Mental health risk factors in the construction industry: Systematic review

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Abstract

Mental ill health is a significant cause of suicide and disability worldwide. It has particularly hit the construction industry, evident in Australia and the UK with high suicide rates 2 and 3.7 times above national averages. This has gained the attention of researchers and construction industries. However, few studies have examined the state of construction workers' mental health. This paper systematically reviewed the existing body of knowledge on mental health in the construction industry. In total, 16 journal articles met inclusion criteria, and 32 risk factors (RFs) were deduced. The foremost RFs are related to job demand and job control. A conceptual framework and checklist to aid in better understanding these RFs were developed. In assessing mental health, the Depression Anxiety Stress Scale was most widely used. The findings of this study help to deepen the understanding of using professional mental health assessment scales, as well as relevant RFs and protective factors within the construction industry. The study concludes that stronger methodologies are needed for studies into RFs and protective factors in the construction industry.

Keywords: mental ill health; risk factor; systematic review; construction workers

Introduction

The construction industry is characterized by working under different weather conditions and engaging in repetitive and strenuous jobs (Boatman et al., 2012). Much of the projects are nomadic and cyclical, resulting in high unemployment rates (European Agency on Safety and Work, 2007). Other characteristics of the industry include high job demand, long working hours, and unrealistic deadlines (Beswick et al., 2007). These characteristics of the industry can negatively transcend into the physical and mental health of construction workers.

Considerable research shows that physical and mental health problems can arise from stress related to work and the workplace (Wang et al., 2017). It is essential to monitor the impact of psychosocial risk factors on the health of workers, to enable a better understanding of their effects on mental health and wellbeing, thereby facilitating the reduction of workplace injuries, prevent disabilities, and increase productivity (Boschman et al., 2013). Poor mental health and risk of mental illness have taken its toll on the construction industry in several countries, as reflected by a high risk of depression, anxiety, suicidality, and eventual suicide (see Burki, 2018; Kamardeen and Loosemore, 2016; Milner et al., 2015). For example, Jacobsen et al. (2013) revealed that as many as nine in ten surveyed respondents on a construction site had mental health challenges and required medical follow up.

According to World Health Organization [WHO] (2001, p.1), mental health is "a state of well-being in which the individual realizes his or her abilities, can cope with the normal stresses of life, can work productively and fruitfully, and is able to make a contribution to his or her community". The definition signifies that good mental health is foundational for well-being and effective functioning (Herrman and Jane-Llopis, 2005), while mental ill health (poor mental health) hinders an individual's ability to realize their potential, work productively and contribute to their community (Herrman and Llopis, 2012). Common mental health problems in the working population include anxiety and depression (Battams et al., 2014; Grove, 2006).

Mental ill health has substantial economic costs on nations, organizations, and individuals, many of which are reflected in heavy labor industries. For instance, in the United Kingdom, approximately 400,000 workdays are reported lost to mental ill-health per year, and specifically among construction workers, there were 1419 suicides between 2011 and 2015, amounting to 3.7 times above the national average (Burki, 2018). In Australia, death resulting from suicide amongst construction workers is two times above the national average (Mates in Construction, 2018; Gullestrup et al., 2011). Mental ill health or poor mental health is also a risk factor for workplace injuries or fatalities (Palmer et al., 2014; Siu et al., 2004). For instance, in the Australian construction industry, for every death by a workplace accident, five to six of such cases were intentional suicide (see Gullestrup, 2019).

Previous studies have revealed that mental ill health and occupational injury have a direct relationship. Park et al. (2001), through a prospective study, explained that workers with depressive symptoms are three times at higher risk of workplace injury and fatalities. Park and colleagues found that depressive symptoms and hours working among farmers were associated with an increased workplace injury. Anxiety, depression, and psychological distress are found to cause sleep problems (Bowen et al., 2018; Taylor et al., 2005), which negatively impact on wellbeing and safety. Similarly, in the construction industry, sleep problems are associated with fatigue, which in turn causes workplace injury and accidents (Powell and Copping, 2016; 2010). Additionally, depression is a significant correlate of fatigue (Sadeghniiat-Haghighi and Yazdi, 2015).

Many studies have linked work stress to poor mental health and suicide; however, concerns have been raised about the dearth of research addressing other factors that can interplay with work-related factors to cause mental health issues and suicide (Sunindijo and Kamardeen, 2017). Mental health prevention programs have demonstrated effectiveness and reduction in costs for health management (Sandler et al., 2014; Knapp et al., 2011). However,

successful prevention of mental health problems and its burden can only be effective after identifying the attributes and exposures known as risk factors that can threaten mental health (Furber et al., 2017). Increased insight into risk factors for mental ill health among the construction workforce is necessary to inform the selection of appropriate interventions (Boschman, 2013), essential for achieving a psychologically healthy and safe workplace.

Based on the preceding, the purpose of this study was to systematically review the body of knowledge regarding mental health in the construction industry, and specifically to evaluate the different risk factors for mental ill health and how mental health has been assessed in the construction industry. Given that few studies to date have used validated scales for assessing mental health in the construction industry (Love et al., 2010), this review addressed the followings questions: i) what validated mental health diagnosis tools have been used to identify or screen for the state of mental health among construction workers?; and ii) what are the risk factors for mental ill health and protective factors for mental health among construction workers?

The overall objective of the study was to provide a guide on how best to evaluate mental health in the construction industry and to determine what appropriate interventions should be adopted. Further, this review will help researchers focus on tackling specific risk factors for adequate mental illness prevention in the construction industry, which can also inform prevention efforts in other heavy labor industries facing elevated risks of mental ill health and suicide.

Methods

Search strategy

The databases of PubMed, Scopus, and Web of Science (WoS) core collection were searched. These databases were selected because PubMed contains the largest concentration of health-related journals (Harris et al., 2014; Fiordelli et al., 2013), while Scopus and WoS provide a

101 comprehensive collection of journals in the field of science and are most frequently visited
102 (Aghaei et al., 2013). More so, according to Harris et al. (2014), using one database to retrieve
103 journals during a systematic review is insufficient. For that reason, the mentioned databases
104 were visited.

105 Several search strings were used, the terms with the highest output related to the
106 domains of "mental health*" "construction industry*"; "psychological health*"; and
107 "construction industry." Google Scholar was searched with specific studies identified from
108 citations and reference lists of articles retrieved from the initial database searches.

109 ***Inclusion and Exclusion criteria***

110 To ensure that studies were eligible for this review, inclusion and exclusion criteria was set.
111 Studies were included if they satisfied all the following criteria:

112 (i) Assessed the mental health status of construction workers using a validated scale or
113 questions (items) extracted directly from a validated scale or previous study. In the
114 case of items retrieved from an earlier study, the reference study should have
115 derived the items from a validated mental health scale;

116 (ii) Such mental health status should be common mental health problems such as
117 depression, anxiety, posttraumatic stress disorder. Studies that considered
118 psychological (mental) distress or strain were included if they fulfilled condition
119 (i);

120 (iii) consider stressors of mental health, referred to as risk factors for mental ill-health;

121 (iv) Be a main empirical study and not a pilot study. A pilot study, in this case, was
122 defined as a preliminary study, primarily conducted to test the feasibility of
123 proposed empirical research. According to Fraser et al. (2018), a pilot study is a
124 precursor to the main research, carried out basically to determine the feasibility of
125 using a designed questionnaire and inform on changes needed to improve on

subsequent data collection. Pilot studies were considered only, in cases where the pilot was not followed by a main empirical study.

(v) Target sample must consist of construction workers. Construction workers in this study refer to persons engaged in the construction industry as:

- Professionals, supervisors, construction project managers involved in planning, coordinating, and controlling of construction projects, and
- frontline workers involved in the manual aspect of the construction work.

(vi) Be written in English language.

Studies reported in conference presentations, book chapters, reviews, perspective articles, and editorial documents were excluded. Therefore, only empirical studies published in journal articles were included. The rationale for this criteria is because articles published in journal articles undergo peer review, whereas other types of publications such as conferences papers or gray literature do not undergo the same rigorous review ahead of publication (Olawumi and Chan, 2018). Also, unlike other sources, journal articles generally provide comprehensive and reputable sources of information in a field of study (Zheng et al., 2016; Yi and Chan, 2013; Ramos-Rodríguez and Ruíz-Navarro, 2004).

Data extraction and synthesis

The data extraction process begun with reading the abstracts of identified articles. The following characteristics were noted: target population, methodology, MH assessment instrument, and research outcome. In the case, where the abstracts were not well detailed, the method or data collection section was read to assess eligibility. Only those articles that met eligibility criteria were subjected to further scrutiny. JMN read the documents thoroughly and recorded the study process and outcomes. To avoid bias, the lead author (APC) reviewed the reasons for exclusion and findings from the studies. After that, JAN independently reviewed all included studies and confirmed the correctness of extracted data.

Results

The initial database search yielded 107 articles (PubMed = 21; Scopus = 50; and WoS = 36). After removing duplicates, 50 articles were subjected to scrutiny using the inclusion criteria. Thereafter, only 13 articles fell within the inclusion criteria. On reading the 13 articles, additional articles were identified from the citations and reference lists. The articles were looked up in Google Scholar, resulting in three additional journal articles that met the inclusion criteria. Finally, a total of 16 articles were included for the review. These articles are deemed adequate, given a similar study on risk factors in male-dominated industries, which employed 18 articles (see Roche et al., 2015). Also, Joyce et al. (2010) employed ten articles in a well-being related review after allowing for inclusion and exclusion criteria.

Figure 1 illustrates the search strategy, exclusion, and inclusion of the final eligible studies. Subsequently, Table 1 gives the details of the included studies and their findings. The following subheadings summarize the mental health assessment tools employed in the construction industry, the various mental ill health risk factors and protective factors in the literature and offer a conceptual framework for mental ill health risk factors in the construction industry.

Insert Figure 1 here

Mental Health assessment tools employed in the included studies

Eleven mental health assessment tools were identified in the included studies (see Fig. 2). These scales were employed in 13 studies, while the three remaining studies probed mental health by using questions extracted from previous studies. Five studies used depression specific screening tools, particularly the Whooley Questions, CES-D (Center for Epidemiological Studies—Depression) scale, and Hamilton Depression Scale (see Table 1). Thus, these studies screened for depression among construction workers and its causative factors. One study employed an anxiety specific tool, namely the State-Trait Anxiety Index (STAI-T).

176 Two studies assessed PTSD using posttraumatic stress disorder (PTSD) specific scales,
177 namely the Impact of Event Scale (IES), and ICD-10 classification of Mental and Behavioral
178 Disorder. In one study, the ICD-10 was used to classify construction workers into PTSD and
179 no PTSD group, after which the severity of depression was assessed in each category using the
180 HAM-D (see Hu et al., 2000). Eight studies employed multi-variant mental health assessment
181 questionnaires, including the DASS, Hopkins Symptom Checklist (HSCL), General Health
182 Questionnaire (GHQ) and Crown-Crisp Experiential Index (CCEI) (see Table 1). All the scales
183 use cut-off points to report the degree of mental health problem.

184 *Insert Figure 2 here*

185 DASS was employed in 5 studies (Kamardeen and Sunindijo, 2017; Langdon and
186 Sawang, 2017; Sunindijo and Kamardeen, 2017; Al-Maskari et al., 2011; Haynes and Love,
187 2004). This questionnaire measures depression, anxiety, and stress (Nieuwenhuijsen et al.,
188 2003), although the included studies primarily focused on depression and anxiety. The CCEI
189 measure types of anxiety, depression, and hysteria (Joukamaa, 1992), and was used in one
190 study to diagnose for depression and anxiety (see Sutherland and Davidson, 1993). The GHQ
191 28 measures somatic, anxiety, social dysfunction, and severe depression (Nagyova et al., 2000),
192 and was employed in one of the studies (see Love et al., 2010).

193 One study screened for depression and anxiety using the HSCL 25 (Jacobsen et al.,
194 2013). This study revealed that HSCL-25 was employed in the construction industry to
195 determine mental health status following pain and injuries, which are quite typical in a
196 construction workplace (see Jacobsen et al., 2013). Generally, the studies revealed a high
197 prevalence of depression and anxiety amongst construction workers. Fig. 3 shows the scales
198 employed for the types of mental ill health diagnosis and the respective studies.

199 Three studies evaluated the effect of occupational stress on the mental health of
200 construction workers by using four to eight questions extracted from previous studies or scales

(Bowen et al., 2018, 2014; Lingard et al., 2007). Two studies (Jacobsen et al., 2013; Al-Maskari et al. 2011) reported suicide ideation amongst construction workers. However, one of the studies did not employ a professional tool while the other used the Mini International Psychiatric Interview (MINI). The MINI is a multivariant assessment tool which is used to diagnose for depression, anxiety, and suicidality (see Li et al., 2017), and was employed in one study for suicide risk assessment (Jacobsen et al., 2013).

Insert Table 1 here

Insert Figure 3 here

Validated mental health assessment scales employed in the studies

Depression Anxiety Stress Scale

The DASS is a psychometric test which can be administered to determine the severity of depression, anxiety, and stress experienced over a past week (Ibrahim et al., 2014). It is available in variants of DASS 42 or DASS 21, with each having three subscales. The numbers signify the total questions. In the case of 21, there are seven questions per subscale, while 42 contains 14 each. DASS has excellent psychometric properties and adequate for evaluating mental ill health in employees and general populations (Nieuwenhuijsen et al., 2003). DASS is easy to use and effective in detecting change after clinical diagnosed mental ill health; however, in recent times, it is used without a prior diagnosis (Ng et al., 2007). Interestingly, the DASS is freely available for use.

General Health Questionnaire (GHQ)

GHQ is a widely used psychological health screening tool developed by Goldberg (Montazeri et al., 2003; Donath, 2001). It is used to evaluate emotional distress and psychiatric disorders (Sterling, 2011). GHQ assesses somatic symptom, anxiety, social dysfunction, and depression (Okubo et al., 2011). Mental health assessment is based on preceding weeks. The tool is

available in variants of 60, 30, 28 and 12 item questions as GHQ-60, GHQ-30, GHQ-28, GHQ-12 respectively and copyrighted.

Hopkins Symptom Checklist 25 (HSCL-25)

HSCL-25 is used to screen for anxiety and depression in trauma and torture victims (Halepota and Wasif, 2001). HSCL-25 contains ten items on anxiety subscale and 15 items on depression subscale (Ventevogel et al., 2007). Initially, it was designed for use amongst refugee; however, in recent times, it is mostly employed in screening for mental health amongst post-conflict populations and traumatized refugees. This study revealed that HSCL-25 was used in the construction industry to determine mental health following pain and injuries, which are quite typical in a construction workplace (see Jacobsen et al., 2013).

Crown-Crisp Experiential Index (CCEI)

CCEI is a self-rating mental health assessment tool used for screening anxiety, depression, and hysteria (Joukamaa, 1992). CCEI has the characteristics of six (6) subscales containing eight questions each for assessing free-floating anxiety, phobic anxiety, obsessionality, somatic anxiety, depression, and hysteria.

CES-D (Center for Epidemiological Studies—Depression) scale

CES-D developed by National Institute of Mental Health is ideal for assessing depression symptoms in the general population (Radloff, 1977). It contains 20 questions scored from 0 to 3; a higher score is directly proportional to higher severity of depression. However, scores ≥16 indicates the presence of depression (Dyrbye et al., 2006). CES-D is available in variants of 10, 20 and not copyrighted.

Whooley Depression

Whooley depression is a 2-item questionnaire used to assess depression. The construct of the questions entails a "yes or no" answer. For instance; during the past month, have you often been bothered by little interest or pleasure in doing things? If the respondents answer "yes" to

any of the two questions, another assessment tool called the "help question" will be handed to them (Suija et al., 2012). According to Howard et al. (2018), the Whooley questions are useful in identifying mental health problem but do not adequately indicate the presence of depression.

Hamilton Depression Scale (HAM-D)

HAM-D developed by Zigmond and Snaith is a 17-item assessment tool used to measure the frequency and state of depression (Akdemir et al., 2001). According to Licht et al. (2005), the HAM-D reliability had been questioned; however, in recent times, it has seen a wide application.

State-Trait Anxiety Index (STAI-T)

STAI-T is a 40-item anxiety assessment tool, with two subscales and available in 2 versions (Julian, 2011). According to Balsamo et al. (2013), the tool assesses State and Trait anxiety. To effectively evaluate anxiety, STAI-T has two subscales; State anxiety (S-anxiety) and Trait anxiety (T-anxiety) subscale. The S subscale assesses the intensity of feelings, while the T subscale evaluates the frequency of anxiety. STAI-T is widely used for assessing anxiety, especially in a musculoskeletal condition (White et al., 2002). Like other assessment tools, it uses cut-off points, and a higher subtest score indicates greater anxiety.

ICD-10 Classification of Mental and Behavioral Disorders

ICD-10 outlines reliable criteria specifically for conducting research on and classification of mental ill health. It helps to ensure the selection and grouping of individuals with same symptoms using clearly defined characteristics. It was used in one (1) of the studies to identify construction workers with PTSD and those without PTSD. After that, each category of respondents was assessed for depression using HAM-D (see Hu et al., 2000). According to ICD-10, the features to look out for, to enable proper classification into PTSD include flashbacks, detachment from people, sense of numbness, emotional blunting, hyperarousal and

emotional responses following a traumatic event. A psychiatrist or trained social worker usually administer the ICD-10.

Impact of Event Scale (IES)

IES is a good instrument for assessing posttraumatic stress and identify individuals who require medical attention (Sundin and Horowitz, 2002). The IES has two subscales used to measure two types of stress reaction. It has shown great validity as a measure for detection of PTSD (Rothbaum et al., 1992). The scale elicits information on frequency in which PTSD symptoms were experienced over a preceding week using a scoring system of 0, 1, 3, and 5 respectively. Initially, the IES did not measure the hyperarousal symptom of PTSD as outlined by Diagnostic Symptom Measure IV (DSM IV). To correct such deficiency, a revised IES with six additional questions and modified response to a 5-point scale with equal interval 0 to 4 was developed (Creamer et al., 2003).

Mini International Neuropsychiatric Interview (MINI)

The MINI is a multivariant assessment tool which is used to diagnose for depression, anxiety, and suicidality (see Li et al., 2017). It can be employed independently or as a second phase mental ill health assessment tool. Most times, MINI is used as a second stage or further diagnosis tool, to probe certain concerns raised in a prior assessment (Li et al., 2017), in which case, respondents with severe depression are further examined using MINI module B. MINI module B helps to assess effectively for suicidality. Diagnosis of anxiety and depression, which are the most common mental health problems, can be difficult, as such can be over-diagnosed or under diagnosed.

According to Petterson et al. (2018), to mitigate such over or under diagnosis, a structured interview is deemed important as part of the assessment process. The study further explained that MINI helps to mitigate such over or under diagnosis, by providing a better

298 understanding of a mental ill health condition, identify psychiatric and stigmatization disorders.
299 MINI allows for a "yes" or "no" answer.

300 **Risk factors for mental ill health**

301 A total of 32 stressors of mental health were reported in the included studies (see Table 2). The
302 stressors were categorized under eight headings following the studies of Okechukwu et al.
303 (2014), Love et al. (2010), Campbell (2006), Michie (2002) and Sutherland and Davidson
304 (1993). As presented in Table 2, the numbers 1-16 on the top horizontal row corresponds
305 respectively to articles listed in Table 1. The marking with symbol (✓) indicates the frequency
306 of a risk factor identified in the articles. The most identified risk factors were hours worked per
307 day (excess of 60hrs per week), work overload, low opportunity/ability to participate in
308 decision making, and occupational climate (authority, tax autonomy, office politics). Though,
309 few studies considered work-life as a stressor.

310 *Insert Table 2 here*

311 **Classification of risk factors for mental ill health in the Construction Industry**

312 It was deduced from the included studies that most (97%) of the identified stressors for mental
313 ill health in the construction industry constitute psychosocial factors. These risk factors can be
314 grouped according to two principles: (i) previous studies that outlined some of these stressors
315 (Love et al., 2010; Sutherland and Davidson, 2007; Michie, 2002); and (ii) definitions of the
316 stressors. The risk factors were grouped as pertaining to the following: job control, work
317 support, job demand, coping strategy, work hazard, family, workplace injustice, welfare, and
318 socio-economic factors. This is shown in the conceptual framework (Fig. 4).

319 *Insert Figure 4 here*

320 From the studies considered, it was gathered that construction workers use specific
321 negative coping strategies to help undergo or relieve the day's job stress (Lingard et al., 2007).
322 However, this coping strategy is termed negative, as it impacts negatively on mental health

(Jacobsen et al., 2013). After classification, the mean scores for the risk factors variables were determined (see Table 3). The mean score was determined by calculating the total number of studies that identified the different measures that form a variable and dividing the total by the number of measures in the variable. For instance, work hazard risk factor was calculated using the equation:

$$\sum\left(\frac{WH_i}{N}\right) = Mean\ Score$$

$$= \frac{WH1+WH2+WH3+\ WH4+WH5}{N}$$

$$= \frac{3+2+1+1+2}{5} = \ 1.80$$

$$N = \text{ total number of measures per variable}$$

$$i = 1,2,3 \ldots \ldots, \ldots \ldots . . n$$

Insert Table 3 here

Based on the equation, the mean score of the risk factor was determined and ranked. The result showed that job demand risk factors pose a significant threat to mental health and as such, workplace reforms on proper job design for quality health and well-being should be enforced.

Protective factors in the construction industry

While risk factors in the construction industry are about 97% based on psychosocial working conditions, studies on protective factors for mental health seem scarce. Protective factors elicited from the studies can be summarized into nine broad categories, namely: marital status, increased job control, increased job support, reduced job demand, reduced workplace discrimination, family-friendly job opportunities, workplace justice, better welfare, and positive socio-economic measures, and positive (adaptive) coping strategies. One study by Lingard et al. (2007) considered compressed working week intervention to improve work-family/life balance in the construction industry. The studies revealed some individual positive coping strategies adopted by construction workers, such as wishful thinking and emotion-

focused coping strategies (see Lim et al., 2017; Langdon and Sawang, 2017). These coping strategies are protective factors. Appropriate mental health promotion and interventions were highlighted by the studies and included: adopting compressed working week, problem-solving; stress management; workplace feedback mechanism, caring; appreciation, encouraging building teamwork, communication skills; job security; creating a sense of involvement in employees; improving workplace safety, good quality of environment; encouraging quality relationship amongst colleagues, and promotion as a reward mechanism. These interventions offer opportunities to enhance protective factors against mental ill health in the construction workplace.

Kamardeen and Sunindijo (2017) considered a combination of personal factors and psychosocial workplace factors. This study determined that marital status acted as a risk factor and moderator. As a moderator, marital status helped to offer social support and a network, which could be lacking in the workplace. Kamardeen and Sunindijo (2017) also proposed that interventions should be designed around scheduled casual gatherings, coffee-break chats and ensuring a more comfortable workplace to cushion the effect of marital status, especially amongst professionals who are not married.

Discussion

As illustrated in Fig 4, the studies included in this systematic review identified several key risk factors for mental ill health in the construction industry. These included: lack of job control, welfare concerns, workplace hazards, job demand, workplace injustice, family, and lack of support.

Lack of job control

For instance, lack of job control emerged as a vital risk factor reflected specifically as limited opportunities for decision making, inability to speak about happenings in the workplace, imbalanced work distribution, authoritarian culture and strict rules for scheduled work routine

(Lim et al., 2017; Boschman, 2013). According to Love et al. (2010), the impact of lack of job control as a risk factor varied by the type of firm and appeared to be present primarily in contracting firms resulting in higher rates of depression (Boschman, 2013). In one study, these factors were described as occupational climate, which involved issues relating to job autonomy, office politics, communication lines, line of authority and inconsistency in communication flow (see Sutherland and Davidson, 1993).

Welfare concerns

Welfare-related risk factors were job insecurity, low income / financial insecurity, inability to further learning, and low socioeconomic status. Job insecurity was associated with a high level of anxiety amongst all grade level (middle and lower level) of construction workers (Sutherland et al., 1993); while low income was associated with a high level of depression and suicide ideation (Al-Maskari et al., 2011). Financial insecurity stemmed from family concerns (Langdon and Sawang, 2018). Also, job insecurity was higher amongst married employees (Lim et al., 2017). The burden of financial and job insecurity was related to the ability to cater for a family in the case of unemployment. Job insecurity is associated with age and project value, Haynes and Love (2004) found that older employees feared job insecurity owing to emerging technology in which younger employees are more knowledgeable.

Project duration and value acted as moderators to job insecurity risk factor (Haynes and Love, 2004). Consequently, concerns about job insecurity were reduced in the case of projects with larger cost and longer length of time. Thus, employees in projects with a higher value may be more emotionally and psychologically stable since the projects are likely to span over a more extended period. Generally, fear of job insecurity was related to the length of time of employment. Income appeared to be a moderator among the studies. For instance, higher income was related to improved coping styles, lower anxiety, and lower rates of alcohol abuse.

Fear of failure stemmed from age and over-promotion (i.e., placing employees in job level greater than their technical ability) (see Haynes and Love, 2004; Sutherland and Davidson, 1993). Fear of failure is also related to fear of job insecurity, as underperformance can lead to unemployment. For instance, it was deduced that age, over promotion, length of time in employment, and fear of failure appeared to cause construction employees to prove themselves which in turn put strains on them, leading to burnout and eventually psychological or mental distress such as anxiety and depression (see Kamardeen and Sunindijo, 2017; Bowen et al., 2014; Haynes and Love, 2004).

Work hazards

Work hazard-related risk factors include physical illness, occupational injury/hazard, post-traumatic stress, and musculoskeletal pain. Occupation injury/hazard contributed to PTSD, which also influenced depression and anxiety (Hu et al., 2000). According to Al-Maskari (2011), physical illness was associated with depression and suicidal ideation. Similarly, mental distress, which is a warning sign for mental illness, was directly associated with pain in the back and other body sites (Jacobsen et al., 2013). This was consistent with the findings of French (2009), which attributed psychological distress to musculoskeletal disorders. However, a more recent study revealed that pre-existing anxiety and depression allows for a greater risk of developing a musculoskeletal disorder (Del Campo, 2016).

Job demand

Job demand related risk factors include nature of work, hours worked per week, work overload, fatigue and need for recovery, and increased work speed. Working for long hours per week, more than 60 hours was common for contractors and foremen, causing them to be more stressed (Love et al., 2010). Similarly, the risk for mental ill health amongst construction supervisors and bricklayers increased as a result of fatigue (Boschman et al., 2013). Al-Maskari (2011)

reported that depression and suicidal ideation were associated with job demand related risk factors, especially the nature of work and hours worked.

Workplace injustice

Workplace injustice related risk factors were gender discrimination, harassment, bullying, age discrimination, and lack of respect from subordinates. Gender discrimination towards females was reported in the construction industry (see Kamardeen and Sunindijo, 2017; Bowen et al., 2014). Kamardeen and Sunindijo (2017) noted that female professionals were often paid a lower salary than their male counterparts. Also, female professionals suffered several forms of harassment ranging from sexual, verbal abuse, physical abuse, and physical contact. The studies also revealed that male subordinates most times would not accept work orders from a female superior; as such, the female professional suffered low job control and support.

Consequently, females suffered more anxiety and depression than their male colleagues. Age discrimination took the form of higher work demand on younger employees accompanied by low job control and less support (Bowen et al., 2014). The age discrimination led to psychological strain. More studies are needed for age discrimination and mental health in the construction industry.

Family

Family-related risk factor included marital status and work-family/life conflict. Work demand was seen to impact negatively on family life and the ability to keep up with family responsibility for both male and female professionals; however, it was more common for the latter. Marital status, on the other hand, was reported as an extrinsic risk factor and a moderator (see Kamardeen and Sunindijo, 2017). Personal stress owing to the marital status of separated, divorced, widowed, or being single caused some levels of anxiety and depression. However, when combined with work stress, the severity of the mental health problem in such

professionals increased. Marital status amongst married professionals appeared to act as a moderator to work stress (see Kamardeen and Sunindijo, 2017).

Lack of work support

Love et al. (2010) reported that the absence of work support resulted in construction workers rationalizing for low work support through self-support mechanisms. This pointed to the need for work support measures to maintain good mental health in the construction industry.

Coping

High job demand, low work support, and job control have resulted in construction workers employing several coping strategies. The coping strategies can broadly be categorized as positive (adaptive) or negative (maladaptive). For instance, a coping strategy attributed to Alcohol, Drug, and Substance Abuse (ADSA) is used as sources of diversion, to shelve the effect of strenuous work (Frone, 2006). The studies also reported construction workers turning to ADSA (Sutherland et al., 1993), with substance abuse revealed to be associated with anxiety (Langdon and Sawang, 2018).

Mushi and Manege (2018) attributed such ADSA coping strategy to the risky or tough nature of each construction trade. Employing negative coping strategy through alcohol abuse may also be linked to the strong drinking culture in the construction industry (Roche et al., 2015). However, ADSA as a coping strategy is negative, as prolonged use of ADSA has been linked to increased risk of job safety (Minchin et al., 2006). Additionally, ADSA leads to physical illness, mental illness, and suicidality (Schuttle and Hser, 2013). On the positive coping strategy, Love et al. (2010) revealed wishful thinking and problem-solving attitudes, as some measures employed by construction workers.

Directions for Further Studies

This systematic review revealed several important risk factors, highlighting many potential pathways causing mental ill health among workers in the construction industry. With growing

complexity in the workplace and rising daily demands placed on employees, the number of cases of mental ill health is increasing (see Kuhn, 2013). Jacobsen et al. (2013) found a strong association between psychological distress and workplace injuries. Jacobsen and colleagues reported a high prevalence of injuries among workers with substantial psychological distress. To address this serious public health concern, it is necessary for researchers to examine factors beyond those occurring directly within the workplace. For example, the construction industry should consider the effects of a range of psychosocial factors spanning both the workplace and the personal lives of construction workers. Such would enable a better understanding of the interactions between the risk factors for mental ill health that an individual can be subjected to in their daily lives, thereby, informing the design of intelligent interventions.

The importance of maintaining mental health across all types of construction firms is high. For instance, one study found that those working with contractors are subjected to more mental ill health risk factors than their counterparts working in consultant firms (Love et al., 2010). Also, many studies have emphasized the mental health of supervisors and people in supervisory positions, while fewer studies have mapped out risk factors for construction trades, or laborer positions such as bricklaying (see Boschman et al., 2013). There is limited research on risk factors and mental ill health by trade. Given the different responsibilities across trades, as well as the various treatment and conditions for employees, further investigation of these trends may help provide answers to specific trade elements or characteristics which can be stressors to mental health. An understanding of this will inform interventions which will be more specific and meet trade needs.

The construction industry has focused mainly on the impact of work stress on mental health. As such only psychosocial factors arising from working condition and workplace are considered. Less emphasis was placed on other psychosocial factors such as marital status, family friction, loneliness, and bereavement. For instance, a finding asserted that PTSD is high

among construction workers owing to workplace hazards (see Stocks et al., 2010). Another study demonstrated that other life events among construction workers could also result in PTSD (see Boschman et al., 2013). Overall, there is a need for more considerable research within the industry into specific factors that can increase the risk of mental ill health. The result could assist in building more robust interventions in the workplace. For instance, if experiences outside the workplace appear to be the primary source of stress, workplace interventions such as the Employee Assistance Program (see Soeker et al. 2015; Nakao 2007) could incorporate possible solutions such as making necessary counseling or therapy resources available to employees in need.

There is a need for intensified research into factors that promote health than concentrating on risk. Research into specific protective factors for mental health in the industry is limited, with protective factors primarily informed by the reversal of risk factors. When protective factors are just a reversal of risk factors, interventions would be shallow and ineffective (Franklin et al., 2017). According to Mrazek and Haggerty (1994), protective factors can exist within the individual, family, community, and other affiliations. While the methodologies used in researching into protective factors in the industry are weak, protective factors such as optimism, resilience, and self-esteem are given little attention. Studies considering a combination of the protective factors are needed, this will inform on protective factors that best suit different construction workforce.

To effectively identify risk and protective factors, focus group approaches could be adopted in which mental health assessment tools could be used to group the respondents into control (comprising those with no mental ill health) and target group (those with mental ill health) (see Rodgers, 2011). After that, characteristics which are found in people without mental ill health and absent in the control group constitute the protective factor. The result will

inform the classification of risk factors, protective factors, and follow up interventions for deploying in the construction industry.

Presently, it is unknown whether the rate of mental ill health reported in the construction industry of developed countries where modern techniques of construction are employed is consistent with lower income countries. More considerable research into risk factors in emerging and developing economies is essential to determine context and cultural factors that pose a risk for mental ill health. Such research will provide information on the impact of laws and policies for worker protection and safety within construction industries across different regions. This is especially important since expatriate companies execute many construction projects in lower-income countries under different procurement options.

Certainly, assessing risk factors is essential to evaluate the level of risk to health. Important to note, risk factors do not emerge in isolation but instead clustered together. Interventions aimed at promoting mental health should be directed towards clusters of risk factors. This would help to intensify research into protective factors for mental health. For example, to reduce the risk of job demand and fatigue, real-time monitoring technology could be adopted by construction organizations. Alternatively, primary job stress and MH interventions to ensure improved and sustainable job design policies across the construction industry of varying economies are needed. Following the boom in technology, increased studies into flexible work arrangement (see Rudolph and Baltes, 2017) within the construction industry are required. While on the secondary intervention aspect, technological interventions to maintain mental fitness through building resilience and stress management should form policy-making within the industry.

Furthermore, there is a need for studies into benchmarking job designs, mental health policies, and interventions in the construction workplace. This will help ensure that construction firms uphold psychological health management as a core duty to ensuring the

well-being of their employees. Studies in the construction industry should assess depression and anxiety at the same time, as this will inform which mental health problem is most prevalent in the industry making it possible to identify specific stressors responsible for each. Lastly, only two studies assessed suicidality, highlighting the need for more significant examination of the risk of suicide within the construction industry using reliable assessment measures. Greater knowledge on the prevalence of mental illness symptoms can also inform the selection and implementation of appropriate workplace interventions such as mental health promotion and preventive efforts, as well as specific treatment programs. This will, in turn, help to achieve a psychologically healthy and safe workplace.

Limitations

A limitation of this study is the relatively small number of articles employed. However, the authors had to ensure studies reviewed contained information from persons diagnosed as having mental ill health. This was necessary as many studies in the construction industry that related work stress to poor mental health may have equated depression to sadness, or anxiety to fear. Also, the studies included in this review offer fundamental insights regarding the risk factors for mental ill health in the construction industry and given the small number of studies with limited representation globally, these results cannot generalize across geographic regions or contexts.

For instance, most of the studies were carried out in higher income nations, highlighting the need for more research into the conditions and resulting impact on the mental health of construction workers in lower resource settings. Due to different work settings, use of sophisticated technology, cultural and religious beliefs, a thorough empirical investigation in different geographical regions, cultures and among different organizational size and structure could be carried out to further characterize risk factors for mental ill health in the construction industry and to inform the design and delivery of interventions.

Conclusion

There is growing importance to address the prevalence of mental ill health facing the construction industry. However, this systematic review revealed that while several studies have examined the stressors faced by construction personnel for many years, only a few have employed reliable mental health assessment tools. Going forward, it will be necessary for studies in the industry to use a full validated mental health assessment scale to make affirmations on the impact of workplace stress on psychological health. This review contributes a greater understanding of risk factors for mental ill health and protective factors to inform occupational health researchers as well as construction regulatory bodies and workforce organizations to develop better-tailored strategies to tackle specific risk factors.

In total, 32 risk factors were identified from 16 studies spanning 8 main categories as detailed in the conceptual framework. This framework and the checklist serve as a composite reference guide to risk factors for future use, though future studies are needed to expand on this framework by considering additional risk factors. This could include poor health, lifestyle, poor relationship with family, custody issues, family to work-life balance, and many other psychosocial, contextual, and cultural factors. The workplace offers the avenue for deploying tailored mental ill health and suicidality interventions within different trades and professions. As such, the industry should work to develop sustainable interventions to address diverse factors that can pose a threat to mental health. There is a need for intensified research into factors that promote health than concentrating on risk. There is a considerable need for the development of more specific, edge cutting protective factors, and emerging intervention frameworks to mitigate the high incidence of mental ill health and suicidality presently plaguing the industry. The findings of this study are useful to policymakers, construction organizations, practitioners and researchers to develop targeted and sustainable interventions

592 in mitigating mental ill-health and resulting impacts among construction workers and other
593 manual laborers.

594 **Data Availability**

595 Data generated or analyzed during the study are available from the corresponding author by
596 request.

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