

A systematic review of factors leading to occupational injuries and fatalities

Abstract

Purpose: The burden of health and safety related issues emanating from modern workplace is overwhelming. Although the prevailing statistics found in the literature show that victims of workplace fatalities and injuries are higher in developing countries and transition economies. However, there is a very limited understanding of the causal factors that may correspond to the continuous increase in the occupational exposure of employees to various fatalities and injuries. The purpose of this study was to review the literature on occupational safety of workers with the objective of highlighting the major causal factors of workplace injuries and fatalities from a multi-regional perspective, particularly on job-contexts with highest safety and health related hazards.

Methodology: A systematic review of the literature was conducted on 73 empirical studies in the regions of Europe, Africa, Middle East, Asia, Australia and the Americas.

Findings: The results showed that the highest number of injury and fatalities was mostly found in the construction industry. It further emerged that most of the studies were centered in developing countries within Africa and Asia. Other results and recommendations were also discussed for each region.

Value: The findings from this study have the potential to expose the regional dynamics in relation to safety in the workplace. This study also addresses the main areas of concern for stakeholders to promote organizational development.

Keywords: *occupational safety, work injuries and fatalities, unsafe behavior, organizational factors, organizational behavior*

Introduction

The extent of human engagement in various occupations has led to a rise in varying degrees of injuries and fatalities across both developed and developing nations. The migration of some industrial undertakings, in particular the manufacturing from higher-income countries to low-and-middle income countries, has intensified exposure to hazardous chemicals (Sorensen et al. 2017), and increased risks to occupational injuries and varying health impairment among workers. According to a report commissioned by the international labor organization (ILO), it is estimated that about 2.78 million deaths (Takala et al. 2017), 313 million non-fatal accident and 160 million work-related diseases occur in the workplace globally. The burden of health and safety related issues emanating from modern workplace is overwhelming. It is estimated that about 10,000,000 occupational injuries occur annually in China (Liu et al. 2015). In the United States, thousands of death and disability cases occur due to occupational accidents annually (Christian et al. 2009). The International Labor Organization avers that most workers are at risk of various work-related injuries, fatalities, and various health challenges. For example, health issues such as pneumoconiosis, musculoskeletal disorders, and mental issues are widespread (Mrema et al. 2015).

Occupational injuries and fatalities have both social and economic cost on a nation as a whole. The economic costs of work-related injuries, fatalities and illness have triggered a number of concerns from scholars and practitioners to the study of workplace safety (Christian et al. 2009; Friend and Kohn 2014). The majority of previous research have focused on accident causing mechanisms and unsafe worker behaviors (Frese and Keith 2015; Liu et al. 2016; Reason 2005; Wirth et al. 2017) in order to explain various work-related injuries and fatalities. Despite this, no clear picture has emerged to show how certain factors of unsafe worker behaviors can contribute to injuries and fatalities in a job specific context such as construction, healthcare, energy, and other domains.

Most countries and industries face a common challenge of managing safety and health of workers. This can be attributed to the fact that most work related accidents and fatalities have immediate effect on workers which require efficient safety management practices to curb them (Fugas et al. 2012; Takala et al. 2014). As such, producing knowledge that highlights areas of concern can be a key for ensuring effective safety management practices. Many researchers have dwelt on safety climate measures as a means of modeling safety behavior of workers (Fogarty et al. 2017; Neal and Griffin 2002; Neal and Griffin 2006; Sullman et al. 2017; Zohar 2010; Zohar and Luria 2005). In addition, safety-maturity models have been utilized in high-hazard industries in an attempt to reduce certain work-related injuries and fatalities (Foster and Houtt 2013; Hudson 2007; Parker et al. 2006). Most previous studies on occupational safety and health were successful in reducing workplace incidents through systems re-engineering and organizational safety culture modifications. Yet, work-related injuries and fatalities continues to occur in various workplaces. This warrants detailed examination of specific factors influencing the recurring cases of occupational injuries and fatalities.

Although previous systematic reviews have attempted to describe associated factors of workplace-related injuries and fatalities, very few studies provided a comprehensive review with focus on varied jobs in a region-specific context. For example, Manu et al. (2012) provided important guidelines for identifying accident trajectories in the construction industry. In addition, Khanzode et al. (2012) mapped out accident causation model and series of events that may contribute to workplace accidents. However, there is a need for further review that expands insight to cover causal factors specific to different industries across regions. Thus, we are of the view that understanding the contextual factors that leads to injuries and fatalities in a specific region is very critical in the drive towards the reduction/elimination of workplace injuries and fatalities. With this in mind, the current study aims to review previous studies on injuries and fatalities in the workplace with the objective of highlighting the major factors in a region-specific manner, particularly on job-contexts with the highest safety and health related hazards. It is assumed that outcomes from this review will expose the regional dynamics in relation to safety in the workplace, as well as underscore the critical areas for concern by stakeholders. Hence, this study seeks to describe the causal factors of injuries and fatalities in the workplace from a multi-regional perspective.

Our review was guided by one research question: “What are the key factors leading to workplace injuries and fatalities in a region-specific context?” To answer this question, we used search and data extraction strategies similar to those of previous reviews (e.g., Lamontagne et al. 2007; Schultz and Edington 2007). The review of major injuries and fatalities was classified to cover regions of Europe, Africa, Middle East, Asia, Australia and Americas/Canada. The reason for this classification is because of differences in work conditions, technologies, local circumstances, and quality or presence of supervisions. Furthermore, categorizing injuries and fatalities factors across these regions may reveal important differences and clues to the organizational role into which the practice of certain safety policies and awareness may grow. In addition, differences in safety practices to reduce the risk of injuries and fatalities are of concern to workers and employees.

Method

We conducted a systematic review of empirical studies on factors influencing occupational injuries and fatalities among workers within the domain of occupational safety and health research. Previous studies that employed both primary (original/empirical) and secondary data (Searcy and Mentzer, 2003), published in peer-reviewed journals and conference proceedings were considered for selection. To ensure that the existing body of knowledge on factors that influence injuries and fatalities were carefully identified for further

evaluation, we followed well-established frameworks for conducting review studies (Fisch and Block 2018; Moher et al. 2009).

Search strategy and data source

A comprehensive search of electronic databases was performed to identify relevant articles. For this study, we selected the following keywords for the search: ("factors" OR "causes" AND "influence") AND ("injuries" OR "fatalities" OR "incidents" OR "accidents") AND ("workplace" OR, "employee's safety"). These keywords were entered into prominent academic databases, including Google Scholar, Scopus, Web of Science, Elsevier, ProQuest, Emerald, and Springer. The databases were searched for citations with no starting date limitation.

Inclusion criteria

The following boundary conditions guided the search strategy and inclusion of previous studies for this review: (a) only empirical peer reviewed research on factors influencing injuries and fatalities among workers; (b) papers published in English language; and (c) published papers from 1998 to 2020. Some of the papers were more central and useful than others. Our initial search led to the identification of 1500 studies. We screened these papers for potential duplicates. All titles and abstracts similar or related to the search keywords were screened and included for further evaluation. The screening of titles and abstracts yielded 300 studies that were found to meet the eligibility criteria for further evaluation. The evaluation of the studies was conducted bearing in mind the objective and the methodological paradigm adopted in this study. After the exclusion of duplicates, 250 full-text eligible articles were reviewed. Systematic review papers, meta-analysis studies, theoretical and conceptual articles, and non-peer reviewed research reports were excluded from this review. Some studies dealing with unspecified work conditions as well as not typically studied certain safety aspects were also excluded. Consequently, 73 peer reviewed empirical studies were identified and used in this review (see Figure 1).

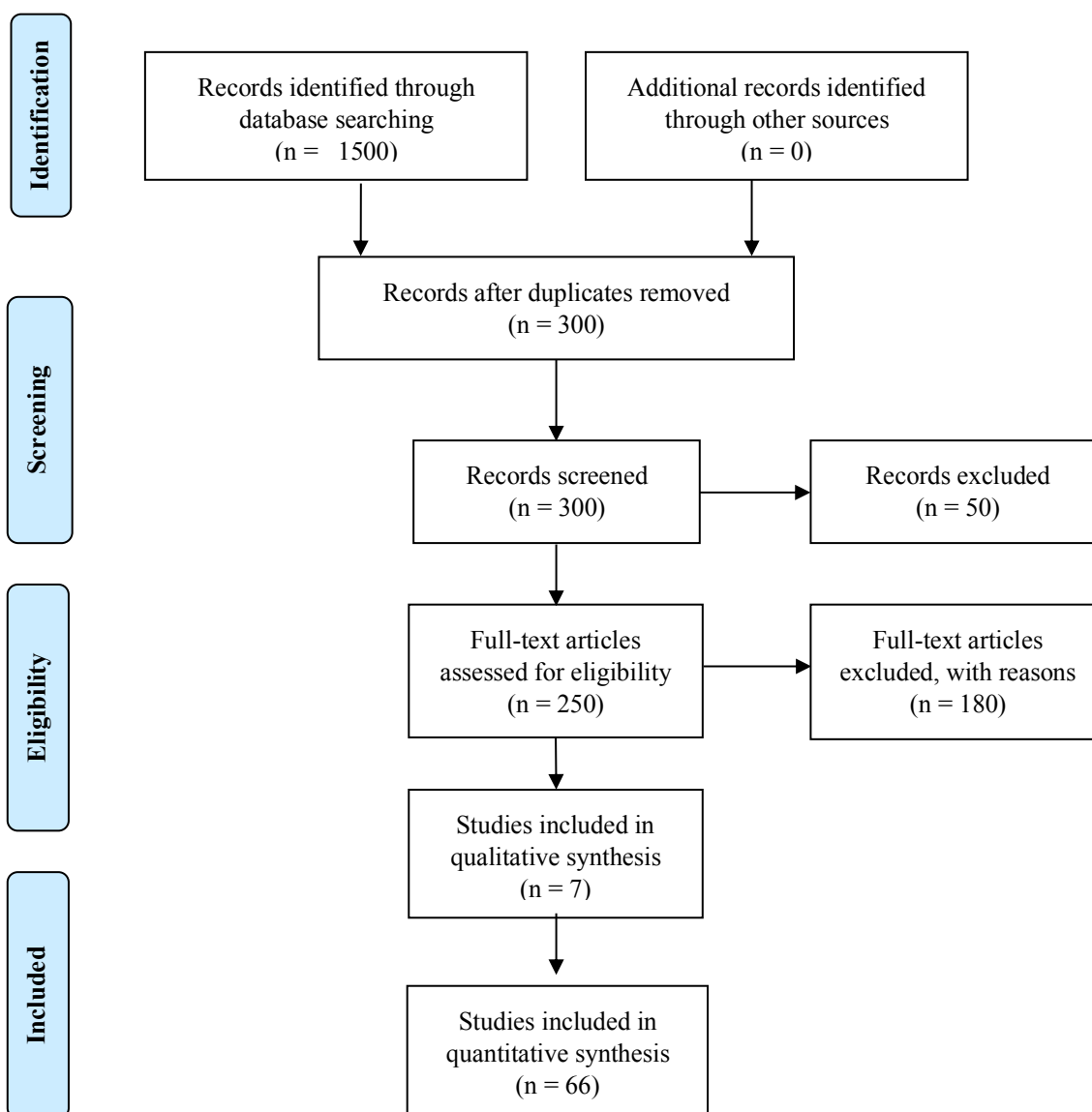


Figure 1: The PRISMA flow diagram for article searching and selection process

Assessment protocol

The 73 studies were carefully reviewed to identify the factors that influence injuries and fatalities among workers in different workplace settings. Two reviewers were asked to code each paper on the basis of originality, methodological soundness, the interpretation of the results and their relevance to this review. They then met to discuss and to reach an agreement on any differences in coding. The interrater agreement (using intra-class correlation coefficient and its 95% confidence interval) between the experts as assessed. The overall quality of the 73 studies was scored from 1-3, low-high) based on: 1) appropriateness of the method, 2) relevance to focus of this review, and 3) whether the findings are credible and valid. We measured the weight of each study by summing scores on each of the three dimensions. The inter-rater reliability (r) for the three dimensions between the two experts ranged from 0.83 to 0.91.

Due to the heterogeneity of the 73 studies (e.g., job contexts, workplace settings, and safety measures), we agreed to code the factors identified according to countries and job contexts (e.g., healthcare, mining, manufacturing, construction, corporate, energy and agriculture). A further synthesis of the identified job-contexts was performed to classify

similar jobs into one job-domain. For example, studies based on oil and gas, petroleum drilling and electricity generation plants were classified as energy industry. This was based on the description of Sovacool and Mukherjee (2011) who reported that the energy sector may include electricity supply, nuclear power, oil and gas. Studies based on production of goods and services (e.g., home based enterprises, wood-workers, artisans, welders, sprayers, mechanics, and rural transport services) on small-scale were categorized as Small and medium-sized enterprises (SMEs). This was based on the International Labor Organization's (ILO) description of such entrepreneurial undertakings, as cited in Doodoo and Al-Samarraie (2019). Further, we classified studies that dealt with banking, media houses and administrative jobs as corporate sector. The foregoing process enabled us to identify multi-regional factors that were associated with injuries and fatalities in different workplace settings.

Results

In order to identify the key factors contributing to workplace injuries and fatalities and their relative outcomes, we categorized the findings based on the context domains and regions (see Table 1). The regional categorization includes: Europe (15%), Africa (31.5%), Middle East (8.2%), Asia (27.4%), Australia (4%), and the Americas/Canada (13.8%). Figure 2 provides an illustration of the distribution of previous studies on factors leading to occupational injuries and fatalities across countries.

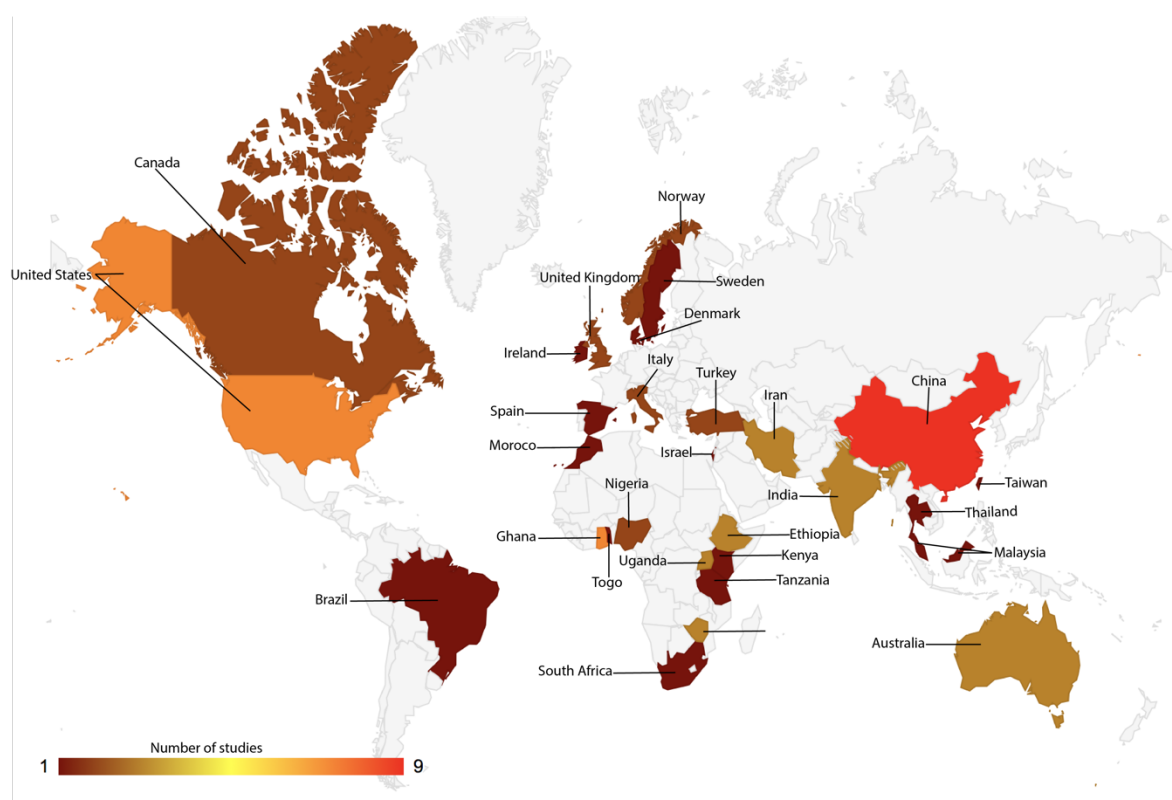


Figure 2: Distribution of studies on factors leading to occupational injuries and fatalities worldwide

Table 1. Factors leading to occupational injuries and fatalities in region-specific

Dimensions/ Regions	Europe	Africa	Middle east	Asia	Australia	The Americas (USA & Canada)
Construction industry	Driving with obstructed visibility by load, unnecessary risk taking, mistakes, violating safety procedures, taking shortcuts, wrong use of equipment, working at height without adequate safeguarding, staying in danger zone, lack of requisite skills for operating machinery, inexperienced workers, lapses in safety supervision	Mechanical hazards, being hit by falling objects and falls from height, long working hours, negligence by management, lack of health and safety awareness, and threat to be fired, alcoholism, smoking, aging workers, insufficient break regimes	Removing safety guards, using machines for irregular purposes, using improper or defected equipment, improper working habits, driving heavy trucks too fast, ignoring to use safety harness, and walking on an unsafe surface/platform at height	Non-use of personal protective equipment (PPE), improper lifting or handling of materials, keeping sharp objects in dangerous locations, over confidence, lack of management support, management pressure, unsafe co-worker behavior, stress, inappropriate safety equipment, work overload, lack of feedback, poor physical environment, poor safety conscientiousness, and inadequate safety supervision, lack of experienced and trained workforce, workplace ostracism, psychological detachment, and emotional exhaustion	N/A	Organizational pressures, schedule delays, smoking, use of cocaine and marijuana, obesity, drinking, multiple jobs, and long working hours
Healthcare sector	Violence and aggression, verbal abuse, work pressure, and job insecurity, lack of assistive devices (sliding sheets, intelligent beds, and ceiling lifts), and poor task collaboration	Long working hours, recapping needles and non-use of gloves, contact with potentially infectious body fluids, glove breakage, high psychological demand, musculoskeletal disorders, sleeping disorders, high use of analgesics, hypnotics, and sedatives	Lack of security measures and knowledge in care giving	Non-use of gloves and poor hand washing habits, carelessness, mistakes in data entry, and non-compliance with procedure	Cognitive saturation, professional loneliness, fear of making errors, rostering system, demands of shift work, sleep deprivation, fatigue, poor organizational climate, distress and low morale	Unsafe workplace, high workload, unrealistic work expectations, and lack of management support

Manufacturing industry	Acceptance of risks, use of shortcuts on the job, risky behaviors of co-workers, stress, low commitment to safety, inadequate staff, and constant trade-offs between productivity and safety, storing equipment and materials in unsuitable areas, and non-compliance with working cycle	Work stress, non-use of PPE, consuming alcohol during working hours, exposure to excessive noise, fumes, dusts, hazards from old and rusty machines	Negative social relationship	Work stress and pressure, over- confidence, lack of concentration, lack of training and supervision for new workers	N/A	N/A
Mining industry	Equipment misuse, non-use of PPE, and not adhering to safety procedures	Non-use of protective clothing, long working hours, falling rocks, suffocation, explosion, exposure to harmful chemicals, exposure to excessive noise, tradeoffs, exhaustion, decreased attention and concentration, inadequate PPE, lack of knowledge on risk associated with mercury use, and non-compliant with safety standards, lapses with supervision, job dissatisfaction, stress, and drug use	N/A	Poor lighting levels, small working space, ventilation and humid levels, lack of resources to detect or deal with fire, ignoring safety threats/alerts, lack of emergency response plan, lack of strict enforcement of hazard prevention measures, illegal operations of miners, inadequate safety knowledge, serious habitual violations and unsafe psychologies, mental fatigue, poor vigilance, decision-making errors, poor fitness for duty, and unsafe leadership	Inadequate operational leadership support, design of equipment and controls, poor ambience, exposure to toxins, adverse mental states of operators, communication and coordination issues	N/A
Energy industry	Work pressure	N/A	Awkward posture, inappropriate or non- use of PPE, dangerous driving, and lack of knowledge on safety procedures, poor direct safety management, perceptions about inconveniences with PPE, work overload,	Human negligence, tradeoffs, and structural deficiencies	N/A	N/A

Agriculture	N/A	N/A	N/A	inadequate skills and training, compromises with safety procedures, condescending safety supervision and bullying, underestimation of hazards, unsafe work condition, unsafe psychological environment	health impairment, stress, improper handling of equipment, interrupted sleep, alcohol consumption, and daytime sleepiness	N/A	Health impairment, multiple engagements with other farms, hand/arm contact with alkalis/acid or glues, and high hours of work per season
Corporate sector	Mental fatigue, physical tiredness, work pressure and intensity	Sedentary habits, as well as poor dietary habits	N/A	Stress, incongruent roles, verbal abuse from superior, long working hours and heavy workload	N/A	N/A	Work-safety tension, high job demand, and exposure to chemical
SMEs	N/A	Long working hours, ignoring road safety rules, over confidence /negligence, poor working environment, lack of management commitment to safety, low or less use of PPE, exposure to hazardous chemicals, poor hygiene, excessive noise levels, use of hazardous hand tools, lack of awareness of health and safety standards	N/A	N/A	N/A	Work-safety tension, high job demand, and exposure to chemical	Work-safety tension, high job demand, and exposure to chemical

Europe

In Europe, we reviewed previous studies in an attempt to identify causes of injuries and fatalities in the workplace from countries such as the United Kingdom, Spain, Italy, Ireland, Sweden, Netherland, Norway and Denmark. The study found a substantial number of empirical studies in the healthcare sector and manufacturing industry, followed by construction industry, corporate sector and the petrochemical industry. It was inferred from the previous studies that the leading contributory factors of healthcare-related injuries were mostly induced by the work environment and emotional state of workers. Factors such as violence and abuse from patients (Angland et al. 2014; Ramacciati et al. 2015) were mostly experienced by nurses, particularly those working in the triage areas, stress from high job demand and job insecurity (Bronkhorst 2015). These factors influenced negatively the emotional and mental state of workers by making them feel vulnerable. By implication, it appears that there is a need for concrete measures to address the environmental factors such as long waiting time. Andersen et al. (2019) investigated back injury risk factors among healthcare workers. The authors found that certain causal factors experienced by workers can be due to patient transfer and lack of psychosocial support. However, lack of critical assistive devices (e.g., sliding sheets, intelligent beds, walking aids, and ceiling lifts) and poor task coordination among co-workers may also contribute to workers' back-injury cases.

Furthermore, our review of studies on manufacturing industry revealed that factors related to safety culture can be the main causes of injuries and fatalities among workers. According to Nordlöf et al. (2015), practices such as constant tradeoffs, non-compliance with safety procedure, risky co-worker behaviors and low management commitment to safety were identified as factors that potentially led to injuries among workers. This was mostly attributed to work-related pressure such as meeting targets and deadlines. We also found that the storage of equipment and materials in unsuitable areas and prolonged work hours can potentially affect the safety and health of workers. This practice was largely blamed on the lack of adequate working space, poor monitoring/supervision and lack of understanding the associated risks of behavior (Baldissone et al. 2019). Due to extended period of work and non-compliance of working cycle, workers are forced to work in non-ergonomic positions which contribute to injuries and other health impairments.

Our review of previous studies on the construction industry showed the role of risk-taking behaviors and lapses with safety supervision in increasing injuries and fatalities among workers. The majority of injury and fatality cases were also found to be attributed to workers' low perceptions of risk and its consequences. This includes aspects such as driving with obstructed visibility, unnecessary risk-taking, non-use of safety equipment, staying in danger zone, skipping a phase in the sequence of operation, and lack of communication between co-workers (Bohm and Harris 2010; Winge et al. 2019). In addition, our review showed that the lack of appropriate skills for handling machines, lapses with supervision (e.g., inability of control unsafe conditions and actions) can result in unsafe practices that potentially induced injuries among workers (Winge et al. 2019).

Within the corporate sector, most of the previous studies emphasized on the role of stress, mental strain, and work pressure in increasing injuries and various health risks among workers (Carter et al. 2013). The corporate sector is often perceived as a risk-free environment in relation to direct injuries resulting from a job. However, workers in this sector experience various psychosocial conditions such as stress, musculoskeletal disorders and other health risks, which often manifest after a long period of time. We found that work pressure and workload can force employees to work in non-ergonomic conditions. In addition, insufficient break to refresh and long working hours were found to contribute almost equally to physical, mental and emotional exhaustion among workers. We are of the view that more attention could be placed on informing management and workers about the

hazards associated with the job, its effects on their safety and health, and the need for comprehensive measures to mitigate these hazards.

In the energy industry, previous studies (Kvalheim and Dahl 2016) have attributed work pressure as the major factor that led to injuries and fatalities among workers. In the mining industry, the literature showed that factors such as non-compliance safety procedures and non-use of personal protective clothing (Sanmiquel et al. 2010) were the main unsafe practices that led to injuries among workers. In sum, the efficacy of any safety and health system should rest largely on individual workers. Therefore, sensitizing workers especially those in the construction, manufacturing, mining, and energy on cue-recognition of hazards and empowering them to report incidents is the way forward.

Africa

In this region, we reviewed previous studies from countries such as Ethiopia, Morocco, Ghana, Togo, Nigeria, Kenya, Uganda, Tanzania, Zimbabwe, and South Africa. A substantial number of empirical studies was linked to the mining industry, followed by the healthcare sector, construction, manufacturing, SME's and corporate sector. Previous studies on the mining industry showed that miners' exposure to harmful chemicals, dust, inadequate ventilation were conditions that potentially led to several health issues, particularly respiratory disorders (Ayaaba et al. 2017). Other factors such as non-use of protective clothing, long working hours, work pressure (Boniface et al. 2013; Chimamise et al. 2013; Long et al. 2015), lack of knowledge on risks associated with the use of harmful chemicals—particularly among artisanal and small and medium scale miners (Armah et al. 2016)—were also found to play a role in increasing injuries and accidents among miners. However, in other previous studies excessive noise levels in the mines (Chadambuka et al. 2013) was associated with injuries and accidents that occur in the mining sector. In addition, Ajith and Ghosh (2019) found that job stress and dissatisfaction, drug usage, poor management and supervision, and poor work conditions were common triggers of accidents, injuries and fatalities among small-scale miners.

Studies on the healthcare sector have also focused on causal factors of injuries and risk of infection among healthcare workers (Aynalem Tesfay and Dejenie Habtewold 2014; Giurgiu et al. 2016; Nsubuga and Jaakkola 2005; Yassi et al. 2014). Some of the main factors were related to needle stick injuries, non-use of gloves or breakage of gloves which are believed to increase the risk of HIV infections. Some work-related injuries were attributed to high job demands associated with healthcare provision in the sub-region. This may be due to insufficient medical facilities and resource constraints on the supply side against the high demand for medical care in most countries in Africa. Furthermore, a limited level of knowledge on occupational safety and health risks among staff (e.g., nurses) may be another factor worth investigating. For this reason, more studies are still needed to reveal the various factors that results in unsafe behavior, injuries and fatalities among healthcare workers to direct future research and policy development.

Our review of the literature on the construction industry in Africa showed that mechanical hazards, unsafe work environment, long working hours, insufficient break regimes, lack of safety awareness and negligence by management were among the factors that led to injuries and fatalities among workers (Irumba 2014; Kheni et al. 2010; Nyende-Byakika 2016). This may lead to the assumption that most of the triggers of occupational hazards are induced by the work environment and lack of management. In addition, Amissah et al. (2019) identified individual related factors such as alcoholism, smoking, and aging as prominent factors associated with injuries and fatalities among construction workers. This study is of the view that future research must focus on the role of regulatory bodies so that employers in the construction industry would be duty-bound to ensure safety and health of

their worker. Meanwhile, studies on the manufacturing industry in Africa also sought to examine the causal factors of work-related injuries (Aderaw et al. 2011; Kifle et al. 2014). Factors such as non-use of personal protective clothing, exposure to excessive noise, fumes, dusts and long working hours were identified as conditions that induced work-related accidents, injuries and fatalities.

As for SMEs, this study identified that long working hours, over confidence, negligence, non-adherence to regulations (Jones et al. 2016; Olvera et al. 2016; Uzundu et al. 2019), low or non-use of personal protective clothing, exposure to hazardous chemicals, poor hygiene, and poor working environments (Atombo et al. 2017; Kwame et al. 2014; Loewenson 1998; Monney et al. 2014; Ohajinwa et al. 2017) were the main causes of injuries and fatalities among workers. The findings showed a limited evidence about the effectiveness of health and work procedures in reducing work-related risks. This may be due to the low level of education among SME workers. In addition, SMEs consist of high level of occupational injury cases than large-scale companies (Faris 2017; Nakata et al. 2006).

In the corporate sector, the study found that the sedentary lifestyle of employees coupled with less physical activities may contribute to workers' health (Aidoo et al. 2015). Our review showed that the majority of employees spend long periods of time in the workplace. Such practice can potentially lead to health-related issues such as cholesterol buildup, high-blood pressure, and obesity. Research on safety and health in this sector has been scarce but the finding calls for attention in this job domain.

Middle East

In the Middle East region, our review revealed some factors related to injuries and fatalities in countries such as Iran, Turkey, and Israel. Studies were mostly found in the energy industry, followed by healthcare sector, manufacturing and construction industry. The identified factors were mostly related to ergonomic hazards, inappropriate or non-usage of personal protective clothing, negligence, and lack of safety awareness, which led to injuries of varying degrees and fatalities (Nouri et al. 2008; Ünsar and Süt 2015). In addition, the review showed that organizational issues related to poor direct safety management (e.g., poor safety monitoring, condescending safety supervision and bullying, and low tolerance of other co-workers), work overload, poor ambience, inadequate skills and training, and insufficient pay were the main influencers of unsafe worker behaviors (Harsini et al. 2020). It is assumed that these factors may create an unsafe psychological work environment which results in influencing workers' sense of belonging and acceptance, low morale and emotional exhaustion.

The literature on the construction industry in this region revealed that injuries and fatalities were mostly due to workers' non-compliance of proper work procedures. For example, using machines for irregular purposes, over speeding, and non-usage of safety equipment (Mohammadfam et al. 2017) were identified as causes of injuries among workers. With respect to the healthcare sector, the study found that the conditions that led to worker injuries were due to the general lack of knowledge in managing patients and ineffective security measures (Çelebioğlu et al. 2010) in the health facilities. With regard to the manufacturing industry, injury-causing situations were mostly linked to the drivers' fatigue or inattention. Our review showed the importance of social influences on consequent behaviors of workers. In particular, it showed that negative risky relationships from co-workers influenced workers' unsafe behavior (Peretz and Luria 2017), thus leading to injuries and fatalities.

Asia

In Asia, we found a number of factors related to injuries and fatalities from countries such as China, Thailand, Hong Kong, India, Taiwan, Singapore, and Malaysia. Most of previous studies in this region were performed in the construction industry, followed by mining, healthcare, manufacturing, agriculture, energy and the corporate sectors. In the construction industry, most studies were concerned about investigating aspects related to non-usage of personal-protective clothing, over confident attitude to risks, influence of unsafe co-worker attitude and unsafe work environment (e.g., poor lighting and limited space) (Aksorn and Hadikusumo 2007; Choudhry 2014; Hon et al. 2010; Huang et al. 2016; Leung et al. 2010; Low et al. 2018). Other organizational factors that we identified were stress due to work overload (Leung et al. 2010) and inadequate supervision, lack of experience and training, and insufficient pay (Gao et al. 2018). Another noteworthy finding relates to the negative impact of workplace ostracism, psychological detachment and emotional exhaustion on workers' safety performance (Chen and Li 2020). This finding not only emphasize the importance of psychological safety on workers' behavior, it also contributes to the overall health and well-being of workers. The findings in this region reiterate the factors identified in Africa. This can be attributed to the fact that most countries in Asia and Africa are striving towards economic development status and undertaking a number of built environment projects. These have led to lapses in the management of the safety and health of their workers.

Our review showed that poor lighting levels, ventilation and humid levels were the causal conditions that led to injuries among miners (Cui et al. 2013). Liu et al. (2019) and Fu et al. (2020) in separate writings attributed injuries and fatalities to habitual violations (e.g., improper operations of gas comprehensive prevention systems, illegal operations of miners, and inadequate safety knowledge), and lack of safety culture (e.g., strong regulation and effective control, poor leadership, lapses in planning and workflow). According to Bhattacharjee et al. (2020), failures at the organizational level and poor decision making at the individual level were the main factors of workplace incidents in the mining industry. For example, at the organizational level, it was found that the lack of resources to detect or deal with fire outburst, management priority on production over safety, and the lack of emergency response plan contributed to fatal mining accidents. At the individual level, aspects related to failure at risks and hazards assessment, ignoring safety threats and alerts were the major unsafe factors. These reflect deficiencies in the overall safety management systems. It raises concerns about workers capacity to fully detect potential hazards and the agency to voice out emergent risks. For example, Chen et al. (2019) in their study showed that poor psychological states (e.g., mental fatigue, medication and alcohol effects) can potentially influence workers' unsafe behavior.

Previous studies in the healthcare sector reported a significant correlation between non-compliance of glove usage and poor hand hygiene (Ji et al. 2005) with the spread of infections among workers and patients. Salahuddin et al. (2020) found unsafe behavior of healthcare practitioners to be associated with health information systems. For example, issues of carelessness in terms of mistakes in data entry was found to result in clinical errors. In addition, workarounds were found to influence delay in data entry, which poses a risk of losing critical information on patients and could lead to medication errors. Our review also showed that non-compliance to proper procedure of logging in and off the system, the habit of copy and paste were potential unsafe behavior of practitioners that could lead to errors and outdated information. Although, these factors may not impose any direct negative effect on the healthcare workers, it may still put the lives of patients in danger.

Moreover, previous studies on the manufacturing sector have reported that stress, over-confidence, lack of training and poor supervision as the conditions that contribute to

injuries and fatalities among workers (Verma and Chaudhari 2017). Within the energy sector, we found that organizational factors such as structural deficiencies, pressure to meet deadlines, disregard for climatic changes and worker factors such as negligence were the main causes of work-related accidents and fatalities (Cheng et al. 2013). This is probably because of workers' low risk perception. Studies on agriculture have tended to investigate aspects related to health impairment, wrong handling of equipment and falls risk as the main work-related injuries (Zheng et al. 2014). Additionally, lack of sleep or interrupted sleep was found to be associated with certain work-related injuries (Zhu et al. 2014). On the corporate sector, stress, role ambiguity, verbal abuse, long hours of work and high job demand (Neelamegam and Asrafi 2010) were identified as conditions that led to injuries and health risks among workers.

Australia

In Australia, our review showed that factors associated with workplace injuries and fatalities were mostly found in the healthcare sector. Previous studies have reported that the potential triggers of unsafe behavior were due to emotional, mental and physical exhaustion (Donovan et al. 2020; Fogarty and Mckeon 2006). The majority of healthcare workers (especially graduate nurses) tend to experience information overload and therefore, leading to mental exhaustion of the individuals involved. In addition, the literature showed that certain emotional distresses (e.g., loneliness) can be critical influencers of injuries in the workplace. We also found that demands of shift work and sleep deprivation, tiredness and fatigue were among the frequent factors influencing the health of healthcare workers. From our review, it is inferred that although these factors may not be similar for all workers, yet are detrimental to the overall health and well-being of healthcare workers.

In the mining sector, we found that factors related to injuries and fatalities were mostly due to lapses in operational leadership support such as training, ergonomic factors (e.g., technological design of equipment), ambience, physical and mental state of workers (Patterson and Shappell 2010). We show that findings relating to mining industry is similar to the commonly experienced limitation in other regions.

Americas/Canada

In America, previous studies in the construction industry have examined aspects related to organizational pressures, schedule delays (Han et al. 2014) and certain working habits and ethics such as smoking, use of drugs, drinking, multiple work engagement and long working hours (Dong et al. 2015) as the main factors that could lead to work-related injuries. However, most of these behaviors are caused by individual worker and other psychological factors. Comparatively with regions such as Europe, Africa, Asia and Middle East, it could be inferred that environmental induced hazards are less in America. It is believed that future research on unsafe behavior must deeply examine the influence of relevant organizational and group factors on the safety behaviors of workers. Furthermore, within the healthcare sector, previous studies were mostly investigating how verbal and physical abuse in the workplace can result in injuries (Wolf et al. 2014) and negative psychological outcomes among workers (McCaughey et al. 2015). For example, Merryweather et al. (2018) found that a number of slips, trips and falls experienced by healthcare workers—especially those who provide homecare services—were due to patients weights, combative patients and hazards within the home and neighborhood environment.

Additionally, a substantial number of studies on agriculture were also found in this region. Factors such as health impairment, contact with chemicals, long hours of work (Lewis et al. 1998), work pressure and poor work environment (Arcury et al. 2012; Seo 2005) were the key causes of injuries and fatalities among workers. In the context of SMEs, emotional

stress (McGonagle and Kath 2010), low safety knowledge, and poor working conditions were found to trigger work-related injuries and various health risks (Gutberlet et al. 2013).

Final Remarks

In order to identify the key contextual issues as pertains to the causal factors of injuries and fatalities in the workplace, we categorized the findings into a multi-regional context. We also clustered the findings into job contexts in their respective regions namely: construction, healthcare, manufacturing, mining, energy, agriculture, corporate, and SMEs. This was for the purpose of providing more insight on the factors associated with workplace injuries and fatalities. The findings from this review can be useful for identifying region-specific incident trajectories based on their socio-economic development pathways. Our review showed that most of the studies were centered in developing countries (mostly African and Asian countries).

The study found that work-related injuries and fatalities were as a result of the following factors:

- In Europe, sensation seeking behaviors and non-compliance with safety procedures were found to contribute to injuries and fatalities among workers. It was evident that issues related to emotional and physical exhaustion among workers, particularly those in the healthcare sector, are worthy of attention from researchers, management and the policy environment.
- In Africa, injuries and fatalities were mostly caused by work environment, organization and individual factors. Common environmental factors that were frequently highlighted are: falling rocks, suffocation, explosion, exposure to harmful chemicals, and exposure to excessive noise. Organizational factors in this region were mostly related to the lack of employer interest in the safety and health of their workers, long working hours, management pressure and non-compliant with safety standards. We also found that certain individual factors were mostly associated with workers' non-use of protective clothing, exhaustion, and lack of knowledge on risk associated with mercury use. These were evident in the construction, mining, manufacturing and the SME's sectors. The findings also indicated that the majority of injury and fatality-causing circumstances were mostly found in the mining sector.
- In the Middle East, our review showed that the major factors that are responsible for injuries and fatalities among workers were due to various work environment risks and hazards. Also, organizational factors such as management pressure and condescending safety supervision styles were found to contribute to injury risk behavior. Another factor that was identified in this region was the effect of negative relationships and friendships on workers' unsafe behaviors. It highlights the influence of co-workers for shaping safety performance in organizations. Therefore, workers easily violate safety procedures when they observe other colleagues engage in same practices.
- In Asia, just like the case of Africa, the major causes of injuries and fatalities in the workplace were due to work environmental, organizational and individual factors. For example, it was found that workers' limited knowledge on safety and health practices, intentional violation of recommended safety practices, over confidence, poor work environment, lack of management commitment to safety, long working hours and job insecurity, risky behaviors of co-workers, and non-use of personal protective equipment were causal factors. Interestingly however, the findings showed a similar trend of factors of injuries and fatalities in the Middle East. Another aspect worth noting is the issue of negative social influence on workers' risky behavior and the lack of psychological safety.
- In Australia, our review showed that the most common factors associated with injuries in the workplace were due to emotional, cognitive and physical exhaustion experienced by

workers, in particular the healthcare sector. Although these factors do not cause injuries directly, but still may impact negatively on the health and well-being of workers.

- In America, the study found that major causes of injuries and fatalities were due to stress emanating from work pressure, drug abuse and other psychological factors. We further found violence and aggression from patients (mostly among healthcare workers). Other environmental factors such as work pressure, job insecurity and work overload were found to significantly contribute to the psychological and emotional disorders of workers.

Recommendations

From the above discussion, it could be inferred that the majority of the factors related to injuries and fatalities in the workplace were mostly similar, especially in regions such as Africa, Asia and Middle East. In addition, countries in these regions are classified as transitioning economies, therefore, they are prone to similar economic conditions, and as a result most employers pay less attention to the safety and health conditions of their employees. In these three regions, the factors that contributed to workers' injuries and fatalities were mostly due to poor work environment, which is also an indication of weak enforcement of safety regulations. For example, in Africa, it is recommended that state actors should take special interest in the safety and health of the working population and strengthen occupational safety and health institutions to oversee the implementation of safety regulations. Reference could be made to the US's and UK's safety and health administrative bodies in order to effectively guide the implementation of indigenous institutions that will monitor and control safety issues in the workplace. We further suggest that employers in the region of Africa should look at more workable scenarios for increasing workers' safety knowledge and safety performance. This includes improving the work environment to reduce hazards, as well as examining how certain behavioral and emotional factors of workers can contribute to their non-compliance of safety procedures. We also recommend that future researchers should pay more attention to explore how changes in workers' commitment can be the reason for them to follow specific safety standards or vice versa.

In Middle East, the study recommends that state actors may consider promoting safety awareness in the region. Also, employers may consider strengthening safety training to increase safety awareness among workers, reduce workplace hazards and take interest to understand the role of psychosocial factors in changing workers safety-oriented behavior. It is believed that this will enable employers to better understand the behavior of workers and allow them to come up with suitable solutions to address various safety-related concerns at the workplace. The study suggests that future research may examine ways to promote safety awareness and behavior among workers. Practitioners should also show commitment to safety training, as well as ensuring a sound balance between production and safety (Kvalheim and Dahl 2016).

In the case of Asia, this study recommends that employers should deepen safety training as well as devote resources to ensure the reduction of hazards at the workplace. Another noteworthy factor was the issue of unsafe psychological conditions that lead workers to experience insecurity in the workplace. Thus, it is anticipated that future studies should be dedicated to exploring how regulatory bodies can effectively monitor and ensure that employers comply with safety and health regulations. In addition, future studies should also consider exploring how organizations could promote psychological safety in the workplace.

As for Australia, America and Europe, it is recommended that decision makers should focus their attention on the various emotional trauma and psychological issues emanating from the workplace, mainly through continuous safety campaigns on stress management. Employers should devote more effort to reduce job pressure on workers by regulating working hours and reducing workload. In addition, employers should take keen interest in

issues, such as violence and aggression at workplace, and introduce proper security measures to protect workers.

The regional dynamics highlighted in this study is an indication that different approaches are required in the drive towards minimizing or eradicating work-related injuries and fatalities. Despite these findings, we are of the view that the state of knowledge on injury and fatality-causing conditions at the workplace is still the subject of some debate. We recommend that future research should rather concentrate on other factors such as theory development, measurement of the relationships between culture, demographic variables and occupational stress or workplace injuries and fatalities, and psychological safety. In addition, we propose for a shift in the methodological approach from the purely quantitative based nature to include qualitative research methodologies. This can offer an in-depth understanding of issues that go beyond the “safety iceberg” and explore the underlying factors that promote or hinder safety in the workplace.

Compliance with Ethical Standards:

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References

- Aderaw Z, Engdaw D, Tadesse T (2011) Determinants of occupational injury: a case control study among textile factory workers in Amhara Regional State, Ethiopia. *J Trop Med* 2011: 657275. <https://doi.org/10.1155/2011/657275>
- Aidoo H, Essuman A, Aidoo P, Yawson AO, Yawson AE (2015) Health of the corporate worker: health risk assessment among staff of a corporate organization in Ghana. *J Occup Med Toxicol* 10:30. <https://doi.org/10.1186/s12995-015-0072-7>
- Ajith MM, Ghosh AK (2019) Comparison of parameters for likelihood and severities of injuries in artisanal and small-scale mining (ASM). *Safety Sci* 118:212-220. <https://doi.org/10.1016/j.ssci.2019.04.010>
- Aksorn T, Hadikusumo B (2007) The unsafe acts and the decision-to-err factors of Thai construction workers. *J Const Developing Countries* 12:1-25
- Amissah J, Badu E, Agyei-Baffour P, Nakua EK, Mensah I (2019) Predisposing factors influencing occupational injury among frontline building construction workers in Ghana. *BMC Res Notes* 12:728. <https://doi.org/10.1186/s13104-019-4744-8>
- Andersen LL, Vinstrup J, Villadsen E, Jay K, Jakobsen MD (2019) Physical and Psychosocial Work Environmental Risk Factors for Back Injury among Healthcare Workers: Prospective Cohort Study. *N J Environ Res Pub Health* 16:4528. <https://doi.org/10.3390/ijerph16224528>
- Angland S, Dowling M, Casey D (2014) Nurses' perceptions of the factors which cause violence and aggression in the emergency department: a qualitative study. *N Emerg Nursing* 22:134-139. <https://doi.org/10.1016/j.ienj.2013.09.005>
- Arcury TA, O'Hara H, Grzywacz JG, Isom S, Chen H, Quandt SA (2012) Work safety climate, musculoskeletal discomfort, working while injured, and depression among migrant farmworkers in North Carolina. *Am J Pub Health* 102:S272-S278. <https://doi.org/10.2105/AJPH.2011.300597>
- Armah FA, Boamah SA, Quansah R, Obiri S, Luginaah I (2016) Unsafe occupational health behaviors: Understanding mercury-related environmental health risks to artisanal gold miners in Ghana. *Front Environ Sci* 4:29. <https://doi.org/10.3389/fenvs.2016.00029>
- Atombo C, Wu C, Tettehfiio EO, Nyamuame GY, Agbo AA (2017) Safety and health perceptions in work-related transport activities in Ghanaian industries. *Safety and Health at Work* 8:175-182. <https://doi.org/10.1016/j.shaw.2016.10.002>
- Ayaaba E, Li Y, Yuan J, Ni C (2017) Occupational Respiratory Diseases of Miners from Two Gold Mines in Ghana. *N J Environ Res Pub Health* 14:337. <https://doi.org/10.3390/ijerph14030337>
- Aynalem Tesfay F, Dejenie Habtewold T (2014) Assessment of prevalence and determinants of occupational exposure to HIV infection among healthcare workers in selected health institutions in Debre Berhan town, North Shoa Zone, Amhara Region, Ethiopia, 2014. *AIDS Res Treatment* 2014:731848. <https://doi.org/10.1155/2014/731848>
- Baldissoni G, Comberti L, Bosca S, Murè S (2019) The analysis and management of unsafe acts and unsafe conditions: Data collection and analysis. *Safety Sci* 119:240-251. <https://doi.org/10.1016/j.ssci.2018.10.006>
- Bhattacharjee R, Dash A, Paul P (2020) A root cause failure analysis of coal dust explosion disaster—Gaps and lessons learnt. *Engin Failure Analy* 111:104229. <https://doi.org/10.1016/j.engfailanal.2019.104229>
- Bohm J, Harris D (2010) Risk perception and risk-taking behavior of construction site dumper drivers. *N J Occup Safety Ergono* 16:55-67. <https://doi.org/10.1080/10803548.2010.11076829>
- Boniface R, Museru L, Munthali V, Lett R (2013) Occupational injuries and fatalities in a tanzanite mine: Need to improve workers safety in Tanzania. *Pan Afr Med J* 16:120. <https://doi.org/10.11604/pamj.2013.16.120.3420>
- Bronkhorst B (2015) Behaving safely under pressure: the effects of job demands, resources, and safety climate on employee physical and psychosocial safety behavior. *J Safety Res* 55:63-72. <https://doi.org/10.1016/j.jsr.2015.09.002>

- Carter B, Danford A, Howcroft D, Richardson H, Smith A, Taylor P (2013) 'Stressed out of my box': employee experience of lean working and occupational ill-health in clerical work in the UK public sector. *Work. Employ Soc* 27:747-767. <https://doi.org/10.1177/0950017012469064>
- Çelebioğlu A, Akpınar RB, Küçüköğlü S, Engin R (2010) Violence experienced by Turkish nursing students in clinical settings: Their emotions and behaviors. *Nurse Educ Today* 30:687-691. <https://doi.org/10.1016/j.nedt.2010.01.006>
- Chadambuka A, Mususa F, Muteti S (2013) Prevalence of noise induced hearing loss among employees at a mining industry in Zimbabwe. *Afr Health Sci* 13:899-906. <https://doi.org/10.4314/ahs.v13i4.6>
- Chen Y, Li S (2020) Relationship between workplace ostracism and unsafe behaviors: The mediating effect of psychological detachment and emotional exhaustion. *Psychol Reports* 123:488-516. <https://doi.org/10.1177/0033294118813892>
- Chen Z, Qiao G, Zeng J (2019) Study on the relationship between worker states and unsafe behaviours in coal mine accidents based on a Bayesian Networks Model. *Sustainability* 11:5021. <https://doi.org/10.3390/su11185021>
- Cheng C-W, Yao H-Q, Wu T-C (2013) Applying data mining techniques to analyze the causes of major occupational accidents in the petrochemical industry. *J Loss Prev Process Ind* 26:1269-1278. <https://doi.org/10.1016/j.jlp.2013.07.002>
- Chimamisa C, Gombe NT, Tshimanga M, Chadambuka A, Shambira G, Chimusoro A (2013) Factors associated with severe occupational injuries at mining company in Zimbabwe, 2010: a cross-sectional study. *Pan Afr Med J* 14:5. DOI:10.11604/pamj.2013.14/5/full/
- Choudhry RM (2014) Behavior-based safety on construction sites: A case study. *Accid Anal & Prev* 70:14-23
- Christian MS, Bradley JC, Wallace JC, Burke MJ (2009) Workplace safety: a meta-analysis of the roles of person and situation factors. *Am Psychol Assoc* 94:1103-1127. <https://doi.org/10.1037/a0016172>
- Cui L, Fan D, Fu G, Zhu CJ (2013) An integrative model of organizational safety behavior. *J Safety Res* 45:37-46. <https://doi-org/10.1016/j.jsr.2013.01.001>
- Dodoo JE, Al-Samarraie H (2019) Factors leading to unsafe behavior in the twenty first century workplace: a review. *Manag Rev Quart* 69: 391-414. <https://doi.org/10.1007/s11301-019-00157-6>
- Dong XS, Wang X, Largay JA (2015) Occupational and non-occupational factors associated with work-related injuries among construction workers in the USA. *N J Occup Environ Health* 21:142-150. <https://doi.org/10.1179/2049396714Y.0000000107>
- Donovan H, Welch A, Williamson M (2020) Reported Levels of Exhaustion by the Graduate Nurse Midwife and Their Perceived Potential for Unsafe Practice: A Phenomenological Study of Australian Double Degree Nurse Midwives. *Workplace Health & Safety* XX: 1-7. DOI:10.1177/2165079920938000
- Faris K (2017) Survey of occupational safety and sanitary conditions in small scale enterprises in Jimma Southwestern Ethiopia. *Ethiopia J Health Dev (EJHD)* 12:183-190
- Fisch C, Block J (2018) Six tips for your (systematic) literature review in business and management research. *Manag Rev Quart* 68:103-106. <https://doi.org/10.1007/s11301-108-0142-x>
- Fogarty GJ, Mckeeon CM (2006) Patient safety during medication administration: the influence of organizational and individual variables on unsafe work practices and medication errors. *Ergono* 49:444-456. <https://doi.org/10.1080/00140130600568410>
- Fogarty GJ, Murphy PJ, Perera HN (2017) Safety climate in defence explosive ordnance: survey development and model testing. *Safety Sci* 93:62-69. <https://doi.org/10.1016/j.ssci.2016.11.010>
- Foster P, Hault S (2013) The safety journey: Using a safety maturity model for safety planning and assurance in the UK coal mining industry. *Minerals* 3:59-72. <https://doi.org/10.3390/min3010059>
- Frese M, Keith N (2015) Action errors, error management, and learning in organizations. *Annu Rev Psych* 66:661-687. <https://doi.org/10.1146/annurev-psych-010814-015205>
- Friend MA, Kohn JP (2014) *Fundamentals of occupational safety and health* (7th edi). Landam: Bernan Press

- Fu G, Xie X, Jia Q, Tong W, Ge Y (2020) Accidents analysis and prevention of coal and gas outburst: understanding human errors in accidents. *Proc Safety Environ Protect* 134:1-23.
<https://doi.org/10.1016/j.psep.2019.11.026>
- Fugas CS, Silva SA, Meliá JL (2012) Another look at safety climate and safety behavior: Deepening the cognitive and social mediator mechanisms. *Accid Anal & Prev* 45:468-477.
<https://doi.org/10.1016/j.aap.2011.08.013>
- Gao S, Low SP, Howe HJA (2018) Systemic lapses as the main causes of accidents in the Singapore construction industry. *Civil Engin Environ Syst* 35:81-98.
<https://doi.org/10.1080/10286608.2018.1518437>
- Giurgiu DI et al. (2016) Wellbeing and occupational risk perception among health care workers: a multicenter study in Morocco and France. *J Occup Med Toxicology* 11:20.
<https://doi.org/10.1186/s12995-016-0110-0>
- Gutberlet J, Baeder AM, Pontuschka NN, Felipe S, Dos Santos TL (2013) Participatory research revealing the work and occupational health hazards of cooperative recyclers in Brazil. *N J Environ Res and Pub Health* 10:4607-4627. <https://doi.org/10.3390/ijerph10104607>
- Han S, Saba F, Lee S, Mohamed Y, Peña-Mora F (2014) Toward an understanding of the impact of production pressure on safety performance in construction operations. *Accid Anal & Prev* 68:106-116. <https://doi.org/10.1016/j.aap.2013.10.007>
- Harsini AZ, Ghofranipour F, Sanaeinasab H, Shokravi FA, Bohle P, Matthews LR (2020) Factors associated with unsafe work behaviours in an Iranian petrochemical company: perspectives of workers, supervisors, and safety managers. *BMC Public Health* 20:1-13.
<https://doi.org/10.1186/s12889-020-09286-0>
- Hon CK, Chan AP, Wong FK (2010) An analysis for the causes of accidents of repair, maintenance, alteration and addition works in Hong Kong. *Safety Sci* 48:894-901.
<https://doi.org/10.1016/j.ssci.2010.03.013>
- Huang Y, Wang X, Ding R, Xia N Risk perception, risk propensity, and unsafe behavior: an empirical study of workers in Chinese construction industry. In: *Industrial Engineering and Engineering Management (IEEM), 2016 IEEE International Conference on, 2016. IEEE*, pp 1121-1125
- Hudson P (2007) Implementing a safety culture in a major multi-national. *Safety Sci* 45:697-722.
<https://doi.org/10.1016/j.ssci.2007.04.005>
- Irumba R (2014) Spatial analysis of construction accidents in Kampala, Uganda. *Safety Sci* 64:109-120. <https://doi.org/10.1016/j.ssci.2013.11.024>
- Ji G, Yin H, Chen Y (2005) Prevalence of and risk factors for non-compliance with glove utilization and hand hygiene among obstetrics and gynaecology workers in rural China. *J Hosp Infection* 59:235-241. <https://doi.org/10.1016/j.jhin.2004.09.027>
- Jones SL, Walsh JT, Appiah-Opoku S (2016) Rural transport health and safety in sub-Saharan Africa: Online survey snapshot of expert opinion. *Develop S Africa* 33:677-702.
<https://doi.org/10.1080/0376835X.2016.1203763>
- Khanzode VV, Maiti J, Ray PK (2012) Occupational injury and accident research: A comprehensive review. *Safety Sci* 50:1355-1367. <https://doi.org/10.1016/j.ssci.2011.12.015>
- Kheni NA, Gibb AG, Dainty AR (2010) Health and safety management within small-and medium-sized enterprises (SMEs) in developing countries: Study of contextual influences. *J Const Engin Manag* 136:1104-1115.
- Kifle M, Engdaw D, Alemu K, Sharma HR, Amsalu S, Feleke A, Worku W (2014) Work related injuries and associated risk factors among iron and steel industries workers in Addis Ababa, Ethiopia. *Safety Sci* 63:211-216. <https://doi.org/10.1016/j.ssci.2013.11.020>
- Kvalheim SA, Dahl Ø (2016) Safety compliance and safety climate: A repeated cross-sectional study in the oil and gas industry. *J Safety Res* 59:33-41. <https://doi.org/10.1016/j.jsr.2016.10.006>
- Kwame O-B, Kusi E, Lawer E (2014) Occupational hazards and safety practices: a concern among small scale sawmilling industries in Tamale Metropolis, Ghana International. *J Scient Tech Res* 3:234-236
- Lamontagne AD, Keegel T, Louie AM, Ostry A, Landsbergis PA (2007) A systematic review of the job-stress intervention evaluation literature, 1990–2005. *N J Occup Environ Health* 13:268-280. <https://doi.org/10.1179/oeh.2007.13.3.268>

- Leung M-y, Chan Y-S, Yuen K-W (2010) Impacts of stressors and stress on the injury incidents of construction workers in Hong Kong. *J Const Engin Manag* 136:1093-1103
- Lewis MQ, Sprince NL, Burmeister LF, Whitten PS, Torner JC, Zwering C (1998) Work-related injuries among Iowa farm operators: An analysis of the Iowa Farm Family Health and Hazard Surveillance Project. *Am J Indust Med* 33:510-517. [https://doi.org/10.1002/\(SICI\)1097-0274\(199805\)33:5:510::AID-AJIM11.3.CO;2-0](https://doi.org/10.1002/(SICI)1097-0274(199805)33:5:510::AID-AJIM11.3.CO;2-0)
- Liu Q, Meng X, Hassall M, Li X (2016) Accident-causing mechanism in coal mines based on hazards and polarized management. *Safety Sci* 85:276-281. <https://doi.org/10.1016/j.ssci.2016.01.012>
- Liu R, Cheng W, Yu Y, Xu Q, Jiang A, Lv T (2019) An impacting factors analysis of miners' unsafe acts based on HFACS-CM and SEM. *Proc Safety Environ Protection* 122:221-231. <https://doi.org/10.1016/j.psep.2018.12.007>
- Liu X, Huang G, Huang H, Wang S, Xiao Y, Chen W (2015) Safety climate, safety behavior, and worker injuries in the Chinese manufacturing industry. *Safety Sci* 78:173-178. <https://doi.org/10.1016/j.ssci.2015.04.023>
- Loewenson RH (1998) Health impact of occupational risks in the informal sector in Zimbabwe. *N J Occup Environ Health* 4:264-274. <https://doi.org/10.1179/oeh.1998.4.4.264>
- Long RN, Sun K, Neitzel RL (2015) Injury risk factors in a small-scale gold mining community in Ghana's Upper East Region. *N J Environ Res Pub health* 12:8744-8761. <https://doi.org/10.3390/ijerph120808744>
- Low BKL, Man SS, Chan AHS (2018) The risk-taking propensity of construction workers—An application of quasi-expert interview. *N J Environ Res Pub health* 15:2250. <https://doi.org/10.3390/ijerph15102250>
- Manu PA, Ankrah NA, Proverbs DG, Suresh S (2012) Investigating the multi-causal and complex nature of the accident causal influence of construction project features. *Accid Analy Prev* 48:126-133. <https://doi.org/10.1016/j.aap.2011.05.008>
- McCaughey D, Turner N, Kim J, DelliFraine J, McGhan GE (2015) Examining workplace hazard perceptions & employee outcomes in the long-term care industry. *Safety Sci* 78:190-197. <https://doi.org/10.1016/j.ssci.2015.04.013>
- McGonagle AK, Kath LM (2010) Work-safety tension, perceived risk, and worker injuries: A meso-mediational model. *J Safety Res* 41:475-479. <https://doi.org/10.1016/j.jsr.2010.09.002>
- Merryweather AS, Thiese MS, Kapellusch JM, Garg A, Fix DJ, Hegmann KT (2018) Occupational factors related to slips, trips and falls among home healthcare workers. *Safety Sci* 107:155-160. <https://doi.org/10.1016/j.ssci.2017.07.002>
- Mohammadfam I, Ghasemi F, Kalatpour O, Moghimbeigi A (2017) Constructing a Bayesian network model for improving safety behavior of employees at workplaces. *Appl Ergono* 58:35-47. <https://doi.org/10.1016/j.apergo.2016.05.006>
- Moher D, Liberati A, Tetzlaff J, Altman DG, Group atP (2009) Preferred Reporting Items for Systematic Reviews and Meta-Analyses: The PRISMA Statement. *Annals Internal Med* 151:264-269. <https://doi.org/10.7326/0003-4819-151-4-200908180-00135>
- Monney I, Bismark D-A, Isaac O-M, Kuffour RA (2014) practices among vehicle repair artisans in an urban area in Ghana. *J Environ Occup Sci* ● Apr-Jun 3:147-153. <https://doi.org/10.5455/jeos.20140528072614>
- Mrema EJ, Ngowi AV, Mamuya SH (2015) Status of occupational health and safety and related challenges in expanding economy of Tanzania. *Annals Glob Health* 81:538-547. <https://doi.org/10.106/j.aogh.2015.08.021>
- Nakata A et al. (2006) The prevalence and correlates of occupational injuries in small-scale manufacturing enterprises. *J Occup Health* 48:366-376. <https://doi.org/10.1539/joh.48.366>
- Neal A, Griffin MA (2002) Safety climate and safety behaviour. *Aus J Manag* 27:67-75. <https://doi.org/10.1177/031289620202701S08>
- Neal A, Griffin MA (2006) A study of the lagged relationships among safety climate, safety motivation, safety behavior, and accidents at the individual and group levels. *J Appl Psycho* 91:946-953. <https://doi.org/10.1037/0021-9010.91.4.946>
- Neelamegam R, Asrafi S (2010) Work stress among employees of Dindigul district central cooperative bank, Tamil Nadu: A study IUP. *J Manag Res* 9:57-69

- Nordlöf H, Wiitavaara B, Winblad U, Wijk K, Westerling R (2015) Safety culture and reasons for risk-taking at a large steel-manufacturing company: investigating the worker perspective. *Safety Sci* 73:126-135. <https://doi.org/10.1016/j.ssci.2014.11.020>
- Nouri J, Azadeh A, Fam IM (2008) The evaluation of safety behaviors in a gas treatment company in Iran. *J Loss Prev Process Ind* 21:319-325. <https://doi.org/10.1016/j.jlp.2007.11.006>
- Nsubuga FM, Jaakkola MS (2005) Needle stick injuries among nurses in sub-Saharan. *Af Trop Med N Health* 10:773-781. <https://doi.org/10.1111/j.1365-3156.2005.01453.x>
- Nyende-Byakika S (2016) Occupational safety and health issues on road construction sites in sub-Saharan Africa: A case study from Uganda. *Afr J Sci, Tech, Innov Dev* 8:256-263. <https://doi.org/10.1080/20421338.2016.1156838>
- Ohajinwa CM, van Bodegom PM, Vijver MG, Olumide AO, Osibanjo O, Peijnenburg WJ (2017) Prevalence and injury patterns among electronic waste workers in the informal sector in Nigeria. *Injury Prev* 0:1-8. DOI.10.1136/injuryprev-2016-042265
- Olvera LD, Guézéré A, Plat D, Pochet P (2016) Earning a living, but at what price? Being a motorcycle taxi driver in a Sub-Saharan African city. *J Transp Geogr* 55:165-174. <https://doi.org/10.1016/j.jtrangeo.2015.11.010>
- Parker D, Lawrie M, Hudson P (2006) A framework for understanding the development of organisational safety culture. *Safety Sci* 44:551-562. <https://doi.org/10.1016/j.ssci.2005.10.004>
- Patterson JM, Shappell SA (2010) Operator error and system deficiencies: analysis of 508 mining incidents and accidents from Queensland, Australia using HFACS. *Accid Anal Prev* 42:1379-1385. <https://doi.org/10.1016/j.aap.2010.02.018>
- Peretz RA, Luria G (2017) Drivers' social-work relationships as antecedents of unsafe driving: A social network perspective. *Accid Anal Prev* 106:348-357. <https://doi.org/10.1016/j.aap.2017.07.005>
- Ramacciati N, Ceccagnoli A, Addey B (2015) Violence against nurses in the triage area: an Italian qualitative study. *N Emerg Nurs* 23:274-280. <https://doi.org/10.1016/j.ienj.2015.02.004>
- Reason J (2005) Safety in the operating theatre—Part 2: Human error and organisational failure. *Qual Safety Health Care* 14:56-60. [http://doi.org/10.1016/S0953-7112\(05\)80010-9](http://doi.org/10.1016/S0953-7112(05)80010-9)
- Salahuddin L, Ismail Z, Hashim UR, Ismail NH, Raja Ikram RR, Abdul Rahim F, Hassan NH (2020) Healthcare practitioner behaviours that influence unsafe use of hospital information systems. *Health Informatics J* 26:420-434. <https://doi.org/10.1177/1460458219833090>
- Sanmiquel L, Freijo M, Edo J, Rossell JM (2010) Analysis of work related accidents in the Spanish mining sector from 1982-2006. *J Safety Res* 41:1-7. <https://doi.org/10.1016/j.jsr.2009.09.008>
- Schultz AB, Edington DW (2007) Employee health and presenteeism: a systematic review. *J Occup Rehab* 17:547-579. <https://doi.org/10.1007/s10926-007-9096-x>
- Searcy DL, Mentzer JT (2003) A framework for conducting and evaluating research. *J Account Lit* 22:130-167
- Seo D-C (2005) An explicative model of unsafe work behavior. *Safety Sci* 43:187-211. <https://doi.org/10.1016/j.ssci.2005.05.001>
- Sorensen G, Nagler EM, Pawar P, Gupta PC, Pednekar MS, Wagner GR (2017) Lost in translation: The challenge of adapting integrated approaches for worker health and safety for low-and middle-income countries. *PloS one* 12:e0182607
- Sovacool BK, Mukherjee I (2011) Conceptualizing and measuring energy security: A synthesized approach. *Energy* 36:5343-5355. <http://doi.org/10.1016/j.energy.2011.06.043>
- Sullman MJ, Stephens AN, Pajo K (2017) Transport company safety climate—The impact on truck driver behavior and crash involvement. *Traffic Inj Prev* 18:306-311. <https://doi.org/10.1080/15389588.2016.1199865>
- Takala J, Hämäläinen P, Nenonen N, Takahashi K, Chimed-Ochir O, Rantanen J (2017) Comparative analysis of the burden of injury and illness at work in selected countries and regions. *Cent Eur J Occup Environ Med* 23:6-31
- Takala J et al. (2014) Global estimates of the burden of injury and illness at work in 2012. *J Occup Environ Hygiene* 11:326-337
- Ünsar AS, Süt N (2015) Occupational accidents in the energy sector: Analysis of occupational accidents that occurred in thermal and hydroelectric centrals between 2002 and 2010 in

- Turkey. *Procedia-Social and Behav Sci* 181:388-397.
<http://doi.org/10.1016/j.sbspro.2015.04.901>
- Uzundu C, Jamson S, Lai F (2019) Investigating unsafe behaviours in traffic conflict situations: An observational study in Nigeria. *J Traffic Transp Engin (English edition)* 6:482-492.
<https://doi.org/10.1016/j.jtte.2018.06.002>
- Verma S, Chaudhari S (2017) Safety of Workers in Indian Mines: Study, Analysis, and Prediction. *Safety Health at Work* 8: 267-275. <https://doi.org/10.1016/j.shaw.2017.01.001>
- Winge S, Albrechtsen E, Mostue BA (2019) Causal factors and connections in construction accidents. *Safety Sci* 112:130-141. <https://doi.org/10.1016/j.ssci.2018.10.015>
- Wirth R, Foerster A, Rendel H, Kunde W, Pfister R (2017) Rule-violations sensitise towards negative and authority-related stimuli. *Cognition and Emotion*:1-14.
<https://doi.org/10.1080/02699931.2017.1316706>
- Wolf LA, Delao AM, Perhats C (2014) Nothing changes, nobody cares: Understanding the experience of emergency nurses physically or verbally assaulted while providing care. *J Emerg Nursing* 40:305-310. <https://doi.org/10.1016/j.jen.2013.11.006>
- Yassi A et al. (2014) Considerations for preparing a randomized population health intervention trial: lessons from a South African–Canadian partnership to improve the health of health workers. *Glob Health Action* 7:23594. <https://doi.org/10.3402/gha.v7.23594>
- Zheng L et al. (2014) Nonfatal work-related injuries among agricultural machinery operators in northern China: a cross-sectional study. *Injury* 45:599-604.
<https://doi.org/10.1016/j.injury.2013.07.004>
- Zhu H et al. (2014) Sleep-related factors and work-related injuries among farmers in Heilongjiang Province, People’s Republic of China. *N J Environ Res Public Health* 11:9446-9459.
<https://doi.org/10.3390/ijerph110909446>
- Zohar D (2010) Thirty years of safety climate research: Reflections and future directions. *Accid Anal Prev* 42:1517-1522. <https://doi.org/10.1016/j.aap.2009.12.019>
- Zohar D, Luria G (2005) A multilevel model of safety climate: cross-level relationships between organization and group-level climates. *J Appl Psycho* 90:616-628.
<https://psycnet.apa.org/doi/10.1037/0021-9010.90.4.616>