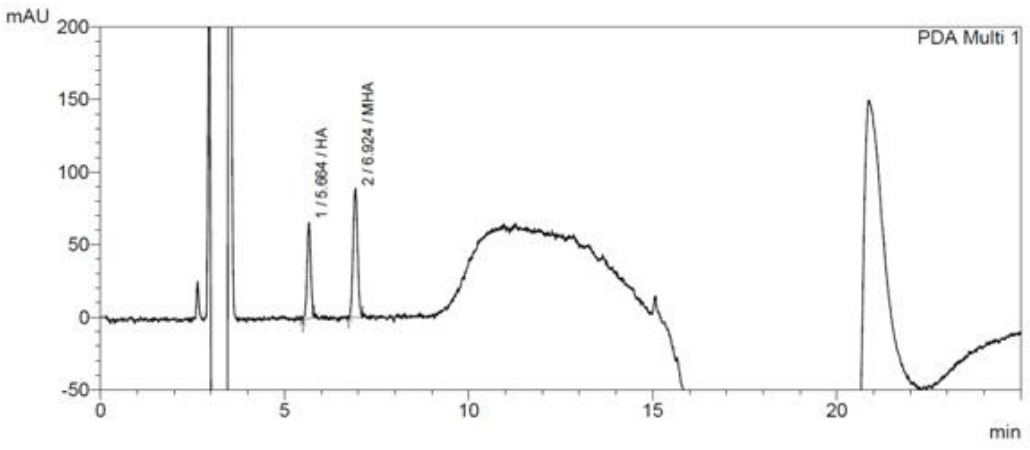

Figure 2: Chromatogram for HA and MHA under optimized conditions.

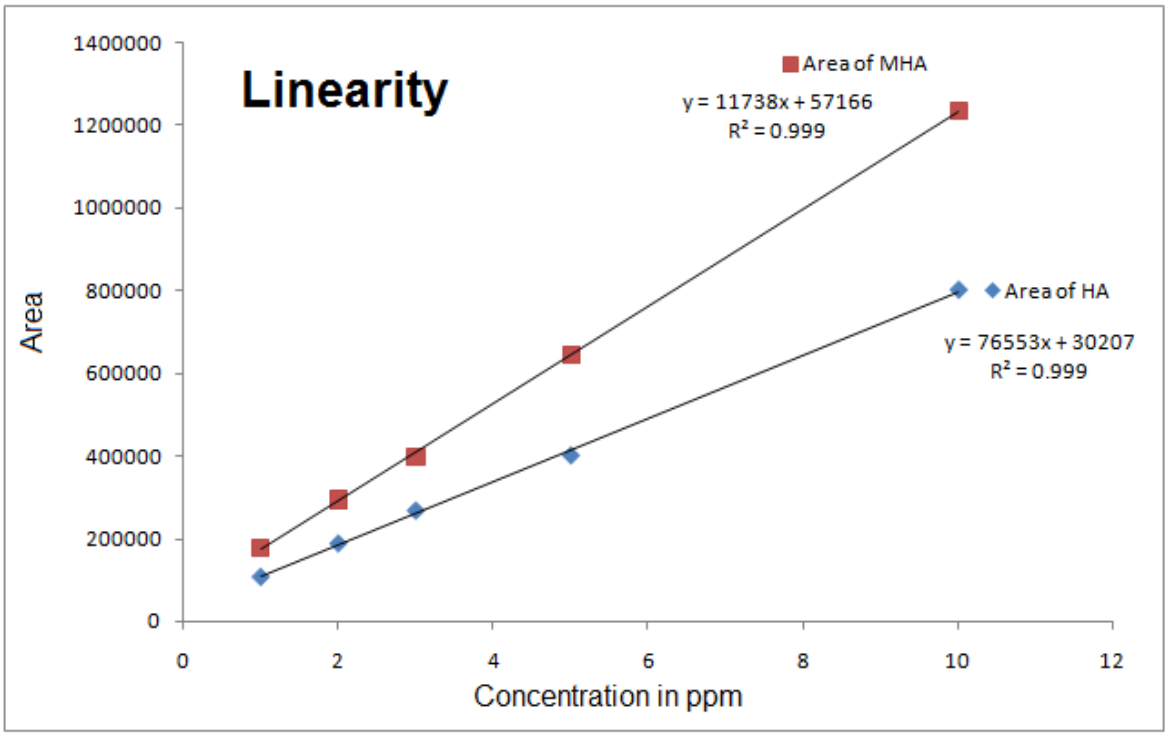

Figure 3: Linearity chart for HA and MHA

Analysis was based on the external standard method. Calibration curve and linearity studies were performed with calibration standards fresh on the day of analysis by diluting the appropriate working solutions with diluent. The standard calibration curve was constructed using blank urine samples spiked with HA and MHA at five different concentrations from 1, 2, 3, 5 and 10 mg/L. The data were subjected to statistical analysis using a linear regression model. The calibration curves were obtained by weighted linear regression (weighing factor $1/x^2$) using Microsoft Excel 2007 software. The suitability of the calibration model was confirmed by back-calculating the concentrations of the calibration standards. The developed method was linear over the tested concentrations with correlation coefficient $r^2 = 0.999$ (for HA) and $r^2 = 0.999$ (for MHA), the calibration curve (**Fig. 3**) was described by equations y = 76553x + 30207 (for HA) and y = 11738x + 57166 (for MHA).

Accuracy and precision studies were performed with, 5 mg/L concentration of HA and MHA, in three replicates were used to validate the accuracy and precision of the developed method. The results showed that the intra- and inter-day accuracy (% bias) for the method ranged between −14.8% and 1.7%, respectively for HA (**Table 1**). The % CV of intra- and inter-day precision was <8.85% for HA. The results showed that the intra- and inter-day accuracy (% bias) for the method ranged between −16.7% and 14.2%, respectively for MHA (**Table 2**). The % CV of intra- and inter-day precision was <9.23% for MHA. The developed method was thus found to meet generally accepted requirements of accuracy and precision over the studied concentration ranges

.

Table 1: Accuracy, Precision and Recovery for HA

			Mean	Std. Deviation	%RSD	
Standard Area (Day-1)			503103	23611.28	4.7	
476445		Sample 3-8	Area of spike sample 3-8	Area spike sample 3-8 corrected	Conc. (mg/L)	Recovery %
521385		118852	589554	470702	4.7	93.6
511478			600789	481937	4.8	95.8
			586578	467726	4.6	93.0
	Mean				4.7	94.1
	Std. Deviation				0.07	1.49
	% Relative Std. Deviation				1.58	1.58
Standard Area (Day-2)			481664	6728.629	1.4	
480863		Sample 3-8	Area of spike sample 3-8	Area spike sample 3-8 corrected	Conc. (mg/L)	Recovery %
488757		131479	592500	461021	4.8	95.7
475371			604001	472522	4.9	98.1
			621307	489828	5.1	101.7
	Mean				4.9	98.5
	Std. Deviation				0.15	3.01
	% Relative Std. Deviation				3.06	3.06
Standard Area (Day-3)			537854	56275.77	10.5	
540587		Sample 3-8	Area of spike sample 3-8	Area spike sample 3-8 corrected	Conc. (mg/L)	Recovery %
480262		139432	683837	544405	5.1	101.2
592714			597473	458041	4.3	85.2
			626738	487306	4.5	90.6
	Mean				4.6	92.3
	Std. Deviation				0.41	8.17
	% Relative Std. Deviation				8.85	8.85
	Overall Recovery					95%

Limit of Detection (LOD) and Quantitation (LOQ) were performed after sample clean-up, and the extracts from spiked urine were injected into the chromatographic systems. The analysis was carried out at decreasing concentrations to determine the minimal concentration with a signal-to-noise ratio of 3:1. The LOD and LOQ for HA was 0.3 mg/L and 1.0 mg/L respectively and for MHA were 0.25 mg/L and 1.0 mg/L respectively.

According to the ICH guideline Q2A, "robustness of an analytical procedure is a measure of its capacity to remain unaffected by small, but deliberate variations in method parameters and indicates its reliability during normal usage".[11] Flow rate and temperature of the optimized method was changed deliberately and no drastic deviation was found by these alterations and the developed method was considered robust.

The developed method was used for three batches of samples that were analyzed after sample preparation and the result has been tabulated below (**Table 3**)

$$Assay = \frac{Area\ of\ analyte\ in\ sample}{Mean\ area\ of\ standard} \times Conc.\ of Standard$$

Table 2: Accuracy, Precision and Recovery for MHA

		Mean	Std. Deviation	%RSD	
Standard Area (Day-1)		768895	36203.59	4.7	
727214	Sample 3-8	Area of spike sample 3-8	Area spike sample 3-8 corrected	Conc. (mg/L)	Recovery %
792523	65648	855513	789865	5.1	102.7
786946		863773	798125	5.2	103.8
		796417	730769	4.8	95.0
			Mean	5.0	100.5
			Std. Deviation	0.24	4.78
			% Relative Std. Deviation	4.75	4.75
Standard Area (Day-2)		739690	19424.47	2.6	
724339	Sample 3-8	Area of spike sample 3-8	Area spike sample 3-8 corrected	Conc. (mg/L)	Recovery %
761528	51623	838496	786873	5.3	106.4
733204		753579	701956	4.7	94.9
		896272	844649	5.7	114.2
			Mean	5.3	105.2
			Std. Deviation	0.49	9.70
			% Relative Std. Deviation	9.23	9.23
Standard Area (Day-3)		824454	64365.06	7.8	
811230	Sample 3-8	Area of spike sample 3-8	Area spike sample 3-8 corrected	Conc. (mg/L)	Recovery %
767729	76950	851699	774749	4.7	94.0
894405		763767	686817	4.2	83.3
		868881	791931	4.8	96.1
			Mean	4.6	91.1
			Std. Deviation	0.34	6.84
			% Relative Std. Deviation	7.51	7.51
				Overall Recovery	98.9%

Table 3: Assay for HA and MHA in three batches of real urine samples.

Standard	Run 1	Run 2	Run 3	Mean	STDEV	%RSD
HA (5mg/L)	476445	521385	511478	503103	23611.28	4.7
MHA (5mg/L)	727214	792523	786946	768895	36203.59	4.7
HA		Sample 1	Sample 2		Sample 3	
		826443	562865		118852	
Conc. (mg/L)		8.2	5.6		1.2	
MHA		Sample 1	Sample 2		Sample 3	
		267520	90923		65648	
Conc. (mg/L)		1.7	0.6		0.4	

Conclusion

A simple, rapid, and robust HPLC method for the determination of HA and MHA was developed. The experimental results concerning linearity, accuracy, precision, specificity and sensitivity demonstrate the reliability of the procedure for its intended application. The method was successfully applied to test real urine samples for the determination of HA and MHA.

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Original Article

Hypertension among auto-rickshaw drivers in Belagavi, South India: A cross-sectional study

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ABSTRACT

Introduction: Auto–rickshaws are still the most commonly used mode of transportation in Tier II & III cities where metros or application-based cab aggregators are non-existent / not available. Auto-Rickshaw Drivers (ARDs) are at a higher risk for Cardiovascular Disease (CVD) because of their common lifestyle practices like irregular eating habits, sedentariness, addictions, and work-related stress. Studies have found that hypertension (HTN) is highly prevalent among ARDs in comparison to the general population. We studied the prevalence of HTN among ARDs of Belagavi.

Methods: It was a cross-sectional study conducted among 600 regular ARDs operating within Belagavi City between January to December 2016. The sample size was calculated to be 570 and rounded off to 600. Two ARDs who were last in the queue were selected from 300 major auto rickshaw stands. After getting informed consent, we collected the data through personal interviews and recorded the blood pressure of all the study participants. Data were analyzed using SPSS software. The Institutional Ethics Committee of J. N. Medical College approved the study.

Results: Among the 600 participants studied, 54 (09%) were previously known and 228 (38%) were newly diagnosed hypertensive. HTN was significantly associated with age, religion, educational status, length of working hours, years in present occupation, and body mass index.

Conclusion: The prevalence of HTN was high compared to the general adult population and increased with increasing age, length of working hours, years in present occupation, and body mass index.

Keywords: Auto rickshaw drivers, Hypertension, Prevalence.

Introduction

Globally, cardiovascular diseases (CVDs) are the leading cause of death, with an estimated 17.9 million deaths attributed in 2019 (32% of worldwide deaths).[1] Hypertension (HTN) is a major risk factor for heart disease and also a leading cause of premature death worldwide. As the condition has no obvious signs or symptoms, the patient is typically unaware of the condition.[2,3] As a result, it is critical that the condition be diagnosed early and treated appropriately using

lifestyle modifications and medications to reduce mortality and morbidity.

Three-wheeled motorized vehicles, commonly known as auto-rickshaws, are an integral part of urban transportation. Auto-rickshaw drivers (ARDs) health unlike other occupational workers' is affected by several determinants at work, including accidents, communicable and non-communicable diseases, and stress-related disorders.[4] ARDs are the group that tends to develop these conditions as they spend most of their time in polluted, noisy, and stressful environments. ARDs work for over 10-12 hours per day and form a substantial part of the urban informal sector in India. ARDs are constantly exposed to increased stress due to irregular shifts, continuous increases in fuel prices, long waiting hours, and occupational factors all of which are identified as risk factors for HTN.[5,6] Tobacco use is also a known risk factor for HTN and is highly prevalent among ARDs in comparison to Indian adults aged 15 and over.[3,7-10]

Studies reveal that HTN is more prevalent among professional drivers compared to the general population.[11-13] Considering these factors, we conducted the study to know the prevalence of HTN and its association with various sociodemographic and occupational factors among ARDs of Belagavi.

Methods

It was a cross-sectional study conducted from January to December 2016 on registered ARDs in Belagavi City. Based on the estimated prevalence of HTN of 35.14% and an absolute error of 4%, a sample size of 570 was calculated.[14] Adding a non-response rate of 5%, we rounded it to 600.

We included those participants who were registered, regular ARDs aged 18 years or above, and residents of Belagavi for at least one year and excluded those who drove part-time.

Based on the information from the Regional transport office, the city had around 300 major auto-rickshaw stands. Following the universal sampling method, we visited all 300 stands and purposively selected two ARDs at each stand who were last in line. Thus, the participants could be interviewed and examined, which would have not been possible if we selected someone else from the queue, as their auto-rickshaw would have been hired in the meantime.

We recorded the data using a questionnaire tailored to the study requirements. We collected socio-demographic information, the number of years in the present occupation, the length of working hours, the number of night shifts performed per week, the use of tobacco, and their history of high blood pressure (HTN). Using standard procedures and standardized instruments, trained personnel measured weight using a digital weighing scale from Omron and height using Prime Surgical Height measuring scale - stadiometer and recorded blood pressure (BP) using a digital blood pressure monitor by Omron.[15,16] We classified the BP using the JNC-8 classification.[17]

Following written informed consent, we interviewed and examined the participants in a convenient place nearby the auto-rickshaw stands. The participants were informed of their right to discontinue the study at any time if they had privacy concerns, confidential concerns, or concerns related to their work. We ensured that the participants had no hindrances in their work.

The Institutional Ethics Committee of J. N. Medical College of KLE University, Belagavi approved the study. After the study concluded, we advised pre-hypertensive and hypertensive participants on non-pharmacological and pharmacological measures to take and offered clinical services to those who desired them.

We analyzed the data through descriptive statistics and a Chi-square test using the Statistical Package for Social Sciences (SPSS) software, version 24.0. $P < 0.05$ was accepted as the statistical significance value.

Results

The mean age of the participants was 39.71 ± 11.07 years [Table 1]. The majority of them (89.83%) were married, 371 (61.83%) stayed in nuclear families, and 346 (57.67%) resided in pukka

houses. The mean ± standard deviation of duration in the present occupation was 15.80 years ± 10.11 years, and participants worked over a length of 9.43 ± 1.82 hours per day. The prevalence of current use of tobacco was 62.17% (373). Cigarettes (87.05%) were the most common smoked form, while gutkha (54.93%) was the commonest smokeless form. The mean ± standard deviation of the duration of tobacco use was 15.31 ± 10.29 years. Based on the Body Mass Index (BMI), 40 (6.67%) were underweight, 210 (35.0%) had normal weight, 197 (32.83%) were overweight and 153 (25.50%) were obese. The mean ± standard deviation of the BMI of the participants was 24.32 ± 4.51 kg/m2.

Table 1. Sociodemographic and occupational profile of the participants (n = 600)

Characteristics		N (%)
Age (years)	< 30	159 (26.5)
	31 – 40	175 (29.17)
	41 – 50	164 (27.33)
	51 – 60	90 (15)
	> 60	12 (2)
Religion	Hindu	143 (23.83)
	Muslim	457 (76.17)
Educational qualification	Illiterate	49 (8.17)
	Primary School	141 (23.5)
	High School	327 (54.5)
	Pre-university college	59 (9.83)
	Diploma / Graduate	24 (4)
Socioeconomic status (Modified BG Prasad SES Scale)	Class I	17 (2.83)
	Class II	65 (10.83)
	Class III	196 (32.67)
	Class IV	265 (44.17)
	Class V	57 (9.5)
Number of years in the present occupation	< 10	235 (39.17)
	11 – 20	189 (31.5)
	> 20	176 (29.33)
Length of working hours on an usual day	6 - 8 hours	51 (8.5)
	8 - 10 hours	218 (36.33)
	10 - 12 hours	191 (31.83)
	> 12 hours	140 (23.34)
Usual number of night shifts per week	0	582 (97)
	> 1	18 (3)

The prevalence of HTN was 47% (282) which included known hypertensive [Figure 1]. Mean± standard deviation of systolic BP was 135.64 ± 17.89 mmHg while diastolic BP was 87.43 ± 13.28 mmHg. All of the 54 who were diagnosed as hypertensive were presently on treatment.

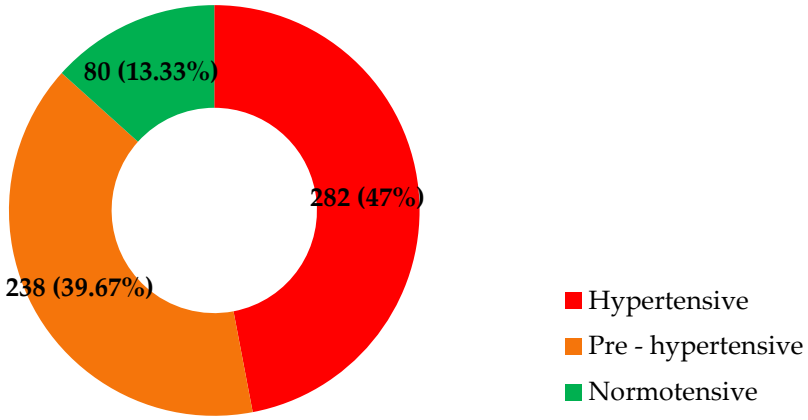

Figure 1. Distribution of study participants according to Blood Pressure (n = 600)

BP was significantly associated with age, religion, and educational status [Table 2]. The years in the present occupation and length of working hours were significantly associated with BP [Table 3]. Although BP increased with tobacco use, it was statistically insignificant. The association between BP with body weight was found to be statistically significant [Table 4].

Table 2. Association between blood pressure and socio-demographic profile

Characteristics		Normotensive (%)	Pre-hypertensive (%)	Hypertensive (%)	Total	χ^2
Association of blood pressure with age	< 30 years	33 (20.76)	101 (63.52)	25 (15.72)	159 (100)	97.2739, df = 6, P value < 0.00001
	31 – 40 years	15 (8.57)	69 (39.43)	91 (52)	175 (100)	
	41 – 50 years	15 (9.15)	41 (25.0)	108 (65.85)	164 (100)	
	> 51 years	17 (16.67)	27 (26.47)	58 (56.86)	102 (100)	
	Total	80 (13.33)	238 (39.67)	282 (47.00)	600 (100)	
Association of blood pressure with religion	Hindu	46 (32.17)	19 (13.29)	78 (54.54)	143 (100)	85.1626, df = 2, P value < 0.00001
	Muslim	34 (7.44)	219 (47.92)	204 (44.64)	457 (100)	
	Total	80 (13.33)	238 (39.67)	282 (47.00)	600 (100)	
Association of blood pressure with educational status	Illiterate	9 (18.37)	13 (26.53)	27 (55.10)	49 (100)	70.7878, df = 8, P value < 0.00001
	Primary	26 (18.44)	51 (36.17)	64 (45.39)	141 (100)	
	High school	22 (6.73)	145 (44.34)	160 (48.93)	327 (100)	
	PUC	8 (13.56)	26 (44.07)	25 (42.37)	59 (100)	
	Diploma & graduate	15 (62.5)	3 (12.5)	06 (25.0)	24 (100)	
	Total	80 (13.33)	238 (39.67)	282 (47.00)	600 (100)	

Table 3. Association between blood pressure and occupational profile

Characteristics		Normotensive (%)	Pre-hypertensive (%)	Hypertensive (%)	Total	$\varkappa^2$
Association between blood pressure and years in present occupation	< 10 years	36 (15.32)	151 (64.26)	48 (20.42)	235 (100)	123.1216, df = 4, P value < 0.00001
	11 to 20 years	23 (12.17)	35 (18.52)	131 (69.31)	189 (100)	
	> 20 years	21 (11.93)	52 (29.55)	103 (58.52)	176 (100)	
	Total	80 (13.33)	238 (39.67)	282 (47.00)	600 (100)	
Association between blood pressure and the length of working hours	6 - 8 hours	21 (41.18)	28 (54.90)	2 (3.92)	51 (100)	74.8055, df = 6, P value < 0.00001
	8 - 10 hours	15 (6.88)	85 (39.0)	118 (54.12)	218 (100)	
	10 - 12 hours	31 (16.23)	82 (42.93)	78 (40.84)	191 (100)	
	> 12 hours	13 (9.29)	43 (30.71)	84 (60)	140 (100)	
	Total	80 (13.33)	238 (39.67)	282 (47.00)	600 (100)	
Association between blood pressure and number of night shifts per week	No night shifts	75 (12.89)	231 (39.69)	276 (47.42)	582 (100)	3.6441, df = 2, P value = 0.1617
	> 1-night shifts	5 (27.78)	7 (38.89)	6 (33.33)	18 (100)	
	Total	80 (13.33)	238 (39.67)	282 (47.00)	600 (100)	

Table 4. Association between blood pressure with tobacco use and body weight

Characteristics		Normotensive (%)	Pre-hypertensive (%)	Hypertensive (%)	Total	$\varkappa^2$
Association of blood pressure with tobacco use	Tobacco users	43 (11.53)	149 (39.95)	181 (48.52)	373 (100)	2.917, df = 2, p = 0.2325
	Non-users	37 (16.30)	89 (39.21)	101 (44.49)	227 (100)	
	Total	80 (13.33)	238 (39.67)	282 (47.00)	600 (100)	
Association of blood pressure with body weight	Underweight	12 (30.00)	24 (60.00)	04 (10.00)	40 (100)	167.089, df = 6, p < 0.00001
	Normal	54 (25.71)	111 (52.86)	45 (21.43)	210 (100)	
	Overweight	05 (02.54)	78 (39.59)	114 (57.87)	197 (100)	
	Obese	09 (05.88)	25 (16.34)	119 (77.78)	153 (100)	
	Total	80 (13.33)	238 (39.67)	282 (47.00)	600 (100)	

Discussion

ARDs unlike other professional drivers spend most of their day in traffic fighting pollution, noise, psychiatric stress, accelerations and decelerations, lateral swaying, and whole-body vibrations while driving. Additionally, poor lifestyle practices such as irregular eating patterns and sleep patterns, low-intensity physical activity, smoking, and tobacco consumption, as well as the existence of comorbidities like overweight and obesity, may be associated with increased prevalence of HTN.[6,18,19]

All 600 participants were male, consistent with other studies.[7,13] Most of the participants had a high school education (54.50%). In comparison with other similar studies, participants had a higher educational level.[7] We can attribute the increase in education to better literacy levels in South India.

The mean ± standard deviation of years in present occupation was 15.80 ± 10.11 years, whereas it was 17.70 ± 7.62 years in the study done in Nagpur.[13] The mean length of working hours per day was 9.43 ± 1.82 hours, while it was 11.52 ± 2.29 hours in the study done in Nagpur.[13]

The prevalence of tobacco use in any form was 62.17%. The study among ARDs in Gwalior showed the prevalence to be 84.26%,[7] 64.44% among ARDs in Bareilly, Uttar Pradesh,[8] and 69% among ARDs in South Delhi.[9] These studies reveal a comparatively high prevalence among ARDs compared to Indian adults aged 15 years and above, which was just 28.6%, according to Global Adult Tobacco Survey (GATS) 2016-17.[10] Furthermore, this rate was higher than 29.41% in Belgaum city.[20]

The comparatively high prevalence among ARDs can be attributed to a variety of occupational factors coupled with socioeconomic factors, as well as many unknown factors.

Among the participants, 58.50% were either overweight or obese. The mean ± standard deviation for the BMI of the participants was 24.32 ± 4.51 Kg / m2. These results are in line with studies among similar subgroups[21,22] that reveal higher BMI among ARDs compared to adult Indian men with a prevalence of 38.4%.[23]

Around 47% of the participants were hypertensive (including previously known cases) consistent with studies done among ARDs and professional drivers.[13,19,21,24]

In general, ARDs have higher levels of HTN, overweight, and obesity than the general population. This can be explained by their sedentary work pattern, long hours of inactivity, constant mental stress, and a higher level of tobacco use all of which are known to be risk factors.

Age was associated with a higher probability of HTN, and this association was statistically significant. An increase in BP with age is viewed as a universal characteristic of aging.[25] The prevalence of HTN was significantly higher among Hindus compared to Muslims, as evidenced by another study that found similar results.[26] The study found an inverse relationship between BP and school education, similar to another study.[27]

Similar to a study conducted in Nagpur, both years in the present occupation and length of working hours were positively associated with BP.[28] ARDs who have been in the current occupation for a longer period are generally older, and age is a major risk factor for HTN.[25] Working long hours results in sedentary habits and inactivity, both of which are known risk factors for hypertension. The number of night shifts had no association with HTN.

Tobacco users were at an increased risk of HTN, however, this association was not statistically significant. The risk of hypertension increased with body weight, and this association was statistically significant. Tobacco and overweight/obesity are well-known modifiable risk factors for HTN.[3]

Conclusions

A large number of participants were pre-hypertensive (39.67%), while almost half were hypertensive (47%). Less than one-fifth of the hypertensive (54, 19.15%) were aware of their condition and all of them were currently on treatment. However, only 11 of them had adequate BP control. Hypertension was

significantly common in elderly participants, Hindus, participants with lower education, longer duration working as ARDs, long working hours, and overweight/obese participants.

Limitations and Recommendations

There is a possibility of recall bias while addressing the risk factors like tobacco consumption, food habits, stress, and so on. We might have missed those ARDs plying exclusively at night due to data collection in the daytime. We could not do the tests that measure the strength of association between the variables (such as Odd's ratio, Correlation coefficient (r) and Regression coefficient (B)) in the study. Workplace interventions for the prevention and control of HTN can include regular health education sessions about periodic health checkups for early detection and treatment, lifestyle changes, medication adherence, and mental health counseling for people experiencing a high level of stress. There is a need for strict implementation of legislation governing tobacco. To intervene at the right time, we have to continuously follow up and treat ARDs with HTN. Strict implementation of national programs and guidelines for the screening and management of HTN for vulnerable occupational groups is needed.

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Original Article

Mental Health among Automobile industry workers in Chennai - A Cross-sectional Study from a Single Industrial Unit

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ABSTRACT

Introduction: Working in a mentally healthy place is necessary for people. Adverse mental health conditions can lead to disruption in work which in turn causes absenteeism, low productivity, and financial constraints. This study intends to assess the levels of depression, anxiety and stress and to determine its associated factors among the workers in the automobile industry in Chennai.

Methods: A cross-sectional study was conducted among 227 Automobile industry workers in Chennai, India. A semi-structured questionnaire was used to collect information about the socio-demographic and working details of the study subjects, while the Depression Anxiety Stress Scale (DASS -21) was used to assess mental health status. Descriptive variables were expressed as proportions, while Pearson's Chi-square test was used to study the association between dependent and independent variables.

Results: A total number of 227 participants were included in the study. More than 80 % of the workers were permanent employees. The prevalence of Depression, anxiety and stress among the study subjects are 38.8%, 43.6 % and 26.9 %, respectively. Workers in the middle age group of 30- 39 years had a higher risk of developing depression, anxiety, and stress than those in the other age groups. For Depression, age, type of family, employment status, and working experience were statistically significant ($p<0.05$). The sleeping hours, comorbidities, substance use, co-worker support, and supervisor support of the workers were the factors that showed no association with Depression, anxiety, and stress.

Conclusion: There is a need for attention to be paid to the development of a healthy psychosocial workplace climate which should be supported by stronger workplace support.

Keywords: Anxiety; Automobile industry workers; Depression; Mental health; Stress.

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Introduction

Mental health is a state of mental well-being that enables people to cope with the stresses of life, realize their abilities, learn well and work well, and contribute to their community.[1]It is an integral component of health and well-being that underpins our individual and collective abilities to make decisions, build relationships and shape our world.1 Anxiety disorders and depressive disorders are the two most common mental disorders in the world, and in 2019, 301 million people globally were living with anxiety disorders; and 280 million were living with depressive disorders (including both major depressive disorder and dysthymia). These

numbers rose significantly as a result of the pandemic.[2]

Working in a mentally healthy place is necessary to attain high productivity levels. Work-life balance is essential nowadays as a healthy mind leads to a healthy life. In contrast, the adverse mental health conditions of people can lead to disruption in work which in turn causes absenteeism, low productivity and financial constraints. [3] Moreover, workplace stress can have psychological effects such as anxiety, depression, decreased concentration, and impaired decision-making skills, which can potentially lead to an increase in accidents caused by human error.[4] In addition, workers employed in asbestos-based industries like cement and automobile parts are at risk of malignant and non-malignant diseases affecting the lungs and others, such as gastrointestinal and laryngeal cancer. [5,6]

While the physical hazards of automobile workers are well-studied, studies associated with mental health are limited.[6-8] Thus, this study was conducted to assess the levels of Depression, anxiety and stress among the automobile industry workers in Chennai and their associated factors.

Methods

A cross-sectional study was conducted in an Automobile industry situated near Chennai, India. This factory consisted of both an asbestos manufacturing unit and a non-asbestos manufacturing unit. The study participants were workers in the factory who were placed in the asbestos-based unit. The management-level workers and workers in the non-asbestos unit were excluded from the study. The study period was from November 2021 to June 2022. The minimum sample size for the study was 180, calculated using Epi info software with a design effect of 1, absolute precision of 10 % and assumed prevalence of anxiety as 46 % in a study conducted by Edimansyah et al.[9] Simple random was used for sampling purposes, and the Institutional review board B(IRB) of our institution approved the study(IRB NUMBER -SMC/IEC/2022/01/007 dated 4.1.22).

Data was collected using a Semi-structured questionnaire which consisted of 2 parts. The first part asked about the participant's socio-demographic data, work, and other relevant information. Depression Anxiety Stress Scale (DASS) 21 was used for the second part. It is based on three subscales of Depression, stress, and anxiety, and each subscale consists of seven questions. The scoring system is of the Likert type, and the total score for each subscale gives the severity of that same symptom, ranging from 0 to 21 in each subscale.[10] The DASS is not a diagnostic test for mental health disorders, and the technical quality of the DASS in an occupational health setting has been studied and validated.[10,11] The questionnaires used were in Tamil, the local language. The forward-backward translation method was employed using two different translators for the same.

The data was collected in person from the workers at the industrial workplace site after getting permission from the factory's Human Resources (HR) department after explaining the study, its objectives, and methodology. In addition, the list of all the workers in the asbestos-based unit was received from them. Participation in the study was entirely voluntary, and employees received no benefit for the same. The confidentiality of the study subjects was maintained, and informed consent was also obtained. Those workers who have been identified with symptomatic Depression, anxiety, and stress were notified to the company, and individuals were counseled and referred to the psychiatric department of our hospital for further management.

Data collected were entered in Microsoft Excel (2010) and were analyzed using IBM Statistical Package for the Social Sciences (SPSS) v.20. Descriptive statistics were done, and Pearson's Chi-square test studied associations between dependent and independent variables. A P value of less than < 0.05 (two-tailed) was taken to be statistically significant.

Results

A total number of 227 participants were included in the study. Most of the study participants were 18-29 years (43.2%), followed by 30-39 years of age group (30.4%). Gender-wise, it was observed that the majority were males (63.4%). Most of the study participants were unmarried (62.6%), and nearly half of the study participants had a monthly family income of more than 30,000 INR. Most of the participants had no smoking or drinking habits (70%), and most of the study participants had no comorbidities (73.6%) (Table 1).

Nearly 61% of the study participants have working experience of more than five years. More than 4/5th of the workers were permanent employees, while 43.2% of the study subjects had a working shift of more than 8 hours. Nearly 66 % of the workers were traveling less than 1 km (Table 2)

Table 1: Socio-demographic characteristics of study subjects (Total N=227)

Variable	Characterization	Frequency	Percentage (%)
Age	18-29	98	43.2
	30-39	69	30.4
	>40	60	26.4
Gender	Male	144	63.4
	Female	83	36.6
Education	Higher Secondary & below	72	31.7
	Graduate & above	155	68.3
Marital status	Married	85	37.4
	Unmarried	152	62.6
Type of family	Nuclear	103	45.3
	Joint	121	54.7

Table 2: Working details of study subjects (Total N=227)

Variable	Characterization	Frequency	Percentage (%)
Working experience	<3	52	23
	3-5	89	39.2
	>5	86	37.8
Working hours per day	<8 hrs.	129	56.8
	>8 hrs.	98	43.2
Working Status	Contract	44	19.4
	Permanent	183	80.6
Travel time to work	< 1hr	149	65.6
	>1hr	78	34.4
Co-workers support	Yes	183	80.6
	No	44	19.4

The prevalence of Depression, anxiety and stress among the study subjects are found to be 38.8%, 43.6 % and 26.9 %, respectively, according to the DASS scale. (Fig1)

In the study, participants who have been identified with Depression, anxiety and stress were most in the category of mild and moderate. A significantly less proportion of the participants was in the highly severe category and were subsequently referred for treatment. The association of study variables with Depression, anxiety and stress was observed, and it was found that for Depression, their age, type of family, employment status, and working experience were found to be statistically significant ($p<0.05$). Among the factors associated with anxiety, age, education, working hours, employment status and traveling time were found to be statistically significant ($p<0.05$). Among factors associated with stress among study participants, educational level, marital status, working hours and employment status were considered statistically significant ($p<0.05$). The sleeping hours, comorbidities, substance use, co-worker support, and supervisor support of the workers were the factors that showed no association with Depression, anxiety, and stress using the pearson's Chi-squared test (Table 3).

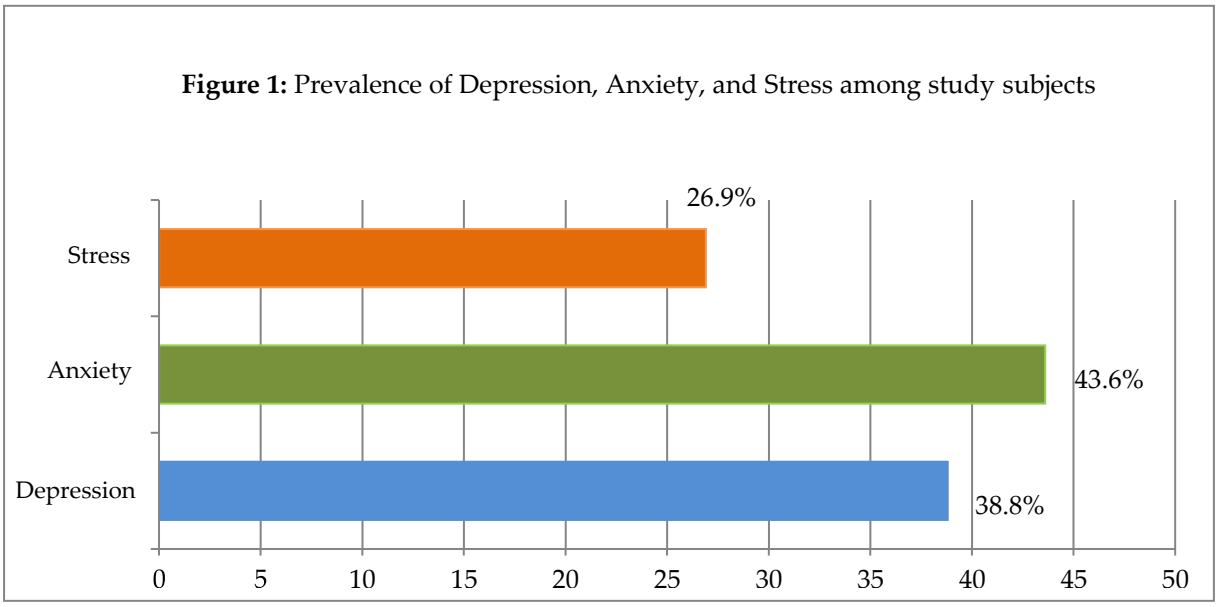

Figure 1: Prevalence of Depression, Anxiety, and Stress among study subjects

Table 3: Association between Study variables and Depression, anxiety, and stress (N-227)

Study variables	Characterization	Depression (n-88)	Anxiety (n-99)	Stress (n-61)
Age (yrs)	<30	29 (29.6)	44(44.8)	26(26.5)
	>30	59 (25)	55(50.4)	35(32.1)
	p-value	p- 0.01*	p- 0.005*	p-0.91
Geneder	Male	60 (41.6)	64(44.4)	38(26.4)
	Female	28(33.7)	35(42.2)	23(27.7)
	p value	p- 0.237	p- 0.739	p- 0.829
Education	Higher Secondary & Below	29 (40.3)	23(32)	11(15.3)
	Graduate & above	59(38.1)	76(49)	50(32.3)
	p-value	p- 0.750	p- 0.016*	p- 0.07
Marital status	Married	31(36.5)	39(45.8)	30(35.3)
	Unmarried	57 (37.5)	60(39.5)	31(20.4)
	p-value	p- 0.582	p- 0.593	p- 0.026 *
Type of family	Nuclear	28(21.5)	42(40.7)	25(24.3)
	Joint	60(49.6)	57(47)	36(29.8)
	p-value	p- <0.001*	p- 0.256	p- 0.295
Working experience	<3yrs	26 (50)	27(52)	19(36.5)
	>3 yrs	62 (35.4)	72(41.1)	42(24)
	p-value	p- 0.007*	p- 0.167	p- 0.073
Working hours per day	<8 hrs	57 (44.2)	71(55)	43(33.3)
	>8 hrs.	31(31.6)	28(28.6)	18(18.3)
	p-value	p- 0.054	p- <0.001*	p- 0.01*
Employment status	Contract	23(52.3)	26(59)	18(41)
	Permanent	65(35.5)	73(39.8)	43(23.5)
	p-value	p- 0.041*	p- 0.021*	p- 0.019*
Traveling time	< 1hr	55(37)	58(39)	39(35.4)
	>1hr	33(42.3)	41(52.6)	22(28.2)
	p-value	p- 0.428	p- 0.049*	p- 0.220

**Statistically significant p< 0.05*

Discussion

This study was done among 227 subjects employed in the asbestos unit of an automobile factory to assess the levels of Depression, anxiety, and stress using the DASS 21 scale. The present study revealed that the prevalence of depression among workers was 38.8%. Similar levels of depression (35.4%) were reported in a study done in Malaysia.[9] In contrast, a study done among the French cohort showed the levels of depression to be around 10%. and among Chinese workers, depression levels were found to be around 20.6% in those with past exposure to asbestos dust.[6,8] The overall prevalence of depression in the present study was double the times reported in the Indian general population, which is 18.5 %.[12] This depicts that the level of depression varies according to the occupation and the workload.

The prevalence of anxiety in our study was around 43.6%, and these findings were similar to the study done by Edimansyah et al.[9] Lower levels of anxiety were reported in France and China. [6,8] The overall prevalence of anxiety among the workers in the current study is much higher than in the general adult population in India, which is 24.4%.[12] These differences might be due to the high level of operating machines by the workers in the asbestos industry and the fear of injuries due to them. Hence the risk of anxiety disorders was found to be high in the industries than in the general population. The prevalence of stress among the study subjects was found to be around 26.9%, whereas lower levels of stress were reported in Malaysia9. Clemente et al. [5] said that there was an association between asbestos exposure and stress among workers in Spain. This correlation was also reported among Chinese industrial workers.[8]

A study conducted among petrochemical industrial workers in Iran showed the presence of depression, anxiety, and stress at 38.92%, 44.31 %, and 29.34%, respectively.[13] These findings were consistent with the results of the present study, though the study population was different. A similar study conducted among Australian industrial workers showed that 28.3 %, 22.3%, and 19.4 % had depression, anxiety, and stress, respectively, which is relatively lesser than the findings of the present day, which could be due to the varying levels of physical work among the different industries.[14]

In the present study, those workers in the middle age group of 30- 39 years were found to have a high risk of developing depression, anxiety, and stress than those in the other age groups, which is consistent with the study conducted in Delhi.[15] In contrast, a survey conducted among industrial workers in Bangalore showed no associations between age and mental disorders.[16] There was no influence of marital status and gender on developing depression, anxiety, and stress in the present study, which is consistent with the previous research conducted among the industrial population in India.[17] However, a study conducted on small and medium enterprise workers showed a significant association between these factors and psychiatric disorders.[18] The differences in these findings may be due to the different working circumstances prevailing in other areas.

Those workers with a habit of smoking and alcohol drinking have no risk of developing depression, anxiety, and stress. This finding is consistent with the study conducted by Ratanasiripong P et al. among small and medium enterprise workers.[18] But similar studies undertaken in the general population showed a significant association between smoking and alcohol habits and any psychiatric disorders.[19,20] These distinct findings may be due to the fewer numbers of workers with smoking and alcohol drinking habits.

Concerning the working conditions, it was found that Depression, anxiety, and stress were significantly associated with employment status. This shows that job security is an essential factor related to mental health. This was further seen by Kim et al. in South Korea.[21] Job security was also found to be a significant factor in developing stress and anxiety in our study. This was consistent with the findings from Malaysia.[9] There was no significant association found between the element of support given by the co-workers and the supervisors in the company and psychiatric morbidities. This is because those workers with help from their co-workers and supervisors were in a much higher percentage than those without their support. However, this was in contrast to studies done in Malaysia and India.[9,16] Finally, working experience (years)in a large automobile factory like the current one has been associated with the development of stress.[22] Similar findings were reported in our study.

Overall, our study tried to report Depression, anxiety and stress among Automobile industry workers. Many studies were exploring physical morbidity, but to the best of our knowledge, we found only a few studies done in this sector exploring mental health.

Limitations

The Limitations of our study include the use of the DASS-21 scale; though validated, it's only a screening tool, but still, the study subjects who

reported severe symptoms were promptly referred for further evaluation. The other limitation of our study is the cross-sectional design, which limits establishing the temporal association and having been done only in one unit of the factory, the external validity of our research is also limited. Further exploratory and longitudinal studies are required to address this grey area in occupational health.

Conclusion

The present study was done to estimate the levels of Depression, anxiety and stress among Automobile industry workers. The levels reported in the study are higher compared to the general population. There is a need for attention to be paid to the development of a healthy psychosocial workplace climate. Employers should prioritize preventing work-related stress and promoting employee well-being through resources for stress management, mental health support, and work-life balance. Addressing work-related stress can improve employee health, increase productivity, and reduce accidents and errors in the workplace.

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Original Article

Noise levels at traffic intersections and awareness of noise pollution among traffic policemen and automobile drivers

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ABSTRACT

Introduction: Noise pollution is an important health hazard in modern times and traffic policemen and automobile drivers are exposed to unregulated vehicular noise. This study aims to estimate the exposure levels from traffic noise for traffic policemen and automobile drivers and assess their awareness regarding noise pollution and the use of noise prevention measures.

Methods: An analytical cross-sectional study was carried out comprising the exposed and the control group with 121 people in each group. Sound level estimation was carried out across 20 traffic intersections in the city at various times to assess the noise levels. All the participants were administered a pretested questionnaire to assess their awareness regarding noise pollution and as well as the use of noise prevention strategies. The chi-square test was used to estimate the difference between the two groups. P <0.05 was considered statistically significant.

Results: The noise levels at traffic intersections are above the permitted and acceptable limits. The mean ±SD of sound levels at traffic points range from 76.8±5.8 dB to 83.4±6.3 dB across various traffic intersections. The mean noise level at the traffic intersection was in the high-risk category (81-86dB) in 25% of traffic points while 75% of traffic points had noise levels in the moderate risk (76 - 81dB) category. 88% of the exposed group and 95% of the control group considered noise to be a form of pollution even though they were not aware of all the harmful effects. In practice, only 34% of study participants used some form of hearing protection measures, even though the majority were aware of the need to do so.

Conclusion: The noise levels at traffic intersections are high. This is coupled with a lack of adequate use of hearing protective devices which can be detrimental to the inner ear. Frequent awareness programs are necessary to educate the occupationally exposed personnel on proper noise prevention strategies. At the same, time it is necessary to take decisive measures to curb the ever-increasing menace of occupational noise exposure.

Keywords: Awareness, Hearing protection device, Noise pollution; Traffic noise

Introduction

Noise is an unpleasant and unwanted loud sound that causes disturbance and irritation[1]. Noise pollution is an important health hazard that can affect people across all age groups. It is estimated that 12.5% of children and 17% of adults have suffered permanent hearing loss due to noise exposure[2]. The detrimental effect of noise exposure is not just limited to hearing loss but also can present a multitude of problems affecting the general well-being of the person. Sources of noise are manifold and vehicular noise contributes to most of the environmental noise. The effect of excessive vehicular noise is borne by the traffic police personnel most of the time. The prevalence of noise-induced hearing loss among the police force is high and is estimated to be 34% in studies.[3,4] It has been seen that nearly 26.8% of automobile drivers are also affected by noise-induced hearing loss[5]. It is well known that awareness of any problem is necessary to take any preventive and remedial measures. Noise pollution has always been a neglected entity and noise levels from vehicular traffic remain unregulated. The study aims to estimate the exposure levels from traffic noise for traffic policemen and automobile drivers and assess their awareness regarding noise pollution and the use of noise prevention measures.

Methods

The study was an analytical cross-sectional design consisting of the exposed group and the control group and was conducted for a period of 2 years from June 2020-2022. Expecting that 50% of the study group will be aware of noise pollution and the use of noise prevention measures and a minimum of 20% difference in the control group with a 95% confidence interval, 80% power with two-sided hypotheses, the sample size was estimated to 105 in each group. Adding a 15% non-response rate, the final sample size was calculated to 121 in each group using Open Epi software version 3.01. The exposed group comprised 121 people (traffic policemen – 66; automobile drivers – 55) who had a history of noise exposure for approximately 8 hours/day for at least 5 years or more. The control or the nonexposed group had 121 participants and comprised healthy volunteers who did not have any history of any prolonged or chronic noise exposure. Any history of ear discharge, vertigo, chronic diseases like diabetes, hypertension, kidney diseases, or thyroid dysfunction was excluded from the study. All the study participants were administered a pretested questionnaire and their responses were recorded. The questionnaire consisted of questions that recorded the basic socio-demographic and employment details of the participants. The questionnaire had questions that recorded the details and duration of noise exposure and the type of exposure that the participants are exposed to. It consisted of closed, semi-closed and open-ended questions to assess the awareness regarding noise pollution and knowledge and use of hearing protection devices by the participants. The chi-square test was used to estimate the difference between the two groups. $P < 0.05$ was considered statistically significant.

Sound level estimation was carried out across 20 traffic intersections in the city with high traffic load. The sound level recording was done with a Class I sound level meter(Lutron SL-4033D model, Lutron Electronic Enterprise Ltd, Taiwan), having a condenser type of microphone and measuring range of 30-130 dB with a resolution of 0.1 dB. The recording was carried out by fixing the sound level meter on a tripod perpendicular to the ground and at a height of 120cm from the ground level. Three sessions of recording were conducted each day at three different times, (9 AM to 10 AM, 2PM to 3 PM and, 5 PM to 6 PM). Each session lasted for one hour and each traffic intersection was mapped for two consecutive days. The recording was done only on the weekdays and was avoided on any holidays. Analysis of data was done with MS Excel 2010 (Microsoft Windows). Mean ± SD was calculated and maximum and minimum sound pressure levels were noted.

Results

The mean ± standard deviation (SD) of sound levels at traffic points range from 76.8±5.8 dB to 83.4±6.3 dB across various traffic intersections with a minimum sound level (L_{min}) of 60.8 dB and maximum sound level (L_{max}) of 117.4 dB are shown below [Table 2].

Based on the mean noise level 25% of traffic points had noise levels more than high risk (81-86dB) and the remaining 75% of traffic points had Moderate risk (76 - 81dB). There was no significant variation in traffic noise levels recorded at different times of the day.

Table 1: Risk stratification based on the sound level at various traffic points.[6]

Sound level (dB)	Risk
Less than 66	Safe
66 – 71	Tolerable
71 - 76	Low risk
76 – 81	Moderate risk
81 – 86	High risk
More than 86	Extremely high risk

Table 2: Distribution of noise levels at various traffic points

SL. No.	Traffic Point	Mean± SD Noise level dB	L_{max}	L_{min}
1	Anjaneya Swamy Temple Ramvarapadu	79.7±6.3	110.4	66.8
2	Auto Nagar	81.7±5.6	108.1	69.5
3	Benz Circle	83.3±5.8	108.4	69.8
4	BRTS Road	76.8±5.8	107	64
5	Chittinagar One Town	80.7±6.1	108.6	68.8
6	IG Stadium	78.8±5.3	105.4	64.2
7	Mahanadu Junction	80.8±5.7	107.7	67.3
8	Netaji Point	83.4±6.3	107	70.2
9	Nirmala Junction	80.8±5.4	107.5	67.9
10	NTR Circle	80.4±6.0	107	67.6
11	Old Bus Stand	81.7±5.2	116.9	69.1
12	Police Control Room	78.7±6.2	106.1	63.1
13	Prakasam Barrage	78.6±6.3	117.4	63.9
14	Pushpa Hotel Point	79.4±5.9	106.3	66.6
15	PWD Ground Signal	79.2±5.3	109.2	60.8
16	Raghavaya Park	79.1±4.9	110.5	67.9
17	Ramesh Hospital Point	81.0±5.5	109	69.9
18	Ramvarapadu Ring Rd	80.7±5.1	109.3	69.2
19	Sitarampura	80.9±5.4	110.6	64.4
20	Vinayaka Temple One Town	80.5±5.8	108	68

In the present study, 88% of the noise-exposed group were aware that prolonged noise exposure was harmful compared to 95 % of the control group. When asked about the effects of noise pollution, symptoms like hearing loss and headache were attributed to noise exposure by a majority of all participants [Table 3]. The majority of the exposed group and the unexposed group did not consider hypertension, sleep disturbance, psychiatric disorders and tinnitus to be harmful effects of prolonged noise exposure [Table 3]. Interestingly, the awareness regarding the symptoms of prolonged noise exposure was more among the control group as compared to the exposure group (P< 0.05) [Table 3]. In the exposed group, awareness levels were better among the traffic policemen than among the automobile drivers [Table 4].

It was also noticed that, compared to the 71% of the exposed group, almost 88.4% of the control group felt the need for using noise prevention strategies (P< 0.001). Nearly 90.9% of traffic policemen felt the need for using noise prevention strategies as compared to 47.3% of automobile drivers (P<0.001). In practice, it was seen that only 34.7% of the exposed group and 77.7% of the control group used some form of noise prevention measures (P <0.01). Both groups considered cotton plugs to be a useful noise prevention strategy and the majority were unaware of the use of ear plugs, ear muffs and noise cancellation headphones as protective noise

prevention measures. There were no awareness programs on noise pollution and nearly 93% of the exposed group had never attended any such program at their workplace [Table 3].

Table 3: Awareness regarding noise pollution and use of noise protection measures**.**

		Exposed n =121	Control n =121	Total	p-value*
Awareness of the harmful effects of noise	Present	107(88.4)	115(95.0)	222(91.7)	0.062
	Absent	14(11.6)	6(5.0)	20(8.3)	
Consider the following symptoms as harmful effects of prolonged noise exposure: -					
1. Dizziness	Yes	1(0.8)	12(9.9)	13(5.4)	0.002
	No	120(99.2)	109(90.1)	229(94.6)	
2. Hearing Loss	Yes	95(78.5)	112(92.6)	207(85.5)	0.002
	No	26(21.5)	9(7.4)	35(14.5)	
3. Hypertension	Yes	9(7.4)	13(10.7)	22(9.1)	0.371
	No	112(92.6)	108(89.3)	220(90.9)	
4. Psychiatry disorder	Yes	11(9.1)	24(19.8)	35(14.5)	0.018
	No	110(90.9)	97(80.2)	207(85.5)	
5. Heart ailment	Yes	23(19.0)	30(24.8)	53(21.9)	0.277
	No	98(81.0)	91(75.2)	189(78.1)	
6. Tinnitus	Yes	10(8.3)	30(24.8)	40(16.5)	0.001
	No	111(91.7)	91(75.2)	202(83.5)	
7. Sleep disturbance	Yes	3(2.5)	15(12.4)	18(7.4)	0.003
	No	118(97.5)	106(87.6)	224(92.6)	
8. Mood swing	Yes	47(38.8)	49(40.5)	96(39.7)	0.793
	No	74(61.2)	72(59.5)	146(60.3)	
9. Headache	Yes	76(62.8)	99(81.8)	175(72.3)	0.001
	No	45(37.2)	22(18.2)	67(27.7)	
Feel the need for protection against noise pollution	Yes	86(71.1)	107(88.4)	193(79.8)	0.001
	No	35(28.9)	14(11.6)	49(20.2)	
Take measures to protect from noise	Yes	42(34.7)	94(77.7)	136(56.2)	<0.001
	No	79(65.3)	27(22.3)	106(43.8)	
Ear plugs	Yes	9(7.4)	17(14.0)	26(10.7)	0.97
	No	112(92.6)	104(86.0)	216(89.3)	
Cotton balls	Yes	40(33.1)	86(71.1)	126(52.1)	<0.001
	No	81(66.9)	35(28.9)	116(47.9)	
Ear muffs	Yes	1(0.8)	5(4.1)	6(2.5)	0.98
	No	120(99.2)	116(95.9)	236(97.5)	
Noise – Cancelling headphones	Yes	0(0)	2(1.7)	2(0.8)	0.156
	No	121(100)	119(98.3)	240(99.2)	
Whether any awareness program was carried out in the workplace on noise pollution	Yes	9(7.4)	5(4.1)	14(5.8)	0.271
	No	112(92.6)	116(95.9)	228(94.2)	

Table 4: Breakup of awareness regarding noise pollution and use of noise protection measures between traffic policemen and automobile drivers.

		Traffic police (n = 66)	**Automobile drivers** (n = 55)	**p-value***
Awareness of the harmful effects of noise	Yes	65(98.5)	42(76.4)	<0.001
	No	1(1.5)	13(23.6)	
Feel the need for protection against noise pollution	Yes	60(90.9)	26(47.3)	<0.001
	No	6(9.1)	29(52.7)	
Take measures to protect from noise	Yes	24(36.4)	18(32.7)	0.675
	No	42(63.6)	37(67.3)	

*Chi-square test was used

Discussion

Vehicular traffic contributes to 80% of the environmental noise.[7] The rising population of the cities along with congested city roads has increased traffic noise levels. The noise levels detected in the present study are above the permissible noise limits set by Central Pollution Control Board which set the maximum permissible noise in industrial, commercial, and residential areas during day time to 75dB, 65 dB, and 55 dB respectively.[8] The effects of chronic noise exposure on health are already established. It is well known that chronic noise exposure has a detrimental effect on the auditory threshold and causes a threefold increase in the risk of developing hearing loss[9]. Approximately 12% of the global population is at risk from noise-induced hearing loss and approximately 68% of traffic policemen are affected by some degree of hearing loss due to prolonged exposure to noise experienced at traffic points.[4,10]Automobile drivers are also exposed to vehicular engine noise which can range from 88dB to 103dB depending on the type of vehicle.[11] The sources of noise exposure in automobile drivers are manifold and include the engine sound, and noise emanating from the exhaust system and the tires. Apart from the auditory effects, chronic noise exposure is associated with hypertension.[12] It is estimated that a 1dB reduction in noise level can avoid 284 premature cardiovascular and 184 premature respiratory deaths.[13] The cognitive functions are affected by noise and there is an increase in the average errors and reaction times while performing difficult tasks.[14] Annoyance is considered to be one of the first and most widespread reactions to environmental noise.[15] Noise has been associated with chronic headaches, sleep disturbance and immune alterations. [16,17,18] It is known that many non-communicable diseases like diabetes, obesity, and cardiovascular diseases are on the rise and many of them owe to lifestyle changes as an etiological factor. There is enough evidence to suggest road traffic noise is associated with diabetes and obesity. [19,20] Chronic exposure to environmental noise has also been associated with male infertility.[21]

Awareness regarding the hazards of noise exposure is necessary for taking any preventive measures. We have seen in this study that even though the participants had some awareness regarding the harmful effects of noise and the need to take preventive measures, fewer adopted the preventive measures. Various studies have also reported low compliance toward the use of hearing protective devices.[22,23] Many factors may be responsible for such non-compliance. Availability of the devices and associated costs along with hygiene, difficulty in communication, and discomfort from the use of such devices may be some factors that are barriers to the proper use of hearing protective devices.[22] Increased cognitive effort to hearing and loss of situational awareness arising from the use of hearing protective devices have also been seen and may contribute to poor acceptance or usage among the noise-exposed group.[24] It is important to use an appropriate protective device depending on the sound level exposure. Cotton plugs even though widely used are not recommended as standard hearing protective measures because of the very low levels of attenuation provided. Ear muffs provide better attenuation at low frequencies while ear plugs provide attenuation at both high and low frequencies.[25] It has been seen that ear muffs can provide attenuation up to 40 dB at 2kHz and beyond that frequency it provides an attenuation of around 35 dB. Ear plugs on the other hand attenuate around 25dB up to 1kHz and around 40dB at higher frequencies.[25] Ear plugs need proper fitting for optimal sound attenuation and pre-molded ear plugs may not provide necessary attenuation in practical scenario.[26,27]

Occupational noise exposure is often a neglected entity. There is a lack of awareness about this form of pollution among the stakeholders.[23,28] Awareness and educational programs regarding noise pollution and noise prevention strategies are necessary to bring about behavioral modifications and the adoption of noise reduction strategies. This will help in reducing the long-term effects of noise pollution. At the same time, it is important to take decisive measures to curb the nuisance of traffic noise. This may be achieved by implementing legislation for regulating noise levels. Proper planning and designing of city roads and traffic intersections can

go a long way in reducing the impact of vehicular noise. Enclosed traffic booths can be a practical solution to protect traffic policemen from chronic noise exposure. Mandatory regular maintenance of vehicles can go a long way to mitigate the noise output of vehicles. It is important to create a noise barrier by plantation of trees surrounding the high noise zones which can help in attenuation of sound energy.[29] It is also necessary to identify and demarcate silence zones and bring in automation in traffic intersections thereby reducing the exposure among the traffic personnel and automobile drivers.

Conclusions

The noise level across various traffic points is above acceptable limits and should act as a warning for the ever-increasing noise pollution that cities are witnessing. A lack of awareness regarding noise pollution can act as a hurdle to the adoption of noise prevention strategies. It is necessary to educate traffic policemen, automobile drivers and others with occupational noise exposure on the harmful effects of noise and carry out frequent sensitization on proper noise prevention strategies, particularly in the settings of occupational noise exposure. It is also imperative to adopt a concerted approach by the citizens and the administration which will help towards reducing the traffic noise levels in cities.

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Original Article

Occupational Safety and Health Management in Selected Industrial Sectors in Sudan

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ABSTRACT

Introduction: Since Heinrich's early studies, work has been recognized as a substantial contributor to psychological and physical illness. Fast technological, economic, and social advancements have increased the number of occupational fatalities and illnesses in developing nations. Nonetheless, it is demonstrated that the creation, application, and enforcement of Occupational Safety and Health Management Systems (OSHMS) reduce accidents and enhance employees' well-being. This study aims to understand Sudan's current occupational safety and health situation and identify any challenges or gaps in the current system.

Methods: A mixed methods approach deploying a literature review and secondary data was adopted to answer the research question about the status of occupational health and safety in Sudan.

Results: A comparison of the artisanal and organized gold mining sectors over the years 2018-2020 shows an increase in the number of accidents in the artisanal sector but a sharp decrease in both the number and severity of accidents in the organized sector. The frequency rate declined in the organized sector but fluctuated in the artisanal sector. It was also found that many OSH incidents of different types and levels of severity occurred. In 2020, the Fatal Accident Rate (FAR) was 66.48 in artisanal gold mining, 0.55 in organized gold mining, and 0.01 in oil and gas. However, calculating and comparing other sectors' performance indicators to evaluate OSH's status was not possible for many reasons.

Conclusion: Findings were constrained, possibly due to the limited occupational health and safety data. There is an urgent need to strengthen and improve the governance of occupational safety and health in Sudan. A more comprehensive study needs to be undertaken to assess the status of the OSH in formal and non-formal sectors and investigate the correlation of OSH to workers' well-being and the Sudanese economy.

Keywords: Health and Safety Management, Safety Performance, Sudan

Introduction

Work was identified as a significant cause of psychological and physical ill-health since the early research of Heinrich.[1] The rapid economic, technical, and social changes have created a substantial burden of occupational deaths and ill health on governments.[1] However, the development, implementation, and enforcement of Occupational Safety and Health Management Systems (OSHMS) have proven to minimize the number of accidents and improve workers' well-being.[1,2] One way of doing that is to calculate safety performance to improve safety management systems. The safety performance can be measured using safety leading or lagging indicators to improve safety management systems,[3] and for informed decision-making.[4] However, the recording of occupational accidents and work-related diseases is considered weak globally.[5]

Despite the efforts put in managing OSHMS, threats to the health and safety of employees continue to exist in the workplace[6], including in developing countries which are subject to a disproportionate amount of hazardous production and unsafe working condition due to their industrial development conditions.[7] The International Labour Organization (ILO) statistics note that the world's workforce sustains at least 2.78 million deaths and 374 million non-fatal injuries because of poor OSHMS.[8] Poor OSHMS contributes to about 5.4% of the global Gross Domestic Product (GDP).[9]

OHS concerns in developing nations are severe, and their effective management has become an essential issue.[10] Workers in developing countries are more likely to be affected by workplace hazards than their counterparts in developed countries.[11,12] For instance, in Africa, workers' life expectancy is negatively impacted due to poor OHS enforcement compared to the rest of the world.[13]

Masekameni et al. argued that OHS in developing countries lags considerably behind developed countries in delivering OHS services to workers.[14] Nuwayhid reasoned that the limited access to OHS services in low-income countries (LIC) is due to the lack of government interest in occupational health, inadequate data collection methods, and lax implementation of health and safety legislation, besides the challenging social, economic, and political situations.[15] In addition, the growing competition and lack of supervision in some developing countries, where most of the global occupational deaths and injuries happen, are due to minimized labor costs and the standards of workers' protection.[16]

Sudan is no different from all developing and Sub-Saharan countries, where workers often work under hazardous conditions, and the status of OHS is ambiguous.[17] The lack of research on occupational health and safety in Sudan[18] and developing countries[19] is a fundamental factor in the ambiguity of OHS in Sudan. Therefore, this study aims to answer the research question: Where does Sudan stand regarding workplace safety and health?

Methods

This study adopted a mixed methods approach to answer the research question about occupational health and safety status in Sudan. Mixed research methods are widely used by researchers where the quantitative and qualitative data gathered and analyzed complement each other.[20] The qualitative data was obtained by searching databases exploring published articles in peer-reviewed journals, technical reports, governmental unpublished reports, and international organizations' websites. The quantitative method adopted a secondary data analysis approach. The quantitative approach is believed to use data already collected for different purposes, and [21] provides various options for research across many fields.[22]

The authors of this study deployed the network strategy to identify the available secondary data by contacting key OHS practitioners during the summer of 2021. A plethora of literature has noted that networks and previously published data can generate information on primary research to undertake manual library searches and/or locate unpublished material, necessitating contacting appropriate local or national organizations working in the field. [23–25] The authors' networks contact resulted in compiling data from accident records for the period between 2018-2020 from the Ministry of Oil and Gas, the Sudanese Mineral Resources Company (SMRC), the Ministry of Labour and Administration Reforms (MLAR), the Ministry of Industry (Industrial Safety Unit), the Pension and Social Insurance Fund (PSIF), and a soap factory in Khartoum, Sudan.

Although the literature criticizes measuring safety performance using accidents, injury, and severity rate (Lagging indicators), it is considered an important indicator to measure workplace safety.[26] In fact, many organizations attempt to improve their safety procedures to reduce and eliminate exposure to hazards in the workplace by measuring and reducing the Lagging indicators.[26]

The primary OSH performance indicators are calculated for three selected Sudanese industrial sectors using the methods included in the WHO manual for direct health care workers of 2002.[17] The secondary data for calculating the primary OSH performance indicators were obtained from several sources. These include the incident summaries of the mining and oil and gas industries provided by the Sudanese Mineral Resources Company (SMRC) and the Ministry of

Energy and Oil. Data on industrial accidents were provided by the Industrial Safety Unit at the Ministry of Industry, in addition to the compensation records provided by the Pension and Social Insurance Fund (PSIF).

Three industries were selected based on the African Development Bank report, which indicates that the leading industrial sectors contributing to the Gross Domestic Product (GDP) in Sudan are mining, agriculture, and manufacturing.[27] The agriculture industry is spread across Sudan; nevertheless, no data on agricultural OSH was found. Therefore, it was replaced with the oil and gas industry. In addition, a soap factory with about 260 employees is taken as a case study to assess the status of the HSE performance.

Calculations example:

The incident rate is calculated by multiplying the total number of accidents by 1000 and dividing it by the total number of workers exposed. In contrast, the frequency rate is calculated by multiplying the total number of accidents recorded in a particular year by 1000 and then dividing that number by the total number of hours worked in that year:

$$Frequency\ Rate\ \ (FR)$$

$$FR\ = \frac{Total\ number\ of\ accidents\ \times\ 10^3}{Total\ number\ of\ hours\ worked}$$

In certain instances, the severity rate is calculated by determining the number of days absent from work for every 1000 hours spent on the job. In addition, there is a distinction made in accident data between injuries that are temporary and those that are permanent and debilitating.

Results

OHS is defined as the discipline of anticipating, recognizing, evaluating, and controlling hazards arising in or from the workplace, which could impair the health and well-being of workers and impact the surrounding communities and the environment.[28] Preventing occupational risks is a complicated task. One of the significant contributors to this complexity is the worldwide reported lack of workers' awareness about their occupational health rights intended to minimize occupational risks.[29]

Although OSH fatal and non-fatal accidents are widely reported in the Sudanese newspaper and social media, no official statistics are published. This is obvious in the high numbers of death that occurred because of mine collapses, handling hazardous materials, and fires in different locations around Sudan.

Since the oil boom of the 1970s, the exploitation of minerals, such as oil and gas and mining, is thought to help developing nations by providing employment, economic growth, and public services, reducing poverty. Yet numerous empirical studies highlight the difficulty of transferring resource income and resource-led growth into poverty reduction.[30] One of the difficulties discussed in the literature is the impact of oil and gas exploration and processing on the health and safety of workers.[31]

The industrial sectors, including factories, processing facilities, and workshops, need to be evaluated for their impact on OHS as another domain. It is believed that, in the manufacturing industry, terrible and dangerous accidents that put people and businesses in danger are happening more and more often. [32] Recent example is the Rana Plaza collapse in Bangladesh in 2013, which resulted in the deaths of over a thousand workers and the injuries of tens of thousands more, highlighting the severity of OSH in developing nations.[33]

In this study, the secondary data of different industrial incidents were analyzed, and incident frequency and severity rates were calculated to compare the selected industries and the industry's performance over specific years. Firstly, the average full-time employee working hours in Sudan were estimated. Secondly, whenever possible, the Frequency Rates (FR), Incident Rates (IR), Lost Workdays (LWD), and Severity Rates (SR) were calculated for the organized and artisanal gold mining, oil and gas and soap factory (case study).

However, occupational injury rates vary considerably by country and are rarely comparable in part due to differences in

legislation, availability of injury records (source of lost-time injury claim), and severity of the injury. The type and other characteristics of work-related injuries will vary with the severity of cases, which reflects the duration of workdays lost, and which is distinct from country to country.[34]

Below is an illustration of the literature review results and the secondary data analysis providing an overview of different industries' occupational health and safety.

Gold Mining in Sudan

Mining continues to be a dangerous activity, whether large-scale industrial or small-scale artisanal mining.[35] The World Bank estimates that 100 million children, women, and men work in ASM worldwide, mainly in remote rural areas of LIC and LMIC.[36] Nonetheless, the number of artisanal and small-scale miners is unknown worldwide, and it is most likely to be substantially more significant than the World Bank estimate. Furthermore, accurate information on the number, gender and age distribution of artisanal and small-scale miners in all countries is lacking, as there is no information on available health and social services.[36]

Artisanal Small-Scale Mining (ASM), which is rapidly increasing in Low-Income Countries (LIC) - and Lower-Middle-Income Countries (LMIC), takes place under extreme conditions with a lack of occupational health and safety.[36] The hazards in ASM include exposure to dangerous chemicals, particularly mercury, lead, cyanide, arsenic, cadmium, and cobalt, as well as severe injuries such as falls from heights, crush injuries from cave-ins, lacerations and amputations from unsecured machinery, among others. [36] Workers in ASM are also exposed to dust and toxins, along with stress from the working environment or managerial pressures, which give rise to various diseases that affect miners.[35] Ergonomic risks posed by using heavy equipment and manual handling in confined spaces contribute to OHS in the mining industry.[37] Adding to the occupational hazards identified in the literature concerns about hygiene and sanitation, the rise of sex workers and associated reproductive health problems in mining communities have been raised by authors.[38]

Sudan is the third-largest gold producer in Africa. Gold mining in Sudan goes back to 3000 BC.[39] In 2017, the director-general of the Geological Research Authority of Sudan (GRAS) declared that more than one million Sudanese are involved in artisanal gold mining,[40] and about 361 companies are involved in gold mining activities in Sudan, ranging from exploration to tailing mining processes. Due to natural disasters, bad socioeconomic conditions, low literacy rates, and long-lasting conflicts, traditional gold miners in Sudan are at risk for several health problems, especially vulnerable internal migrant miners exposed to short, medium, and long-term health consequences and disparities.[41] Hence, artisanal gold mining in Sudan presents substantial risks to miners.[42]

Nevertheless, it is believed that in LMIC, governmental oversight is rare, especially in areas where ASM is illegal.[36] Sudan, as a lower middle-income country[43] is no exception when it comes to ungoverned artisanal mining. Fadlallah (2020) highlighted the experience of the Sudanese internal migrants working as traditional gold miners. He stated that internal gold miners experience increased health risks, a dearth of apparent migration and mining policies and limited awareness of government and healthcare providers of the migrants' needs.[41]

Based on the secondary data obtained from the incident summaries of the mining industries provided by the Sudanese Mineral Resources Company (SMRC), the trend of gold mining incidents in the artisanal and organized sections is illustrated (Figure 1). The figure shows that artisanal mining witnessed an increase in the number of accidents while the organized section witnessed a steady decrease in the total number of incidents between 2018-2020. However, comparing the two sectors is impossible because of the lack of information on the number of workers in each.

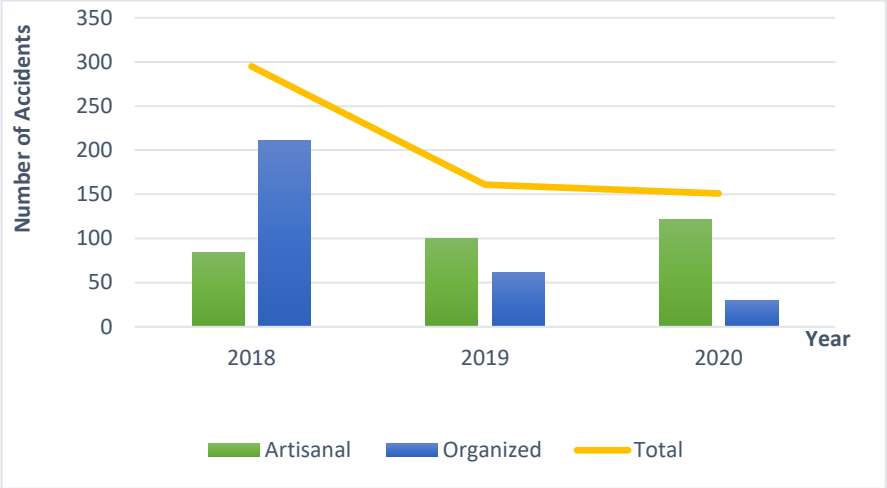

Figure 1: Distribution of gold mining incidents (Source SMRC)

The incidents, frequency, and severity rates were calculated for organized and artisanal gold mining to measure their performance over three years between 2018-2020. It was found that the performance indicators in organized mining experienced a vast decrease over the three years of the study (Table 1). Although it was difficult to calculate the performance indicators in artisanal mining due to the limited data available, the considerable fluctuations in the frequency rate were obvious (Table 2).

Table 1: Performance indicators of organized gold mining assuming 7.5 hours/day and a five-day week

Year	Total Number of Incidents	Number of Fatalities- Related to the work	Number of Lost Workday Cases (LWDC)	Frequency Rate (FR)	Fatal Accident Rate (FAR)
Organized Gold Mining					
2018	211	15	9	115.93	8.24
2019	61	5	8	33.52	2.75
2020	30	1	8	16.48	0.55

Table 2: Performance indicators of artisanal gold mining assuming 7.5 hours/day and a five-day week

Artisanal Gold Mining				
Year	Total Number of Incidents	Number of Fatalities-Related to the work	Frequency Rate (FR)	Fatal Accident Rate (FAR)
2016	31	DNA[1]	17.03	DNA
2017	134	DNA	73.63	DNA
2018	84	DNA	46.15	DNA
2019	100	DNA	54.95	DNA
2020	121	121	66.48	66.48

[1] Data Not Available

Oil and Gas in Sudan.

Although the oil and gas industry is expected to apply higher standards of corporate governance and even greater transparency in reporting practices when it comes to matters related to OHS principles.[31] It was noted that the oil and gas sector is among many industries characterized by the convergence of numerous hazardous exposures that can potentially cause serious catastrophes and work-related accidents.[44] This was evident in the oil and gas catastrophes accidents like the Piper Alpha disaster in 1988 and the Montara blowout in 2010 that claimed a life and caused damage to properties.[44] Previous oil and gas

disasters proved that the occupational hazards associated with petroleum refining require impeccable health and safety management systems.[45]

On the other hand, although the Arab region is the largest oil and gas producer globally, minimal research has been done at the sectoral level and across various aspects of the oil and gas value chain. Along the same lines, the literature on oil and gas in Sudan is poor and could not be found in any digital resources searched.[46]

Sudan's oil is estimated at 0.3% of the world's total oil reserves,[47], most of which are in the separated South. While oil and gas were first discovered in Sudan in the 1970s, the civil war and the lack of infrastructure contributed to the delays in their production.[48] Nevertheless, the impact of oil and gas on the Sudanese economy was undeniable before the separation of Southern Sudan in 2011.[49]

The oil and gas business in Sudan is administrated by the Ministry of Petroleum & Minerals.[50] The authors managed to visit the ministry during the summer of 2021 and received a copy of the HSE annual report of one of the major companies operating in oil and gas in Sudan. The report illustrates that the HSE Key Performance Indicators (KPIs) show exemplary achievements with scope to improve. The report shows that the HSE training in 2020 is more than double that of 2019 (Table 3). The fatal accidents rate for two consecutive years was extracted from the report and is displayed below. (Table 4).

Table 3: Summary of leading and lagging indicators in an oil and gas company (Source Ministry of Energy and Oil)

Leading HSE Indicators					
No.	**Description**	**Definition/ Formula**	**2019**	**2020**	**Target**
1	Management HSE Inspection (MHSEI)	Number of planned visits vs. actual during the current year	8	0	9
2	HSE training	60% of the average population	466	1096	900
3	Unsafe Acts and Conditions + Controlled Hazards	30% of the average population	586	707	650
Lagging HSE Indicators					
No.	**Description**	**Definition/ Formula**	**2019**	**2020**	**Tolerance**
1	FAR (Fatal Accident Rate)	Number of fatalities per 100 million man. hr	0	12.44	0
2	Lost Time Incident Frequency (LTIF)	Number of LTI per million man. hr	0	0	<0.5
3	Total Recordable Incident Rate (TRIR)	Number of TRI per 100 million man. hr	0	0.12	<1.5
4	Fire Incidents	Number of incidents	3	5	0
5	Vehicle Accidents	Numbers	1	5	0
Health Performance Indicators HPI					
No.	**Description**	**Definition/ Formula**	**Actual**		**Target**
1	Occupational Illness Frequency (OIF)	Number of illnesses* 1,000,000 Total/ actual man-hours worked	0		0
2	Employee Patients	Employees served	2524		Actual
3	Health awareness program trainee	First aid and Trauma life support	Ongoing + COVID-19 awareness		Need base

Table 4: Summary of Fatal Accident Rate (FAR) (Source Ministry of Energy and Oil).

Oil and Gas	
Year	**Fatal Accident Rate (FAR)**
2019	0.00
2020	0.01

Industry in Sudan

Manufacturing industries commonly see an increase in catastrophic and hazardous events

that put the lives of individuals and companies at risk.[32] The international and local legislation mandates the management of occupational health and safety within organizations, yet many organizations in developing countries are negligent at adhering to the safety measures, with no evidence of proper enforcement.[51] However, during the past few decades, the industrial sector in Arab nations has undergone significant growth. However, the sector's significant occupational risks have created great concern and suffering among workers.[6]

In Sudan, manufacturing is still in its infancy and is dominated by the processing of food and beverage products, focusing on sugar refining, vegetable oil, soap, and cotton ginning.[23] Nevertheless, implementing OSH within the Sudanese industry is thought to be challenging due to a lack of resources. The literature identified numerous industrial hazards, including aging industrial buildings, the absence of emergency exit doors, and inadequate lighting and ventilation. However, if they existed, the welfare and sanitary facilities would be old and not usable.[52]

Zanko and Dawson noted that the workers' representatives' participation could improve health and safety.[1] However, the dissolution of the workers' trade unions in 1989 did not help the workers' situation. Although it was founded in 1940, the Sudanese trade unions were unable to ensure the protection of the economic and social rights of Sudanese laborers.[53]

The analysis of the secondary data obtained from the Industrial Safety Unit at the Ministry of Industry and the MLAR indicates that there are several health and safety injuries with different severities, as illustrated below (Figures 2 and 3).

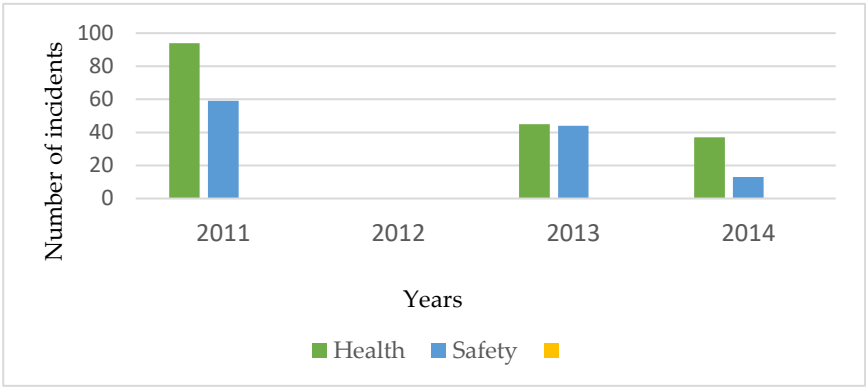

Figure 2: Occupational health and safety incident types 2011-2014, (Source MLAR)

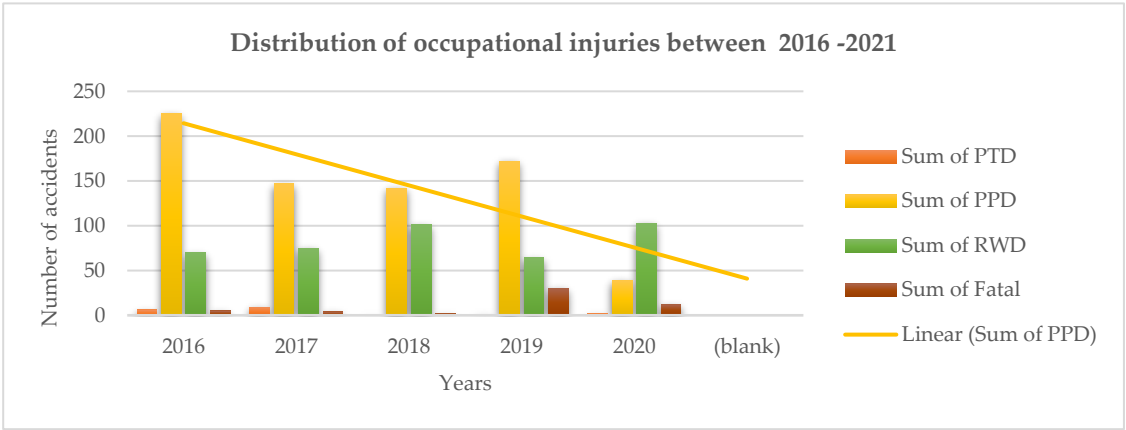

Figure 3: Distribution of occupational injuries between 2016 -2021 (Source MLAR)

The health incidents are higher than the safety incidents in 2011 and 2014, even in 2013; no records for 2012 were found. The severity of the industrial accidents is categorized as follows:

i. Permanent Total Disability (PTD)
ii. Partial Permanent Disability (PPD)

iii. (Temporary Disability) Restricted Workday (RWD)
iv. Fatality

The number of Partial Permanent Disabilities (PPT) is always higher than the other three categories followed by the (Temporary Disability) Restricted Workday (RWD).

OHS at a Sudanese Soap Factory

Workers involved in detergents and cleaning products worldwide are exposed to health hazards in manufacturing facilities.[54] The development of severe lung and skin ailments is linked to detergent manufacturing.[55] The raw material, product storage, and waste streams in soap manufacturing are sources of potential odour sources that are considered one of the main atmospheric pollution problems.[56] The literature notes that in the manufacturing industry, employers should implement and comply with all the guidance and procedures on safety and health at the workplace to minimize the number of accidents.[57] Enzyme proteins employed in the production of detergents have the potential to trigger occupational allergies or asthma.[58] The irritant contact dermatitis is one of the occupational health effects of soap detergent manufacturing in Sudan.[59]

Table 5: Performance indicators of a Soap Factory, assuming 7.5 hours/day and a five-day week
(Source Factory's incident data)

Year	Total Number of Incidents	Total Number of Lost Days	Number of Fatalities - Related to the work	Number of Lost Workday Cases (LWDC)	Frequency Rate (FR)	Severity Rate (SR)	Lost Workdays Rate (LWD)	Total Recordable Incident Rate (TRIER)	Fatal Accident Rate (FAR)
2015	5	35	0	5	2.75	7000	19.23	19.23	0
2016	2	8	0	2	1.10	4000	4.40	7.69	0
2017	DNA	DNA	DNA	DNA	DNA	DNA	DNA	DNA	DNA
2018	7	49	0	7	3.85	7000	26.92	26.92	0
2019	2	41	0	2	1.10	20500	22.53	7.69	0
2020	4	111	0	4	2.20	27750	60.99	15.38	0

[1] Data Not Available

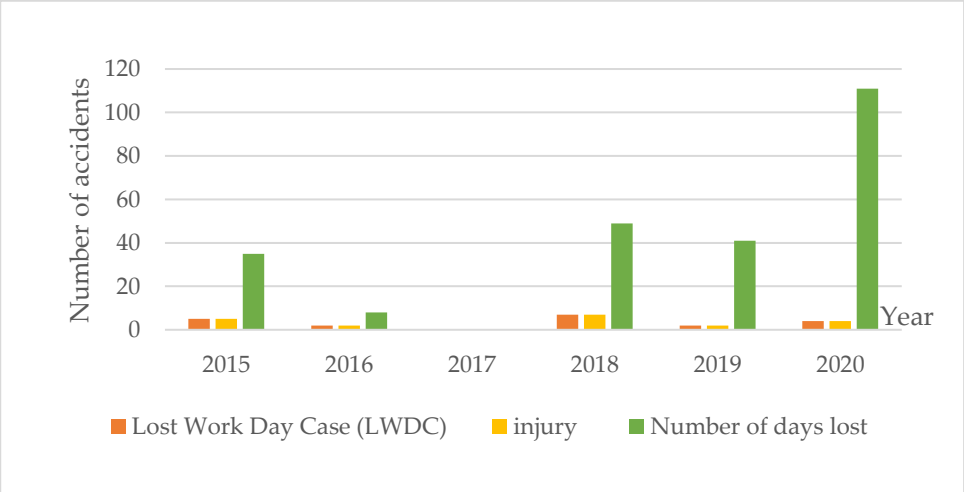

Figure 4: Incidents distribution in the Soap Factory

As can be seen in Table 5, the severity rate, lost worker rate, and total recordable incident rate at a soap factory fluctuate.

The severity of accidents in 2020 was greater than in previous years, with few injuries and lost workday cases, yet much higher numbers of days lost (Figure 4). The highest insurance benefits were paid for partial permanent disability,

followed by health disability and occupational fatality, where the lowest was permanent total disability (Figure 5).

The Socio-Economic Impacts of OSH in Sudan

The International Labor Organization (ILO) estimates that 4% of global GDP is lost owing to occupational accidents and diseases. [60]

In most advanced economies, 2–3% of the global GDP is lost to social insurance expenditure on occupational safety and health, including statutory sick pay, disability allowances, and industrial injuries disability and incapacity benefits, far exceeding the typical expenditure on unemployment benefits. [61]

The Socio-Economic Impacts of the Industrial Sector are one of the most fundamental issues affecting most of the world's population, particularly in developing countries and areas where the corporation operates. It is the obligation of every individual, government, non-governmental organization, and business sector worldwide to develop alternative processes that will improve the standard of living and economics of the world without causing severe environmental and socioeconomic issues. [62]

The expense for disability payments or pensions provided by health and employee injury insurance plans is eventually borne by society, therefore, the occurrence of workplace accidents and diseases has a substantial effect on the viability of social security systems.[63]

The total costs of an occupational accident or disease are often underestimated because certain costs are external to the enterprise and because some internal costs may be difficult to quantify or recognize, such as compensated time, lost production, reduced work capacity and lower workforce participation.[63]

It was determined that disability benefits and early retirement on occupational and health fall within the authority of the Pension and Social Insurance Fund (PSIF) in Sudan. According to the data acquired, between 2016 and 2020, partial permanent disability insurance benefits were paid at the highest rates, followed by health disability and occupational fatality. (Figure 5).

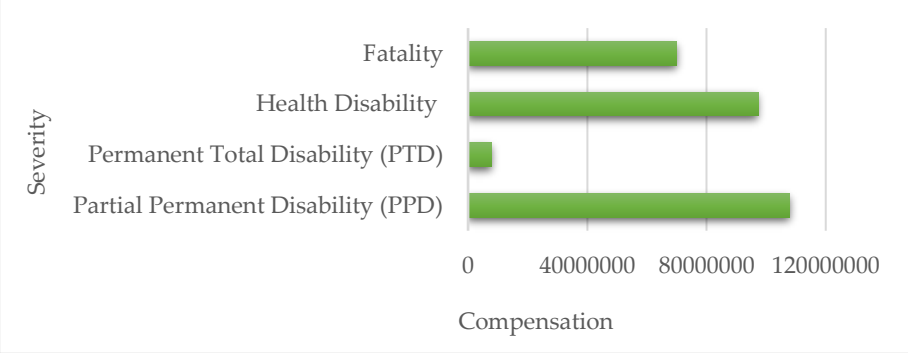

Figure 5: Compensation paid for occupational injuries 2016-2020 (Source PSIF)

Discussion

This preliminary study scrutinized the characteristics of the previous and current Sudanese OSH data found within government and private entities. In addition, this research has sorted out the research undertaken on occupational Safety and Health implementation and scarcities. The results of the literature and the examined data show that many OSH incidents with different types and severities emerged. However, calculating and comparing the performance indicators of different industries to evaluate the status of OSH was not possible for many reasons. Constraints of calculating industry performance indicators include the absence of the denominator and the number of workers per industry or organization for the selected case studies. Furthermore, the secondary data from governmental and private bodies lacked essential details. Including the causes of the accidents, investigations, corrections and follow-up measures after the occurrences. In Sudan, general

awareness about occupational safety and hazards is not widespread.[33]

Occupational risks in the mining industry have received much attention since millions of miners operate in hazardous artisanal and small-scale gold mining worldwide. Although the hazards associated with mining have generally decreased, there is not enough information on how beneficial occupational health interventions are in this industry.[38] The authors believe that the decrease in organized mining incidents after 2016 could be due to several measures taken by the Sudanese government, such as establishing the Sudanese Mineral Resources Company (SMRC), under which all registered mining companies operate. Another reason could be the introduction of the mineral exploitation act of 2016 (SMRC).[34]

However, the measures implemented decreased the fatalities among organized miners but did not eradicate them, as could be seen from the numbers illustrated in the result section. Regarding artisanal mining, the findings indicate that artisanal mining in Sudan desperately needs stringent governance on national, provincial, and local levels.

This study confirms that Sudan's oil and gas industry has occupational health and safety management in place. That is believed to be due to the oil and gas industry development[6], the involvement of foreign and international investors, and leadership involvement and commitment.

To some extent, the involvement of international investors in gold mining in Sudan contributed to the decrease in the number of accidents in organized mining. However, it was impossible to compare the two sectors due to the lack of information on the number of workers.

In terms of the economy, millions of Sudanese pounds are paid in occupational compensation. Nevertheless, the correlation between OSH accidents and the economy is never investigated in Sudan.

Conclusions

This study aimed to assess the status of occupational health and safety in Sudan. From the little published work on occupational health and safety status, there is an urgent need for an independent body, at a national level to govern occupational health and safety in Sudan. This body can be modeled, for example, after the British Health and Safety Executive (HSE), which oversees overseeing workplace health and safety, managing workplace data, and promoting relevant research.

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Original Article

Prevalence and Factors Associated with Occupational Musculoskeletal Disorders among the Nurses of a Tertiary Care Center in Nepal

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ABSTRACT

Introduction: Musculoskeletal disorders (MSDs) are injuries or pain in the human musculoskeletal system which could lead to temporary or permanent impairments. The nature of nursing jobs makes nurses vulnerable to MSDs. This study aimed to assess the prevalence and potential risk factors associated with MSDs among nurses.

Methods: In between March to June 2021, a cross-sectional study was conducted among 165 nurses using self-administered questionnaires. A standardized Nordic Questionnaire was used to measure MSDs. Pearson's chi-square test and binary logistic regression at a 5% level of significance were performed to identify factors associated with upper extremities and spinal musculoskeletal disorders (UMSD) and lower extremities musculoskeletal disorders (LMSD). Variables associated with UMSD and LMSD in bivariate analysis were subjected to multiple logistic regression.

Results: The prevalence of UMSD and LMSD experienced by nurses was 86.1% (95% CI: 79.4%-90.9%) and 66.1% (95% CI: 58.9%-74.3%), respectively. Among several factors, working in same position for long periods (AOR: 4.16, 95% CI: 1.2-13.4), not receiving training in injury prevention programs (AOR: 3.15, 95% CI: 1.0-9.2), not enough rest breaks during the day (AOR: 4.65, 95% CI: 1.3-15.9) and moderate to higher job stress (AOR: 3.62, 95% CI: 1.2-10.8) were found to be significantly associated with UMSD. Not having enough rest breaks during the day (AOR: 2.19, 95% CI: 1.0-4.7) was significantly associated with LMSD.

Conclusion: Higher prevalence of MSDs among nurses is a serious concern that threatens individual health as well as the overall healthcare system. Sensitization and capacity enhancement programs on the issue could prevent MSDs among nurses.

Keywords: Ergonomics, Musculoskeletal disorder, Nepal, Nurses Occupational health, Prevalence, Risk factors

Introduction

Musculoskeletal disorders (MSDs) are injuries or pain in the human musculoskeletal system such as muscles, nerves, tendons, joints, and structures supporting limbs, neck and back resulted due to sudden or sustained exposure to stressors such as external forces, repetitive motions, vibrations, and awkward positions.[1] MSDs are the most serious public health hazard, which could result in individuals' temporary or permanent impairment.[2] Globally, MSDs have become a leading cause of disability.[3, 4] The healthcare sector is known to have a significant risk of MSDs.[5-7]

Healthcare personnel such as physicians, nurses, and paramedics are exposed to repeated stress

and frequent strains while performing daily patient care activities which can lead to chronic sickness and musculoskeletal problems.[8, 9] Even among healthcare professionals, nurses are suggested to have a higher risk of MSDs.[10-12] The nature of the nursing job requires activities such as manual lifting heavy loads and patients, bending over patients, transporting patients from bed to the floor, pulling and pushing equipment, and sometimes working in confined spaces and awkward postures making them more prone to injury.[9, 13, 14] The presence of MSDs not only affects the quality of life of the nurses but also could lead to increased work resistance, absenteeism, early retirement, transfer to another job, and even disability which ultimately results in financial hardship on an individual as well as to the family and society in general.[15-17]

Studies throughout the world suggest that the 12-month prevalence of MSDs in the nursing population varies between 21.0% and 91.9%.[6,9,18-20] In South Asia, this prevalence lies between 21.0% and 89.2%.[19,21,22] In Nepal, limited studies have assessed musculoskeletal pain or disorders in the general population while few have targeted healthcare professionals focusing only on lower back pain. From these limited studies, the prevalence of lower back pain among nurses was observed to be around 60.0%-78.0%.[24-26] However, there is no evidence illustrating the overall rate of MSDs experienced by nurses in seven days and/or twelve months duration as well as its impact and determinants in these vulnerable populations. The occurrence of MSDs in the nursing population could impact the overall health system of the nation as nurses are one of the major health workforces. Identifying these risk factors is critical for understanding the causative linkages of these disorders and implementing the most effective preventative measures in the workplace. For this reason, this study aimed to measure the prevalence and potential risk factors associated with musculoskeletal disorders among nurses working in a tertiary care center in Nepal.

Methods

The cross-sectional study was conducted among the nurses working at Dhulikhel Hospital between March and June 2021. Dhulikhel Hospital situated in Dhulikhel Municipality of Kavre district is one of the biggest tertiary hospitals in Nepal. The hospital provides a wide range of preventive and curative services with a total of 336 nurses working actively in its 22 departments.

The sample size was calculated using the Cochrane formula for estimation of proportion, $n=z^2pq/d^2$, using a past prevalence of MSD among nurses at a 95% confidence interval (CI) and at a 5% margin of error. The MSD prevalence of 89.1% from a past study was taken for the estimation of sample size.[23] The initial sample size was estimated at 149 nurses which was optimized to 165 after adjusting the 10% non-response rate. Nurses were selected randomly using a systematic random sampling technique. For this, every k^{th} (336/149=2.74≈2.25) i.e. 3rd nurse from the provided sample frame was approached to be enrolled as a participant. The nurses who reported a prior history of medically diagnosed musculoskeletal problems before starting their job and nurses who were pregnant or had a child under two years of age were excluded from the study to control confounding and to assure the observed MSD is associated with the nature of their job.

A self-administered questionnaire was used for data collection. The questionnaire used for data collection consisted of four sections including questions related to the socio-demographic profiles of the nurses, perceived stress scale,[27] to measure job stress, questions related to ergonomic factors, and Standardized Nordic Questionnaire (SNQ)[28] to measure musculoskeletal disorders.[29] SNQ consists of diagrammatic marking of nine anatomical regions for precision. It also reports whether the discomfort has prevented the participants from doing their normal work and if they have consulted a physician during the last 12 months for their condition.[28] The Nursing In-charge arranged a private place where the selected nurses were invited for orientation. The questionnaire was distributed and explained to the nurses, and their informed consent was acquired during the orientation. The nurses were allowed to fill out the questionnaire at their time of convenience.

The anthropometric measurements (height and weight) of the selected nurses were also taken at the time of distribution of the questionnaire. It was ensured that the complete response for each of the questions was acquired from the participants before collecting all the questionnaires. Thus, a 100% response rate was achieved from 165 nurses.

The collected data were entered and analyzed through Statistical Package for Social Sciences version 22. The data were summarized in terms of frequency and proportion. Pearson's chi-square tests and binary logistic regression were performed to identify the factors associated with UMSD and LMSD at a 5% level of significance. The variables which were significant in bivariate analysis were subjected to multivariate analysis to assess the adjusted odds ratio. Crude odds ratio

(COR) has also been reported along with the adjusted odds ratio for those variables which were significant in bivariate analysis for each model. For the multivariate analysis, the Variance Inflation Factor (VIF) test was performed to check multi-collinearity among independent variables.[30,31] The Hosmer-Lemeshow test (HL test) for goodness-of-fit was performed and Nagelkerke R square was reported.

The study was ethically approved by the Institutional Review Committee of Manmohan Memorial Institute of Health Science (Registration no: MMIHS-IR 580) and the Institutional Review Committee of Kathmandu University School of Medical Sciences (Approval No: 33/2020). Written informed consent was obtained from all the participants before conducting the study and all the information was kept confidential.

Results

The prevalence of UMSD and LMSD experienced by the nurses in the past 12 months was found to be 86.1% and 66.1% respectively. Likewise, in the context of MSD experienced by nurses in the past week, 53.9% reported having UMSD, and 33.3% reported having LMSD. Lower back pain was the predominant MSD in the last 12 months at 75.8% followed by neck pain and upper back pain at 60.0% and 51.5% respectively (Table 1).

Table 1: Prevalence of musculoskeletal disorders (n=165)

Body region	MSD in 12 months		MSD in 7 days	
	n (%)	95% CI	n (%)	95% CI
Neck				
Yes	99(60.0)	52.8-67.3	41(24.8)	20.0-31.4
No	66 (40.0)	32.7-47.2	124(75.2)	68.6-80.0
Shoulder				
Yes	75(45.5)	38.3-54.4	31(18.8)	12.2-26.1
No	90(54.5)	45.6-61.7	134(81.2)	73.9-87.8
Elbows				
Yes	12(7.3)	4.2-12.0	4(2.4)	0.6-4.8
No	153(92.7)	88.0-95.8	161(97.6)	95.2-99.4
Wrists/hands				
Yes	71(43.0)	36.4-50.3	27(16.4)	11.5-21.2
No	94(57.0)	49.7-63.6	138(83.6)	78.8-88.5
Upper back				
Yes	85(51.5)	44.9-59.8	37(22.4)	15.9-29.1
No	80(48.5)	40.2-55.1	128(77.6)	70.9-84.1
Lower back				
Yes	125(75.8)	68.6-81.8	69(41.8)	33.9-49.6
No	40(24.2)	18.2-31.4	96(58.2)	50.4-66.1
Hips/Thighs				
Yes	58(35.2)	27.5-42.9	26(15.8)	10.4-21.7
No	107(64.8)	57.1-72.5	139(84.2)	78.3-89.6
Knees				
Yes	64(38.8)	31.5-47.9	30(18.2)	13.3-24.8
No	101(61.2)	52.1-68.5	135 (81.8)	75.2-86.7
Ankles/Feet				
Yes	61(37.0)	29.2-44.2	32(19.4)	13.9-26.6
No	104(63.0)	55.8-70.8	133(80.6)	73.4-86.1
Overall UMSD				
Yes	142(86.1)	79.4-90.9	89(53.9)	45.6-61.7
No	23(13.9)	9.1-20.6	76(46.1)	38.3-54.4
Overall LMSD				
Yes	109(66.1)	58.9-74.3	55(33.3)	26.1-41.1
No	56(33.9)	25.7-41.1	110(66.7)	58.9-73.9

Out of the total nurses who experienced low back pain in the past 12 months, a majority (62.4%) reported the pain has affected their daily activities, whereas, only less than a quarter (20.0%)consulted physicians for treatment. Likewise, only 16.1% of the nurses with chronic neck pain were consulting a physician for their condition while almost half (44.4%) reported that chronic neck pain has impacted their daily activities (Table 2).

In bivariate analysis, general characteristics of the participants such as age, marital status, education, and BMI were not found to be significantly associated with UMSD. However, the participant's age was found to be significantly associated with LMSD at a 5% level of significance ($p<0.05$) (Table 3).

Table 2: Impact on daily activities due to MSDs in 12 months and physician consultation (n=165)

Body regions	Limit normal activities		Consulted Physician	
	Yes (%)	No (%)	Yes (%)	No (%)
Neck (n=99)	44 (44.4)	55 (55.6)	16 (16.1)	83 (83.9)
Shoulder (n=75)	34 (45.3)	41 (54.7)	9 (12.0)	66 (88.0)
Elbows (n=12)	6 (50.0)	6 (50.0)	0 (0.0%)	12 (100.0)
Wrists/Hands (n=71)	32 (45.1)	39 (54.9)	5 (7.0)	66 (93.0)
Upper back (n=85)	48 (56.5)	37 (43.5)	11 (13.0)	74 (87.0)
Low back (n=125)	78 (62.4)	47 (37.6)	25 (20.0)	100 (80.0)
Hips/thighs (n=58)	33 (56.9)	25(43.1)	6 (10.3)	52 (89.7)
Knees (n=64)	31 (48.4)	33 (51.6)	11 (17.2)	53 (82.8)
Ankles/Feet (n=61)	44 (44.4)	55 (55.6)	16 (16.1)	83 (83.9)

Table 3: Association between general characteristics with UMSD and LMSD (n=165)

Variable	UMSD		$\chi 2$ (p-value)	LMSD		$\chi 2$ (p-value)
	Yes (%)	No (%)		Yes (%)	No (%)	
Age(years)						
<25	58(90.6)	6(9.4)	3.048	48(75.0)	16(25.0)	9.891
25 -30	65(85.5)	11(14.5)	(0.218)	51(67.1)	25(32.9)	**(0.007)**
>30	19(76.0)	6(24.0)		10(40.0)	15(60.0)	
Marital status						
Married	62(86.1)	10(13.9)	0.000	42(58.3)	30(41.7)	3.402
Single	80(86.0)	13(14.0)	(0.987)	67(72.0)	26(28.0)	(0.065)
Education						
PCL nursing	124(86.1)	20(13.9)	0.002	96(66.7)	48(33.3)	0.185
BSc nursing	18(85.7)	3(14.3)	(0.961)	13(61.9)	8(38.1)	(0.667)
BMI						
Normal	93(86.1)	15(13.9)	0.413	76(70.4)	32(29.6)	4.575
Underweight	13(81.2)	3(18.8)	(0.813)	7(43.8)	9(56.2)	(0.102)
Overweight/Obese	36(87.8)	5(12.2)		26(63.4)	15(36.6)	

In the context of work-related factors, rest breaks during the day and work schedules were found to be associated with both UMSD and LMSD at $p<0.05$. Moreover, training in injury prevention, treating a large number of patients in a day, and job stress were found to have a statistically significant relationship with UMSD. Similarly, participants' work experience was found to be associated with LMSD (Table 4).

In context of ergonomic factors, working in awkward or cramped positions, carrying/lifting/ moving heavy materials or equipment, performing same task repeatedly, and working in same position for long periods were found to be associated with UMSD at $p<0.05$. However, no association was found between LMSD and ergonomic factors (Table 5).

Table 4: Association between work-related factors with UMSD and LMSD (n=165)

Variable	UMSD		χ2 (p-value)	LMSD		χ2 (p-value)
	Yes (%)	No (%)		Yes (%)	No (%)	
Work experience						
< 5 years	91(85.0)	16(15.0)	0.261 (0.610)	79(73.8)	28(26.2)	8.199 (**0.004**)
≥ 5 years	51(87.9)	7(12.1)		30(51.7)	28(48.3)	
Work shift						
Rotation	121(85.8)	20(14.2)	0.049 (0.826)	97(68.8)	44(31.2)	3.231 (0.072)
Fixed	21(87.5)	3(12.5)		12(50.0)	12(50.0)	
Training in injury prevention						
Yes	37(74.0)	13(26.0)	8.699 (**0.003**)	29(58.0)	21(42.0)	2.079 (0.149)
No	105(91.3)	10(8.7)		80(69.6)	35(30.4)	
Treat large number of patients in a day						
No	26(74.3)	9(25.7)	5.134 (**0.023**)	20(57.1)	15(42.9)	1.576 (0.209)
Yes	116(89.2)	14(10.8)		89(68.5)	41(31.5)	
Rest breaks during the day[a]						
Enough	31(72.1)	12(27.9)	9.458 (**0.002**)	21(48.8)	22(51.2)	7.695 (**0.006**)
Not enough	111(91.0)	11(9.0)		88(72.1)	34(27.9)	
Assist patients at gait activities						
Rarely	47(82.5)	10(17.5)	0.943 (0.331)	37(64.9)	20(35.1)	0.051 (0.821)
Frequently	95(88.0)	13(12.0)		72(66.7)	36(33.3)	
Work at or near your physical limits						
Rarely	57(85.1)	10(14.9)	0.091 (0.762)	43(64.2)	24(35.8)	0.178 (0.673)
Frequently	85(86.7)	13(13.3)		66(67.3)	32(32.7)	
Work with confused/ agitated patients						
Rarely	34(79.1)	9(20.9)	2.369 (0.124)	24(55.8)	19(44.2)	2.723 (0.099)
Frequently	108(88.5)	14(11.5)		85(69.7)	37(30.3)	
Work schedule[b]						
Normal	18(72.0)	7(28.0)	4.856 (**0.028**)	12(48.0)	13(52.0)	4.287 (**0.038**)
Overtime	124(88.6)	16(11.4)		97(69.3)	43(30.7)	
Job Satisfaction						
Satisfied	76(81.7)	17(18.3)	3.347 (0.067)	56(60.2)	37(39.8)	3.248 (0.072)
Dissatisfied	66(91.7)	6(8.3)		53(73.6)	19(26.4)	
Job Stress						
Low stress	44(75.9)	14(24.1)	7.755 (**0.005**)	35(60.3)	23(39.7)	1.303 (0.254)
Moderate/High Stress	98(91.6)	9(91.6)		74(69.2)	33(30.8)	

[a]Rest breaks during the day: Enough ≥30 minutes, Not enough < 30 minutes

[b]Work schedule: Normal ≤8 hours a day, Overtime >8 hours a day

Table 5: Association between Ergonomic Factors with UMSD and LMSD (n=165)

Variable	UMSD		χ2 (p-value)	LMSD		χ2 (p-value)
	Yes (%)	No (%)		Yes (%)	No (%)	
Work in awkward or cramped positions						
Rarely	53(79.1)	14(20.9)	4.550 (**0.033**)	41(61.2)	26(38.8)	1.192 (0.275)
Frequently	89(90.8)	9(9.2)		68(69.4)	30(30.6)	
Lift or transfer dependent patients						
Rarely	53(81.5)	12(18.5)	1.828 (0.176)	41(63.1)	24(36.9)	0.426 (0.514
Frequently	89(89.0)	11(11.0)		68(68.0)	32(32.0)	
Carry, lift, or move heavy materials or equipment						
Rarely	32(74.4)	11(25.6)	6.571 (**0.010**)	26(60.5)	17(39.5)	0.812 (0.367)
Frequently	110(90.2)	12(9.8)		83(68.0)	39(32.0)	
Repeated task						
Rarely	19(73.1)	7(26.9)	4.337 (**0.037**)	13(50.0)	13(50.0)	3.551 (0.060)
Frequently	123(88.5)	16(11.5)		96(69.1)	43(30.9)	
Perform manual orthopedic techniques						
Rarely	38(79.2)	10(20.8)	2.682 (0.102)	29(60.4)	19(39.6)	0.962 (0.327)
Frequently	104(88.9)	13(11.1)		80(68.4)	37(31.6)	
Work in the same position for long periods						
Rarely	45(77.6)	13(22.4)	5.354 (**0.021**)	39(67.2)	19(32.8)	0.056 (0.814)
Frequently	97(90.7)	10(9.3)		70(65.4)	37(34.6	

For multivariate analysis, the Variance Inflation Factor (VIF) test among the independent variables was performed where the highest reported VIF was 1.793so there was no issue of multi-collinearity.

Nurses reporting moderate to higher job stress were found to have three times more odds (AOR: 3.621, 95% CI: 1.2-10.8) of experiencing UMSD as compared to nurses who reported lower job stress. Likewise, nurses reporting not having enough rest breaks had a four-fold increase in odds of UMSD (AOR: 4.657, 95% CI: 1.3-15.9) as compared to nurses who reported having enough rest breaks. The odds of UMSD were found 4.16 times higher (AOR: 4.163, 95% CI: 1.2-13.4) among nurses who reported working in the same position for a long duration of time. Similarly, nurses who did not receive training in injury prevention were thrice more likely to have UMSDs (AOR: 3.150, 95% CI: 1.0-9.2) in comparison to those who had received training. (Table 6).

In the context of lower extremities musculoskeletal disorders, not having enough rest breaks during the day was found to increase the odds of LMSD among nurses by two folds (AOR:2.193, 95% CI:1.0-4.7) as compared to nurses reporting enough rest breaks while adjusting with all the associated factors (Table 7).

Table 6: Multivariate analysis for UMSD among the nurses (n=165)

Variables	COR	95%CI	p-value	AOR	95%CI	p-value
Work in awkward/ cramped positions						
Rarely	Ref			Ref		
Frequently	2.612	1.0-6.4	0.037	1.399	0.4-4.6	0.582
Carry/lift/ move heavy materials/ equipment						
Rarely	Ref			Ref		
Frequently	3.151	1.2-7.8	0.013	2.276	0.7-6.6	0.132
Repeated task						
Rarely	Ref			Ref		
Frequently	2.382	1.0-7.7	0.044	1.557	0.3-6.2	0.530
Work in the same position for long periods						
Rarely	Ref			Ref		
Frequently	2.802	1.1-6.8	0.024	4.163	1.2-13.4	**0.017**
Training in injury prevention						
Yes	Ref			Ref		
No	3.689	1.4-9.1	0.005	3.150	1.0-9.2	**0.036**
Treat large number of patients in a day						
Yes	2.868	1.1-7.3	0.028	1.155	0.3-3.8	0.815
No	Ref			Ref		
Work schedule[a]						
Normal	Ref			Ref		
Overtime	3.014	1.0-8.3	0.033	0.718	0.1-2.7	0.632
Rest breaks during the day[b]						
Enough	Ref			Ref		
Not enough	3.906	1.5-9.7	0.003	4.657	1.3-15.9	**0.014**
Job Stress						
Low	Ref			Ref		
Moderate/High	3.465	1.3-8.6	0.007	3.621	1.2-10.8	**0.022**

Nagelkerker R Square 0.332; Hosmer Lemeshow Chi-square 5.449, p=0.709
CI: confidence interval, COR: Crude odds ratio, AOR: Adjusted odds ratio

Table 7: Multivariate analysis for LMSD among the nurses (n=165)

Variables	COR	95%CI	p-value	AOR	95%CI	p-value
Age						
<25	4.500	1.6-11.9	0.003	2.100	0.6-7.1	0.234
25-30	3.060	1.2-7.7	0.019	1.943	0.6-5.4	0.210
>30	Ref					
Work experience						
<5 years	2.633	1.3-5.1	0.005	1.993	0.8-4.6	0.108
≥5 years	Ref			Ref		
Work schedule[a]						
Normal	Ref			Ref		
Overtime	2.444	1.0-5.7	0.042	2.007	0.7-5.0	0.140
Rest breaks during the day[b]						
Enough	Ref			Ref		
Not enough	2.711	1.3-5.5	0.006	2.193	1.0-4.7	**0.048**

Nagelkerker R Square 0.149; Hosmer Lemeshow Chi-square 6.411, p=0.379
CI: confidence interval, COR: Crude odds ratio, AOR: Adjusted odds ratio

Discussions

A higher rate of UMSD and LMSD were observed among the nurses at 86.1% and 66.1% respectively. The finding is in line with the studies from India where the 12 months MSD among nurses was found to range between 81% to 89.2%.[19,20] Similarly, a higher rate of MSDs was observed among nurses of both developing as well as developed nations such as Nigeria, Zimbabwe, Vietnam, and China where more than three-fourths of the nurses were found to have experienced any form of MSD in the past 12 months.[9, 32-34] Furthermore, lower back pain, neck pain and upper back pain were the major forms of MSDs among nurses. The past studies from two of the major tertiary hospitals of Nepal; Sahid Gangalal National Heart Centre and Tribhuvan University Teaching Hospital revealed that 78% and 64.5% of the nurses experienced lower back pain.[24,25]

Despite a higher prevalence of these disorders among the nurses which has affected their daily activities, only a few of them sought treatment. A similar observation was seen in the study from Bangladesh where out of all nurses who experienced lower back pain only 36.2% reported seeking medical care for their condition.[35] This indicates many of the nurses are troubled by musculoskeletal pain and discomfort which has heavily impacted their work efficiency but very few are seeking proper medical attention. The reason behind this poor health-seeking behavior among healthcare professionals needs to be further studied. These findings point to a significant and under-researched occupational health problem among Nepalese nurses.

The ergonomic factors such as working in awkward/cramped positions, carrying heavy material and/or equipment, performing repeated actions, and working in the same positions for a long period were found to be associated with UMSDs in bivariate analysis. This is in line with the findings from past studies suggesting that working in the same position for a long time duration has been perceived to be a major contributor to work-related MSDs among the nursing population.[9,36,37] Findings from past studies showed that working in awkward/cramped positions is significantly associated with MSDs among nurses.[34,38] It was also noted that nurses not receiving enough rest during the day were four times more likely to experience UMSD and twice times more likely to experience LMSD as compared to nurses having enough rest. Similar to this finding, rest breaks were found to be a protective factor for MSDs in the studies from Saudi Arabia and China.[34, 38] The positive association between rest breaks and MSDs has been observed in other occupations as well. For instance, a randomized control trial performed among agriculture workers noted the nature of rest breaks could significantly result in the alleviation of musculoskeletal pain in the neck, shoulder, back, and upper limbs.[39] The continuous exertion of force and repeated movements could lead to inflammation and pain in body tissues resulting in reduced motor function, or muscle/bone discomfort and inducing risk of injuries. Thus, proper rest breaks during work should be ensured among nurses to prevent them from such discomforts and assure their efficiency.

Training in injury prevention can be another crucial intervention to prevent MSD as the nurses who did not receive training in injury prevention were found to have three-fold higher odds of MSD. Similar observations were made by the study from Zimbabwe where ergonomic training was significantly associated with work-related musculoskeletal disorders among nurses ($p<0.05$).[33] In line with current findings, studies suggest education and training on ergonomics and MSDs could be an effective intervention for MSD prevention among nurses.[40-42] This finding emphasizes the importance of ergonomic training and MSD education. Hospitals should provide training for their employees to improve their injury prevention abilities and thereby lower the risk of MSDs. Thus, providing proper training and educational programs on MSDs targeting nurses and other health professionals might be a crucial strategy to reduce the risk of MSD in this vital health workforce.

The nurses who reported experiencing moderate or high stress were thrice more at odds of experiencing UMSD as compared to nurses with a low level of stress. This is in line with past studies from China, Thailand, Uganda and Canada where a significant association between mental stress and musculoskeletal discomfort was observed among the nurses.[14,21,34,43] Tension and stress cause muscle strain and hardness. Furthermore, anxious nurses are more likely to notice any form of discomfort that occurs in their body as a result of attending to negative thoughts when they self-report their MSDs.[21] This finding suggests that hospitals should arrange recreational activities to reduce stress and anxiety among nurses to reduce the risk of experiencing MSDs.

Despite being one of the few studies examining the prevalence and risk factors for MSDs among nursing population this study is not free from its

limitations. The information of MSDs is self-reported by the participants rather than medical diagnosis thus there are some chances of reporting bias though the study population was nurses. The study was conducted in one of the major tertiary hospitals of Nepal which might not provide a complete representation of all Nepalese nurses working in primary healthcare centers and/or small health units. However, the nurses selected in this study were working at different departments and wards of Dhulikhel Hospital so the diversity of the selected participants aids in the generalizability of the results. The findings of this study are expected to provide fruitful insights to the concerned stakeholders to focus on occupational health.

Conclusion

There is a high prevalence of MSDs among nurses which could impact the overall healthcare system. Working in the same position for a long duration, not receiving training in injury prevention, not having enough rest breaks, and job stress were the major factors found to be associated factors with musculoskeletal disorders among nurses. Thus, providing healthcare professionals with training related to injury prevention and educating them about ergonomics and posture could reduce their risk of MSDs.

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Original Article

The Correlations between Language Barriers and Occupational Safety and Health Communication: A Descriptive Study in Indonesia

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ABSTRACT

Introduction: Miscommunication can cause accidents in workplaces due to ineffective occupational safety and health (OSH) communication. There are many factors of ineffective OSH communication, one of which is the language barrier. The research aims to unveil the types of language barriers and their relation to the effectiveness of OSH communication in Indonesia.

Methods: A descriptive cross-sectional approach using a structured questionnaire was done in this research. The structured questionnaire survey was done among 102 workers in West Java, Indonesia. Spearman rho was used to determine the correlation between language barriers and effective OSH communication. The research was conducted between August and November 2022.

Results: All of the types of language barriers except vernacular correlate positively, strongly, and significantly to the effectivity of OSH communication ($0.50 \leq r \leq 0.699$, p-value < 0.05). Vernacular correlates positively, moderately, and significantly to the effectivity of OSH communication (r 0.497, p-value < 0.05).

Conclusion: Based on the findings, OSH communication should be communicated accurately, clearly, and concisely in a language that everyone can understand.

Keywords: Communication, Language barriers, Occupational health, Occupational safety, OSH

Introduction

In Indonesia, the Social Security Administering Body on Employment (BPJAMSOSTEK) reports that the number of total work accidents has been increasing by 22.11% for the past three years, from 182,835 cases in 2019 to 234,370 in 2021.[1] The number is apprehensive regardless not all of the cases cause fatality. The government has enacted Act Number 13 Year 2003 concerning Manpower Affairs which stated in Article 87 that any company is obliged to apply the OSH Management System to protect the safety of workers to achieve optimally higher productivity.[2]

To implement Article 87, the government has established the Regulation of the Government Number 50 Year 2012 known as OSH Management System.[3] This management system is in line with ISO 45001:2018, an international standard regarding OSH Management Systems. Within the standard, there is an aspect of OSH communication, which is routine communication regarding safety matters between stakeholders in an organization to improve safety in the workplace.[4] This aspect is very important because

it has the purpose of eliminating hazards and minimizing OSH risk.[5] The communication can be implemented through several methods including newsletters, emails, memorandums, caution signs, signposts, and other indications of safety.[6] Another aim of safety communication is making sure that everyone comprehends their roles and responsibilities concerning OSH, regardless of the safety managers play significant roles in ensuring all stakeholders are fully informed about OSH policies, practices, concerns, and other information.[4,7]

It is revealed that OSH communication mediates the association between safety culture and safety performance partially.[8] However, as mentioned earlier, accidents still happened due to the ineffectiveness of OSH communication. The ineffectiveness of communication can be caused by many factors, one of which is the language used. As conscious individuals who are aware of the existence of others, we utilize language as our primary tool to communicate and interact with them during every encounter.[9–13] Nevertheless, language remains the main impediment to effective communication due to the barriers it carries. Language barriers cause adversities in the capital market, healthcare, scientific community, and safety of workers.[14–17]

Language barriers avert people from comprehending each other which causes miscommunication; something that should be avoided especially when it comes to safety in the workplace. The Tenerife Tragedy, the deadliest accident in aviation history, is one of the examples of accidents due to miscommunication in the workplace. Language barriers or sometimes known as linguistic barriers appeared when at least two parties who do not share the same language try to communicate but failed to interpret the messages, leading to the absence of communication.[12] Considered as one the most impeding factors to communication, language barriers derive from foreign languages, dialects, pidgins, accents, jargon, slang, word choice, literacy, lexical, grammar, and spelling.[18] Language barriers create difficulties for workers in communicating occupational hazards and understanding OSH information, which may enhance the workers' exposure to OSH risks.[17]

In recent years, much research regarding language barriers has been conducted as well as safety communication. The research related to language barriers generally discusses immigrants' difficulties outside of Indonesia in communicating which caused them to have difficulty in getting access to health care.[9,10,19,20] Meanwhile, the research regarding safety communication generally discusses the use of communication for improving safety.[21–24] However, research regarding language barriers and their relation to effective OSH communication in Indonesia has not been widely disseminated. Hence, this research aims to reveal the correlation between language barriers, consisting of foreign language, vernacular, jargon, word choice, and spelling, and effective OSH communication in the Indonesian context.

Methods

The research employed a descriptive cross-sectional approach using a structured questionnaire which was developed based on the CoLB-q questionnaire and safety communication with some modifications relevant to the research.[25–27] The population of the study comprised outsourced security guards who worked for PT ABC, a security service company in Indonesia. PT ABC assigns its outsourced security guards to companies from various types of industries throughout Indonesia. The sampling method used in this study was purposive sampling, with the inclusion of those assigned to the power plant, as it posed the highest level of risk based on the hazard identification, risk assessment, and control determination (HIRADC) conducted by PT ABC.[28] The power plant mentioned was the DEF power plant, located in West Java, Indonesia. More than 70% of the stages of work carried out by the outsourced security guards in this power plant were classified as significant. One hundred and two (102) outsourced security guards were working at the DEF power plant who were the respondents in this research conducted between August and November 2022.

To obtain the data for analysis, an online questionnaire was distributed to the respondents. The respondents filled out the consent form before proceeding to the questionnaire. Since the respondents in this research are mostly Indonesians, the questionnaire was prepared in Indonesian, regardless of whether the original instrument was developed in English. Next, the questionnaire was pre-tested to ensure validity by discussing it with two experts in the field of OSH and a linguist. The questionnaire used a five-point Likert scale item; (1) strongly disagree, (2) disagree, (3) neutral (neither agree nor disagree), (4) agree, and (5) strongly agree.[28] After that, statistical analysis was used to test the validity (p-value < 0.05; valid) and reliability (Cronbach's Alpha > 0.7; reliable) of the items.[29]

The collected questionnaire was processed by the statistical software, Minitab 21. The approach used to determine the correlation between language barriers and effective OSH communication was Spearman's rho. The correlation coefficients of 1.00 or -1.00 implied a perfect correlation, which had never been discovered in any social science research.[30] Thus, the intervals were used to interpret the correlation. The coefficient ranging from 0.70 to 1.0 (or -0.70 to -1.0) was considered a very strong relationship; the coefficient ranging from 0.50 to 0.699 (or -0.50 to -0.699) was considered a strong relationship; the coefficient ranging from 0.20 to 0.499 (or -0.20 to -0.499) was considered as moderate relationship; and the coefficient ranging from 0.00 to 0.199 (or -0.00 to -0.199) was considered as a weak relationship.

The correlation between variables would be considered statistically significant if the p-value <0.05. The hypotheses for the research were (1) H_0: There is no significant positive correlation between language barriers (consisting of foreign language, vernacular, jargon, word choice, and spelling) and effective OSH communication and (2) H_a: There is a significant positive correlation between language barriers (consisting of foreign language, vernacular, jargon, word choice, and spelling) and effective OSH communication.

Results

The demographic profile of the respondents consisting of age, educational level, and working experience are shown below (Table 1). The age distribution of the respondents revealed that the majority (approximately 88%, n = 90) fell within the 20 to 50-year age range. Additionally, a significant proportion of the participants (79%, n = 81) reported having a senior high school educational background. Furthermore, more than half of the respondents (52%, n = 53) possessed work experience spanning a duration of 5 to 10 years.

Table 1: The age, educational level, and working experience of the respondents

Description	Characterization	Frequency
Age	> 50	6 (6%)
	40 to 50	27 (26%)
	30 to 40	32 (31%)
	20 to 30	31 (30%)
	< 20	6 (6%)
	Total	102 (100%)
Educational Level	Undergraduate Degree	2 (2%)
	Senior High School	81 (79%)
	Junior High School	19 (19%)
	Total	102 (100%)
Working Experience	> 10 years	4 (4%)
	5 to 10 years	53 (52%)
	3 to 4 years	36 (35%)
	1 to 2 years	5 (5%)
	< a year	4 (4%)
	Total	102 (100%)

Table 2: Validity test of language barriers

Types of Language Barriers	Statement	Correlation	P-Value
Foreign Language	I can only understand OSH procedures/instructions in Indonesian.	0.629	0.000
	Toolbox meetings and/or safety induction and/or safety talks are easier to understand in Indonesian than in foreign languages.	0.683	0.000
	OSH banners and/or bulletins are easier to understand in Indonesian than in foreign languages.	0.73	0.000
	OSH promotion should use Indonesian to make it easier to understand.	0.667	0.000
Vernacular	I have difficulty understanding when my colleagues speak their vernacular during working hours.	0.602	0.000
	My colleagues have difficulty understanding when I speak my vernacular.	0.651	0.000
Jargon	I understand the abbreviations for OSH, PPE, fire extinguishers, and first aid.	0.631	0.000
	Incidents and accidents are two different things.	0.671	0.000
Word Choice	Clear and concise writings on OSH banners and/or bulletin boards make it easy for me to understand the information.	0.692	0.000
	OSH signs without writing are more difficult to understand.	0.629	0.000
	The company's policy on OSH should be written as concisely as possible so that it is easier to understand.	0.704	0.000
	The colors of OSH signs should vary to make them easier to understand.	0.725	0.000
Spelling	The misspelling on the OSH banner and/or signs and/or bulletin boards makes it difficult for me to understand the information.	0.727	0.000
	Writing the wrong digits of accidents on the OSH bulletin boards make me misunderstand the information.	0.684	0.000

Table 3: Validity test of effective OSH communication

Description	Correlation	P-Value
There is a written OSH policy related to the prevention of work-related accidents & diseases at your workplace.	0.783	0.000
You know the person in charge of OSH at your workplace.	0.685	0.000
Information regarding OSH (including work accidents) is easy to get at your workplace.	0.797	0.000
OSH signs have been installed following the standards and technical guidelines at your workplace.	0.79	0.000
You receive instructions and training on emergency procedures appropriate to the level of risk.	0.715	0.000
Emergency instructions/procedures and emergency liaison are clearly and conspicuously displayed at your workplace.	0.774	0.000
There is a procedure for reporting hazards related to OSH at your workplace.	0.704	0.000
The warning signs for chemical hazardous substances are installed following the requirements of the relevant laws and/or standards.	0.707	0.000
Training is provided to all workers, including new and transferred workers so that they can carry out their duties safely.	0.801	0.000
The employer/ management provides refresher training to you.	0.778	0.000

Next, the result of the validity test for the variables used in this research is given in Table 2 and Table 3. From Table 2 and Table 3, the p-values for all of the items are less than 0.05. Thus, all of the items are valid.

The Cronbach's Alpha values in Table 4 are 0.8992 for language barriers and 0.9148 for effective communication, respectively. Both values are more than 0.7 implying that all of the items are reliable.

Table 4: Reliability test

Language Barriers	Effective OSH Communication
0.8992	0.9148

The result of the correlation between language barriers, consisting of jargon, word choice, foreign language, spelling, and vernacular, and effective OSH communication are presented below (Figures 1 to 5).

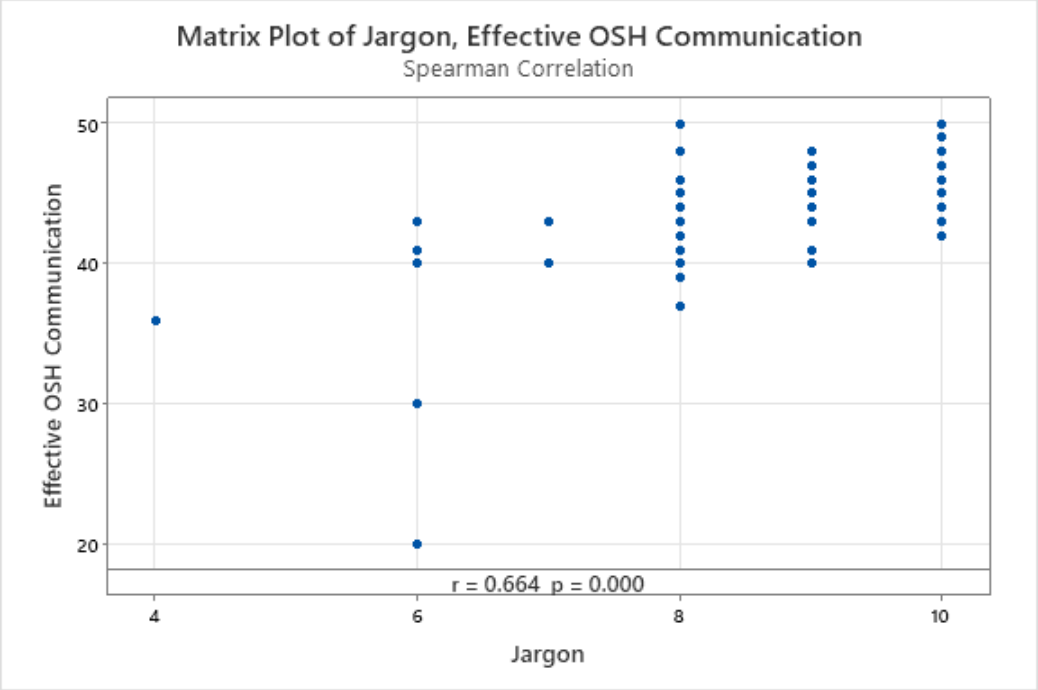

Figure 1: Correlation of jargon and effective OSH communication

Among the various types of language barriers, jargon exhibited the strongest and statistically significant correlation with effective occupational safety and health (OSH) communication, as indicated by a strong positive correlation coefficient ($r = 0.664$, $p < 0.05$) (Figure 1). The incorporation of jargon in OSH communication was commonly observed through the utilization of specific terminology, including OSH, personal protective equipment (PPE), fire extinguishers, first aid, accidents, and incidents. Consequently, the alternative hypothesis (H_a) is supported and accepted.

The subsequent factor identified in the study was word choice, which exhibited a strong and statistically significant positive correlation ($r = 0.622$, $p < 0.05$) with the effectiveness of OSH communication, as illustrated in Figure 2. This finding indicates that the selection of appropriate vocabulary plays a crucial role in facilitating successful OSH communication. The aspects of word choice examined in the study encompassed clear and concise writing styles, the presence or absence of written content on OSH signs, the extent of verbosity in written materials, and the use of colors. Therefore, the study's hypothesis (H_a) concerning the significant impact of word choice on OSH communication is supported by the empirical evidence obtained.

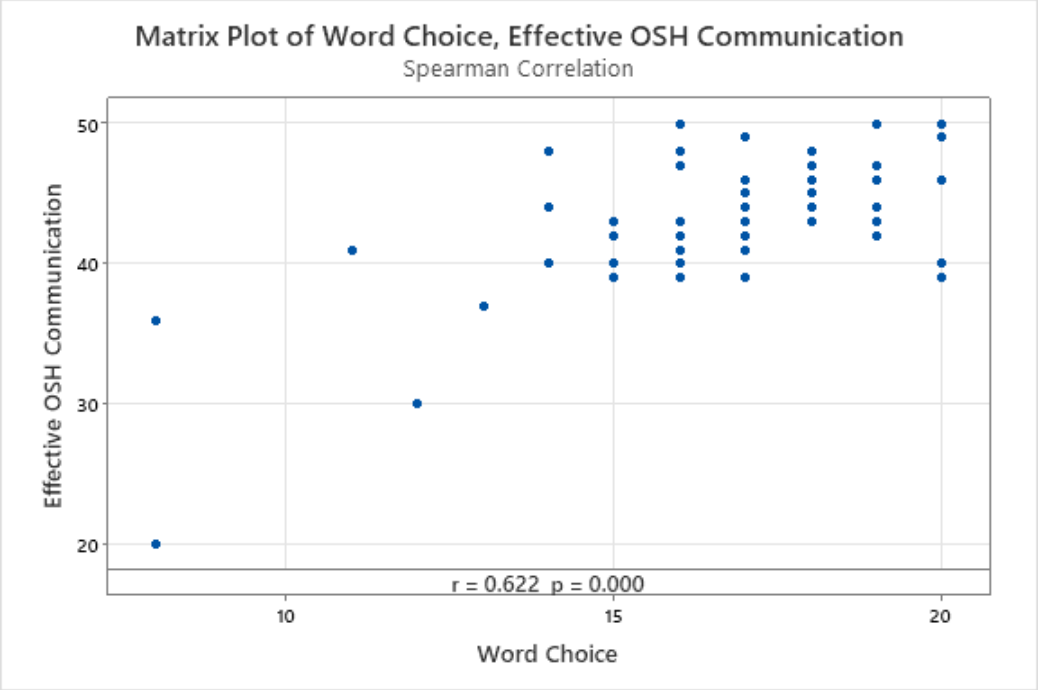

Figure 2: Correlation of word choice and effective OSH communication

Among the language barriers encountered, the third type identified was the presence of a foreign language. The analysis revealed a strong and statistically significant positive correlation ($r = 0.573$, $p < 0.05$) between the use of a foreign language and the effectiveness of OSH communication, as depicted in Figure 3. The use of a foreign language encompassed various aspects, such as the utilization of non-native languages in OSH procedures, instructions, toolbox meetings, safety inductions, safety talks, OSH banners, bulletins, and OSH promotional materials. Consequently, the hypothesis (H_a) positing the significant influence of foreign languages on OSH communication is supported by the empirical findings.

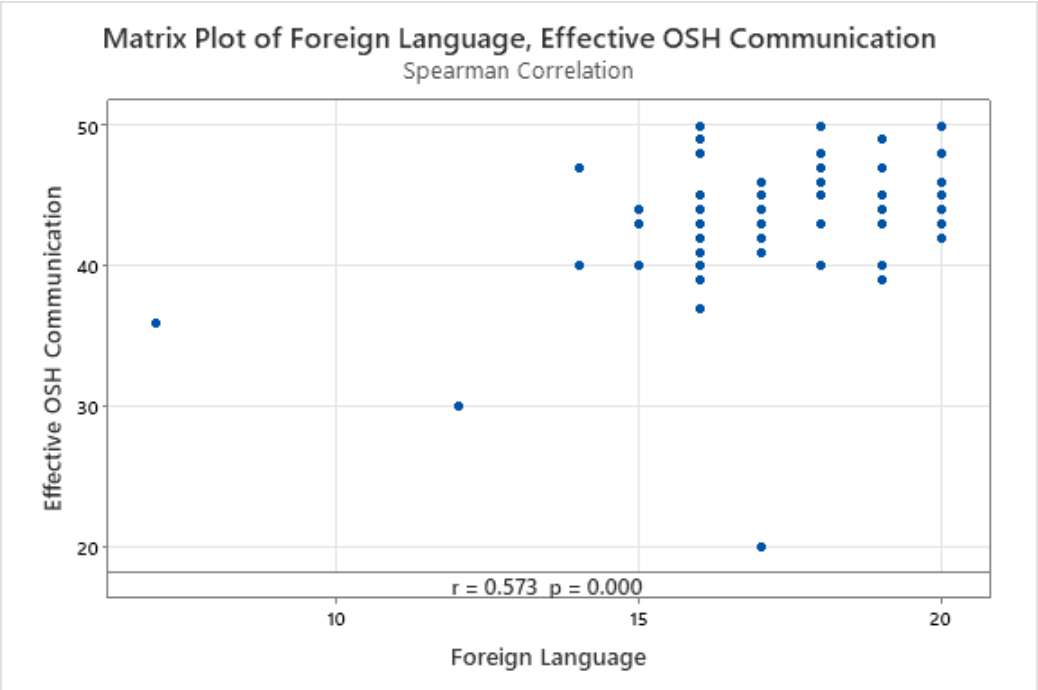

Figure 3: Correlation of foreign language and effective OSH communication

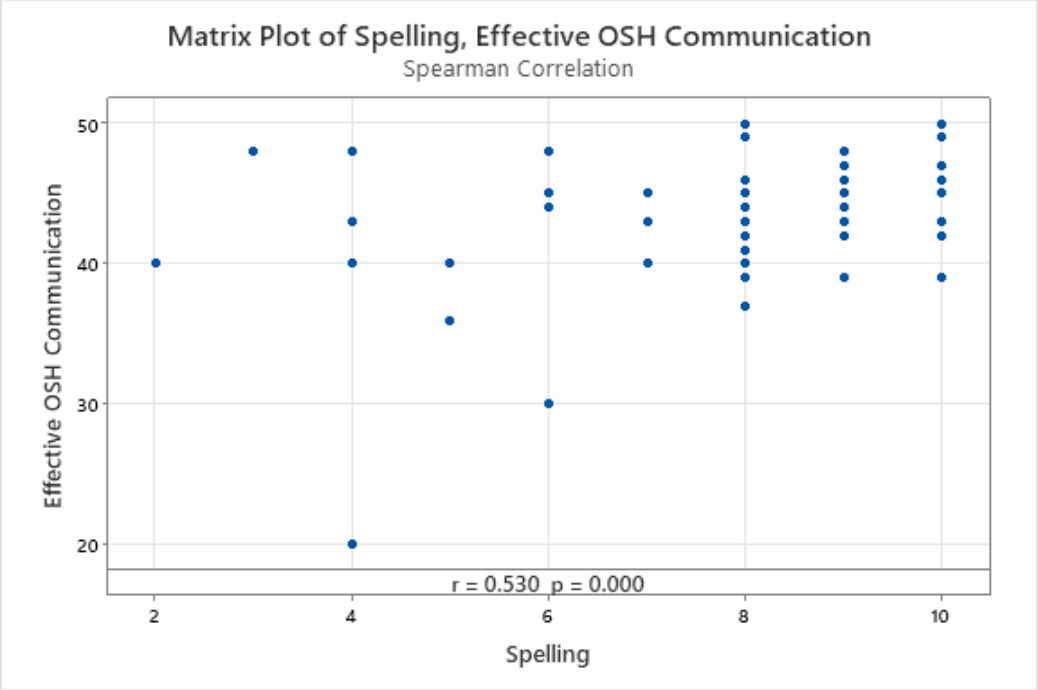

Figure 4: Correlation of spelling and effective OSH communication

Within the context of this study, the fourth category of language barriers identified pertained to spelling errors. Specifically, these errors manifested as misspelled words and/or digits found on various OSH media, such as banners, safety signs, and bulletin boards. The analysis revealed a strong and statistically significant positive correlation ($r = 0.530$, $p < 0.05$) between spelling errors and the effectiveness of OSH communication, as illustrated in Figure 4. Therefore, the hypothesis (H_a) proposing a significant impact of spelling errors on OSH communication is supported by the empirical evidence obtained in this study.

The final category of language barriers identified in this study pertained to the utilization of vernacular languages spoken among colleagues during working hours. The analysis indicated a moderate, positive correlation ($r = 0.497$) that was statistically significant ($p < 0.05$) between the use of vernacular languages and the effectiveness of occupational safety and health (OSH) communication. Consequently, the alternative hypothesis (H_a) is supported, as illustrated in Figure 5.

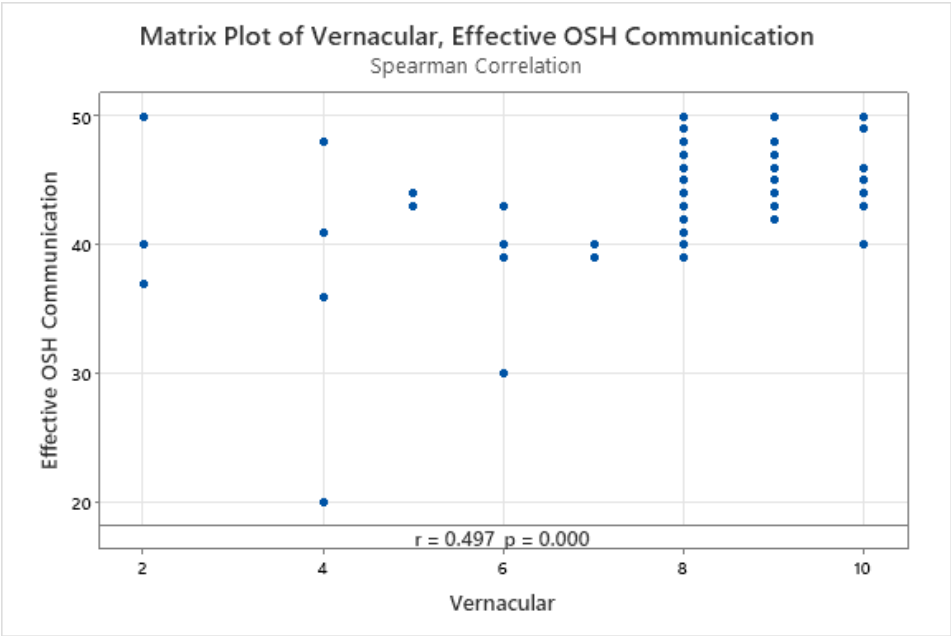

Figure 5: Correlation of vernacular and effective OSH communication

Discussion

Communication becomes ineffective when two people or more speak different languages which have no similarity, especially in terms of lexical. It is also applied not only to foreign languages but also vernaculars. The respondents of this research have difficulty understanding OSH communication when the messages are in a foreign language namely English because they speak Indonesian daily; sometimes vernacular which causes the same problem again. The research is in line with several studies regarding the language barriers that affect migrant workers.[9,17]

Distinct terms or expressions are something that people cannot avoid in the workplace; the failure to understand the terms or expressions will cause unintelligibility. In a workplace that has a high risk of accidents like a DEF power plant, unintelligibility should be avoided by using effective OSH communication.

Other types of barriers that can lead to ineffective OSH communication are wordy messages or writings, signs without descriptions and distinct colors, and misspellings or typos. Clear, concise, and accurate messages are the most preferable messages in communicating OSH to workers in every workplace. Otherwise, the OSH communication will become ineffective or fail. The result supports the study conducted by Buarqoub on language barriers to effective communication regardless he did not specifically mention the rest of the language barriers in the context of OSH.[12]

This research provides details on the types of language barriers in effective OSH communication and specifically discusses the context of OSH communication in Indonesia. However, the respondents in this study are only from one company and all of them are males which may not represent the overall population of workers in Indonesia. Based on the overall findings, the language barriers and effective OSH communication are strongly related, but the direct factors and causes are not scrutinized.

Conclusions

OSH communication is one of the most important aspects to encourage the workers' safety but an ineffective communication system leads to miscommunication. Ineffective OSH communication can be attributed to several factors, including language barriers as one of the significant contributors. Based on the results, the language barriers derived from a foreign language, vernacular, jargon, word choice, and spelling have a positive correlation with effective OSH communication. Thus, OSH communication should be communicated clearly, concisely, and accurately in a language that everyone can understand.

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Review Article

Adoption of occupational health and safety as a fundamental human right and its implications for Nigerian workers

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ABSTRACT

Introduction: This paper examines the recognition of occupational health and safety (OHS) as a fundamental human right and its implications for Nigerian workers. It highlights the need for employers and governments to prioritize workers' safety and reviews the challenges faced by Nigerian employers in providing a safe working environment.

Methods: A critical review of existing literature and secondary sources of information was conducted to explore the meaning of fundamental human rights as they pertain to OHS. The paper investigated the need for recognizing OHS as a fundamental right and the role of governments and employers in fulfilling this right.

Results: The recognition of OHS as a fundamental human right is crucial in protecting workers' lives and promoting decent work, leading to economic and social benefits. Employers, governments, and international organizations must respect, protect, and fulfill this right for all workers. The adoption of OHS as a fundamental right would encourage governments to introduce legislation promoting a culture of safety and sensitizing businesses to the need to implement policies, procedures, and processes to provide a safe working environment, including standard safety training and adequate resources.

Conclusion: Adopting OHS as a human right is beneficial for the workforce but requires investments from employers to comply. The Ministry of Labor and Employment in Nigeria should ensure that all accidents are reported and recorded to build a useful database. Improving OHS in Nigeria necessitates compliance, training, and access to resources. Accurate data is crucial to develop effective solutions for workplace accidents.

Keywords: Compliance, fundamental human right, occupational health and safety, safe working environment, workplace accidents.

Introduction

Workers have the right to do their jobs in a place that is safe, healthy, free of pollution, clean, and in balance with the environment. Many Nigerian companies do not understand how important it is to manage health and safety, so they put making money ahead of their workers' lives and see health and safety as very expensive for the company. Nigerian workers have been in all kinds of accidents at work, from minor to fatal. Some have lost their lives, and others have lost limbs, which can leave them disabled for life without any kind of compensation. This ugly situation prevails because occupational health and safety laws are not respected, and the place of workers' health and safety has been relegated to the background in favor of profit-making.

This paper aimed to re-establish the fact that the ability to return home after the close of work unharmed, well, alive, and healthy is a fundamental human right that every worker should naturally enjoy. This paper advocates a return to the human-based approach to business, in line with the three-legged model of sustainability, which is people, planet, and profit.

The meaning of fundamental human rights

Fundamental human rights are the basic rights and freedom essential to the dignity and well-being of all human beings. They are protected by national and international laws, and cannot be taken away or denied to any individual. They are the foundation of democracy and the rule of law and play a crucial role in protecting individuals from abuse and oppression. They are also interdependent and indivisible, meaning that the protection of one right is necessary for the protection of all rights. Fundamental human rights were derived from the moral belief that human life is precious and priceless.[1] However, from the perspective of occupational health and safety, fundamental human rights refer to the individual's right to reside and work in an environment that promotes or sustains safety and health, such that the individual is free from exposure to any risk of harm.[2]

Twigg classified fundamental human rights into two types: civil and political rights, and economic, social, and cultural rights.[3] Of the two categories, the one that applies more to health and safety is economic, social, and cultural rights, since this has a direct impact on the work environment.[4] Until this time, there have been four fundamental human rights that workers have enjoyed: freedom of association and the right to collective bargaining; freedom from all forms of forced labor; freedom from child labor; and freedom from employment discrimination. These formed the four categories or pillars of fundamental principles and rights at work and were adopted by the General Conference of the International Labor Organization (ILO) during its 86th Session held in Geneva, Switzerland in June 1998. The right to a safe and healthy work environment was added to this list on June 10, 2022, during the 110th session of the International Labor Conference, which was held in Geneva from May 27 to June 11, 2022.[5-7] Hence, the 2022 Declaration is only an amendment of Paragraph 2 of the 1998 Declaration. It should be emphasized that fundamental human rights are not fundamental because the Declaration says so; they are fundamental because they are.

Overview of the five pillars of Fundamental Principles and Rights at Work

The International Labor Organization (ILO) has identified five fundamental principles and rights at work, also known as the "pillars of decent work", which are considered essential for promoting and protecting the rights and well-being of workers.[5] These principles and rights form the basis for the ILO's efforts to promote and protect the rights and well-being of workers globally and are considered to be fundamental for achieving decent work for all. The ILO encourages governments, employers, and workers to work together to implement these principles and rights in practice, to ensure a fair and just world of work. The five pillars of decent work are discussed below.

1. Freedom of association and right to collective bargaining: Workers have the right to form and join trade unions and to negotiate and bargain collectively with employers. Workers everywhere are free to become members of trade unions and to independently elect safety and health representatives.[8] In cases where there are no trade unions in the area of operation, senior management should put alternative measures in place to enable workers to organize exclusive meetings where issues bordering on their condition of service can be discussed. Senior management should ensure that they regularly consult with and engage approved worker representatives in collective bargaining. Senior management should also endeavor to notify the union whenever there is going to be a redundancy exercise or other significant changes in operations.

2. Elimination of child labor: The UN General Assembly adopted the Convention on the Rights of the Child in 1989, which recognizes children's right to be protected from child labor and exploitation. Child labor is prohibited, and organizations should make the minimum age for applicants in outsourced positions clear to recruiting agencies.[9]

Companies should refer to a country's legal minimum working age if it is higher than their minimum age. Young workers who want to work and study can be employed with scheduled adjustments. Companies should also conduct surveys to ensure that the tasks assigned match employees' physical and mental abilities to prevent harm.

3. Elimination of all forms of forced or compulsory labor: Forced or compulsory labor is strictly prohibited and efforts must be made to eliminate it in all forms. According to Sanofi,[10] forced labor is said to occur where work or service is exerted by the government, employers, or managers in an organization who have the will and power to use threats on workers, including economic sanctions, for example, withholding salaries or restricting people's movements. Such acts of intimidation may also include sexual harassment, physical and psychological assault, and the threat to reveal the victim's illegal status to law enforcement agents.

4. Elimination of all forms of discrimination in employment or occupation: Discrimination based on race, gender, religion, age, or other factors is prohibited in the workplace. There are two types of discrimination: direct and indirect. Direct discrimination occurs when laws, rules, or practices deny people equal opportunities based on specific grounds. Indirect discrimination is less obvious, as rules or practices may appear neutral, but some people are denied certain opportunities.[10] Equality at work means everyone should have the same opportunities to improve their skills, knowledge, and competence in relevant areas. Written policies should make it clear that the company won't tolerate exclusion, preferential treatment, or distinction in decision-making based on personal traits, such as race, gender, sexual orientation, religion, age, disability, or trade union membership.

5. Promotion of a safe and healthy working environment: Employers have a responsibility to provide a safe and healthy working environment for their employees. National governments and employers of labor must guarantee the safety and health of their employees by providing an appropriate work environment, including the provision of personal protective equipment. The health and safety of vulnerable groups, such as young people, disabled employees, and pregnant women, should be considered in workplace design. Safety rights are a crucial part of human rights for everyone, and the ILO has developed conventions to promote these rights and protect vulnerable groups. This research will explore the intersection of safety rights with international human rights and the ILO's conventions on eliminating child labor and protecting women's rights.

The Universal Declaration of Human Rights (UDHR) recognizes the right of every person to work in safe and healthy conditions, free from discrimination and exploitation. However, women and children often face significant challenges in the workplace, including discrimination, harassment, and unequal access to safe working conditions.[11] Women are more likely than men to work in jobs that are physically demanding and have a higher risk of injury, and they may also face pregnancy-related health concerns.[12] Research has shown that women who work in male-dominated fields, such as construction, are at a higher risk of experiencing harassment and discrimination.[13]

Similarly, children who work also face specific risks and require special protections. Child labor is prohibited under international law, and the ILO has adopted several conventions that aim to eliminate child labor and protect the rights of children. The ILO's Minimum Age Convention sets a minimum age for employment, and the Worst Forms of Child Labor Convention prohibits the worst forms of child labor, such as slavery, forced labor, and trafficking.[14,15] Research has shown that child labor is often associated with hazardous working conditions, low wages, and limited opportunities for education and social mobility.[16]

For all workers, the ILO has adopted several conventions that protect the safety and health of workers. The Occupational Safety and Health Convention aims to promote safe working conditions by setting minimum standards for workplace safety and health. The ILO also adopted the Promotional Framework for Occupational Safety and Health Convention, which provides guidelines for implementing occupational safety

and health policies and programmes.[17,18] Research has shown that these conventions have been effective in reducing workplace injuries and fatalities in many countries.[19]

Emergence and evolution of the concept of fundamental human rights at work

The idea of fundamental human rights at work is not completely new. The concept of fundamental human rights at work has emerged and evolved, as a result of the efforts of governments, international organizations, and civil society to promote and protect the rights and well-being of workers. Occupational health and safety have been considered a fundamental human right since the dawn of the modern human rights era, as the concept repeatedly resonates in multiple international laws.[7] Several international treaties, conventions, and declarations, regional directives, and national regulations have always recognized that people have certain fundamental rights within the confines of the place where they work; however, the Universal Declaration of Human Rights of 1948 provided the foundation upon which modern human rights stand today.[20] Article 3 of the 1948 Universal Declaration of Human Rights states that everyone has the right to "life, liberty, and the security of person".[11] The UDHR and the ILO Declaration share similarities in their focus on human rights and protecting workers' rights. However, the UDHR covers a broad range of rights for all individuals, while the ILO Declaration specifically targets workers and identifies five fundamental principles and rights at work. The ILO Declaration promotes decent working conditions and social justice and has been incorporated into international labor standards and national laws.[7, 11]

Various international instruments recognize the right to a safe and healthy working environment as a fundamental human right. Article 7 of the Committee on Economic, Social, and Cultural Rights, Article 3 of the European Social Charter, and Article 31 of the Charter of Fundamental Rights of the European Union all proclaim the right to healthy and safe working conditions. The Universal Declaration of Human Rights, ILO Conventions No. 81 and No. 155, the UN Guiding Principles on Business and Human Rights, and the WHO Constitution also recognize this right. Additionally, the African Charter on Human and Peoples' Rights and the Sustainable Development Goals acknowledge the importance of promoting safe and secure working environments for all workers.[7]

It is important to point out that the constitutions of most countries in the world already contain provisions that give credence to the idea of treating health and safety as fundamental principles and human rights. Such countries include Ethiopia, Burkina Faso, Turkey, Argentina, Portugal, Belarus, South Korea, the Benin Republic, Chile, Bulgaria, Colombia, Moldova, the Kyrgyz Republic, Nigeria, and a host of others.[3] The right to a safe and healthy working environment is a fundamental human right.[21] Many countries have adopted laws and regulations to protect workers' health and safety, and Norway is a recognized leader in this area. The country's Working Environment Act,[22] guarantees the right to a safe and healthy working environment, and employers are required to take measures to prevent accidents and injuries. According to a study by the European Agency for Safety and Health at Work, Norway has one of the lowest rates of workplace accidents and fatalities in Europe.[23] Canada's labor laws also prioritize worker safety. The Canadian Labor Code outlines the responsibilities of employers to ensure the health and safety of their workers, and the Canada Occupational Health and Safety Regulations provide detailed requirements for workplace safety. According to a report by the Canadian Centre for Occupational Health and Safety, the rate of workplace fatalities in Canada has been declining over the past decade, in part due to the country's strong safety regulations.[24] The Work Health and Safety Act in Australia mandates employers to ensure a safe working environment and prevent accidents and injuries. Safe Work Australia reports a decline in work-related fatalities in recent years, attributed to Australia's strong safety regulations.[25] Japan's Industrial Safety and Health Act,[26] sets out the requirements for ensuring the safety and health of workers in Japan. The act requires employers to take measures to prevent accidents and injuries and to provide training and education to workers on workplace safety. According to a report by the

Japan International Labor Foundation, Japan has made significant progress in improving worker safety over the past few decades, with the rate of workplace fatalities declining steadily.[27] The European Union (EU) has adopted several directives and regulations aimed at protecting workers' health and safety. The EU Framework Directive on Safety and Health at Work,[28] sets out the general principles of workplace safety, and other directives cover specific hazards such as noise, vibration, and hazardous substances.[28] According to a report by the European Agency for Safety and Health at Work, the EU has made significant progress in reducing workplace accidents and fatalities in recent years.[29]

However, the African Union does not recognize occupational health and safety as a fundamental human right but instead as a precondition for economic growth.[30] The Nigerian constitution recognizes the right of workers to work in an environment that will not negatively impact their health and well-being. On November 8, 2022, the Nigerian government ratified ILO Convention No. 187, which is one of the bedrocks of occupational health and safety and among the ILO's Conventions that was recently recognized as an instrument in the area of fundamental principles and rights at work. By ratifying Convention No. 187, Nigeria has pledged to remain committed to the continuous improvement of occupational health and safety in a sustainable way.[31] The 1999 constitution of the Federal Republic of Nigeria also captures the concept of fundamental human rights in Section 17 Subsection 3 which opines that citizens of the country can seek employment anywhere in the country without any bias; working conditions should be fair with a suitable balance between work and other socio-cultural activities; health, safety, and well-being of workers should be a priority; suitable and sufficient health care services; no gender disparity; and pay should be proportional to work done.[32]

Even while occupational health and safety is recognized as a human right in practically all major human rights documents, it hasn't received as much attention as other crucial human rights concerns.[33] The Global Commission for the Future of Work, which first proposed the idea that the time had come for occupational health and safety to be adopted as a fundamental principle and human right at work, was responsible for the recent adoption of occupational safety and health as a fundamental human right.[6] The concept of fundamental human rights at work has evolved over time as a result of the efforts of governments, international organizations, and civil society to promote and protect the rights and well-being of workers. These efforts have led to the recognition of occupational health and safety as a fundamental human right in June 2022.

The value of human life and accident rates in developing countries

The Telegraph newspaper reports that in India, the cost of human life is low, and this has compromised the safety of the Indian workforce.[34] He compared compensation entitlements for work-related deaths in India with that of the United Kingdom (UK) and the United States of America (USA) and found that it is between 500 000 – 1 000 000 Rupees in India, between £1 - £2 million in the UK, and $5 - $10 million in the USA. Using the current exchange rates, it means that compensation paid to the family of a worker that dies in a work-related accident is about 199 times more in the UK, and 823 times more in the USA, than in India. It is therefore very clear that most organizations in India would prefer to pay a few Rupees as compensation for the death of a worker in a project worth millions of dollars. Although the compensation system in Nigeria does not have fixed values for occupational fatalities, the situation is not too different from what has been described in India.

It should be the fundamental human right of every worker to be able to return home alive and healthy at the end of the workday.[35] For the past fifty-five years, stakeholders in occupational health and safety have been advocating for the recognition of the right of workers to a safe working environment in national and international settings.[36] The history of occupational disasters serves as a tragic reminder that accidents and illnesses result from unhealthy and unsafe working conditions, which have an appalling human cost associated with each event.[6] Occupational injuries, illnesses, and deaths have a

devastating effect on families as well as their communities at large.[37] At the core of achieving sustainability and decent working conditions is the need to protect workers' health and safety. Morally speaking, workers are not supposed to sustain injuries, become sick, or even lose their lives due to poor working conditions.[38] Global statistics are persistently alarming, and the increasing accident rate, especially in developing countries, is a source of concern. Values published by the International Labor Organization on their website for the past decade suggest that worldwide, approximately 2.3 million people are killed as a result of work-related accidents or diseases, which implies that globally, over 6 300 workers die every single day at work.[12,13] More recent data given by the United Nations Global Compact estimates that each year 2.78 million workers die from occupational accidents and work-related diseases, while an additional 374 million suffer from non-fatal occupational accidents. This implies that 7,500 people die from unsafe and unhealthy working conditions every single day, which exceeds the daily number of people that die from road accidents, war, violence, and HIV/AIDS, and two-thirds of these deaths occur in Asia and Africa.[41] If the annual number of workers who die prematurely as a result of work-related illnesses is factored into the analysis, the figures may be far greater than what is currently being estimated. The fact that over two million workers lose their lives every year as a result of unsafe conditions at the workplace is a serious cause for concern, and this will have a debilitating effect on the global workforce. Translating all this into economic terms, the European Union loses over 3.3 percent of its gross domestic product annually due to work-related accidents and illnesses.[38] There is overwhelming evidence from global statistics alone that there has been a failure to uphold and implement human rights at work.[39,40] In Nigeria, the occupational accident rate and the general nonchalance of employers of labor toward workplace health and safety are becoming an emerging problems.[42] Ezenwa,[43] reported that there were 3 183 reported cases of injured workers and 71 fatalities resulting in a case fatality rate of 2.2 per 100 injured workers in Nigeria between 1987 and 1996, which was higher than that of Kenya and the USA. Although there are no reliable records of accident statistics in Nigeria, the National Social Insurance Trust Fund (NSITF) reported that 3 461 occupational accidents occurred between 2014 and 2016, out of which 238 fatalities were recorded.[32]

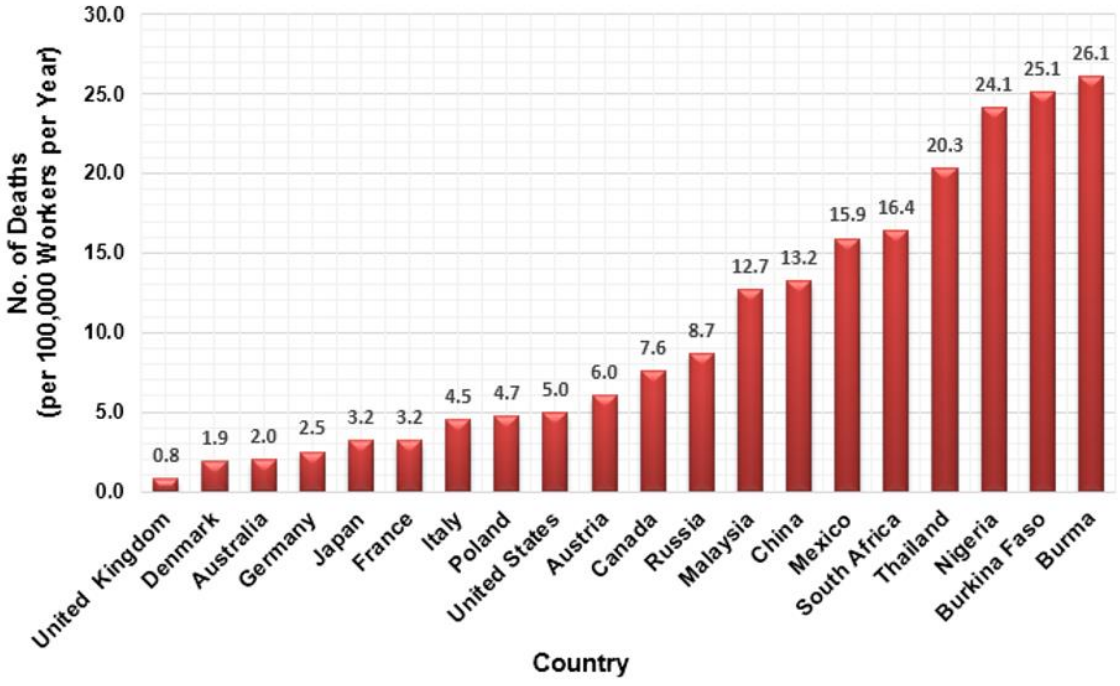

Figure 1. Occupational death rates for twenty countries in 2003 as adapted from Hämäläinen[44]

Occupational accident statistics in Nigeria are difficult to obtain, as many accidents go unreported. However, it is known that the number of workplace accidents and injuries is high in Nigeria. Abubakar,[45] pointed out that occupational health and safety data in Nigeria was difficult to come by; however, extracts from the study carried out by Hämäläinen[44] showed the yearly work-related death rate of 24 fatalities per 100 000 employees in Nigeria, which is among the worst in the world, as shown in Figure 1.

It is believed that occupational accidents don't just happen; they are mostly caused by a failure on the part of management to put control measures in place to mitigate risks. Ngwama,[42] attributes the cause of despicable working and living conditions for millions of Nigerian workers to greed and corruption on the part of the government, which frequently allows employers of labor to get away with poor health and safety standards, even when such a docile attitude may lead to the deaths of workers. The avaricious global economic competition, driven by the quest for cheap labor, has placed a demand on multinational companies to persistently seek the lowest cost of production. The combined woes of poverty, high cost of living, inflation, and a high rate of unemployment have plunged Nigerian workers into the quagmire of lack, leaving in their wake a bandwagon of helpless workers desperate for a job and who are even willing to work in the most deplorable and dangerous conditions. There are so many multinational companies that have the wherewithal to ameliorate the tragic episode of Nigerian workers by creating a conducive working environment, and this is the significance of recognizing occupational health and safety as a fundamental principle and human right at work.

Prevalence of occupational diseases in Nigeria

Nigeria's industrial growth has not been matched by adequate occupational health and safety measures to protect workers from workplace hazards. As a result, workers in Nigeria face risks of developing occupational diseases, including respiratory diseases, skin diseases, noise-induced hearing loss, Musculoskeletal Disorders (MSDs), and infectious diseases.

A study by Akande,[46] investigated the prevalence and correlates of respiratory symptoms among welders in Lagos, Nigeria. The study found that welders were at a high risk of developing respiratory symptoms due to exposure to welding fumes and dust. The study recommended the use of personal protective equipment and good ventilation systems in welding workshops to prevent respiratory problems. Another study by Amah et al,[47] investigated the prevalence of musculoskeletal disorders (MSDs) and ergonomic risk assessment among carpenters in the Enugu metropolis, Nigeria. The study found that carpenters were at a high risk of developing MSDs due to the repetitive manual tasks involved in their work. The study recommended the use of ergonomic interventions such as job rotation and breaks to prevent MSDs in carpenters. Babatunde and Akintayo,[48] conducted a narrative review on occupational skin diseases in Nigeria. The review highlighted the various occupational skin diseases prevalent in Nigeria, including contact dermatitis and skin cancer. The review recommended the use of personal protective equipment and regular health checks for workers at risk of developing occupational skin diseases. Egbi et al,[49] investigated occupational noise-induced hearing loss (NIHL) in Nigeria. The study found that workers in industries such as mining, construction, and manufacturing were at a high risk of developing NIHL due to exposure to loud noise. The study recommended the use of hearing protection devices and regular hearing checks to prevent NIHL in workers. Ikeh et al,[50] investigated the prevalence and determinants of low back pain (LBP) among cement factory workers in southeastern Nigeria. The study found that cement factory workers were at a high risk of developing LBP due to the nature of their work. The study recommended the use of ergonomic interventions such as good postures and breaks to prevent LBP in cement factory workers.

Employers and policymakers should prioritize effective occupational health and safety measures in Nigeria to prevent occupational diseases and protect workers' health. The Federal Ministry of Health Nigeria,[51] has developed a national policy to guide the implementation of such measures.

The role of government, workers, and employers of labor

Occupational Health and Safety (OHS) is a shared responsibility that involves the cooperation and collaboration of employers, workers, government, and regulators. Each of these groups plays an important role in ensuring the safety and well-being of workers in the workplace. Employers have a legal responsibility to provide a safe and healthy working environment for their employees. This includes assessing and managing risks, providing training and information, and ensuring that workers have the appropriate personal protective equipment. Workers have a right to a safe and healthy working environment and a responsibility to take care of their own health and safety and that of their co-workers. This includes following safety procedures and reporting hazards and incidents. Government plays a role in setting OHS regulations, standards and policies and enforcing them. Governments also provide oversight of OHS and have the responsibility to ensure that employers are in compliance with OHS regulations, by providing inspection and enforcement services. Regulators are responsible for enforcing OHS regulations and ensuring that employers are in compliance with OHS regulations. This includes investigating complaints, conducting inspections, and issuing fines and penalties for non-compliance. International organizations such as the International Labor Organization (ILO) and the World Health Organization (WHO) play a role in promoting OHS globally by setting international standards, providing technical assistance and raising awareness. All these groups have important roles and responsibilities in ensuring OHS. Employers have the primary responsibility to provide a safe and healthy working environment, but workers, government, regulators and international organizations all play a critical role in supporting and complementing the employer's efforts. Collaboration and cooperation among all stakeholders are key to achieving effective OHS outcomes.

With the determined collaboration of government, employers, and workers, the number of occupational accidents and ill health can be drastically reduced as exemplified in China, where the annual workplace accidents were lowered by 27 percent and the associated fatalities dropped by 23.6 percent in 2022, and this is attributed to improved safety audits and workplace inspections.[52]

Unsafe and unhealthy working conditions are mainly caused by a combination of underlying factors such as gaps in governance, deficiencies in legislative frameworks, inadequate resources, a lack of knowledge, adopting business practices that are not sustainable, and an absence of an accident-prevention culture at organizational and national levels. Hence, national governments and employers of labor each have their respective roles to play to ensure a safe and healthy working environment.[32]

National governments are responsible for the provision of suitable and sufficient infrastructure, laws, and services that are necessary to ensure that businesses thrive. This can be achieved in partnership with employers and workers through the development of national policies and programmes, as well as management systems that foster compliance with occupational health and safety laws and policies.[53]

It should be borne in mind that employers alone are not exclusively responsible for ensuring workers' safety and health; public authorities and workers also have a role to play. Employers have legal statutory obligations to ensure that workers understand the methods of carrying out their jobs in a safe manner, point out the inherent risks associated with tasks, inform workers of risk control techniques and personnel responsible for risk control implementation, engage and consult with workers, and establish emergency procedures in anticipation of an emergency.

Workers should exercise their stop-work authority and evacuate dangerous areas; workers should only work in places where risks have been controlled to levels that are as low as reasonably practicable; workers should draw the attention of employers to unsafe conditions by reporting them immediately; and workers should not destroy items provided for their own safety by using them for the purpose for which they were designed to be used.[54]

Gross,[55] argued that, even though consultation and

engagement of workers in the decisions that affect their health and safety is one of the hallmarks of a true democracy, the United States labor policy was not largely influenced by the concept of human rights. Hilgert,[38] has pointed out that the recognition of health and safety as a fundamental human right can only be sustained through reviving labor rights in the workplace.

The implications for Nigerian workers

The ILO's acceptability and influence have been reinforced by the organization's recognition of health and safety as a fundamental human right, which has also popularized the ILO's institutional uniqueness as a tripartite organization and given its goals and mandate new life.[6] No matter whether they have ratified the pertinent Conventions or not, Member States of the ILO have made a commitment or covenant to respect and promote the fundamental right to a safe and healthy working environment. This is the implication of the official recognition of a healthy and safe working environment as a fundamental human right.[41] Hence, all stakeholders need to step up their work, renew their efforts to create a safe and healthy working environment and rise to the occasion to realize this objective. The recognition of occupational health and safety as a fundamental principle and human right will help to consolidate the global agenda, which stipulates that workers' rights should not only be respected but this idea should be promoted by employers of labor and should be complied with by the Nigerian government, irrespective of the fact that Nigeria, being a member of the ILO, has or has not ratified the ILO Conventions.[6] This pronouncement is a fulfillment of the mandate of the ILO, which is to advance social and economic justice by setting international labor standards, benchmarks, and international best practices whose objectives are geared towards the protection of workers against workplace accidents and ill-health. In line with the vision for a better future of work, this solid confirmation of a safe and healthy working environment as a fundamental human right is a landmark victory for millions of workers all over the world, especially in Nigeria.

Adopting Occupational Health and Safety (OHS) as a fundamental human right would have a significant impact on the workforce. This adoption would prioritize the safety and well-being of workers in the workplace, requiring employers to provide safe and healthy working conditions. Workers would have the right to participate in identifying and assessing hazards, refuse dangerous work, access information and training, and be protected from retaliation for reporting OHS concerns. This would enhance job security and protect workers from abuse and exploitation while strengthening the legal framework for OHS.

Conclusions and Recommendations

Recognizing OHS as a fundamental human right is vital for protecting workers' lives, promoting decent work, and achieving economic and social benefits. Employers, governments, and international organizations must respect, protect, and fulfill this right for all workers. Workers' health and safety should be treated as a sacred human right, and employers should prioritize their workers' lives above economic gains. The paper reviewed the implications of recognizing occupational health and safety as a fundamental human right at work. It supports the action by the ILO, stating that it will encourage national governments to introduce legislation that promotes a culture of safety and sensitizes businesses to the need for safe practices. The declaration did not create a new principle but reaffirmed the fundamental nature of an existing one: that every worker deserves to work under suitable and equitable conditions, which is now considered a fundamental human right. While risks and hazards are peculiar to specific industries and companies around the world, businesses need to pay more attention to workplaces in countries such as Nigeria with limited resources, weak legal structures, and inadequate enforcement and support functions. Employers in Nigeria face significant challenges in providing a safe working environment for their workers, but these challenges can be overcome by implementing policies, procedures, and processes and having a competent team. Providing standard safety training and adequate resources is necessary. Employers should also monitor the labor practices of their clients and

business partners to ensure compliance with human rights provisions. This will go a long way toward reducing the rate of occupational accidents in Nigeria. Employers have the primary responsibility to provide a safe and healthy working environment, but governments, regulators, and international organizations all play a critical role in supporting and complementing employers' efforts. The adoption of OHS as a fundamental human right would have significant positive implications for the workforce, but it would also require employers to make additional investments to ensure compliance with the new regulations. The lack of reliable data on occupational accidents and injuries in Nigeria makes it difficult to develop effective policies and programmes to address the problem. The Ministry of Labor and Employment, in coalition with the NSIFT, should ensure that all occupational accidents are reported, recorded, and published annually to build a useful database. The high number of workplace accidents in Nigeria is a serious concern, and more needs to be done to improve OHS in the country, including increasing compliance with OHS regulations, providing OHS training and education, and increasing access to OHS resources. Accurate data is needed to fully understand the extent of the problem and to develop effective solutions.

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