ME4333

Measures to Improve the Mental Health of Construction Personnel Based on Expert Opinions

Janet M. Nwaogu[1]; Albert P. C. Chan[2]; John A. Naslund[3]

[1]The Hong Kong Polytechnic University, Hong Kong. Ph.D. Candidate, Dept. of Building and Real Estate. Block Z, 181 Chatham Road South, Hung Hom, Kowloon, Hong Kong, China. Email: janet.nwaogu@connect.polyu.hk (MSc., corresponding author).

[2]The Hong Kong Polytechnic University, Hong Kong. Chair Professor and Head, Dept. of Building and Real Estate. Block Z, 181 Chatham Road South, Hung Hom, Kowloon, Hong Kong, China. Email: albert.chan@polyu.edu.hk (Ph.D.)

[3]Harvard Medical School, Boston, USA. Instructor, Department of Global Health and Social Medicine, 641 Huntington Ave, Boston, MA 02115, USA. Email: john_naslund@hms.harvard.edu (Ph.D.)

Abstract

Increasing rates of depression, anxiety, and suicide in the construction industry have drawn the attention of researchers to consider mental health as an integral part of health and safety. However, prior research has focused mainly on determining the sources of work stress, with a paucity of studies related to measures to improve mental health. This study aims to fill this gap by evaluating the mix of measures within an integrated approach that can be adopted to promote good mental health. Surveys were collected from 62 construction experts based in 4 countries. The data were analyzed using descriptive statistics, structural equation modeling (SEM), and a post-survey interview. SEM showed that secondary intervention measures such as those focused on *healthy coping and individual resilience* do not necessarily mitigate mental health stressors; it also signals

the importance of including primary intervention measures in a workplace mental health intervention. These findings highlight intervention measures that could be implemented to create a psychologically healthy workplace. These measures can guide policy-making to boost job satisfaction, mental health, safety, and performance. Furthermore, these results provide a compass for building construction organizations to determine which measures are yet to be implemented in their workplaces and need to be explored.

Keywords: construction industry; interventions, mental health promotion; health and safety

Introduction

Globally, in the workplace, increased work speed, low job control causes job dissatisfaction and heightens perceived stress (Burke, 2019). The dynamic nature of construction projects elevates the stressful nature of the industry, thus exposing construction professionals to workplace stress and poor mental health (Liang et al., 2021;Bowen et al., 2013). In the construction industry, stressors such as high job demand, poor interpersonal relationships, bullying, and harassment constitute psychosocial risk factors for mental distress and mental ill-health symptoms (Sunindijo and Kamardeen, 2017;Chan et al., 2020;Leung et al., 2016). Mental ill-health, when left unattended, is a precursor to suicidality (Sunindijo and Kamardeen, 2017), accidents, and presenteeism (Siu et al., 2004). Therefore, increasing the mental health of personnel holds excellent benefits to the industry.

Stress reactions have prompted countries, such as Australia, Canada, United Kingdom, and the United States, to put measures in place to promote mental health. In the UK, for example, workdays lost to mental health problems cost employers about £43 billion per annum due to presenteeism and sickness leave (Ajayi et al., 2019). Although presently, data on mental health in the construction industry is not readily available for all countries, international research has shown

that compared to the general population, the construction industry suffers higher rates of poor mental health and suicide risks (Bryson and Duncan, 2018;Milner et al., 2017). Mental ill-health symptoms and suicidal ideation are prevalent in the construction industry. For instance, in the Netherlands, among building construction supervisors, there was an 18% and 20% prevalence rate of depression and post-traumatic stress disorder symptoms; 11% and 7% among skilled workers (Boschman et al., 2013). Among building construction practitioners pooled from seven countries, the prevalence rate for anxiety and depression was 87% and 70%, respectively (Rees-Evans, 2020). To effectively deal with mental health concerns at work, occupational health researchers have advocated adopting an integrated intervention approach (see LaMontagne et al., 2014). According to LaMontagne et al. (2018), "an integrated intervention approach to mental health" or "integrated mental health framework" involves adopting measures that (i) protects employee's mental health by reducing work and non-work risk factors for mental health problems; (ii) promote employee's mental health by developing the positive aspects of work, as well as the strengths and positive capacities of the employee; and (iii) respond to mental health problems that manifest in employees at work regardless of cause whether work or non-work-related".

Creating a workplace that considers the well-being of its employees will lead to greater job satisfaction, improved safety, mental health, performance, and organizational productivity (Burke, 2019). Previous studies on mental health in the construction industry focused on determining mental health symptoms and their stressors (Boschman et al., 2013;Sunindijo and Kamardeen, 2017). The studies provide a foundation for this present research. Although there exists research on mental health in the construction industry, empirical evidence on measures required to improve the mental health of on-site construction personnel remains insufficient. Additionally, existing

studies on mental health among construction personnel have not employed an integrated approach to mitigate or prevent mental health problems.

While evidence shows that measures to improve mental health are available in other sectors, solutions are unique to the workplace context (LaMontagne et al., 2014), as the one-size-fits-all interventions do not apply to mental health problems (Rebar and Taylor, 2017). For example, measures for job redesign in the construction industry for site-based personnel may differ from those required in the banking sector. Likewise, given the nature of the construction industry, the combination of measures necessary to make the construction workplace psychologically healthy and their importance will vary from those needed for other industries (Nwaogu and Chan, 2021). This further emphasizes the need for context-specific solutions, e.g., the measures needed for construction personnel would differ from those needed for office clerks.

Towards informing efforts to make the construction workplace psychologically safe and healthy, the aim of this study is to determine the mix of measures that can be adopted to promote good mental health in the construction industry. To achieve the aim, the following objectives are set out: (i) to identify measures necessary for mental health promotion and their importance; (ii) to model the influence of the measures on stressors quantitatively. This study provides valuable initial evidence on primary, secondary, and tertiary intervention measures that can be implemented in the construction industry to create a psychologically safe and healthy workplace. The study will guide policies for boosting job satisfaction, mental health and well-being, safety, and performance in the construction workplace. Furthermore, the study potentially provides a checklist to construction organizations on measures yet to be implemented in their workplaces and need to be explored.

Literature review

Types of interventions

Effective workplace intervention that organizations can adopt within an integrated approach to mental health would consider combining primary, secondary, and tertiary interventions. Such workplace intervention would address work-related stress, build individual resilience or coping measures, detect mental health problems, and recommend an appropriate treatment. Intervention measures designed to prevent the development of work-related mental health problems are primary interventions (LaMontagne et al., 2014;Pignata et al., 2017). Primary interventions are directed towards eliminating or reducing stressors and sources of mental health problems (LaMontagne et al., 2014;Pignata et al., 2017).

Intervention measures directly channeled towards the employees are known as secondary interventions (LaMontagne et al., 2014). Secondary interventions include measures to reduce mental health problems by modifying how employees respond to or deal effectively with stressors (Pignata et al., 2017). Tertiary interventions are reactive in nature, as they involve responding to mental health problems by treating employees, offering counseling or financial assistance (LaMontagne et al., 2014;Nwaogu and Chan, 2021). Intervention measures (or measures) refer to strategies that can be initiated or facilitated to prevent depression, anxiety, or both, treat or rehabilitate a worker with diagnosed mental ill-health symptoms (Joyce et al., 2016). Stressor refers to a cause of stress, potential mental ill-health risk factor; it is a threat to an individual (Murison, 2016).

The Research Problem

Previous studies on measures to improve mental health focused on job stress mitigation (e.g., Havermans et al., 2018;Pignata et al., 2017;Pignata et al., 2018;Yip and Rowlinson, 2009) and mental ill-health symptoms (e.g., Joyce et al., 2010;Joyce et al., 2016;Tan et al., 2014;Gullestrup et al., 2011;Lingard et al., 2007). Pignata et al. (2017), examining employees in the education sector, deduced that academic staff employed mostly secondary interventions such as coping measures to reduce stress. In contrast, non-academic staff relied on primary intervention measures to reduce and manage stress among employees. Pignata et al. (2018), surveying five Australian Universities, deduced that measures implemented to reduce stress include increased salary, recognition practices, fairness, career development, and improved work-life balance. The findings in Pignata et al. (2017) and Pignata et al. (2018) emphasize that a single-mode intervention (i.e., secondary, primary, or tertiary) is not adequate for stress mitigation and mental health management.

Havermans et al. (2018) reported that "communication about stress", "having a supportive workplace", and "the availability of stress prevention measures" in the workplace were some measures perceived by employees to reduce stress. Generally, a meta-analysis by Tan et al. (2014) showed that most organizations employed secondary intervention to mitigate mental health problems among workers. While secondary interventions assist in coping and resilience building, they are ineffective in modifying risk factors as their effect wears out in a short time (Joyce et al., 2016;LaMontagne et al., 2014). Unlike this study, Pignata et al. (2017), Pignata et al. (2018), and Havermans et al. (2018) were related to employees in sectors that are not related to construction. Solutions to make a workplace psychologically healthy and safe are context-specific (LaMontagne et al., 2014), as the one-size-fits-all interventions are not appropriate with mental health problems (Rebar and Taylor, 2017). For example, measures for job redesign in the construction industry may

differ from those required in non-construction related occupations (e.g., health or education). Also, the studies neither identified the level of importance of the measures nor examined their perceived impact on identified stressors.

Within the construction industry, there have been a few single-mode intervention studies on mental health. For instance, Gullestrup et al. (2011) adopted secondary intervention measures to mitigate suicide among tradesmen in the Australian construction industry (Nwaogu and Chan, 2021). The measures included mental health literacy, stimulating helping behaviors, and some aspects of employee assistance programs. However, while the intervention increased mental health literacy, it did not mitigate mental ill-health and suicide. Additionally, studies in the construction industry have evaluated primary intervention measures such as job redesign measures (see Yip and Rowlinson, 2009;Lingard et al., 2007). Lingard et al. (2007) achieved increased work-life balance and productivity using a compressed working week arrangement. Yip and Rowlinson (2009) reported mild effectiveness against the sources of burnout (emotional exhaustion, cynicism, and professional efficacy) using a reduced workday and fortnight off-work measure. However, both studies did not provide for non-work factors that can cause or worsen mental ill-health, to which the primary interventions may be ineffective. Therefore, to ensure a sustainable mental health promotion in the industry, adopting an integrated approach to mental health management is more reliable than a single-mode approach because it can modify and mitigate risk factors.

Although previous research in the construction industry examined the single-mode approach to stress prevention or mental health promotion among personnel, Nwaogu and Chan (2021) moved the conversation forward by examining potential multimodal measures for mental health promotion among construction personnel in Nigeria. However, the study was based on contributions from experts in a single country. Little is known about the opinion of experts in other

161 climes on the measures. Also, like previous studies (Havermans et al., 2018;Yip and Rowlinson,
162 2009;Pignata et al., 2017;Pignata et al., 2018;Gullestrup, 2019;Gullestrup et al., 2011), Nwaogu
163 and Chan (2021) did not examine the perceived impact of the measures on identified stressors.
164 Based on the preceding, this present study is intended to fill the gap and advance Nwaogu and
165 Chan (2021) by determining the impact of those multimodal measures on perceived stressors based
166 on the experiences of construction experts from a variety of climes.

167 **Theoretical background**

168 Since the integrated approach to mental health holds a promising mix of solutions to mental health
169 in the construction industry, this study adopted the Job Demand-Resources (JD-R) model to
170 evaluate the impact of the measures on mitigating stressors. Other models that have been employed
171 in the stress and health literature include the Demand-Control (DCM) and Effort-Reward
172 Imbalance (ERI) model. In contrast to prior models that are restricted to particular job demands or
173 resources, the scope of JD-R is broader (Schaufeli and Taris, 2014). The JD-R model is considered
174 because it encompasses a wide range of work-related factors and can be tailored to different
175 workgroups (Schaufeli and Taris, 2014). The JD-R assumes that every occupation has unique
176 resources, risk factors, and personal characteristics that may influence an employee's health, well-
177 being, and motivation (Bakker and Demerouti, 2007;Schaufeli and Taris, 2014).

178 This study uses the JD-R model and the integrated mental health as guiding principles on
179 measures needed to eliminate or mitigate job demand and strain reactions to boost good health,
180 work engagement, and job performance. In order to meet the integrated approach to mental health,
181 the measures identified from existing literature (e.g., Enns et al., 2016;Hanisch et al., 2016;Sinclair
182 et al., 2017;Aguinis et al., 2012;Joyce et al., 2010;Ahola et al., 2012) were a mix of primary,
183 secondary, and tertiary intervention measures (see Table 1). The measures were later grouped into

seven constructs following Nwaogu and Chan (2021). The JD-R model served as a guide for selecting the measures that can motivate employees (e.g., IM19, IM20, IM22) and testing their impact on stressors. In Table 1, primary intervention measures, such as IM19 (job sculpting), IM22 (job crafting), IM23, and IM24, can boost job autonomy, higher levels of resources, and improve motivation among on-site personnel. Thus, fulfilling the motivation aspect of the JD-R model (Bakker and Demerouti, 2017). Improving motivation will boost health and productivity (Johari and Jha, 2020). Whereas, secondary intervention measures such as IM01, IM02, IM03, IM04, IM06 aimed at building coping and individual resilience in construction personnel would meet the personal resources aspect of the JD-R model.

Insert Table 1

Since the measures are needed to mitigate poor mental health, understanding the perceived impact of the measures on some stressors could improve decision-making. Therefore, this study investigates the influence of the measures on some stressors adapted from Chan et al. (2020) (see Table 2). To test the relationship, it is hypothesized that each measure construct will be negatively associated with the stressors. This implies that on implementing the measures, the stressors and their impact should reduce. Although the study is focused on measures to improve mental health, the purpose of the stressor questions was to aid confirmatory analysis of the intensity of the measures.

Insert Table 2

Methodology

Survey instrument

The research instrument is an online administered questionnaire developed by adapting measures and perceived stressors in the construction industry (see Appendix I). The questionnaire is divided

into three parts. Part A solicited demographic questions, while Part B elicited questions relating to perceived stressors in the industry. Part C consisted of measures required to mitigate the stressors and their impact. The respondents were required to indicate their level of agreement with each stressor or measure on a four-point Likert scale with 1 = "strongly disagree," and 4 = "strongly agree".

Face and Content Validity

A panel of five experts was used to conduct face and content validity on the draft questionnaire. The panelists consisted of three occupational health psychologists and two construction professionals with over 18 publications in the field of occupational health and safety. The validity was conducted involving a three-stage review. Upon receiving feedback from each stage, the questionnaire was redeveloped based on panelists' comments, and the new draft was sent to them for perusal. Upon approval, the final questionnaire underwent pilot testing. The pilot testing involved ten corporate members of the Chartered Institute of Building (CIOB) and Royal Institute of Chartered Surveyors (RICS). The professionals were asked to comment on their understanding of the questions and the time taken to complete the survey. All participants indicated the questions were appropriate, understandable, and took approximately seven minutes to complete.

Data collection

The questionnaire was used to elicit expert opinions from a purposive sample of construction practitioners chosen based on the criteria that they hold a position as a construction professional occupying a policy-making role in the construction industry. An expert refers to a person with the skill or knowledge exhibited in leadership positions or who presents in conventions or is recognized by journal publications (Darko and Chan, 2018). Therefore, for this study, an expert refers to a construction professional with the skills and pedigree in building production and

management policy-making roles within the building construction workplace. The experts are targeted as respondents because they have risen from the lower level to top management level and key policymakers within the construction industry. The term "personnel" refer to "on-site supervisory personnel (e.g., the site engineers, site supervisors) on a building construction project".

The experts for the questionnaire survey were purposively selected from (i) the Royal Institution of Chartered Surveyors (RICS) website, (ii) websites of construction companies, (iii) a complied list of construction practitioners who partook in a previous survey conducted by the researchers or their network. The websites of other professional bodies in the Architectural, Engineering and Construction (AEC) industry were consulted; however, only RICS afforded the possibility of finding members and getting their email addresses. For RICS, only members engaged in health and safety, building surveying, and construction positions were surveyed. After identifying the participants, the questionnaire was administered through an email containing a brief introduction to the study and a link to access the survey.

All participants are members of a professional body engaged in construction management, health, and safety. Albeit the subject of making the workplace psychologically healthy and safe seems a general concern that any construction professional can answer, it is not, considering the constraints of time, cost, and quality when organizing construction activities. Based on convenience and purposive sampling, approximately 247 questionnaires were sent to potential respondents. Finally, to assess the findings and gain better insights into the study, a post-survey interview was conducted with five experts who partook in the survey and indicated a further interest in the research. To aid the post-survey interview, the result obtained from the survey alongside a brief explanation was provided to the experts (see Hwang et al., 2020). The

interviewees were asked to assess and give their suggestions on the findings with reference to the purpose of the study.

Data analysis methods

The data collected were analyzed using mean score ranking via SPSS 26.0 package and structural equation modeling performed using the SmartPLS 3.3.3 software.

Consistency reliability of experts' ranking

Prior to conducting the analysis, internal consistency reliability was determined. Internal consistency reliability determines the understanding of the questions used for measuring a phenomenon among a sample of respondents (Taber, 2018). As stated by Flo et al. (2018), "a commonly accepted rule for describing internal consistency when using Cronbach's alpha includes: $\alpha \geq 0.9$ = excellent, $0.9 > \alpha \geq 0.7$ = good, $0.5 > \alpha$ = unacceptable".

Mean ranking of the measures

The measures were ranked using their mean score and standard deviation (SD) values to determine their significance in achieving the aim of the study. This was employed as it is the most commonly used descriptive statistics to rank measures perceived by respondents in a quantitative study (Chan and Adabre, 2019;Darko and Chan, 2018). In a case where two or more measures had the same mean, the measure with the lowest standard deviation is ranked highest, following Darko and Chan (2018) approach.

Kruskal-Wallis Test

The Kruskal-Wallis test was used to determine if experts' opinions from the countries differed regarding a particular intervention measure. Kruskal-Wallis test is a non-parametric test suitable for assessing the difference among three or more independently sampled groups (Nwaogu and Chan, 2021;McKight and Najab, 2010). With a significance level of 0.05, the null hypothesis (H_0)

in Kruskal-Wallis test holds that "there is no difference in the mean ranks of the groups" (Nwaogu, 2021;Nwaogu and Chan, 2021;McKight and Najab, 2010). Therefore, if the p-value is greater than 0.05, there is no statistically significant difference in the experts' opinion regarding a particular intervention measure. However, if the p-value is less than 0.05, the H_0 is rejected, indicating a statistically significant difference in their opinion.

Suppose the null hypothesis (H_0) is rejected after conducting the Kruskal-Wallis test. In that case, a post hoc test must be conducted to determine which group of respondents differ significantly in their opinion concerning a variable (Leon, 1998). The post hoc test was conducted using pairwise comparisons of the experts' opinions for measures with a statistically significant difference. Pairwise comparisons using Dunn's approach were conducted using SPSS software, as the software automatically produces them for variables (i.e., the measures) with a statistically significant difference.

Structural equation modeling

The structural equation modeling (SEM) analytical technique can test hypotheses to establish the relationship between items. The partial least square (PLS-SEM), a type of SEM method, was employed for this analysis because it is suitable for analyzing non-normal data and can handle a sample size of less than 250 (Darko et al., 2018;Hair et al., 2014). Specifically, PLS is a variance-based SEM method (Hair et al., 2014). It can appropriately handle reflective and formative models for construct measurement and test model fit (Henseler, 2017;Hair et al., 2014).

In order to identify the relationship between the variables in PLS-SEM, the process begins by creating a path model that connects variables and constructs based on theory and logic (Hair et al., 2014). One logic to consider is that PLS-SEM can only handle models with no circular relationship between the constructs (Hair et al., 2014). This implies that while PLS-SEM can

298 examine causal relationships, it cannot deduce reverse-causal relationships. The relationship
299 between the constructs is designed as either exogenous or endogenous. Exogenous constructs are
300 independent variables and do not have an arrow pointing at them. In contrast, endogenous
301 constructs are the dependent variables as other constructs explain them; thereby, they have arrows
302 pointing at them (Hair et al., 2014). In this study, the stressors' construct is endogenous, while the
303 intervention measure constructs (e.g., JRC-M) are exogenous (see Figure 1).

304 *Insert Figure 1 here*

305 Another logic is specifying the inner and outer models. The outer models are either
306 designed in a reflective or formative manner (Hair et al., 2014). As shown in Figure 1, the outer
307 model in this study takes the reflective manner, in that the indicators point out from the constructs
308 (e.g., JRC-M) to the variables (i.e., IM12, IM13, IM19). According to (Hair et al., 2014),
309 "reflective variables are linked to a construct through loadings, that is the bivariate correlations
310 between the variable and the construct". In order to assess reflective outer models, the reliability
311 and validity must be verified. This is done using two major steps. Firstly, Cronbach's alpha or
312 composite reliability score of 0.70 or higher is used to evaluate the construct's internal consistency
313 reliability (Hair et al., 2016). The second step involves the assessment of validity, which is
314 examined by construct's convergent validity and discriminant validity.

315 Average variance extracted (AVE) score of 0.50 or higher is used to assess construct's
316 convergent validity. According to Henseler et al. (2015), "AVE indicates the mean amount of
317 variance that a construct explains in its indicator variables relative to the overall variance of the
318 indicators". Discriminant validity ensures that a variable in a construct does not correlate too
319 highly with another variable in another construct (Henseler et al., 2015). Henseler and colleagues
320 asserted that if discriminant validity is not fulfilled, the accuracy of results confirming the

hypothesized structural paths may not be certain. The discriminant validity can be assessed using the Heterotriat Monotrait (HTMT) criterion at a threshold of less than 0.85 (Henseler et al., 2015).

After sketching the model in the PLS-SEM environment, analysis begins by deducing the path coefficients. The analysis involves eliminating all measures and stressors in the model whose factor loading is below the threshold of 0.5 (Hair et al., 2016). This process also aids in ensuring that the construct reliability and discriminant validity of the constructs meet minimum requirements. Variables within a reflective outer model are interchangeable and can be eliminated without changing the meaning of the construct because they are highly correlated and consist of a set of possible variables within the conceptual domain of a construct (Hair et al., 2014). To assess the construct reliability and validity, Cronbach's alpha scores ≥0.70, composite reliability scores >0.70, and average variance extracted (AVE) scores ≥0.50 were used (Darko et al., 2018;Hair et al., 2016;Cheung and Zhang, 2020). Furthermore, the discriminant validity was assessed using the Heterotriat Monotrait (HTMT) criterion <0.85 (Henseler et al., 2015).

After confirming the construct reliability and discriminant validity, the path coefficients and effects of the measures on stressors and the hypothesis were tested using bootstrap analysis. The number of bootstrap samples was set at default (5000) to reduce the result's variations when run again. The decision on the hypothesis were based on t-values threshold for two-tailed test: 2.58 (at significance level = 0.01), 1.96 (significance level = 0.05) and 1.65 (significance level = 0.1). The R-square, coefficients of p-value, and path coefficients were used for the structural model.

Results

Profile of the respondents

A total of 62 duly filled questionnaire responses were retrieved from 4 countries (see Table 3), accounting for about 25.1% response rate. Usually, online surveys face challenges with low

response rates (Chan and Adabre, 2019). However, the central limit theorem holds that a sample size of at least 30 is valid and sufficient (Chan and Adabre, 2019;Nwaogu and Chan, 2021). Thus, 62 responses are deemed adequate to the study considering international surveys in the field of construction management, e.g., Owusu et al. (2020) and Chan and Adabre (2019). Owusu et al. (2020) was based on 44 responses from experts based in 18 different countries. Similarly, Chan and Adabre (2019) received 51 responses from 18 countries.

All respondents were affiliated with a professional construction body, and the majority of them (58.1%) had over 20 years of work experience (see Table 3). 56 out of the 62 respondents (90.3%) were actively engaged in industry practice, while 9.7% were in academia or research institute (see Table 3). The representation of experts is as follows: architects (3.2%), civil engineers (32.3%), quantity and building surveyors (3.2%), and construction managers (61.3%).

Insert Table 3 here

Mean ranking of the measures to improve psychological health

As shown in Table 4, based on the combined response from all the countries, the top measures include "celebrate employee's success (IM21)", "better planning of work tasks and shifts (IM29)", "give constructive feedbacks instead of reprimanding (IM20)", "create policies to eliminate harassment (IM16)", with mean scores of 3.58, 3.56, 3.45, and 3.42 respectively. Kruskal Wallis test revealed a statistically significant difference in the experts' response to eight measures (i.e., IM07, IM08, IM10, IM13, IM16, IM26, IM27, IM31).

Insert Table 4 here

As shown in Table 5, post hoc test further showed that while respondents agreed on the importance of most of the measures, experts in Hong Kong seemed to differ on the importance of most of the measures. Overall, the analysis yielded an excellent Cronbach's alpha (α) ranging between 0.70

and 0.84 for each construct (see Table 4), indicating that the experts' understanding of the measures in each construct is consistent. Unlike other measure constructs, "job demand and satisfaction" and "job redesign and control measures" had individual measures with a mean score below 3.00, as approximately 30% of the respondents disagreed about the viability of implementing the measures to achieve a psychologically safe workplace for on-site construction personnel.

Insert Table 5 here

Structural equation modeling

Evaluation of the model measurements

With 62 responses, the PLS/SEM was deemed appropriate for the modeling. After eliminating all measures and stressors with factor loading below the threshold of 0.5, only 25 measures and 18 stressors were fit for the analysis (see Figure 1). The six eliminated measures include IM05, IM09, IM10, IM14, IM25, and IM31. The 20 eliminated stressors include CS01, CS02. CS09, CS10, CS13, CS15, CS17, CS18, CS19, CS20, CS21, CS22, CS23, CS24, CS25, CS28, CS30, CS31, CS37 and CS38. Following Hair et al. (2014), the measures and stressors with factor loading below 0.5 could be eliminated without changing the meaning of the construct in which they were initially situated because they are highly correlated, and the construct consists of a set of possible variables. As shown in Table 6, the constructs had Cronbach's alpha above 0.70, composite reliability scores above 0.70, and AVE above 0.50. This indicates appropriate construct reliability and validity, as the Cronbach's alpha, composite reliability, and AVE scores were within threshold ≥ 0.70 and ≥ 0.50 used for assessing construct reliability and validity (Darko et al., 2018).

Insert Table 6 here

389 The constructs also had acceptable discriminant validity, with the HTMT of the constructs being
390 below 0.85 (see Table 7). According to Henseler et al. (2015), when testing for discriminant
391 validity, the Heterotriat Monotrait (HTMT) criterion is <0.85.

392 *Insert Table 7 here*

393 *Evaluation of structural model*

394 The bootstrapping result showed that some measures impacted the stressors as hypothesized (see
395 Table 8). In PLS-SEM, for two-tailed test, the t-values threshold are 2.58 (at significance level =
396 0.01), 1.96 (significance level = 0.05) and 1.65 (significance level = 0.1) (Darko et al., 2018). The
397 paths testing hypotheses H1, H2, H4, and H7 were significant because they had t-values within the
398 range 1.65, 1.96, or 2.58 (see Table 8). However, only hypotheses H1, H4, and H7 were supported
399 because it is hypothesized that each measure construct will have a negative relationship with the
400 stressors. Likewise, because the path testing H2 had a positive association with the stressors, H2
401 was not supported. The positive association shows that although experts perceive that
402 implementing secondary intervention measures to build coping and resilience would more likely
403 improve psychological health among construction personnel, increasing the intensity of the
404 measures alone will not necessarily mitigate the stressors.

405 *Insert Table 8 here*

406 The model depicting the impact of the measures on stressors had an R^2 of 0.561, as shown
407 in Figure 1. The R^2 indicates a satisfactory predictive ability of the model (Hair et al., 2014). The
408 higher the path coefficient, the greater the influence of the independent variable (measure
409 construct) on the dependent variable (the stressors). As noted in Darko et al. (2018), path co-
410 efficient ≤ 0.3 indicates a weak influence, $0.3 < \alpha \leq 0.5$ indicates a moderate influence, and
411 $0.5 < \alpha \leq 1.0$ indicates a strong influence. Hypotheses H1, H2, H4 had a path coefficient of 0.639,

412 0.559, 0.697, indicating a strong influence on the stressors. Whereas the path linking workplace
413 justice-related measures to the stressors (H7) with path co-efficient 0.462 had a moderate influence
414 on the stressors.
415
416 ***Post-survey interviews***
417 All interviewees agreed to the findings of the survey, found them reasonable and practicable. They
418 also provided explanations on the measures that had a lower ranking (i.e., mean score below 3.00).
419 As regards IM02, an interviewee (#2) who is a senior construction project manager, gave an
420 example.
421 *"As one of my organization's mental health and well-being policies, we created indoor games at*
422 *the head office held every Thursday by 4 pm while Fridays are for workout aerobic dance section.*
423 *However, most site managers who need it are not always available. It is not enough to have such*
424 *policies; on-site personnel should be encouraged to join or have the arrangement at the site office"*
425 *(Interviewee #2).*
426 Regarding IM30, the interviewees agree that given the nature of the industry, hiring more
427 personnel depends on the volume of work, contract sum, and firm size. All experts agreed to the
428 findings regarding the job redesign measures (IM22, IM23, and IM24). However, interviewee #4
429 tried to explain the direction of the survey score for that measure construct.
430 *"Both IM22 and IM23 need to be adequately planned and subjected to rigorous experimentation,*
431 *and that is the reason for the lower mean score. In theory, it seems possible; we want it to work*
432 *like that. However, unlike other construction team members who are seldom on the job site, site*
433 *engineers or supervisors need to be around for total quality management, so the compressed*

workweek arrangement is more practical to be adopted than other job redesign measures" (Interviewee #4).

Discussion

Measures such as "celebrate employee's success", "better planning of work tasks and shifts", "give constructive feedbacks instead of reprimanding", "create policies to eliminate harassment" were perceived as most important in order to have a construction workplace that is psychologically healthy and safe. They comprise measures to boost employee morale, reduce job demand, eliminate justice, and build coping and resilience among on-site construction professionals. Thus, it highlights the need to adopt measures that are multimodal in nature. This finding corroborates Nwaogu and Chan (2021), where the measures ranked among the most essential to implement.

Construct 1: Stress control measures

The measures underlying this construct are secondary and tertiary interventions and include those instrumental in stress control among construction personnel. The PLS-SEM result did not support a negative association between the measures and stressors. This may highlight that secondary and tertiary interventions mainly directed to ease personnel reaction to a stressor are insufficient because some stressors will need primary intervention measures for them to be eliminated or reduced. Thus, this further draws attention to the need for an integrated approach to workplace intervention on mental health.

Irrespective of the PLS-SEM result, some of the measures in this construct ranked on the agreement scale. This corroborates Bowen et al. (2014) that recommended stress management workshops and Chan et al. (2020) that posited the need for employee assistance programs (EAPs)

457 in the construction industry to address stressors. Likewise, Gullestrup (2019) used mental health
458 literacy to shift beliefs regarding suicide and mental health in the Australian construction industry.
459 Measures built around employee assistance models hold an effective intervention to enhance
460 mental health and well-being in the workplace (Saju et al., 2019), as they can be preventive or
461 reactive (LaMontagne et al., 2014;Tan et al., 2014).

462 Although the experts from Hong Kong differed a little on the need to implement policies
463 for sustainable retirement plans, experts in other countries recommend it. This implies that, overall,
464 such a measure is essential. Considering the dependence of construction companies on project
465 availability, to mitigate the stress that arises from unplanned retirement or job loss, employers
466 should enlighten and enroll their personnel in a variety of available retirement schemes to drive
467 satisfaction benefits and productivity (Marcellus and Osadebe, 2014).

468 The ability to communicate about work stress has been suggested to increase awareness
469 about an individual's needs, the changes required in a workplace, and the selection of the best
470 mental health intervention (Havermans et al., 2018). Therefore promoting communication about
471 stress from the personnel is essential. Interventions like mental health literacy among construction
472 personnel should be implemented as they hold the ability to furnish employees with important
473 precursors to help-seeking, particularly the ability to recognize mental ill-health and identify
474 available intervention options (Moll, 2014).

475 ***Construct 2: Healthy coping and individual resilience-focused measures***

476 The measures underlying this construct are aimed at enhancing *healthy coping and building*
477 *individual resilience* among construction personnel. The measures that make up this factor are
478 secondary interventions. Tan et al. (2014) deduced that most organizations employed secondary
479 interventions to mitigate mental health problems among workers. However, while secondary

480 interventions assist in coping and resilience building, they are ineffective in modifying risk factors,
481 as their effect wears out in a short time (Joyce et al., 2016;LaMontagne et al., 2014). Consistent
482 with these findings, the structural equation modeling showed that efforts to increase *healthy coping*
483 *and individual resilience* did not mitigate the stressors.

484 With all the measures in this construct ranking on the agreement scale, this result is
485 consistent with prior studies (see Moll, 2014;Chen et al., 2017), showing that these measures are
486 essential to improving psychological health. Coping with mental health problems involves several
487 techniques, including seeking professional help or seeking social support from colleagues, and
488 family members (Moll, 2014;Nwaogu et al., 2021;Nwaogu and Chan, 2021). Therefore, measures
489 to eradicate stigma as well as stimulate helping behaviors towards people suffering from mental
490 health problems in the construction workplace should be implemented or reinforced. This is
491 expedient as poor support from managers has been reported to double the risk of a mental ill-health
492 related sickness (Moll, 2014). Colleagues are a significant stakeholder that may first notice
493 changes in an employee's behaviors, and their attitude can have a considerable impact on whether
494 an employee is supported or discriminated against when they are unwell (Moll, 2014).

495 The level of an individual's resilience predicts the possibility of developing mental health
496 problems; thus, enhancing resilience appears to be a good target for indicated interventions
497 (Glozier and Brain and Mind Centre, 2017). Therefore, empowering employees to be more
498 resilient through resilience training, wellness programs in workplaces, and competence training
499 can allow construction personnel to build relevant resilience and stress-coping skills for mental
500 health management. Additionally, consistent with this study, Havermans et al. (2018) found that
501 competence training will help employees cope with stress, set boundaries, and deal with changes.
502 Pointing to the need for competence training, Haynes and Love (2004) found that older

503 construction personnel suffered job insecurity owing to the difficulty in adopting emerging
504 technologies. Similarly, in this study, providing employees' with competence training ranked the
505 fourth significant measure needed for achieving a psychologically healthy workplace in the
506 construction industry. Hence, appropriate competence training is desirable to help personnel cope
507 adequately with changes and trends in technological applications relevant to their jobs, such as the
508 use of cutting-edge technology in carrying out their responsibilities.

509 ***Construct 3: Workplace (organizational) justice-focused measures***

510 The measures in this component are mainly primary interventions related to ensuring
511 organizational justice in the construction workplace. The PLS-SEM result supported a negative
512 association between the measures and the stressors. The findings corroborate Nwaogu et al. (2019),
513 which recommended measures to eliminate organizational injustice in the construction workplace.
514 Likewise, among the measures in this group, enforcing policies to mitigate harassment appeared
515 to be an effective measure as they ranked in the top five, pointing to its importance in creating a
516 psychologically healthy and safe construction workplace. The threatening of staff with
517 disengagement when they make mistakes can lead to fear of job insecurity and job dissatisfaction.
518 Thus, measures to reduce this form of workplace injustice are pertinent, as concerns over job
519 insecurity have been found to cause increased poor mental health (Chan et al., 2020). Therefore,
520 ensuring organizational justice through promoting civility can act as a resource to improve mental
521 health and well-being in the construction workplace.

522 ***Construct 4: Job demand and satisfaction focused measures***

523 The measures in this construct are mainly primary intervention measures. The PLS-SEM result
524 supported a negative association between the measures in this construct and the stressors. The path
525 coefficient signaled that the construct is perceived to have a strong impact on mitigating the

stressors. This signifies that primary intervention measures that will mitigate stressors and the onset of mental health problems are essential and should be part of mental health intervention. These findings are consistent with Havermans et al. (2018), who found that better planning of work tasks and hiring more personnel are required to effectively reduce job stress. Likewise, in this study, better planning of work tasks ranked in the top five measures needed to create a psychologically healthy construction workplace. However, regarding hiring more personnel, the interviewees explained that given the nature of the industry, the intervention measure would be highly dependent on the volume of work, contract sum, and firm size.

In order to sufficiently mitigate job demand as a risk factor, it is worth conducting an employee satisfaction survey so construction personnel can communicate what workplace psychosocial stressors may impact their mental health and well-being. Thus, corroborating Bowen et al. (2014) that recommended conducting stress appraisal as a way for employers to understand the effect of occupational stress on construction personnel. Also, Havermans et al. (2018) found that there is a need for meetings focused on work stress with employee satisfaction surveys as an effort to prevent work stress. Although employee satisfaction is highly subjective, the information gathered on an individual-to-individual basis will inform the organization on appropriate job demand risk factors that need attention and guide the initiation of necessary measures. Employee satisfaction can be achieved through different channels, particularly minimizing job demand, increasing job control, and providing job support. Ensuring employee satisfaction can positively impact job performance, family satisfaction, and performance (Bakotić, 2016;Wu et al., 2016).

Construct 5: Employee morale and engagement-focused measures

The construct is characterized by primary and secondary intervention measures that are related to building employee morale and improving job engagement. This construct comprises measures that

549 ranked the highest, consistent with Nwaogu and Chan (2021). The PLS-SEM result supported a
550 negative association between the measures in this construct and the stressors. Also, the path
551 coefficient showed that the construct is perceived to have a strong impact on mitigating the
552 stressors, pointing to the significance of multimodal measures that incorporate primary and
553 secondary interventions. Havermans et al. (2018) deduced that employees perceived that an
554 organizational culture that celebrates successes helped mitigate job stress. Likewise, in this study,
555 celebrating employees' success ranked the most significant measure. Therefore, construction
556 organizations should implement policies that celebrate the achievements of employees.
557 A positive organizational culture that offers employees a sense of respect and encourages
558 constructive criticisms can reduce fears of job insecurity and unemployment (Bryson and Duncan,
559 2018;Havermans et al., 2018). Bryson and Duncan (2018) reported that younger employees
560 required a supportive approach when communicating feedback on job performance, unlike older
561 construction personnel. The differences in communication styles caused more stress to younger
562 personnel leading to absenteeism. Maintaining a supportive organizational culture that creates a
563 feeling of unity, constructive criticism, and focuses on people holds the potential to prevent work
564 stress (Havermans et al., 2018). A primary measure for minimizing job stress for positive mental
565 health achievement is to design job roles aligned with employees' deeply embedded interests; a
566 technique referred to as job sculpting.
567 Job sculpting has proved effective in changing the perception of job stress, boosting
568 morale, job performance, job satisfaction, and employee engagement (Hlanganipai and Mazanai,
569 2014;VanAntwerp and Wilson, 2018). Hlanganipai and Mazanai (2014) found that most
570 employees were satisfied with job sculpting and recommended its adoption. Similarly, the result
571 of this study showed that the respondents recommend the adoption of job sculpting as a measure

572 to improve mental health within the construction industry. It is expedient that the construction
573 industry becomes more transparent by collecting suggestions on an employee's embedded life
574 interest to enable building an aspect of the job responsibility to capture such interest. Therefore,
575 ensuring a supportive organizational culture within the construction industry could boost personnel
576 morale and positively affect mental health and well-being.

577 ***Construct 6: Job redesign and control focused measures***

578 The measures in this component are mainly primary interventions aimed at redesigning the work.
579 The measures also allow improving job control and mitigating work-life imbalance. However, the
580 PLS-SEM result did not support a negative association between the measures and the stressors.
581 This may be because some measures in the construct scored the lowest on mean score analysis,
582 which may point to the feasibility concern about adopting those measures for site-based
583 construction professionals as they need to be present for supervisory roles. Nonetheless, similar to
584 Nwaogu and Chan (2021), the measure that involves employing compressed working week
585 (CWW) arrangement to balance work and life ranked the highest in this construct. The findings
586 further corroborate Lingard et al. (2007), who found CWW to positively impact work-life balance
587 and be practicable in the construction industry. CWW ranked within the top ten measures with no
588 difference in experts' perception about its importance, indicating that the experts believe that
589 adopting CWW arrangement is more accessible for on-site construction personnel. As emphasized
590 by interviewee #4, the result implies that implementing job crafting and flexitime in the
591 construction industry for site engineers or supervisors could be possible but needs adequate
592 planning. This finding is in line with LaMontagne et al. (2014) that opined that the measures to
593 improve job control for clerks would differ from those to achieve the same for managers.

Therefore, due to the industry's culture, adopting the CWW arrangement is more feasible for construction organizations to improve job perceptions and the well-being of site supervisors.

Construct 7: Interpersonal relationship related measures

This construct contains measures that are related to improving interpersonal relationships between employees. The PLS-SEM result did not support a negative association between the measures and the stressors. This may be because the experts' responses differed on two measures in the construct. However, one of the measures ranked in the top ten. This signifies the need to improve interpersonal relationships in order to mitigate adverse psychological outcomes in personnel. This finding is consistent with Chen et al. (2017) on occupational health in the construction industry. Consequently, to create quality interpersonal relationships at work, communication and mutual trust need to be encouraged. Furthermore, barriers to interpersonal relationships, such as difficulties in information sharing and complex organizational culture, have to be removed (Migowski et al., 2018). Creating a quality relationship in the workplace can provide compassion, predict job performance, and promote mental health (Chu, 2017). Therefore, measures to effectively improve interpersonal relationships like those itemized in this construct can boost trust, confidence, and a sense of security in the construction industry.

Limitation of the study

This study is not without limitations. One of which is that only an online questionnaire survey was employed to gather data from the experts, and the sample was relatively small, relying on the use of purposive sampling techniques. Therefore, these findings likely do not generalize to the entire construction industry, highlighting the need to further investigate these findings. Furthermore, since the survey relied mainly on international experts recruited through email addresses retrieved

from various websites, there was no access to other contact details to aid rigorous qualitative inquiry. Moreover, this study is part of a broader research effort, and extensive qualitative structured interviews will be conducted as the second stage of data collection to aid in expanding on the findings presented here. For instance, this will include investigating workable examples of on-site construction activities that could permit flexible work arrangements, especially those that could afford the personnel some form of job control.

Although this study offers an initial step to inform policies necessary to improve mental health, from a broad perspective of experts within the industry, further studies are needed to investigate which of the group of measures are of urgency to the context of specific countries. Such studies will allow for comparability by employers and human resources managers engaged in decision-making process. This study should be extended by examining the perception of onsite personnel on the combination of measures required in the construction workplace to improve their mental health. The result will aid comparability and the identification of possible bias of the experts and employees concerning the intervention measures. Finally, while the respondents for this study emerged from several countries, the result may not generalize to those climes because of the low response. Nonetheless, the result may serve as a guide to the industry at large.

Conclusions

This study investigated the mix of measures that can improve mental health among on-site construction personnel engaged as site engineers or supervisors from the perspectives of a purposive sample of experts in the construction industry. Based on the findings, the most significant measures needed to improve mental health among the personnel include “celebrate employee success,” “better planning of tasks and work shifts,” “give constructive feedbacks instead of reprimanding” and “create policies to eliminate harassment”. Further analysis using

640 structural equation modeling technique signals the importance of primary intervention measures
641 in a multimodal intervention.

642 The study also revealed opportunities for job redesign and control measures, with the
643 compressed workweek arrangement as the most viable intervention measure for mental health
644 promotion among on-site construction personnel. The implementation of these measure constructs
645 could help ensure that: (i) risk factors are minimized or modified, (ii) the positive aspect of the
646 work and worker's strength is strengthened, and (iii) mental health problems are addressed
647 irrespective of the cause. Therefore, fulfilling the three threads of the integrated mental health
648 framework.

649 The seven components were developed as measure constructs needed to improve mental
650 health by modifying risk factors related to job demand, job control, workplace support,
651 organization injustice, individual coping, family, welfare, and socio-economic status. This study
652 is novel as it adapted a mix of measures from an integrated approach to inform practicable
653 construction context-specific decision making for improving mental health. Another novelty of
654 this study is the introduction of job sculpting to the construction context and body of occupational
655 health as a measure to boost morale and satisfaction. This study bridges the gap between
656 knowledge in occupational health literature and the practicability of the intervention measures in
657 the construction context. The lower mean value of "job crafting", "flexible work arrangement
658 (particularly flexitime)", and "hiring of more on-site personnel" may indicate that thorough
659 planning and intervention studies are needed.

660 Based on the findings of this study, it can be stated that all seven measure constructs are
661 significant and practicable for improving the mental health of on-site personnel in the construction
662 workplace. However, some measures within the job redesign and control measure construct will

need proper planning before implementation. As it was deduced that while *CWW arrangement* is more practicable, *job crafting* and *flexible work arrangement (particularly flexitime) measures* would need thorough planning and intervention studies to determine their viability among the category of construction personnel considered in this study. Therefore, although the job redesign and control-focused measures are significant, implementing all the measures in the construct may be less practicable. As regard implementation within the integrated approach to mental health, construction firms will benefit by selecting at least two measures from each of the constructs for implementation.

This study has helped provide valuable initial evidence related to primary, secondary, and tertiary intervention measures that can be implemented in the construction industry at organizational and individual levels to create a psychologically safe and healthy workplace. The measures fit into the integrated intervention approach for sustainable mental health promotion and management. These measures can guide policy-making in the construction workplace to boost job satisfaction, good mental health, well-being, safety, and performance. Furthermore, the study provides a compass to guide construction organizations in determining which measures are yet to be implemented in their workplaces and need to be explored.

More studies that will further examine the validity of the measures in mitigating the stressors and perceptions of experts using SEM techniques are recommended. Finally, future studies will benefit from determining how these measures could apply to varying firm sizes across different contexts, including developed and developing context settings, and importantly, the resulting impact of these measures on employees' mental health and well-being.

Data Availability Statement

Some or all data, models, or code that support the findings of this study are available from the corresponding author upon reasonable request.

Acknowledgments

This research is part of a doctoral study financially facilitated by the Hong Kong Polytechnic University. Thus, studies that share related backgrounds but with different scopes and methodologies may be produced.

References

Aguinis, H.; Gottfredson, R. K. & Joo, H. 2012. Using performance management to win the talent war. *Business Horizons,* 55**,** 609-616. https://doi.org/10.1016/j.bushor.2012.05.007

Ahola, K.; Vuori, J.; Toppinen-Tanner, S.; Mutanen, P. & Honkonen, T. 2012. Resource-enhancing group intervention against depression at workplace: who benefits? A randomised controlled study with a 7-month follow-up. *Occup Environ Med,* 69**,** 870-876

Ajayi, S. O.; Jones, W. & Unuigbe, M. 2019. Occupational stress management for UK construction professionals: Understanding the causes and strategies for improvement. *Journal of Engineering, Design and Technology,* 17**,** 819-832. 10.1108/JEDT-09-2018-0162

Bakker, A. B. & Demerouti, E. 2007. The Job Demands-Resources model: state of the art. *Journal of Managerial Psychology,* 22**,** 309-328. https://doi.org/10.1108/02683940710733115

Bakker, A. B. & Demerouti, E. 2017. Job demands–resources theory: Taking stock and looking forward. *Journal of Occupational Health Psychology,* 22**,** 273

Bakotić, D. 2016. Relationship between job satisfaction and organisational performance. *Economic Research-Ekonomska Istraživanja,* 29**,** 118-130. 10.1080/1331677X.2016.1163946

Boschman, J.; Van Der Molen, H.; Sluiter, J. & Frings-Dresen, M. 2013. Psychosocial work environment and mental health among construction workers. *Applied Ergonomics,* 44**,** 748-755. https://doi.org/10.1016/j.apergo.2013.01.004

Bowen, P.; Edwards, P. & Lingard, H. 2013. Workplace stress among construction professionals in South Africa: The role of harassment and discrimination. *Engineering, Construction and Architectural Management,* 20**,** 620-635

Bowen, P.; Govender, R. & Edwards, P. 2014. Structural equation modeling of occupational stress in the construction industry. *Journal of Construction Engineering and Management,* 140**,** 04014042. https://doi.org/10.1061/(ASCE)CO.1943-7862.0000877

Bryson, K. & Duncan, A. 2018. Mental health in the construction industry scoping study. *In:* SR411, B. S. R. (ed.). Judgeford, New Zealand: BRANZ Ltd.

Burke, R. J. 2019. Creating psychologically healthy workplaces. *Creating psychologically healthy workplaces.* Edward Elgar Publishing.

721 Chan, A. P. & Adabre, M. A. 2019. Bridging the gap between sustainable housing and affordable
722 housing: The required critical success criteria (CSC). *Building and Environment,* 151**,** 112-
723 125
724 Chan, A. P. C.; Nwaogu, J. M. & Naslund, J. A. 2020. Mental Ill-Health Risk Factors in the
725 Construction Industry: Systematic Review. *Journal of Construction Engineering and*
726 *Management,* 146**,** 04020004. https://doi.org/10.1061/(ASCE)CO.1943-7862.0001771
727 Chen, Y.; Mccabe, B. & Hyatt, D. 2017. Impact of individual resilience and safety climate on
728 safety performance and psychological stress of construction workers: A case study of the
729 Ontario construction industry. *Journal of safety research,* 61**,** 167-176
730 Cheung, C. M. & Zhang, R. P. 2020. How organizational support can cultivate a multilevel safety
731 climate in the construction industry. *Journal of Management in Engineering,* 36**,** 04020014
732 Chu, L. C. 2017. Impact of Providing Compassion on Job Performance and Mental Health: The
733 Moderating Effect of Interpersonal Relationship Quality. *Journal of Nursing Scholarship,*
734 49**,** 456-465. 10.1111/jnu.12307
735 Darko, A. & Chan, A. P. C. 2018. Strategies to promote green building technologies adoption in
736 developing countries: The case of Ghana. *Building and Environment,* 130**,** 74-84.
737 https://doi.org/10.1016/j.buildenv.2017.12.022
738 Darko, A.; Chan, A. P. C.; Yang, Y.; Shan, M.; He, B.-J. & Gou, Z. 2018. Influences of barriers,
739 drivers, and promotion strategies on green building technologies adoption in developing
740 countries: The Ghanaian case. *Journal of Cleaner Production,* 200**,** 687-703
741 Enns, J.; Holmqvist, M.; Wener, P.; Halas, G.; Rothney, J.; Schultz, A.; Goertzen, L. & Katz, A.
742 2016. Mapping interventions that promote mental health in the general population: a
743 scoping review of reviews. *Preventive medicine,* 87**,** 70-80
744 Flo, J.; Landmark, B.; Hatlevik, O. E. & Fagerström, L. 2018. Using a new interrater reliability
745 method to test the modified Oulu Patient Classification instrument in home health care.
746 *Nursing open,* 5**,** 167-175
747 Glozier, N. & Brain and Mind Centre 2017. Review of evidence of interventions to reduce mental
748 ill-health in the workplace. *In:* SAFEWORK (ed.). New South Wales: SafeWork NSW.
749 Gullestrup, J. 2019. To study workplace and industry approaches to mental health and suicide
750 prevention globally. Queensland.
751 Gullestrup, J.; Lequertier, B. & Martin, G. 2011. MATES in construction: impact of a multimodal,
752 community-based program for suicide prevention in the construction industry.
753 *International journal of environmental research and public health,* 8**,** 4180-4196
754 Hair, J. J.; Sarstedt, M.; Hopkins, L. & Volker, G. K. 2014. Partial least squares structural equation
755 modeling (PLS-SEM): An emerging tool in business research. *European Business Review,*
756 26**,** 106-121. 10.1108/EBR-10-2013-0128
757 Hair, J. J. F.; Hult, G. T. M.; Ringle, C. & Sarstedt, M. 2016. *A primer on partial least squares*
758 *structural equation modeling (PLS-SEM)*, Sage publications.
759 Hanisch, S. E.; Twomey, C. D.; Szeto, A. C.; Birner, U. W.; Nowak, D. & Sabariego, C. 2016.
760 The effectiveness of interventions targeting the stigma of mental illness at the workplace:
761 a systematic review. *BMC psychiatry,* 16**,** 1
762 Havermans, B. M.; Brouwers, E. P.; Hoek, R. J.; Anema, J. R.; Van Der Beek, A. J. & Boot, C. R.
763 2018. Work stress prevention needs of employees and supervisors. *BMC public health,* 18**,**
764 642

765 Haynes, N. S. & Love, P. E. 2004. Psychological adjustment and coping among construction
766 project managers. *Construction management and economics,* 22**,** 129-140
767 Henseler, J. 2017. Partial Least Squares Path Modeling. *In:* LEEFLANG, P. S. H., WIERINGA,
768 J. E., BIJMOLT, T. H. A. & PAUWELS, K. H. (eds.) *Advanced Methods for Modeling*
769 *Markets.* Cham: Springer International Publishing.
770 Henseler, J.; Ringle, C. M. & Sarstedt, M. 2015. A new criterion for assessing discriminant validity
771 in variance-based structural equation modeling. *Journal of the Academy of Marketing*
772 *Science,* 43**,** 115-135. 10.1007/s11747-014-0403-8
773 Hlanganipai, N. & Mazanai, M. 2014. Career management practices: Impact of work design on
774 employee retention. *Mediterranean Journal of Social Sciences,* 5**,** 21-21
775 Hwang, B.-G.; Ngo, J. & Her, P. W. Y. 2020. Integrated Digital Delivery: Implementation status
776 and project performance in the Singapore construction industry. *Journal of Cleaner*
777 *Production***,** 121396
778 Johari, S. & Jha, K. N. 2020. Impact of work motivation on construction labor productivity.
779 *Journal of Management in Engineering,* 36**,** 04020052
780 Joyce, K.; Pabayo, R.; Critchley, J. A. & Bambra, C. 2010. Flexible working conditions and their
781 effects on employee health and wellbeing. *Cochrane database of systematic reviews,*
782 Joyce, S.; Modini, M.; Christensen, H.; Mykletun, A.; Bryant, R.; Mitchell, P. B. & Harvey, S. B.
783 2016. Workplace interventions for common mental disorders: a systematic meta-review.
784 *Psychological medicine,* 46**,** 683-697. https://doi.org/10.1017/S0033291715002408
785 Lamontagne, A. D.; Martin, A.; Page, K. M.; Reavley, N. J.; Noblet, A. J.; Milner, A. J.; Keegel,
786 T. & Smith, P. M. 2014. Workplace mental health: developing an integrated intervention
787 approach. *BMC psychiatry,* 14**,** 131
788 Lamontagne, A. D.; Shann, C. & Martin, A. 2018. Developing an integrated approach to workplace
789 mental health: a hypothetical conversation with a small business owner. *Annals of work*
790 *exposures and health,* 62**,** S93-S100
791 Leon, A. C. 1998. 3.12 - Descriptive and Inferential Statistics. *In:* BELLACK, A. S. & HERSEN,
792 M. (eds.) *Comprehensive Clinical Psychology.* Oxford: Pergamon.
793 Leung, M.-Y.; Liang, Q. & Olomolaiye, P. 2016. Impact of Job Stressors and Stress on the Safety
794 Behavior and Accidents of Construction Workers. *Journal of Management in Engineering,*
795 32**,** 04015019. https://doi.org/10.1061/(ASCE)ME.1943-5479.0000373
796 Liang, Q.; Leung, M.-Y. & Zhang, S. 2021. Examining the Critical Factors for Managing
797 Workplace Stress in the Construction Industry: A Cross-Regional Study. *Journal of*
798 *Management in Engineering,* 37**,** 04021045
799 Lingard, H.; Brown, K.; Bradley, L.; Bailey, C. & Townsend, K. 2007. Improving employees'
800 work-life balance in the construction industry: Project alliance case study. *Journal of*
801 *Construction Engineering and Management,* 133**,** 807-815
802 Marcellus, I. O. & Osadebe, N. O. 2014. A review of the promises and challenges of the 2004
803 pension reform in Nigeria. *Mediterranean Journal of Social Sciences,* 5**,** 472-482.
804 10.5901/mjss.2014.v5n15p472
805 Mckight, P. E. & Najab, J. 2010. Kruskal‐wallis test. *The corsini encyclopedia of psychology***,** 1-
806 1
807 Migowski, E. R.; Oliveira Júnior, N.; Riegel, F. & Migowski, S. A. 2018. Interpersonal
808 relationships and safety culture in Brazilian health care organisations. *Journal of Nursing*
809 *Management,* 26**,** 851-857. 10.1111/jonm.12615

Milner, A.; Maheen, H.; Currier, D. & Lamontagne, A. D. 2017. Male suicide among construction workers in Australia: a qualitative analysis of the major stressors precipitating death. *BMC public health,* 17**,** 584

Moll, S. E. 2014. The web of silence: a qualitative case study of early intervention and support for healthcare workers with mental ill-health. *BMC public health,* 14**,** 138

Murison, R. 2016. Chapter 2 - The Neurobiology of Stress. *In:* AL'ABSI, M. & FLATEN, M. A. (eds.) *Neuroscience of Pain, Stress, and Emotion.* San Diego: Academic Press.

Nwaogu, J. M. 2021. *An Integrated Approach to Improve Mental Health Among Construction Personnel in Nigeria.* Ph.D. A thesis submitted in partial fulfilment of the requirements for the degree of Doctor of Philosophy, The Hong Kong Polytechnic University. [Accessed.

Nwaogu, J. M. & Chan, A. P. C. 2021. Evaluation of multi-level intervention strategies for a psychologically healthy construction workplace in Nigeria. *Journal of Engineering, Design and Technology,* 19**,** 509-536. https://doi.org/10.1108/JEDT-05-2020-0159

Nwaogu, J. M.; Chan, A. P. C.; Hon, C. K. H. & Darko, A. 2019. Review of global mental health research in the construction industry: A science mapping approach. *Engineering, Construction and Architectural Management,* 27**,** 385-410. https://doi.org/10.1108/ECAM-02-2019-0114

Nwaogu, J. M.; Chan, A. P. C. & Tetteh, M. O. 2021. Staff resilience and coping behavior as protective factors for mental health among construction tradesmen. *Journal of Engineering, Design and Technology,* ahead-of-print. 10.1108/JEDT-11-2020-0464

Owusu, E. K.; Chan, A. P.; Shan, M. & Pärn, E. 2020. An empirical study on construction process corruption susceptibility: A vignette of international expertise. *Science and engineering ethics,* 26**,** 325-349

Pignata, S.; Boyd, C. M.; Winefield, A. H. & Provis, C. 2017. Interventions: Employees' perceptions of what reduces stress. *BioMed Research International,* 2017. 10.1155/2017/3919080

Pignata, S.; Winefield, A. H.; Boyd, C. M. & Provis, C. 2018. A qualitative study of HR/OHS stress interventions in Australian universities. *International journal of environmental research and public health,* 15**,** 103

Rebar, A. L. & Taylor, A. 2017. Physical activity and mental health; it is more than just a prescription. *Mental Health and Physical Activity,* 13**,** 77-82

Rees-Evans, D. 2020. Understanding Mental Health in the Built Environment. Bracknell, UK: Chartered Institute of Building.

Saju, M.; Rajeev, S.; Scaria, L.; Benny, A. M. & Anjana, N. 2019. Mental health intervention at the workplace: A psychosocial care model. *Cogent Psychology,* 6**,** 1601606

Schaufeli, W. B. & Taris, T. W. 2014. A critical review of the job demands-resources model: Implications for improving work and health. *Bridging occupational, organizational and public health.* Springer.

Sinclair, M.; Kernohan, W. G.; Begley, C. M.; Luyben, A. G. & Gillen, P. A. 2017. Interventions for prevention of bullying in the workplace. *The Cochrane Database of Systematic Reviews,* 2017

Siu, O.-L.; Phillips, D. R. & Leung, T.-W. 2004. Safety climate and safety performance among construction workers in Hong Kong: The role of psychological strains as mediators. *Accident Analysis & Prevention,* 36**,** 359-366

Sunindijo, R. Y. & Kamardeen, I. 2017. Work Stress Is a Threat to Gender Diversity in the Construction Industry. *Journal of Construction Engineering and Management,* 143**,** 04017073. https://doi.org/10.1061/(ASCE)CO.1943-7862.0001387

Taber, K. S. 2018. The use of Cronbach's alpha when developing and reporting research instruments in science education. *Research in Science Education,* 48**,** 1273-1296

Tan, L.; Wang, M.-J.; Modini, M.; Joyce, S.; Mykletun, A.; Christensen, H. & Harvey, S. B. 2014. Preventing the development of depression at work: a systematic review and meta-analysis of universal interventions in the workplace. *BMC medicine,* 12**,** 74

Vanantwerp, J. J. & Wilson, D. 2018. Differences in motivation patterns among early and mid-career engineers. *Journal of Women and Minorities in Science and Engineering,* 24**,** 227-259. 10.1615/JWOMENMINORSCIENENG.2018019616

Wu, G.; Duan, K.; Zuo, J.; Yang, J. & Wen, S. 2016. System Dynamics Model and Simulation of Employee Work-Family Conflict in the Construction Industry. *International Journal of Environmental Research and Public Health,* 13**,** 1059

Yip, B. & Rowlinson, S. 2009. Job burnout among construction engineers working within consulting and contracting organizations. *Journal of Management in Engineering,* 25**,** 122-130. https://doi.org/10.1061/(ASCE)0742-597X(2009)25:3(122)

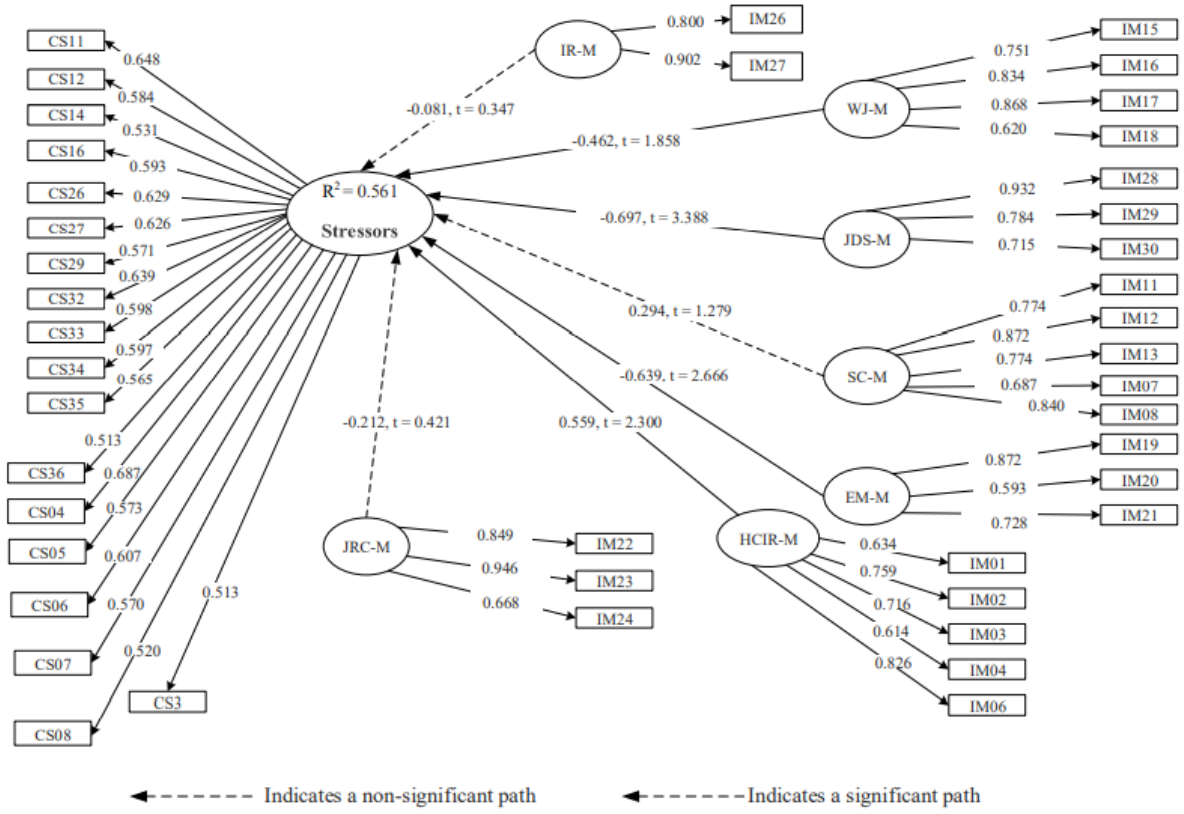

Figure 1: The Final Structural Equation Model

Table 1. The potential mix of strategies to improve mental health in the construction industry

No.	Measures to improve mental health	References	Type of intervention
	Healthy coping and individual resilience-focused measures		Secondary
IM01	Empower staff to be individually more resilient through resilience training programs	Enns et al. (2016); Tan et al. (2014)	
IM02	Introduce wellness programs to workplaces/site offices	Burke (2019); Enns et al. (2016)	
IM03	Promote talks about anti-stigma (anti-stigma campaign)	Gullestrup et al. (2011); Hanisch et al. (2016)	
IM04	Stimulate helping behaviours towards people suffering from mental health problems through mental health first aid	LaMontagne et al. (2018), Gullestrup et al. (2011)	
IM05	Put measures in place for exercises such as exercise weekends	Havermans et al. (2018); Enns et al. (2016)	
IM06	Provide employees with competence training	Pignata et al. (2018); Enns et al. (2016)	
	Stress control focused measures		Secondary, Tertiary
IM07	Promote mental health awareness through literacy programmes	LaMontagne et al. (2018), Gullestrup et al. (2011)	
IM08	Provide practical stress management training	Havermans et al. (2018); Enns et al. (2016)	
IM09	Put better education policies in place (e.g., providing subsidies for / encouraging employee career development	Pignata et al. (2018); Enns et al. (2016)	
IM10	Conduct regular team meetings with supervisors and subordinates focused on addressing work stress	Havermans et al. (2018)	
IM11	Promote communication about work stress from supervisors or subordinates without penalty	Pignata et al. (2018); Havermans et al. (2018)	
IM12	Offer assistance to non-work stressors such as marital challenges	Pignata et al. (2018); LaMontagne et al. (2014)	
IM13	Provide aid for stressors such as financial challenges	Pignata et al. (2018); LaMontagne et al. (2014)	
IM14	Offer a sustainable retirement plan for employees	Pignata et al. (2018); LaMontagne et al. (2014)	
	Workplace (organizational) justice-focused measures		Primary
IM15	Create policies to eliminate bullying	Pignata et al. (2018); Sinclair et al. (2017)	
IM16	Create policies to eliminate harassment	Pignata et al. (2018)	
IM17	Promote equality policies irrespective of gender, and age	Pignata et al. (2018); Enns et al. (2016)	
IM18	Reduce threatening of staff with disengagement when they make mistakes	Havermans et al. (2018)	
	Employee morale and engagement-focused strategies		Primary, Secondary
IM19	Promote employees' deeply embedded life interest (i.e., job sculpting)	Hlanganipai and Mazanai (2014); Aguinis et al. (2012)	
IM20	Give constructive feedback instead of reprimanding	Havermans et al. (2018)	
IM21	Celebrate employee's success	Havermans et al. (2018)	
	Job redesign and control focused measures		Primary
IM22	Employees should be allowed some flexibility to design their job roles and tasks while, human resources, approves it inline with the job position and goals of the organization (i.e., job crafting)	Pignata et al. (2018); Joyce et al. (2010)	
IM23	The workplace should allow site employees' to a flexible work schedule, with regards to work time and duration with no intention to reduce productivity or performance (i.e. flexitime)	Pignata et al. (2018); Joyce et al. (2010)	
IM24	Offer employee's opportunities to balance work and life using compressed working week arrangements	Pignata et al. (2018), Lingard et al. (2007)	
	Interpersonal relationship-related measures		Primary, Secondary
IM25	Ensure swift conflict resolution	Havermans et al. (2018)	
IM26	Supporting improved relationships at work	Enns et al. (2016); Ahola et al. (2012)	
IM27	Put in place measures that increase cooperation between colleagues	Pignata et al. (2018); Havermans et al. (2018)	
	Job demand and satisfaction focused measures		Primary
IM28	Allow the taking of regular breaks to enable rest	Havermans et al. (2018)	
IM29	Better planning of work tasks and shifts	Havermans et al. (2018)	
IM30	Hire more personnel to reduce the workload	Havermans et al. (2018)	
IM31	Conduct employee satisfaction surveys	Havermans et al. (2018)	

Table 2. Stressors of mental health in the construction workplace

Code	Stressors of mental health
CS01	Physical illness
CS02	Nature of work causing increased mental demand
CS03	Hours worked per day (in excess of 60hrs per week)
CS04	Work overload (too much quantity of work)
CS05	Increased work speed
CS06	Little opportunity/ability to participate in decision making
CS07	Little social support from colleagues/immediate supervisors
CS08	Little relationship with colleagues/co-workers
CS09	Occupational injury/hazards
CS10	Poor working conditions (such as no leave, or leave without allowances, no housing allowances)
CS11	Job insecurity (fear and/or uncertainty about the work)
CS12	Strict adherence to the time or schedule (you cannot decide the timing for executing a task)
CS13	Fatigue resulting from work causing poor sleep and recovery
CS14	Criticisms from boss and colleagues
CS15	Lack of feedback mechanism in place
CS16	Low socioeconomic status (your position relative to your peers)
CS17	Over-promotion- the job task is more than your experience with no mentoring
CS18	Little task control, responsibility, or authority
CS19	Fear of failure
CS20	Interpersonal conflict
CS21	Musculoskeletal pain and injuries
CS22	Poor physical working condition
CS23	Lack of respect from subordinates
CS24	Workplace harassment
CS25	Workplace bullying
CS26	Work-home conflict/life imbalance (lack of time for family and other leisure due to work)
CS27	Low income causing financial insecurity
CS28	Wages not paid on time
CS29	Unsatisfactory living condition at home
CS30	Marital relationship or challenges
CS31	Poor family connection / relationships
CS32	Increased level of education not relative to getting better jobs & income leading to frustration and worries
CS33	Lack of medical subsidies for you or your family
CS34	Lack of subsidies for family travel fees
CS35	Lack of opportunity for career development while you still work on a particular job (such as furthering your studies)
CS36	Lack of opportunity for promotion
CS37	Lack of team or departmental or company social get togethers
CS38	Past traumatic experiences (death of a relative or accident or bad happening)

Note: CS – Cause of stress (i.e stressor)

Table 3. Responses from various countries based on purposive sample and years of experience.

Description	Number of responses	Percent
Countries		
South Africa	19	
Hong Kong SAR	18	
Singapore	14	
USA	11	
Total	62	
Years of experience		Percent
11-20	32	42.0
21-30	16	25.8
Over 30	20	32.3
Total	62	100.0
Professional practice		
Industry	56	90.3
Academia/Research institute	5	8.1
Total	62	100.0
Profession		
Architects	2	3.2
Civil Engineers	20	32.3
Quantity and Building Surveyors	2	3.2
Construction Managers	38	61.3
Total	62	100.0

Table 4. Mean score analysis of the measures to improve psychological health

No.	Measures to improve mental health	Ranking			Kruskal Wallis test	Cronbach Alpha
		Mean	SD	Rank		
	Healthy coping and individual resilience-focused measures					0.733
IM01	Empower staff to be individually more resilient through resilience training programs	3.11	0.603	23	0.339	
IM02	Introduce wellness programs to workplaces/site offices	3.40	0.586	5	0.079	
IM03	Promote talks about anti-stigma (anti-stigma campaign)	3.02	0.665	25	0.335	
IM04	Stimulate helping behaviours towards people suffering from mental health problems through mental health first aid	3.18	0.641	21	0.112	
IM05	Put measures in place for exercises such as exercise weekends	3.02	0.779	26	0.288	
IM06	Provide employees with competence training	3.37	0.550	7	0.506	
	Stress control focused measures					0.840
IM07	Promote mental health awareness through literacy programmes	3.31	0.715	18	**0.000**	
IM08	Provide practical stress management training	3.32	0.594	14	**0.027**	
IM09	Put better education policies in place (e.g., providing subsidies for / encouraging employee career development	3.32	0.594	15	0.527	
IM10	Conduct regular team meetings with supervisors and subordinates focused on addressing work stress	3.13	0.713	22	**0.027**	
IM11	Promote communication about work stress from supervisors or subordinates without penalty	3.21	0.704	20	0.126	
IM12	Offer assistance to non-work stressors such as marital challenges	3.00	0.768	27	0.099	
IM13	Provide aid for stressors such as financial challenges	2.95	0.798	29	**0.023**	
IM14	Offer a sustainable retirement plan for employees	3.31	0.667	17	0.150	
	Workplace (organizational) justice-focused measures					0.815
IM15	Create policies to eliminate bullying	3.35	0.704	10	0.231	
IM16	Create policies to eliminate harassment	3.42	0.714	4	**0.019**	
IM17	Promote equality policies irrespective of gender, and age	3.23	0.734	19	0.051	
IM18	Reduce threatening of staff with disengagement when they make mistakes	3.34	0.723	13	0.119	
	Employee morale and engagement-focused measures					
IM19	Promote employees' deeply embedded life interest (i.e., job sculpting)	3.34	0.651	12	0.103	0.638
IM20	Give constructive feedback instead of reprimanding	3.45	0.563	3	0.356	
IM21	Celebrate employee's success	3.58	0.529	1	0.148	
	Job redesign and control focused measures					0.809
IM22	Employees should be allowed some flexibility to design their job roles and tasks while, human resources, approves it inline with the job position and goals of the organization (i.e., job crafting)	2.90	0.824	30	0.162	
IM23	The workplace should allow site employees' to a flexible work schedule, with regards to work time and duration with no intention to reduce productivity or performance (i.e. flexitime)	2.95	0.777	28	0.639	
IM24	Offer employee's opportunities to balance work and life using compressed working week arrangements	3.37	0.607	8	0.270	
	Interpersonal relationship-related measures					0.701
IM25	Ensure swift conflict resolution	3.40	0.586	6	0.089	
IM26	Supporting improved relationships at work	3.34	0.477	11	**0.029**	
IM27	Put in place measures that increase cooperation between colleagues	3.31	0.561	16	**0.031**	
	Job demand and satisfaction focused measures					0.769
IM28	Allow the taking of regular breaks to enable rest	3.37	0.633	9	0.470	
IM29	Better planning of work tasks and shifts	3.56	0.562	2	0.914	
IM30	Hire more personnel to reduce the workload	2.89	0.851	31	0.658	
IM31	Conduct employee satisfaction surveys	3.03	0.746	24	**0.029**	

Note: SD = Standard Deviation; C.A = Cronbach's Alpha; Bold values are significant at p-value < 0.05; IM = Intervention measure

Table 5. Post hoc test following Kruskal-Wallis Test

Measures	Kruskal-Wallis test	Countries				Pairwise comparison	Significance level
		US	HK	SA	SG		
IM16	0.019	43.05	25.17	34.08	27.07	HK-US	0.023
IM26	0.029	29.61	29.16	43.55	27.64	SA-US	0.046
IM08	0.027	35.59	22.06	34.24	36.71	HK-SG	0.048
IM27	0.031	38.09	23.06	35.97	31.11	HK-SA	0.040
IM07	0.000	34.91	17.28	36.95	39.71	HK-US	0.032
IM10	0.027	39.23	22.33	35.82	31.36	HK-US	0.047
IM31	0.029	37.18	22.33	36.00	32.71	HK-SA	0.043
IM13	0.023	40.23	22.53	30.97	36.89	HK-US	0.035

Note: IM = Intervention measure; US = United States of America; SA = South African; SG = Singapore; HK = Hong Kong

Table 6. Measurement model evaluation

	Construct Code	Item code	Loading	Cronbach's Alpha	Composite Reliability	Average Variance Extracted (AVE)
Measures	EM-M	IM19	0.872	0.700	0.780	0.547
	VIF = 2.427	IM20	0.593			
		IM21	0.728			
	HCIR-M	IM01	0.634	0.799	0.837	0.510
	VIF = 2.268	IM02	0.759			
		IM03	0.716			
		IM04	0.614			
		IM06	0.826			
	IR-M	IM26	0.800	0.633	0.842	0.727
	VIF = 2.168	IM27	0.902			
	JDS-M	IM28	0.932	0.775	0.855	0.665
	VIF = 1.582	IM29	0.784			
		IM30	0.715			
	JRC-M	IM22	0.775	0.813	0.873	0.700
	VIF = 2.029	IM23	0.963			
		IM24	0.774			
	SC-M	IM11	0.774	0.863	0.893	0.627
	VIF =2.117	IM12	0.872			
		IM13	0.774			
		IM07	0.687			
		IM08	0.840			
	WJ-M	IM15	0.751	0.816	0.855	0.599
	VIF =2.168	IM16	0.834			
		IM17	0.868			
		IM18	0.620			
Stressors		CS11	0.648	0.816	0.855	0.599
		CS12	0.584			
		CS14	0.531			
		CS16	0.593			
		CS26	0.629			
		CS27	0.626			
		CS29	0.571			
		CS32	0.639			
		CS33	0.598			
		CS34	0.597			
		CS35	0.565			
		CS36	0.623			
		CS03	0.513			
		CS04	0.687			
		CS05	0.573			
		CS06	0.607			
		CS07	0.570			
		CS08	0.520			

Note: EM-M = Employee morale and engagement focused measures; HCIR-M = Healthy coping and individual resilience focused measures; IR-M = Interpersonal relationship related measures; JDS-M = Job demand and satisfaction focused measures; SC-M = Stress control focused measures; WJ-M = Workplace (organizational) justice focused measures.

Table 7. Discriminant Validity (HTMT Criterion)

	EM-M	HCIR-M	IR-M	JDS-M	JRC-M	SC-M	Stressors	WJ-M
EM-M								
HCIR-M	0.647							
IR-M	0.559	0.841						
JDS-M	0.701	0.494	0.474					
JRC-M	0.805	0.401	0.217	0.573				
SC-M	0.700	0.809	0.706	0.598	0538			
Stressors	0.346	0.248	0.282	0.289	0.212	0.197		
WJ-M	0.965	0.583	0.460	0.375	0.778	0.563	0.266	

Note: EM-M = Employee morale and engagement focused measures; HCIR-M = Healthy coping and individual resilience focused measures; IR-M = Interpersonal relationship related measures; JDS-M = Job demand and satisfaction focused measures; SC-M = Stress control focused measures; WJ-M = Workplace (organizational) justice focused measures.

Table 8. Direct relationship for testing the hypothesis.

Hypothetical path		Path coefficient			Level of	Hypothesis
H	Relationship		|t-value|	p-value	Significance	Decision
H1	EM-M → Stressors	-0.639	2.666	0.004**	Significant	Supported
H2	HCIR-M → Stressors	0.559	2.300	0.020*	Significant	Not Supported
H3	IR-M → Stressors	-0.081	0.347	0.880	Not Significant	Not supported
H4	JDS-M → Stressors	-0.697	3.388	0.000**	Significant	Supported
H5	JRC-M → Stressors	-0.212	0.421	0.674	Not Significant	Not supported
H6	SC-M → Stressors	0.294	1.279	0.578	Not Significant	Not supported
H7	WJ-M → Stressors	-0.462	1.858	0.031*	Significant	Supported

Note: * significant at p value < 0.05; ** significant at p value < 0.01; H = Hypothesis

References

Aguinis, H., Gottfredson, R. K. and Joo, H. 2012. Using performance management to win the talent war. *Business Horizons,* 55**,** 609-616. https://doi.org/10.1016/j.bushor.2012.05.007.

Ahola, K., Vuori, J., Toppinen-Tanner, S., Mutanen, P. and Honkonen, T. 2012. Resource-enhancing group intervention against depression at workplace: who benefits? A randomised controlled study with a 7-month follow-up. *Occup Environ Med,* 69**,** 870-876.

Burke, R. J. 2019. Creating psychologically healthy workplaces. *Creating psychologically healthy workplaces.* Edward Elgar Publishing.

Enns, J., Holmqvist, M., Wener, P., Halas, G., Rothney, J., Schultz, A., Goertzen, L. and Katz, A. 2016. Mapping interventions that promote mental health in the general population: a scoping review of reviews. *Preventive medicine,* 87**,** 70-80.

Gullestrup, J., Lequertier, B. and Martin, G. 2011. MATES in construction: impact of a multimodal, community-based program for suicide prevention in the construction industry. *International journal of environmental research and public health,* 8**,** 4180-4196.

Hanisch, S. E., Twomey, C. D., Szeto, A. C., Birner, U. W., Nowak, D. and Sabariego, C. 2016. The effectiveness of interventions targeting the stigma of mental illness at the workplace: a systematic review. *BMC psychiatry,* 16**,** 1.

Havermans, B. M., Brouwers, E. P., Hoek, R. J., Anema, J. R., Van Der Beek, A. J. and Boot, C. R. 2018. Work stress prevention needs of employees and supervisors. *BMC public health,* 18**,** 642.

Hlanganipai, N. and Mazanai, M. 2014. Career management practices: Impact of work design on employee retention. *Mediterranean Journal of Social Sciences,* 5**,** 21-21.

Joyce, K., Pabayo, R., Critchley, J. A. and Bambra, C. 2010. Flexible working conditions and their effects on employee health and wellbeing. *Cochrane database of systematic reviews*.

Lamontagne, A. D., Shann, C. and Martin, A. 2018. Developing an integrated approach to workplace mental health: a hypothetical conversation with a small business owner. *Annals of work exposures and health,* 62**,** S93-S100.

Lingard, H., Brown, K., Bradley, L., Bailey, C. and Townsend, K. 2007. Improving employees' work-life balance in the construction industry: Project alliance case study. *Journal of Construction Engineering and Management,* 133**,** 807-815.

Pignata, S., Winefield, A. H., Boyd, C. M. and Provis, C. 2018. A qualitative study of HR/OHS stress interventions in Australian universities. *International journal of environmental research and public health,* 15**,** 103.

Sinclair, M., Kernohan, W. G., Begley, C. M., Luyben, A. G. and Gillen, P. A. 2017. Interventions for prevention of bullying in the workplace. *The Cochrane Database of Systematic Reviews,* 2017.

Tan, L., Wang, M.-J., Modini, M., Joyce, S., Mykletun, A., Christensen, H. and Harvey, S. B. 2014. Preventing the development of depression at work: a systematic review and meta-analysis of universal interventions in the workplace. *BMC medicine,* 12**,** 74.

187
188