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Systematic Review of Occupational Injuries and Illnesses in the Nigerian Mining Industry

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Abstract: *Nigerian mining sector (NMS) has been ranked as second industrial sector with numbers of occupational injuries and illnesses (OII) that pose serious social and economic impacts on workers and society. Meanwhile, little is known about the specific aspects of OII in the mining sector that have been studied in the literature. As a result, this study seeks to review the existing research on workers' OII with the intention of identifying the primary causes, symptoms, and influencing factors that may relate to a persistent rise of injuries and illnesses in the NMS. This is to determine the sector dynamic in relation to OII and provide stakeholders in the sector with lack data that are required for planning, implementation, and monitoring sustainable OII. The study employed widely accessible electronic databases (Science Direct, PubMed, Scopus, Google Scholar, and Web of Science) to perform a systematic review of peer-reviewed articles from 2010 to 2023. The causes, symptoms, and influencing factors of OII in the mining industry were highlighted in the compilation of pertinent data. The study search yielded 210 peer-reviewed publications with 70 publications retained after systematic screening and 20 were retained for final analysis. The study identified eight major causes, four body parts that are most harmed, and five primary symptoms of OII in the NMS. Also, the factors that influencing OII in NMS were classified as sociodemographic, behavioural and organizational/management factors. The study concluded that the use of personal protective equipment, provision of first aid and medical facilities, enactment of safety laws and policies and adequate safety training and supervision are the most common ways that can reduce the high rate of OII in the Nigerian mining sector.*

Keywords: *Unsafe Practices, Hazard, Injuries, Illnesses, Occupational Safety Management*

1. INTRODUCTION

Occupational injuries and illnesses (OII) have been classified as worldwide dangerous and hazardous problems. Scholars around the world have defined and described these two scenarios in various forms that simplify their understandings. They were defined by Kazantzis [1], and Varacallo and Knoblauch [2] as any personal injury, illness, or death ensuing from a workplace accident. El-Menyar et al. [3] referred to them as one of the worst global problems since the Industrial Revolution, based on the enormous records of suffering and resulting costs. The statistical records show that about 317 million non-fatal and 321,000 fatal occupational injuries occur worldwide every year, which translates to 151 workers suffering an industrial injury every 15 seconds [4].

The contribution of the mining sector to employment generation is estimated to be 1% of the world's workforce [5]. Despite this low figure of employment, the mining industry is well known as one of the riskiest industries in the world [6, 7] and has a high potential for the occurrence of occupational injuries and illness. Occupational injuries and illnesses in the mining sector have been a serious issue since the early 17th century, when there were manifestations of illness and workers' health issues in the mining environment [8, 9]. Since then, the simultaneous growth in mineral exploitation has been attributed to its high demand both in local and international markets, with increasing occupational injuries and illnesses [10]. In the EU, it accounted for about 0.83% of industrial accidents in 2019 [11]. Based on the 2018 injury and accident data in Spain, the mining sector accounted for about 13,150 injuries per 100,000 workers [12]. Other countries from the literature that have documented work-related injuries and illnesses in the mining sector are the United States, China, Sweden, Brazil, Ghana, Turkey, and Pakistan [13-19].

Nigeria is not excluded from the countries that are battling with the dangers of an increasing rate of occupational injuries and illnesses in the mining sector. The Nigerian mining industries, whether engaged in artisanal or quarry mining, have documented a range of incidences regarding occupational injuries and illness in various dimensions. The sector employed over 2 million people in 2021 [20] and contributed about 0.85% to national GDP as of 2022 [21]. The statistics of notable occupational injuries and illnesses in the Nigerian mining sector have been documented. For instance, Kareem et al. [22] reported about 60.8% of occupational injuries and accidents among solid mineral miners in Ose Local Government of Ondo State. In Abakaliki, Ebonyi State, 89.5% of quarry workers experienced musculoskeletal disorders, while 74.1% had poor quality of life [23,24]. In Ogun State, about 43.0% of lower back and shoulder pain injuries were reported among the

sand mine workers [25], while shock injuries (46.0%), nasal infections (29.2%), asthma (4.6%), cough (26.0%), catarrh (20.0%), and sinusitis (15.0%) were reported among the Abeokuta quarry workers. Alaba [26] identified the occupational injuries and accidents associated with artisanal gold mining in Zamfara State as body weakness, brain damage, gastrointestinal tract, and neuropsychiatric.

Despite previous studies on occupational injuries and illnesses in the Nigerian mining sector, little attention has been paid to systematic reviews of OII, resulting in a lack of effective planning and mitigation measures for OII that could have been gained from previous collaborative research efforts. Therefore, this study needs to be conducted in a timely manner to provide stakeholders with compressed data needed for the planning, implementation, and monitoring of sustained occupational injury and illness in the Nigerian mining industry.

2. MATERIALS AND METHODS

The study used a secondary method of data collection in line with the Principles of Systematic Reviews and Meta-Analyzes (PRISMA) to ensure proper classification and recording of reviewed articles while avoiding subjective selection and repetition. The selected articles for the study were between the periods of 2010 and 2023 and were searched using only English keywords. The search keywords include, but are not limited to, unsafe practices, hazardous situations, occupational injuries, occupational illnesses, safety management, hazard identification, and causes in the mining sector. A total of 210 articles were identified by searching PubMed, Scopus, and Web of Science databases, while 50 articles were identified through other sources (Science Direct and Google Scholar). In addition, databases of international organizations (World Health Organization, Occupational Safety and Health Association, International Labour Organization, and European Union) were manually searched to broaden the scope of published studies and generate data entries. By applying the exclusion and inclusion criteria, we excluded 90 duplicate articles, 100 screened articles, and 70 after-assessed full-text articles, while the 20 full-text articles were included in the qualitative synthesis and the quality evaluation, as shown in Figure 1.

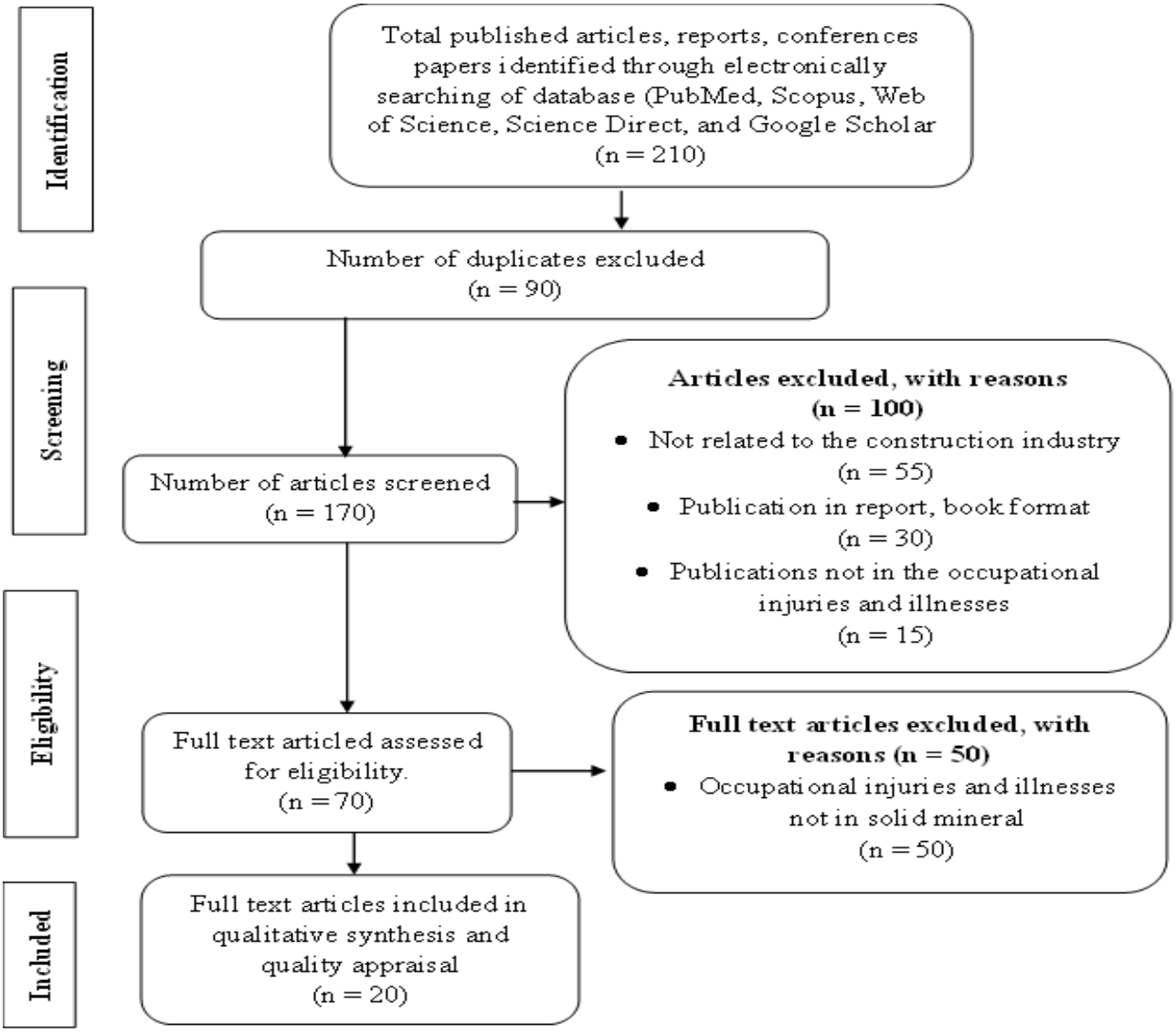

Figure 1: Reviewed articles for exclusion and inclusion flow diagram

The reviewed articles were analyzed using content and thematic data analytical methods as described in Vaismoradi and Snelgrove [27]. The content analysis was adopted to quantify the frequency and relationships among the occupational injuries and illnesses in the mining sector. Meanwhile, the thematic analysis was applied to view the experiences, thoughts, and behaviors of miners regarding occupational injuries and illnesses. The content and thematic data were descriptively analyzed using SPSS software, version 25.

3. RESULTS AND DISCUSSIONS

The results of twenty selected and reviewed articles across the Nigerian states (Abia, Ebonyi, Edo, Ekiti, Kaduna, Kwara, Ogun, Ondo, and Sokoto) between 2010 and 2023 are shown in Table 1. According to Table 1, with eight articles, Ebonyi dominated the state in terms of articles published; Edo State came in second with three published articles; Ogun and Ondo came in third with two published articles each; and Abia, Ekiti, Kaduna, Kwara, and Sokoto each had one publication. Accordingly, one article was published in each of the following years: 2010, 2011, 2014, 2016, and 2023; two articles were published in 2012, 2013, 2017, 2018, 2020, and 2022; and three articles were published in 2021.

Table 1: List of selected reviewed articles of OII in the Nigerian mining sector between 2010 and 2023

State	Number of articles	Review article number, author first name and year of publication
Abia	1	[14] Kelechi et al., 2020
Ebonyi	8	[1] Oginyi et al., 2010; [4] Nwibo et al., 2012. [6] Egwuonwu et al., 2013. [9] Okoye et al., 2017; [10] Henry et al., 2017. [11] Cajetan et al., 2018. [16] Njaka et al., 2021; [20] Njaka et al., 2023
Edo	3	[2] Aigbkhaode et al., 2011; [8] Isara et al., 2016. [19] Oluwatope et al., 2022
Kaduna	1	[3] Sufiyan and Ogunleye, 2012
Ekiti	1	[5] Babatunde et al., 2013
Kwara	1	[7] Saliu et al., 2014
Ogun	2	[13] Adeyemi et al., 2020; [15] Afolayan et al., 2021
Ondo	2	[17] Kareem et al., 2021; [18] Kareem et al., 2022
Sokoto	1	[12] Kaoje et al., 2018

3.1 Causes, Body Parts Injured and Symptoms of OII in the Nigerian Mining Sector

Table 2 shows, based on the reviewed papers, the number and percentage contribution of each of the causes, body parts injured, and symptoms of OII in the Nigerian mining sector.

3.1.1 Causes of OII in the Nigerian mining sector

Out of 18 reviewed articles (Table 2), the most frequent causes of OII in the Nigerian mining industry are slips, trips, and falls (STF) with 2 (11.0%), heat/cold exposure (HCE) with 4 (22.0%), noise/sound exposure (NSE) with 2 (11.0%), dust/particulate exposure (DPE) with 8 (45.0%), and chemical/metal exposure (CME) with 2 (11.0%). In the reviewed articles, 94.4% of workers in Ezza North LGA, Ebonyi State, work under extreme heat [24], while 56.1%, 81.6%, and 6.1% of them were exposed to ENS pollution, EDP inhalation, and extreme heat [28]. Meanwhile, 1.7% of them in Sabon-Gari LGA, Kaduna State, had cases of STF injuries [29]. Comparing the findings of this study with those of other countries, Lu [30] found that the mining sector in the Philippines reported 10% lower cases of STF injuries, while Zimbabwe recorded a 40% higher case rate [31]. Other nations that have reported comparable causes of OII in their mining industry include Spain, the United States, Ghana, and China [5,13,17,32,33]. The findings of this study, which identified similar global causes of OII in the mining sector, can be used as an opportunity to develop operational planning and mitigation strategies, particularly in Nigeria, where 90% of mining is artisanal.

3.1.2 Body parts injured by OII in the Nigerian mining sector

Out of 14 reviewed articles, the identified primary body parts that were injured by OII were grouped into Hand/Shoulder/Elbow (HSE) with 3 (21.0%), Leg/Toe/Ankle (LTA) with 2 (14.0%), Head/Lung/Neck (HLN) with 5 (36.0%), and Chest/Abdomen/Waist (CAW) with 4 (29.0%), as shown in Table 2. In the reviewed papers, the percentage of mine workers in Sabon-Gari LGA, Kaduna State, with hand, leg, and head injuries was 80.0%, 30.0%, and 1.7% [34], but that of lung and eye injuries in Sokoto State was 38.4% and 34.5%, respectively [35]. Consequently, 89.8% of workers in Ebonyi State had CAW problems [23], and 34.5% had hand injuries in Ose LGA, Ondo State [22]. Similar findings regarding injured body parts were reported in an American grocery store, where 11% of workers suffered CAW injuries [36]. However, 20.2% of workers reported head injuries in the mining sector in Serbia [37], while 48.5% reported back pain in the construction sector in Saudi Arabia. Saudi. Also, 32.8% of Iranian industrial workers reported injuries to their

eyes, head, and neck, while 28.3% reported injuries to their arms, wrists, and fingers, and 22.1% reported injuries to the legs, knees, and toes [29]. The high prevalence report of body part injuries due to OII and resulting harmful and long-term effects in global mining research, are not beneficial to the mining industry.

3.1.3 Symptoms of OII in the Nigerian mining sector

In the reviewed articles, the most prevalent identified symptoms of OII experienced by workers in the Nigerian mining sector were dry cough (DC) with 6 (13.0%); hearing loss (HL) with 4 (9.0%); eye irritation (EI) with 6 (13.0%); skin irritation (SI) with 4 (9.0%); respiratory issues (RI) with 9 (19.0%); runny nose (RN) with 2 (4.0%); musculoskeletal (MS) problems with 11 (24.0%); and body weakness (BW) with 4 (9.0%); as shown in Table 2. In the reviewed articles, it was discovered that exposure to and production of dust/particulate matter in significant amounts was the source of the health symptoms associated with DC, EI, SI, RI, and RN [22,35]. Meanwhile, repetitive tasks involving lifting, loading, and moving materials were the sources of MS and BW [24,38]. Also, generating plants, earthmoving equipment, and crushing machines employed in the mining industry are responsible for the HL [39]. In the articles published by Egwuonwu et al. [38] in the mining sites located at Ishiagu community, Ebonyi State, the prevalence rate of MS and BW was 83.3%, while in the articles published by [40] in the Umuoghara Community, Ebonyi State, the prevalence rates for chest pain, cough, and respiratory issues were 47.6%, 40.7%, and 6.5%, respectively. According to Babatunde et al. [41], 39.8% of artisanal miners in Ijero-Ekiti experienced chest pain, followed by a persistent cough (33.1%), musculoskeletal issues (77.1%), and skin inflammation (19.5%). However, Henry et al. [28] reported that 57.1% of mine workers in Ebonyi State had chest pain, with common complaints of bodily ache (42.9%), cough (38.8%), hearing loss (12.2%), eye inflammation (1.0%), and skin irritation (0.5%). When compared to stonemasons and stone-cutting workers in Iran, Nigerian quarry workers had higher prevalence rates of BW and MS than those reported in Iran [42]. The worldwide report of global research on the symptoms of OII in the mining sector is far more dangerous than many other sectors, particularly in underdeveloped countries like Nigeria, where the hazards may also be exacerbated by numerous other socioeconomic reasons.

Table 2: Causes, body part injured and symptoms of OII in the Nigerian mining sector

OII factor	Type	No. of publication	Reference publication number (RPN)
Causes of OII	• Slips, trips, and falls (STF)	2 (11.0%)	[3], [19]
	• Heat/cold exposure (HCE)	4 (22.0%)	[10], [16], [19] [20]
	• Noise/sound exposure (NSE)	2 (11.0%)	[10], [19]
	• Dust/particulate exposure (DPE)	8 (45.0%)	[1], [3], [4], [7], [8], [9], [10], [14], [19]
	• Chemical/metal exposure (CME)	2 (11.0%)	[15], [19]
Injured Body Parts by OII	• Hand/Shoulder/Elbow (HSE)	3 (21.0%)	[3], [13], [17]
	• Leg/Toe/Ankle (LTA)	2 (14.0%)	[3], [17]
	• Head/Lung/Neck (HLN)	5 (36.0%)	[3], [10], [12], [17], [20]
	• Chest/Abdomen/Waist (CAW).	4 (29.0%)	[1], [4], [10], [12]
Symptoms of OII	• Dry cough (DCS)	6 (13.0%)	[2], [4], [5], [7], [10], [12], [14]
	• Loss of hearing (LOH)	4 (9.0%)	[1], [7], [10], [19]
	• Irritation of eyes (IOE)	6 (13.0%)	[3], [7], [9], [10], [12], [17]
	• Irritation of skin (IOS)	4 (9.0%)	[5], [7], [10], [12], [14]
	• Respiratory problems (REP)	9 (19.0%)	[1], [4], [5], [7], [8], [10], [12], [14], [15], [19]
	• Nasal discharge problems (NDP)	2 (4.0%)	[8], [17]
	• Musculoskeletal problems (MSP)	11 (24.0%)	[4], [5], [6], [7], [10], [12], [15], [16], [17], [19], [20]
	• Bodily weakness/pain (BWP)	4 (9.0%)	[5], [12], [16], [20]

3.2 Influencing Factors of OII in the Nigerian Mining Sector

Tables 3 and 4 show, based on the reviewed papers, the analysis of reviewed articles for both main themes and sub-themes influencing factors of OII in the Nigerian mining sector.

3.2.1 Sociodemographic factor (SDF)

The SDF was grouped into 4 sub-themes, which include gender, age, educational level, and work experience;

i. **Gender:** Out of the 15 papers that were reviewed on gender issues in the mining sector, 12 (80.0%) reported more males and 3 (20.0%) reported more females (Table 3), which means that there are more men than women employed in Nigeria's mining industry. To affirm this fact, Njaka et al. [24] found that, at the Umuoghara mine site in Ezza North LGA of Ebonyi State, 66.9% of the quarry workers are men and 31.1% are women. At the Xiamen Win Stone company in Ose LGA, Ondo State, there were 90.8% men and 9.2% women workers [22], while 82.4% men and 17.6% women worked in the quarry industries at Akoko Edo LGA, Edo State [43]. Similar findings were observed in Iran, the Philippines, Zimbabwe, the United States, and Ghana [29-31,44,46]. The prevalence of more male working in the mining sector than their females has been linked to the use of large equipment, labor-intensive, and physical tasks involved in mining operations. Based on this, global research reported that more male mine workers had occupational injuries and illnesses than their female counterparts. For instance, Ashuro et al. [46] reported that male workers are 2.44 times more likely than female workers to sustain workplace injuries and illnesses.
ii. **Age:** Considering the mining workers' ages, after reviewing 13 papers in total, 11 (87.0%) of them reported ages under 45, while 2 (13.0%) reported ages over 45 (Table 3). This demonstrated that younger people than elderly people are primarily employed in Nigeria's mining industry. For instance, Aigbkhaode et al. [43] affirmed that 59.0% of the labor force in the mining industries at Edo State's Akoko Edo LGA was between the ages of 20 and 29. In Sabon-Gari LGA, Kaduna State, 90.5% of the population was between the ages of 15 and 44 [34]. These results were in line with other research from other countries, which established that younger and more energetic workers are more vulnerable to workplace injuries and illnesses in the mining industry than are their older counterparts [34,47,48].
iii. **Educational level:** Out of the 15 reviewed articles on the educational status of mine workers, 6 (40%) reported workers who had completed elementary and middle school, and 9 (60%) reported workers who had completed secondary and tertiary education (Table 3). However, compared to elementary, secondary, and tertiary education attendants, it was discovered that the number of tertiary school attendants was low. For example, the mine workers in Umuoghara, Ebonyi State, had 40.2% completed primary education, 49.1% completed secondary education, and 10.2% completed tertiary education [40]. According to Sufiyan and Ogunleye [34], there was no tertiary education attendant among the workers in Sabon-Gari LGA, Kaduna State, where the primary and secondary education rates were 29.7% and 27.0%, respectively. The percentage of educational status of the workforce in the quarry industries in Abakaliki was given as primary education (51.95%), secondary education (27.93%), and tertiary education (8.37%), respectively [49]. The outcomes of earlier research conducted in Iran and Tanzania are consistent with these findings [29,50]. The low level of Nigerian mining workers may be responsible for the low benefit gain from an efficient training program that is supposed to raise their level of safety awareness on OII mitigation. This was consistent with the finding that workers with less education have more than three times higher rates of OII than those with more education, and that workers with fewer qualifications have lower awareness of OII [51,52].
iv. **Work experience:** Table 3 shows that thirteen articles were reviewed for job experiences, of which 8 (62%) reported less than four years of work experience, while 5 (38%) reported more than four years. The reviewed paper pointed out that a large percentage of Nigerian mine workers lacked experience. For example, AIgbkhaode et al. [43] found out that 78.3% of mine workers in Akoko Edo LGA had less than four years of experience, while 62.41% of the mine workers in Abakaliki also had less than four years of experience [49]. Meanwhile, 86.0% of the mine workers at Umuoghara, Ebonyi State, had less than five years of experience [40]. The findings from many scholars revealed that workers knowledge about OII is determined by their years of work experience [53].

3.2.2 Behavioral factor (BEF)

The BEF was divided into two sub-themes: workers uses of personal protective equipment (PPE) and workers uses of illicit drug/alcohol/smoking (DAS).

i. **Workers uses of PPE:** Thirteen articles on the uses of PPE by the workers in the Nigerian mining sector were reviewed, of which 3 (23.0%) subscribed to the frequent uses while 10 (77.0%) subscribed to the nonfrequent uses of PPE (Table 3). Based on the reviewed articles, Aigbkhaode et al. [43] documented that 28.6% of workers utilized PPE constantly, 33.4% occasionally, and 41.0% never used PPE at their mine site in Akoko Edo LGA of Edo State. Furthermore, 98.3% of the mine workers did not wear any kind of PPE in Ebonyi State at the Umuoghara mine site [40]. However, this is contrary to Sufiyan and Ogunleye's [34] findings, which showed that 71.6% of mine workers in Sabon-Gari LGA, Kaduna State, always used PPP devices. In the reviewed articles, there are several explanations put forth for why PPE equipment is not being used in Nigeria's mining sector. The study by Kaoje et al. [35] showed that one-third of workers did not use PPE because they could not afford to buy it, and 16% felt unpleasant when wearing it. Meanwhile, Afolayan et al. [54] reported that 53.6% of the mine workers were unaware of the advantages of wearing PPE. These results collaborated with research conducted in other nations, which found that societal and religious views, ignorance, and a lack of supervision are some of the reasons why workers do not wear PPE at work [46].
ii. **Workers use illicit drug/alcohol/smoking (DAS):** Seven articles in all were reviewed based on DAS, of which 2 (29.5%) reported frequent uses of DAS while 5 (71.0%) reported nonfrequent uses of PPE during working hours (Table 3). In Nigeria, there are more reports on smoking among mining workers than on drug and alcohol consumption. Based on the Nwibo et al. [40] article, 82.4% of the mine workers in Umuoghara, Ebonyi State, were

involved in smoking, while 17.6% were not. Njaka et al. (2021) reported that 40.5% of the mine workers in Abakaliki, Ebonyi State, were smoking, and 21.8% used drugs. Meanwhile, 16% of stone crushing employees in Sokoto State acknowledged using drugs and drinking alcohol, while 55.1% of them were smoking [35]. The findings from the reviewed articles agree with other scholars from other nations that dependence on alcohol and other harmful substances impairs thinking capability, which leads to a lack of focus and result in occupational injuries and illnesses [55,56].

Table 3: Socio-demographic factor influencing OII in the Nigerian mining sector

Theme	Subtheme	No. of publication	Reference publication number
Socio-demographic factor (SDF)	• Gender		
	✓ Male	12 (80.0%)	[2], [3], [4], [5], [6], [8], [12], [15], [16], [17], [18], [20]
	✓ Female	3 (20.0%)	[9], [10], [11]
	• Age		
	✓ Youth < 45 years	11 (87.0%)	[2], [3], [4], [5], [6], [8], [9], [12], [15], [16], [17], [18], [20]
	✓ Old ≥45 years	2 (13.0%)	[10], [13]
	• Educational level		
	✓ Elementary and middle school < 60%	6 (40.0%)	[3], [9], [10], [11], [12], [15]
	✓ Secondary and tertiary school ≥ 60%	9 (60.0%)	[2], [4], [5], [6], [8], [16], [17], [18], [20]
	• Work experience		
	✓ Low < 4 years	8 (62.0%)	[4], [5], [10], [11], [13], [17], [18], [20]
	✓ High ≥ 4 years	5 (38.0%)	[2], [3], [8], [9], [16]
Behavioral factor (BEF)	• Uses of PPE		
	✓ Non frequent < 60%	10 (77.0%)	[2], [4], [5], [8], [9], [10], [12], [15], [16], [20]
	✓ Frequent ≥ 60%	3 (23.0%)	[3], [17], [18]
	• Drug, Alcohol, Smoking (DAS)		
	✓ Non frequent < 60%	5 (71.0%)	[4], [8], [15], [16], [20]
	✓ Frequent ≥ 60%	2 (29.0%)	[9], [12]

3.2.3 Organizational/management factor (OMF)

The OMF was grouped into two subthemes, including safety training/supervision (STS) and workers job satisfaction (JSA).

i. **Safety training/supervision (STS):** A total of thirteen articles were reviewed based on STS, of which 4 (31.0%) were deemed to have acceptable safety training and supervision, and 9 (67.0%) were deemed to have poor safety training and supervision in the mining industry in Nigeria (Table 4). The reviewed articles pinpoint that high percentages of insufficient safety training and supervision in Nigeria's mining industry are responsible for the high rate of OII [22,25,54]. Oginyi [57] revealed that proper supervision and training remove OII and give employees the required skills to handle OII in a protective and preventative manner. In the reviewed articles, various sources of information on the management of OII in the Nigerian mining industry were highlighted. For example, Aigbkhaode et al. [43] reported that information on the management of OII in the Nigerian mining industry was provided through friends, co-workers, training seminars, safety conferences, and the media. The findings from this study are in line with other studies from other nations showing that safety supervision and training contribute to the early detection of OII.

ii. **Worker job satisfaction (WJS):** WJS includes employees' assessments of their work environment and is an important factor determining job performance [58]. In the mining sector, WJS is influenced by many factors, such as working hours, compensation, health and safety priorities, and organizational efficiency [59]. Regarding WJS, nine articles were reviewed, of which 4 (44.0%) claimed that mine workers were satisfied with their jobs and 5 (56.0%) claimed that they were not satisfied (Table 4). The reviewed articles established that workers in the Nigerian mining sector work more than normal daily 8-working hours. For example, in Umuoghara, Ebonyi State, 40.5% of workers work nine to twelve hours per day, whereas 81.0% of workers work between five and twelve hours in Kaduna [34]. On the contrary, 67.6% of mine workers worked within eight hours per day at Akoko Edo LGA in Edo State, while only 32.4% of mine workers worked between nine and seventeen hours per day [43]. The findings from this study are consistent

with studies from countries that found prolonging work hours in mining activities made workers more vulnerable to OII, which in turn decreased their job satisfaction [60].

Table 4: Organizational/management factor influencing OII in the Nigerian mining sector

Organizational / management factor (OMF)	• Safety training/supervision (STS)		
	✓ Not adequate < 60%)	9 (69.0%)	[1], [5], [9], [10], [12], [15], [16], [18], [20]
	✓ Adequate ≥ 60%	4 (31.0%)	[2], [3], [17], [18]
	• Workers Job satisfaction (JSA)		
	✓ Yes ≥ 60%	4 (44.0%)	[2], [9], [16], [20]
	✓ No < 60%	5 (56.0%)	[1], [3], [5], [11], [15]

4. CONCLUSION

The review of occupational injuries and illnesses in Nigeria's mining industry has been effectively accomplished for the years 2010-2023. Systematic reviews from PubMed, Scopus, Web of Science Direct, Research Gate, and Google Scholar were performed on 20 selected papers. The study found that with 8 (45.0%) articles, dust/particulate exposure leads the causes of OII, followed by heat/cold exposure with 4 (22.0%). Head, lung, and neck have the most published articles 5 (36.0%) among the injured body parts, followed by Chest, abdomen, and waist with 4 (29.0%) articles. Musculoskeletal problems account for the majority of OII symptoms, with 11 (24.0%) articles, while respiratory problems (REP) account for 9 (19.0%). The distribution of the articles by main themes and sub-themes, based on OII's influencing variables, shows that sociodemographic factors (SDF) have the most published articles at 17 (40.0%), while behavioral and organizational/management factors have 13 (30.0%) published articles each. The study concluded that this systematic review of OII would assist policymakers in the Nigerian mining sector to develop a robust framework for planning, implementing, and monitoring sustainable occupational injuries and illnesses.

5. STRENGTHS AND LIMITATIONS OF THE STUDY

This study's strong point is the application of inclusion and exclusion criteria in the selection of the reviewed articles, as well as careful analysis and interpretation of the findings. The systematic analysis and discussions of the causes, body parts harmed, and symptoms of OII, along with the factors influencing them, are another strength of the study. Despite this, there are still certain constraints facing the study. The primary constraint is the paucity of published articles on the OII in the Nigerian mining sector. Furthermore, the use of secondary data (published articles) which may be under or overreported by the OII in the Nigerian mining sector, may affect the reliability of the data provided in this study.

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