Focus Group Study to Explore Critical Factors for Managing Stress of Construction Workers

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Journal of Construction Engineering and Management

A FOCUS GROUP STUDY TO EXPLORE CRITICAL FACTORS FOR MANAGING STRESS OF THE CONSTRUCTION WORKERS

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Abstract:	<p>Construction workers (CWs) are directly responsible for the success of any construction project. However, the construction industry is stressful, which may significantly affect CWs' performance and safety at work. It is possible to prevent CWs experiencing unmanageable stress and the associated negative consequences, if the critical factors for managing their stress were known. Yet very few studies have been conducted to explore these critical stress management factors for them. With consideration of their unique work characteristics and environment, current study set out to fill this research gap through exploration of CWs' coping behaviors, stress symptoms and performance.</p> <p>Focus group studies were conducted to collect qualitative data from skilled CWs, general CWs, and supervisors of CWs. The study explored 15 coping behaviors (categorized as either problem-based or emotion-based), five emotional and 11 physical stress symptoms, and five indicators of CWs' performance and safety. The principal findings include: CWs often not only experience physical stress symptoms, but also suffer from emotional stress symptoms; and unlike the managerial staffs, CWs usually adopt more emotion-based than problem-based coping behaviors (10 types and five types, respectively). A propositional model was proposed and validated by a short questionnaire survey study. Practical recommendations are made for promoting effective stress management and improving project management on CWs. The research limitations are discussed and suggestions for future research are made. This paper is the first attempt to explore CWs' coping behaviors, specific stress symptoms, and performance, which forms a basis for a future large-scale study.</p>	
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A FOCUS GROUP STUDY TO EXPLORE CRITICAL FACTORS FOR MANAGING STRESS OF THE CONSTRUCTION WORKERS

Qi Liang¹, Mei-yung Leung², Cary Cooper³

ABSTRACT

Construction workers (CWs) are directly responsible for the success of any construction project. However, the construction industry is stressful, which may significantly affect CWs' performance and safety at work. It is possible to prevent CWs experiencing unmanageable stress and the associated negative consequences, if the critical factors for managing their stress were known. Yet very few studies have been conducted to explore these critical stress management factors for them. With consideration of their unique work characteristics and environment, current study set out to fill this research gap through exploration of CWs' coping behaviors, stress symptoms and performance.

Focus group studies were conducted to collect qualitative data from skilled CWs, general CWs, and supervisors of CWs. The study explored 15 coping behaviors (categorized as either problem-based or emotion-based), five emotional and 11 physical stress symptoms, and five indicators of CWs' performance and safety. *The principal findings include: CWs often not only experience physical stress symptoms, but also suffer from emotional stress symptoms; and unlike the managerial staffs, CWs usually adopt more emotion-based than*

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problem-based coping behaviors (10 types and five types, respectively). A propositional model was proposed and validated by a short questionnaire survey study. Practical recommendations are made for promoting effective stress management and improving project management on CWs. The research limitations are discussed and suggestions for future research are made. This paper is the first attempt to explore CWs' coping behaviors, specific stress symptoms, and performance, which forms a basis for a future large-scale study.

Keywords: Construction Workers; Focus Group; Health; Performance; Safety; Stress

INTRODUCTION

Despite the application of advanced management methods and mechanization in the construction industry, the success of any construction project still largely depends on the performance of construction workers (CWs; Han et al. 2008). For instance, heavy equipment must be operated by CWs; and metal and wood joints must be handmade by them. Thus, it is critically important to improve CWs' performance in order to ensure the successful project management. However, CWs have to carry out tasks that are physically demanding (involving repetitive movements, heavy lifting, maintaining awkward postures, etc.) while under psychological pressure (with long working hours, job insecurity, deadlines to meet, etc.) and in challenging construction site environments (with extreme temperatures, excessive noise, air pollution, etc.). The unfavorable work characteristics and environment not only affect their productivity, but also result in high turnover rates and severe safety problems (Kazaz and Ulubeyli 2007; Leung et al. 2016).

In fact, the construction industry is stressful for its participants (Chartered Institute of Building 2006), especially for CWs; all over the world, they have been regarded as having the one of the most stressful occupations (International Labour Organization 1992; Jacobsen et al. 2013). More than those in most other occupations (e.g., nurses, factory workers, teachers, etc.), CWs suffer from demanding work characteristics and face hostile environments (Hoonakker and Duivenbooden 2010). CWs work in dynamic site environments that are much affected by extreme weather; they work at very hazardous places on the construction site; and they work on projects whose schedules are usually very tight, but they rarely have opportunities for promotion within their own construction organization or even within the industry (Boschman et al. 2013; Gatti et al. 2013). Therefore, it may be incorrect to assume that CWs experience the same levels of stress and the same consequences of stress that empirical research has shown to affect individuals working in other jobs/professions.

The adoption of coping behaviors is the key to deciding whether various stress symptoms will result or not (Lazarus and Folkman 1984), while stress significantly affects individual's performance (e.g., Leung et al. 2006). The coping behaviors and its influence for construction professionals have been extensively researched (e.g., Haynes and Love 2004; Leung et al. 2006; Yip et al. 2008), while very few studies have explored CWs' coping behaviors. To fill in the research gap, it was necessary to conduct an empirical study exploring CWs' coping behaviors, specific stress symptoms, and performance at work.

LITERATURE REVIEW

Coping Behaviors

Individuals normally experience appraisal processes in which they evaluate their capability, availability and resources to cope with stressful events, and proponents of the classical transactional model of stress and coping claim that appropriate coping behaviors can shield individuals from stress (Lazarus and Folkman 1984). Coping behaviors have been viewed as individuals' conscious efforts to manage conflicts between the demands on them and their resources (Haynes and Love 2004; Weiten and Lloyd 2009). Commonly identified coping behaviors in professions other than CWs (e.g., construction professionals, nurses and salesmen) include avoidance of stress, confrontive problem solving, emotional discharge, support seeking and so on (e.g., Haynes and Love 2004; Leung et al. 2015a).

During the coping process, several factors may influence an individual's selection of coping behaviors; these factors include personality, socioeconomic status, past experience, perceived level of stress, and occupation (Dewe and Cooper 2017; Leung et al. 2006, 2014; Ursin and Eriksen 2004). As stressful situations for CWs in real life are extremely complicated, it is hard to predict their coping behaviors simply from their work characteristics, stress levels and backgrounds. In general, coping behaviors can be broadly categorized as being either problem-based or emotion-based (Chan et al. 2012, 2016; Leung et al. 2006). Those belonging to the former category (i.e., problem-based coping behaviors) focus on addressing the source of stress (i.e., problems), while those belonging to the latter category (i.e., emotion-based coping behaviors) put efforts in regulating individuals' negative emotions (Folkman 2010).

Stress

Stress is defined as the non-specific body response which appears as a result of frequent and/or continuous discrepancies between the demands on an individual and his/her ability to cope with the demands (Ganster and Rosen 2013; Lazarus 1990; Selye 1956). Stress can induce internal adjustments of the human body, and the adjustments may further develop into physical stress symptoms in response to chronic exposure (Ganster and Rosen 2013). Common physical stress symptoms in individuals include physical pain (headaches, back pain, etc.), eyestrain, and respiratory ailments (Nixon et al. 2011; Schat et al. 2005). It has also been claimed that various emotional stress symptoms, such as anxiety, tension, and depression, can also manifest in human beings as a result of continuously facing stressful events (e.g., Bryant 2013; Meliá and Becerril 2007).

Performance

The success of construction projects heavily depends on the performance of CWs in terms of cost, time and quality (e.g., Kazaz and Ulubeyli 2007). According to Campbell's performance model (Campbell et al. 1993), performance should concern the task proficiency of CWs (e.g., completion of the task in time, and job quality), the interrelationships between CWs and their co-workers (i.e., CWs need to work together as a team for completing complicated construction tasks), and their commitment to their organizations (e.g., related to the turnover rate, and shortage of manpower). In addition, safety is always one project objective, so CWs' safety performance should also be taken into account (Fung et al. 2005; Liao et al. 2015).

RESEARCH METHODOLOGY

Focus Groups

Focus groups are widely used in qualitative research and have increasingly been used in research studies on health and safety (e.g., Asquin et al. 2010; Leung and Chan 2012). A focus group session is conducted in the form of a group discussion with a moderator/facilitator prompting the participants to exchange ideas, express their feelings, and describe their experiences in response to a set of questions on a certain topic (Cooper and Schindler 2006). A focus group has a group dynamic and brings several benefits to the gathering of data, including a synergistic group effect that stimulates discussion, with each participant reacting to or being inspired by the comments of the others; efficient use of time; substantial content generated from the discussion; observation by the mediator/researcher in a natural setting; and less mediator bias (Berg 2001; Conchie et al. 2013).

Sample

The research design and number of groups for a focus group study should be fit for data collection that best achieves the research purpose (e.g., Gamson 1992). The literature on CWs' occupational health and safety suggests that general CWs (GCWs) and skilled CWs (SCWs) have different rates of health and safety problems (Hess et al. 2004; Memarian and Mitropoulos 2013). Both GCWs and SCWs are under the supervision and management of their supervisors (site agent, foremen, etc.), who have deep insight into CWs' daily activities and behaviors.

Although the number of participants in a focus group should be between two and 20, six to 10 participants are optimal for a study aiming to collect their true feelings and opinions (Breakwell et al. 2006; Morgan 1996). In addition, a small group size allows each participant more time to express his/her opinions and ideas. Hence, the current study recruited eight SCWs for the SCW group, six GCWs for the GCW group, and 10 CSs for the CS group from different construction companies and projects.

As the targeted samples are CWs and their supervisors, purposive sampling was employed to select eligible participants based on the following criteria: 1) they were working in the mainstream construction industry (i.e., for developer, main contractor, subcontractor, supplier, etc.); 2) all of them had at least over six-months practical experience in the construction industry; and 3) the SCWs were registered tradesmen (e.g., concreters or bricklayers) and the CSs had experience managing CWs. Formal invitation letters were sent to the construction organizations and CSs by post and/or email. The CWs were assigned by their organization to participate in the study, and the authors recruited the CSs individually.

Around 44% of the participants were at least 50 years old, 26% were aged 40-49, 26% were aged 30-39, and only 4% were aged 29 or under. Only one participant was female; this reflects the male-dominated nature of the industry (Rumens 2013). Almost all the participants in the SCW and CS groups had amassed more than 10 years' work experience in the construction industry. The CWs' education level was generally low: the education of 70% of them ended after they had attended high school and the remaining 30% had had only a primary school education. As for the project types, over 80% of the participants were working on different building projects, 12.5% on various civil engineering projects, and the

rest on alteration & addition projects to existing buildings; these figures reflect the overall picture for the Hong Kong construction industry (Development Bureau 2015).

The participants in each group were relatively homogenous in terms of their role in construction projects, type of contract, gender, and so on. For instance, all the CWs were employed by subcontractors. However, it is interesting that all the SCWs were employed through subcontracting by subcontractors, while all the GCWs were directly employed by subcontractors. Perhaps, because of the recent boom in the construction industry and a serious shortage of skilled manpower (South China Morning Post 2014), SCWs have many job opportunities in the open market. Subcontracting enables them to work for several projects at the same time so as to maximize their income. On the other hand, construction organizations need to maintain a certain staffing level and employing GCWs is much cheaper than employing SCWs. Some intra-group differences – regarding age, work experience, project types, organizations, and so forth – were allowed in order to gather a wider range of views.

Focus Group Study

To facilitate the comparisons of the results, the same mediators posed a standardized set of semi-structured questions under the same framework with the identical procedure throughout all the three focus groups (Knodel 1993). The semi-structured questions cover four aspects: (1) CWs' emotional stress symptoms and how long these symptoms last; (2) CWs' *physical* stress symptoms and how long these symptoms last; (3) what CWs commonly do to relieve their stress and the effectiveness of these behaviors; and (4) the influence of stress on CWs' performance. As the manifestation of the stress symptoms is the result of chronic exposure to

stressful events, the participants were asked how long they have been suffering one specific stress symptom during the focus group study (see above questions 1 and 2). The symptoms, which only emerged once or lasts very shortly (i.e., less than two days; Cardena et al. 2000), were not reported by the participants in current study. A short questionnaire was also used to collect the demographic information of the participants.

Each of the focus group studies was lasting for two and half hours to three hours. At the beginning of each focus group study, the mediator/researcher stated clearly the research purpose and the schedule for each session; the mediator/researcher also made it clear that everyone would have equal status and should have an equal voice, and that the participants should be free to express themselves without criticism. The participants were assured that all the information collected would be kept strictly confidential and would be used only for academic purposes (Berg 2001). In order to enhance mutual understanding among the participants who were generally not familiar with each other before the focus groups studies, and to create a relaxed and harmonious atmosphere, each participant was invited to make a self-introduction at beginning of each focus group study (Tracy et al. 2006).

The mediator/researcher used multiple resources to record the research results, including worksheets, immediate note-taking, videotaping, and a blackboard, in order to ensure the accuracy and reliability of the research results. The notes were doubled-checked by the participants during the focus group meetings and were reviewed by the author (who was also the focus group mediator) during the writing of this paper. To foster a group dynamic and prevent some voices dominating, the mediator/researcher intentionally gave the participants equal opportunities to speak.

Short Questionnaire Survey

In order to cross-validate the qualitative data generated in the focus group, a short questionnaire survey was also conducted after the group discussion. The questionnaire was designed based on extensive literature review, and includes various validated scales for measuring coping behaviors, stress, performance and safety (e.g., Cardena et al. 2000; Folkman et al. 1986; Leung et al. 2015, 2016). A seven-point Likert scale, ranging from 1 (never/extremely disagree) to 7 (always/extremely agree), was used by the participants to reflect their individual opinion on the coping behaviors, stress, performance and safety factors. SPSS 22 was used to statistically analyze the collected data from questionnaire survey.

CONTENT ANALYSIS, RESULTS AND DISCUSSION

After the qualitative data collected from focus group studies and recorded by multiple sources (e.g., immediate notes, radio record, and so on), content analysis, which is one commonly used qualitative data analysis method, was employed to analyze the data in order to identify the collective opinions of the participants regarding the CWs' stress symptoms, coping behaviors and performance (Berg 2001; Hughes and DuMont 1993). Each of the participants' responses to specific question under the framework (e.g., their emotional stress symptoms) was closely examined by researchers. The common keywords and phrases in the statements made by the different participants were inductively identified, abstracted and further classified into different groups according to previous literature (e.g., stress symptoms groups,

coping behaviors groups, and performance group). The interesting findings have been pointed out and discussed.

Coping Behaviors of CWs

In total, 15 CWs' coping behaviors were explored through current focus group study. In accordance with the focus of the coping behaviors on either 'resolving source of stress' (i.e., problem-based coping) or 'regulation of negative emotions' (i.e., emotion-based coping), they can be categorized into two groups (see Table 1; Arciniega et al. 2008; Folkman 2010). The problem-based coping behaviors include *seeking instrumental support* (one excerpt; see number of "x" in Table 1), *increasing wages* (one excerpt), *making positive reappraisals* (one excerpt), *negotiating* (three excerpts), and *relaxing* (one excerpt); while the emotion-based coping behaviors include *engaging in physical exercise* (one excerpt), *listening to music and playing games* (two excerpts), *gambling* (three excerpts), *consuming alcohol and smoking cigarettes* (three excerpts), *expressing negative feelings* (one excerpt), *using bad language* (three excerpts), *arguing and fighting* (three excerpts), *socializing* (two excerpts), *seeking family support* (one excerpt), *quitting* (three excerpts), and *self-controlling* (three excerpts).

The results show that unlike their supervisors (e.g., project managers who used to adopt problem-based coping behaviors; Aitken and Crawford 2007; Leung et al. 2015a), the CWs generally tend to adopt more emotion-based (10 types; 25 excerpts) than problem-based coping behaviors (five types; seven excerpts) when suffering from stress. Moreover, it is interesting to find that only the CWs (both the SCWs and GCWs) reported that they adopt problem-based coping behaviors to cope with stress; while according to the CSs who are the CWs' supervisors, CWs only adopt emotion-based coping behaviors (see 'x' columns for

SCWs and GCWs; and ‘0’ excerpts reported by CSs in Table 1). This finding uncovered the realistic situation that the CWs generally have very limited resources at work (e.g., less/no power to make their work favorable for them; Stattin and Jarvholm 2005) and private life (e.g., low socioeconomic status; Ursin and Eriksen 2004), which prevents them from adopting problem-based coping.

< Table 1 >

Problem-based Coping Behaviors

Planful problem solving behavior *was not found* being adopted by CWs for coping stress in current study, while it is the most commonly adopted problem-based coping behavior by construction professionals (e.g., engineers; Haynes and Love 2004; Chan et al. 2012). In fact, this difference is understandable. The CWs often have very limited resources (e.g., power of decision making over their task) and knowledge (e.g., knowledge for effective problem solving) at work for resolving the complicated problems, and thus, prevent them from adoption of the planful problem solving behavior.

Construction tasks are normally too big and complicated for a single CW, and it is not uncommon for a CW to be stressed by difficulties they encounter in their work. Fortunately, CWs often work in a team to complete a task. When they come across problems, they can then “resolve problems through seeking the help of friends who are able to deal with them” (SCW1). In addition, the construction industry and the management team have gradually adopted a mentor-mentee program among CWs (Hoffmeister et al. 2011); this allows junior and/or inexperienced CWs to seek advice and help from experienced/skilled CWs to resolve

their problems. In fact, the behavior to seek support for resolving problem is the manifestation of *instrumental support seeking behavior* that has regarded as one of problem-based coping.

Lacking an adequate co-worker, one SCW cannot complete his tasks on time and has long been criticized and pushed by his supervisor, which makes him very stressed. Hence, he said that he is going to “pay a high wage to employ a suitable co-worker, so as to complete the tasks as soon as possible” (SCW1). His remark indicates his intention to finish tasks (i.e., source of his stress) in the quickest way, despite the monetary cost. This is a manifestation of *confrontive coping behavior*; such behavior is defined as making aggressive efforts (e.g., taking risks) to change threatening situations (Penley et al. 2002).

Although CWs have limited knowledge and lack the necessary socioeconomic resources to change threatening situations at work, they can still adjust their perceptions. This study reveals that CWs adopt positive reappraisal to cope with stress. For instance, one SCW said, “After getting enough sleep, I can reappraise everything positively” (SCW4). Their being unable to change external circumstances forces CWs to cultivate the ability to adopt positive reappraisal as one way of coping. As perception of the stressful events largely decides the generation of stress consequences, positive reappraisal reduces the CWs’ opportunity to suffer stress consequences.

It was found that—contrary to the public image of CWs as being passive, rude, and straightforward—CWs actively resolve their problems (i.e., actively address the sources of stress). While engaged on construction tasks, CWs “try to find a good way to resolve [problems]” (GCW5) and/or “negotiate with other CWs and try to resolve the problems”

(SCW3; also mentioned by GCW2). Moreover, it is interesting to find that CWs understand the negative influence of the demanding construction tasks and the hostile construction site environment, and therefore intentionally make themselves relax. They often “intentionally slow down and relax mind and body [after work]” (SCW6). These behaviors represent CWs’ active coping. In general, active coping leads to resolution of the stressful problems, well-being and effective stress reduction (Haritatos et al. 2007). In summary, the five problem-based coping behaviors were therefore further categorized into four subgroups: seeking instrumental support, confrontive coping, positive reappraisal, and active coping (see Table 1).

Emotion-based Coping Behaviors

The results show that, in order to cope with their stress, CWs like to “do some physical exercises” and “listen to music and play computer games” (GCW3; also mentioned by GCW4); “express my negative emotions by talking to close friends” (GCW1 and SCW8); “use to have bad language” (SCW5; also mentioned by CS3 and CS7); they “like to gamble to relieve stress” (SCW2; also mentioned by GCW2 and CS2); and “smoke a lot when stressed” (GCW6; also mentioned by CS1). In addition, the CS group complained that “CWs often quarrel with their supervisor to relieve their stress” (CS5; also mentioned by CS6 and CS8). All seven of these coping behaviors are an outlet for/to express CWs’ unpleasant emotions, and they are therefore regarded as *emotional discharge* (Chan et al. 2014). However, emotional discharge may be ineffective in terms of stress management; even worse, it may exacerbate existing stress symptoms (e.g., Vallis and Leddin 2004). For instance, gambling may cause more stress to CWs, if they lose (SCW2).

The participants reported that they liked to *seek emotional support* from their co-workers and friends when experiencing stress. For instance, CWs like to chat with their co-workers and socialize (e.g., go fishing, go out for dinner, etc.) with their friends (SCW5 and CS7). In addition, the family can help relieve CWs' stress. "My children give me the strength and energy to work and shield me from stress," said GCW1. Unlike instrumental support, which addresses the source of stress, emotional support can only regulate CWs' negative emotions (i.e., emotion-based in nature). Perhaps, although the CWs intend to seek supports for problem-solving, the support-providers (e.g., co-workers, family members and even supervisors who are often placed on the low level of the project management) are also lack of resources for resolving problems; instead, the support providers may just be able to help regulating the negative emotions of CWs through chats, sympathy and accompanies.

It was found that CWs think about finding another job when they suffer from stress. Suffering from stress leads many CWs to quit their job, as they think they "cannot carry on anymore" (SCW4) and should "find another job in the open market" (SCW5). One supervisor (CS3) commented that the high turnover of CWs is a manifestation of the *escape* strategy, which involves avoiding facing a stressful situation.

The participants also reported that CWs do not like to discuss their stress (GCW2 and GCW3). Most CWs are male and the main source of their family income. They think that telling their families about their stress can achieve nothing but only cause their family to worry (GCW3). At the same time, the construction industry usually has a traditional machismo culture, and it has been claimed that this culture also affects CWs' coping behaviors (Ankrah et al. 2009; Arciniega et al. 2009). As SCW6 put it, CWs do not admit to their stress because "that would show weakness." These responses to stress can be regarded

as *self-controlling* behaviors, which suppresses the negative emotional reactions to stress (Leung et al. 2015a). In fact, the self-controlling behavior was also reported as one of the most commonly adopted emotion-based coping behaviors by the supervisor of CWs (e.g., project managers; Haynes and Love 2004). Adoption of the self-controlling behaviors both by CWs and their supervisors indicates the prevalence of the machismo culture in the industry.

Stress Symptoms of CWs

The present study revealed that CWs experience over ten stress symptoms. These symptoms are manifested either as physical stress symptoms (with 16 excerpts) or as emotional stress symptoms (with 14 excerpts; see Table 2).

< Table 2 >

Physical Stress Symptoms of CWs

Physical pains are the most widely reported physical stress symptoms (eight excerpts; see Table 2); these include *pains in the leg* (two excerpts), *waist* (two excerpts), *back* (three excerpts), and *fingers* (one excerpt; GCW2, GCW4, GCW6, SCW2, and SCW6). Previous studies have regarded the pain experienced by CWs as a sign of musculoskeletal disorders (MSDs) and have attributed MSDs to strenuous physical activities, awkward work postures, and so on (e.g., Hess et al. 2004; Spielholz et al. 2006); however, *it is interesting to know that physical pain may also be a manifestation of stress and this fact is supported by the observations of the focus group participants*. The SCW and CS groups tried to explain how

these physical stress symptoms are induced. One project manager (CS2) thought that heavy workloads cause the onset of back pain in CWs; and a skilled worker (SCW6) explained that “under stress, I unconsciously use excessive force, resulting in pain in the fingers”. A CW may make bodily adjustments in response to external forces; for example, exerting more force with the leg in order to work faster. Long-lasting bodily adjustments without proper breaks may cause physical stress symptoms in the form of pains.

The participants of the focus group study reported that as a result of stress, CWs suffer eyestrain (one excerpt; SCW1), skin diseases (one excerpt; CS7), and lung problems (two excerpts; SCW6 and CS7). Moreover, it is first time to reveal that the prostate problem (one excerpt) prevalent among CWs may also be one of their physical stress symptoms. The problem was noted by the CS group. “If there is a common problem among CWs, it is a prostate problem. They very frequently go to the toilet” (CS1). Perhaps, the secretion of hormones in the brain affects the prostate gland; and if this occurs over a long period, prostate problems (such as prostate hyperplasia) result (Ullrich et al. 2005). Therefore, it is very likely that prostate problems are the physical manifestation of stress (e.g., Ko et al. 2005).

Other physical stress symptoms – including dizziness (one excerpt; CS7), sleep disorders (one excerpt; SCW3), and loss of appetite (one excerpt; SCW1) – were found in the CWs. While working on a hostile construction site environment, CWs perform physically and psychologically demanding tasks and they are distracted by interactions with others and by their own thoughts. “All of these cause CWs to become dizzy and thus cause accidents,” reported one managerial staff (CS7). Stress also manifests itself in CWs as loss of appetite. The great time pressure imposed by supervisors and a lack of adequate co-workers to

complete work tasks may exert stress on CWs that results in “loss of appetite” (SCW1). It is likely that external forces cause the secretion of hormones in the blood. Over a long period, excessive secretion of hormones causes an imbalance in the internal environment of the human body that is reflected in the form of dizziness, sleep disorders, and loss of appetite (Nixon et al. 2011).

Emotional Stress Symptoms of CWs

The CWs’ stress were often ignored, because people used to claim that CWs mainly carry out various physical tasks on the construction site, and their health and safety problem may be solely caused by the physical factors (e.g., heavy materials handling, awkward posture, etc.; Sobeih et al. 2009). Interestingly, however, this study found that in addition to physical stress symptoms, CWs simultaneously experience five emotional stress symptoms (14 excerpts in total; see number of ‘x’ in Table 2), including anxiety (one excerpt), being angry (three excerpts), tension (two excerpts), listlessness (three excerpts) and worrying (five excerpts).

Anxiety was regarded as being an emotional stress symptom by the participants. SCW3 remarked, “My stress symptoms include anxiety, worrying, and being upset and angry.” It is understandable that suffering from heavy workloads and severe physical demands can easily make CWs anxious. Getting upset and angry was also identified as a stress symptom by both the SCW and CS groups. The supervisors observed that it is very common for CWs to become upset and irritable, especially when criticized (CS2 and CS6). The SCW group added that stress induced their anger. As one SCW put it, “When I am under stress, I lose my temper, get upset, and use vulgar language” (SCW6). Finally, tension was identified by both

the SCW and GCW groups as being an emotional stress symptom. Perhaps the tension is due to CWs' feelings of being unsafe when working on a construction site. "We are tense, and we have to spend a lot of emotional energy on thinking about our safety. This is because we know that we will be hurt or killed if we are not careful" (SCW6). It is likely that the three above mentioned symptoms are the instant results of suffering the demanding work characteristics (e.g., facing approaching deadline, uncomfortable construction site environment, rude behaviors of co-workers, and so on), which can disappear quickly as long as the source of stress is not available. For instance, they become relaxed after work (i.e., after leaving the site environment) and their tension disappeared (SCW5 and SCW6).

The CWs' tasks are often repetitive and monotonous (Gatti et al. 2013). "It is very rare for CWs to enjoy what they are doing. They just have to do what they have to do" (SCW5). The repetitiveness and monotony can result in stress to CWs that manifests itself as listlessness. The participants in both the SCW and GCW groups admitted that their work makes them feel listless because they have worked for a very long time, feel no passion for their work, and are bored with it (SCW4 and GCW6). Suffering from listlessness results in lack of motivation and may result in CWs' carelessness, which not only reduces their productivity but also increases their safety risks. All three focus groups observed that CWs continuously worry at work. For instance, GCW1 said, "I worry about money"; GCW3 worries that "girls don't like CWs"; and SCW1 continuously worries at work. The CSs also mentioned CWs' worrying in their focus group meeting. One CS said, "CWs may also worry at work because they do not have job security. They may work on one site today but on another site the next" (CS10). Such worrying by CWs may result from their inability to control their own jobs and lives to make them more favorable than unfavorable to them, because they lack knowledge and occupy the lower rungs of their organizations and even of society as a whole.

Performance of CWs

As the CWs' performance is closely related to the success of construction project, the participants were also asked to assess the CWs' performance under stress. Through the focus group studies, five types of CWs' performance were explored, including quality of work (*four excerpts; see the number of 'x' in Table 3*), work speed (*two excerpts*), interpersonal relationships (*three excerpts*), intention to leave (*three excerpts*) and accidents (*five excerpts*). In accordance with Campbell's performance model (Campbell et al. 1993), the five performances were further classified into four groups, including task performance (including quality of work and work speed), interpersonal performance (interpersonal relationships with others), organizational performance (intention to leave), and safety performance (accidents). In general, it is interesting to find that, from the point of view of CS group, CWs perform poorly in all respects of performance (i.e., in task performance, interpersonal performance, organizational performance, and safety performance; see the excerpts of CSs in Table 3).

CWs' task performance has two aspects: *the quality of the work* and *the speed at which the work is done*. One CW expressed an attitude common among the CWs: "I keep the job quality as high as possible if I feel no stress" (GCW5); while their "quality of work is low" when they are suffering from stress. The CS group was generally dissatisfied with both the quality of CWs' work and the speed at which CWs work (CS3 and CS4), and they attributed CWs' poor performance to stress. One participant of the CS group made the observation that "stress distracts CWs and upsets them, leading to poor quality work" (CS4). Stress also slows down the speed at which CWs work, because stress causes them to be too "tense" to work (SCW4). If CWs can shield themselves from stress, they can "finish [their] tasks on

time and well” (GCW2). In fact, it has been claimed that under stress, individuals used to become hasty, preoccupied by source of stress, and hard to concentrate on present tasks (e.g., Ganster and Rosen 2013), which definitely causes to the decreases in the quality and speed of CWs’ performance.

< Table 3 >

This study also reveals that CWs’ interpersonal relationships deteriorate when they are under stress; this affects the success of a project (GCW2). One skilled CW admitted that stress harms his relationships with colleagues; he explained, “When I am stressed and worried, I do not want to speak to and often argue with my colleagues and I use a lot of bad language. All of which impairs the relationships I have with my colleagues” (SCW5). Worse still, the CS group reported that CWs fight each other on construction sites, due to their poor interpersonal relationships (CS2). Under stress, the CWs may become irritable, unreasonable, aggressive confrontive, and impatient, which can definitely bring about higher opportunity of conflict and poor interpersonal relationships.

Stress was also found to be one reason why CWs leave a company. There was a consensus among the SCW and CS groups that once CWs became stressed, they quit their job and find another job in the open market (SCW1, CS2, and CS3). In fact, the links between construction companies and CWs are very weak: construction companies cannot offer CWs incentives other than payment, while the availability of other work opportunities and their stressful situation very often lead CWs to leave the industry.

The participants reported that various stress symptoms (both emotional and physical ones) contribute to their accidents (e.g., hurrying – SCW6; feeling tense – GCW4; insufficient sleep – GCW6). The CS group reported that “CWs always want to make thing easy and reduce their own *workload*, and *they therefore often engage in unsafe practices*” (CS9). However, it is likely that suffering from these stress symptoms make it hard for CWs to concentrate on their tasks and be aware of the potential safety hazards around. They may just want to finish their tasks as soon as possible in order to take rest early for alleviating their stress symptoms, and in this case, the safety hazards were often ignored and accidents are likely.

THE PROPOSITIONAL MODEL

New findings regarding the stress management of the CWs have been revealed through current study. *Firstly, this study confirmed that the CWs suffer from both physical (11 types; 16 excerpts) and emotional stress symptoms (five types; 14 excerpts) in the realistic working context. The prostate problem was reported to be one of the physical stress symptoms; this problem has not been previously identified in other professions. CWs were found to adopt more emotion-based (23 excerpts) than problem-based (seven excerpts) coping behaviors, unlike their supervisors (e.g., construction professionals). This finding reflects the fact that CWs lack the resources to resolve their problems at work. Of the subgroups of coping behaviors, emotional discharge is the most widely adopted by CWs. It includes engaging in physical exercise, listening to music and playing games, gambling, consuming alcohol and smoking cigarettes, expressing negative feelings, using bad language, and arguing and fighting. The focus groups also explored four aspects of their performance that may be affected by stress: the speed and quality of their work (task performance), their interpersonal*

relationships (interpersonal performance), their intention to leave (organizational performance), and their accident rates (safety performance).

To improve the current understanding of stress management for CWs and industrial practices in the management of CWs, it is necessary to situate the current research results in previous established theoretical models (Taylor et al. 2011), such as the coping behaviors–stress–performance model for cost estimation (Leung et al. 2006) and the transactional stress management model for the general population (Lazarus 1966). Therefore, based on current research findings and literature, a propositional model for CWs’ stress management has been developed in this study (see Figure 1).

< Figure 1 >

Model Validation with Results of Short Questionnaire Survey

The results of the short questionnaire survey are shown in below Table 4, including the mean value of the CWs’ coping behaviors, stress, performance and safety. For the easy comparison in the results between focus group study and the short questionnaire survey, the number of excerpts resulting from focus group study regarding specific factor were also included in the Table 4. The comparison shows that the number of excerpts in focus group basically matches with the mean value in questionnaire survey (i.e., more excerpts associated with higher mean value for SCWs and GCWs, respectively). For instance, the SCWs, who have reported more physical stress than emotion stress in focus group (i.e., 7 vs 4 excerpts), shown higher mean value in physical stress than in emotional stress in questionnaire survey (i.e., 3.61 vs 3.10; see Table 4); and the GCWs, who reported more emotion-based coping than problem-based

coping in focus group study (i.e., 7 vs 2 excerpts), rated higher in emotion-based coping than in problem-based coping in questionnaire survey (i.e., 3.40 vs 2.90).

Although there are five excerpts in focus group for both SCWs' problem-based and emotion-based coping behaviors, the mean value of their problem-based coping is slightly higher than the mean value of emotion-based coping (i.e., $4.88 - 4.41 = 0.47$). It is obvious that the 'Instrumental Support Seeking' (5.50) largely contributes to the little differences. In fact, the high frequent adoption of 'Instrumental Support Seeking' by SCWs is understandable when taking their realistic situation into consideration. On one hand, the construction industry has long been adopting the mentor-mentee program among CWs, which allows CWs learn from others; on the other hand, the SCWs almost always work on similar/same tasks on the construction site, and the junior SCWs may encounter problems that were facing the senior SCWs before. Therefore, seeking instrumental support from experienced SCWs should be one effective and frequent way for SCWs to resolve problems.

< Table 4 >

RECOMMENDATIONS

Practical Implications

The current study explored CWs' coping behaviors, stress symptoms, and performance, and proposed a propositional stress management model for them. A number of problems for CWs' stress management and performance have displayed by the proposed propositional

model, such as adoption of more emotion-based than problem-based coping behaviors, various emotional and physical stress symptoms, and so on. Hence, it is recommended that construction organizations, the project management team, and CWs themselves take actions to manage the stress CWs experience and thus improve their performance.

This study reveals that CWs adopt more emotion-based than problem-based coping behaviors (23 excerpts vs. seven excerpts). As problem-based coping is generally adaptive in term of stress reduction, construction organizations and project management team should facilitate CWs' problem-based coping behaviors through *provision of coping resources, such as providing coaching by supervisors, encouraging co-worker support, and delegation of job authority* (e.g., Schaufeli and Bakker 2004). The *establishment of hometown associations* for CWs should enhance their mutual understanding and interpersonal relationships and thus facilitate co-worker support. Project management team should adopt a proactive management style, *provide all necessary information and assistance to CWs to enable them to complete their tasks satisfactorily, and take CWs' abilities and preferences into account when assigning tasks to them.*

As the results show, the participants subjectively judged the effectiveness of some of the coping behaviors. For instance, the CWs mentioned that they like to gamble to relieve their stress but they become more stressed if they lose money; and they are able to reappraise everything more positively after getting enough sleep. Project management team should educate CWs on the negative consequences of gambling and prohibit gambling by CWs on construction sites. In addition, because getting enough sleep helps CWs to recover their energy and affect their stress, construction companies and project management team should

encourage CWs to go to bed and rise at regular times; promote the use of a sleep-monitor phone app by CWs; and help CWs who have sleep problems.

In the present study, CWs were found to suffer from both emotional and physical stress symptoms. Therefore, construction organizations and project management team should *organize seminars and training workshops in stress management for their CWs*. The seminars would enable CWs to understand how and why stress comes about and that how big a problem stress becomes depends on how CWs appraise it. These seminars would raise CWs' awareness of stress, which might increase CWs' resistance to stress. There are numerous training programs for managing stress, such as mindfulness-based stress reduction programs that cultivate individuals' mindfulness as a way of relieving stress (Bishop et al. 2004); somatic experiencing is a form of therapy for relieving mental and physical stress symptoms through focusing on physical sensations (Levine 1997); and Tai Chi has been found to be beneficial in promoting well-being and in managing stress (Sandlund and Norlander 2000).

Given the reported interaction between CWs' stress and their performance, necessary action should be taken to mitigate the negative effects of stress. For instance, the participants mentioned that the various stress symptoms cause CWs to engage in unsafe behaviors, leading to high accident rates. Construction organizations and project management team should, before every task and at the beginning of every day at work, remind CWs that if they feel stressed they should take a rest instead of persevering with the job in hand. CWs who have reported stress need the special attention and management of construction organizations, project management team, on-site nurses, and so on.

Research Limitations and Future Directions

The data for this study was gathered from focus group studies, composed of SCWs, GCWs, and CSs groups. Given that every research method has potential biases (Webb et al. 1981), various actions were taken in current study to ensure the reliability of the research results: (1) a purposive sampling technique was used to ensure the suitability of the participants (e.g., they needed to have a certain amount of experience and have a specific trade); (2) standardized questions and procedures were applied to ensure comparability of the among groups; (3) the policy regarding confidentiality was announced at the beginning of the focus group sessions, so that the participants felt free to express their opinions; (4) to prevent some voices dominating, the mediator/researcher gave the participants equal opportunities to speak; (5) multiple resources were used to record the evidence, including note-taking during the sessions, voice recording, worksheets, and so on; (6) the participants were relatively homogeneous in each group, so that they had similar experiences of specific issues; (7) the purpose of the research was explained to the participants at the beginning of each focus group session, so they had a good understanding of what the mediator/researcher wanted to learn from them; and (8) the focus group studies involved skilled CWs, general CWs and their supervisors with different background (e.g., organization, employment types and project types), which ensures the representativeness of the study. In addition, the proposed propositional model has been validated by a short questionnaire survey study with quantitative data (i.e., between-methods triangulation; Berg 2001). In view of above, it is confident that the results of current study are reliable.

This study adopted a qualitative research method (i.e., focus group study) to realistically explore CWs' specific coping behaviors, stress symptoms, and performance, which are

fundamental and necessary for the future research in relevant direction. However, it is advocated that future study with different research methods (i.e., quantitative research methods like a questionnaire survey) could be conducted to investigate the interactions among the coping behaviors, stress symptoms, and performance of CWs. This would accord with the concept of methodological triangulation: the congruence of findings derived from different research methods ensures greater reliability and validity of the findings (Berg 2001). It is also necessary to conduct case studies for real construction projects and construction participants (i.e., in the form of individual interview), which will allow for the collection of detailed content information for validating the proposed stress management model for CWs in real projects (Fern 1982). Nevertheless, the current focus group study contributed to set up the necessary and important step for the future study (e.g., the design of the questionnaire and establishment of a propositional model) and improvement of current industrial practices.

The current study mainly set out to explore the coping behaviors, stress symptoms and performance of CWs in HK. As the adoption of the coping behaviors and generation of stress can be affected by situational factors, such as cultural value (e.g., individualism and collectivism; Schaubroeck et al. 2000), socioeconomic status in country (e.g., socioeconomic factors have larger effect on CWs in developing country than in developed country; Kazaz and Ulubeyli 2007), and so on, future study is recommended to focus on the differences in the stress management factors among CWs from different countries/districts. This sort of studies will definitely bring about benefits for the establishment of comprehensive stress management model for CWs.

Stress stimulates physiological adjustments of the human body; and objective measurement of these physiological adjustments is viable with proper instruments, such as wristbands for

measuring sleep patterns (Sharma and Gedeon 2012). In addition, the participation of the medical experts, such as dermatologist, pulmonologist, internist and so on, should ensure the correct identification of the various symptoms of CWs and enhance our understanding of the CWs' stress management. Hence, researchers with cross-disciplinary background and expertise are suggested to collaboratively adopt multiple research methods (i.e., including both quantitative questionnaires method and qualitative case studies method) and use various equipment and high-techs to validate the current research findings, and based on current findings, to establish a practical, realistic and comprehensive stress management model for CWs.

CONCLUSION

It has been widely recognized that CWs are vulnerable to various health and safety problems, have high turnover rates, and low productivity. Excessive stress has resulted in significant loss to individual CWs, the project management, construction organizations, and the industry as a whole. Although it is critical to manage CWs' stress through appropriate coping behavior, no previous study has explored the coping behaviors of CWs and very few studies have set out to explore CWs' stress symptoms and performance. The present study therefore set out to fill this research gap.

As this study was aimed at exploring the participants' true opinions and feelings about their coping behaviors, stress, and performance, three focus group sessions (with a standardized set of questions and procedures) were conducted. It was found that 15 common coping behaviors are adopted by CWs to cope with stress. 10 of these are emotion-based coping

behaviors; they are divided into four groups, including emotional discharge, emotional support seeking, escape, and self-controlling behaviors. The remaining five coping behaviors are problem-based; they are included in instrumental support seeking, confrontive coping, positive reappraisal, and active coping. Five emotional stress symptoms were explored, and 11 physical stress symptoms had eight aspects: physical pains, skin diseases, eyestrain, respiratory illnesses, prostate problems, dizziness, loss of appetite, and sleep disorders. Four aspects of the performance of CWs are affected by stress: task performance, interpersonal performance, organizational performance, and safety performance. A propositional model was established based on the results of focus group study, and it was validated through a short questionnaire survey study.

To manage stress and improve the performance of CWs, several recommendations are made, including the establishment of hometown associations; the application of a proactive management style; and organizing seminars and training workshops (such as a mindfulness-based stress reduction program, somatic experiencing, and Tai Chi sessions). This study is the first to explore CWs' coping behaviors, stress symptoms, and performance. It can be used as the basis for establishing a comprehensive stress management model for CWs all over the world.

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DATA AVAILABILITY STATEMENT

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

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Table 1 Summary of CWs' Coping Behaviors

Coping Behaviors		SCWs	Group GCWs	CS	Excerpts from the transcripts
Problem-based Coping					
1. Seek inst'l support	Seek inst'l support	x			SCW1: I like to resolve problems through <i>seeking the help of friends who are able to deal with them</i> .
2. Confrontive coping	Increase wages	x			SCW1: I am also going to <i>pay a high wage</i> to employ a suitable co-worker so as to complete the tasks as soon as possible.
3. Positive reappraisal	Positively reappraise	x			SCW4: After getting enough sleep, I can <i>reappraise everything positively</i> .
4. Active coping	1 Negotiate	x			SCW3: I will <i>negotiate with other CWs</i> and try to resolve the problems.
			x		GCW2: We <i>negotiate with each other</i> to resolve problems.
			x		GCW5: When I have problems at work, <i>I find a good way to resolve them myself</i> .
	2 Relax	x			SCW6: We relax after work. For example, we intentionally <i>slow down and relax mind and body</i> .
Sub-total No. Excerpts (7)		5	2	0	
Emotion-based Coping					
1. Emotional discharge	1. Other activities		x		GCW3: I often do some <i>physical exercises</i> to relieve my stress. I also <i>listen to music</i> , eat a lot, and chat with my friends.
			x		GCW4: I like to listen to music and <i>play computer games</i> to relieve my stress.
	2. Gamble	x			SCW2: I like to <i>gamble (handbookinger)</i> to relieve my stress. However, <i>if I lose, I get even more stressed</i> .
			x		GCW2: <i>I play mahjong</i> , eat a lot, smoke, and drink when I feel stressed.
	3. Drink alcohol and smoke			x	CS2: <i>Gambling</i> is the most common way for CWs to cope with stress.
			x		CS1: <i>CWs consume alcohol</i> after work, gamble, and go to Shenzhen to relax.
	4. Express negative feelings				GCW6: I <i>smoked</i> a lot when I was stressed in the past.
			x		GCW1: I express my negative emotions out by talking to close friends and seek their support.
	5. Use bad language	x			SCW5: I <i>use to have bad language</i> , complain, consume alcohol, and go to Shenzhen to relax.
				x	CS3: They <i>use bad language</i> at work.
				x	CS7: <i>Bad language</i> .
	6 Argue & fight		x		GCW2: People usually <i>argue and fight</i> when they are under stress.
				x	CS5: Some CWs usually <i>quarrel with their supervisor</i> to relieve their stress.
				x	CS6: CWs don't like being criticized and often <i>argue with their supervisor</i> .
2. Emotional support seeking	1. Socialize	x			SCW5: I also like to <i>socialize with my friends</i> and have a few drinks.
				x	CS7: CWs like to go out and <i>socialize</i> .
	2. Seek family support		x		GCW1: <i>My children give me the strength and energy</i> to work and shield me from stress.

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3. Escape	Quit	x			SCW4: I will leave the job the next day if I think I cannot <i>carry on any more</i> .
		x			SCW5: I even want to quit my job, because I think I can <i>find another job outside the industry</i> .
			x		CS3: Because of all the job opportunities, CWs will <i>quit if they are criticized</i> .
4. Self-controlling	Self-control		x		GCW 2: I do <i>not talk to my family</i> about my stress.
		x			SCW 6: I do <i>not talk to my friends and family</i> , because that would show weakness.
			x		GCW 3: I do <i>not like to talk to my family</i> . I am a man, the support of the family. I do not want them to worry.
Sub-total No. Excerpts (23)		6	9	8	
Total No. Excerpts (30)		11	11	8	

Note: SCWs = skilled CWs; GCWs = general CWs; CS = CWs' supervisors; x = excerpt

Table 2 Summary of CWs' Stress Symptoms

Stress		Group			Excerpts from the transcripts
		SCWs	GCWs	CS	
Physical Stress Symptoms					
1. Physical pain	1. Leg	x			SCW2: My leg is painful, but I am an optimistic man.
			x		GCW2: I am old, and my leg and waist are painful after work.
	2. Waist		x		GCW6: My wrist is painful.
			x		GCW4: My waist is painful, and it is job-induced.
	3. Back	x			SCW4: Sometimes, my back hurts.
			x		GCW1: My back is painful.
				x	CS2: A common physical health problem for CWs is pain in the back or low back. I think this is due to their heavy workload.
	4. Fingers	x			SCW6: When under stress, I unconsciously use excessive force, resulting in pain in the fingers.
2. Eyestrain	Eyestrain	x			SCW1: I have eye problems.
3. Skin problems	Skin diseases			x	CS7: Both painters and mason have skin diseases.
4. Respiratory ailments	Lung problems	x			SCW6: Lots of dust in the air can cause CWs' lung problems, including me.
				x	CS7: For masons, the most common health problems are lung problems.
5. Prostate problem	Prostate problem			x	CS1: If there is a common problem among CWs, it is a prostate problem. They very frequently go to the toilet.
6. Dizziness	Feeling dizzy			x	CS7: CWs are also distracted by their own thoughts, because they want to earn more money and want to find a better job all the time. All of these cause them to become dizzy and thus cause accidents.
7. Loss of appetite	Loss of appetite	x			SCW1: My former partner quit his job and the new co-workers lack sufficient ability to finish the tasks. I cannot finish my tasks on time, and my boss keeps pushing me. I cannot get enough sleep and sometimes even lose my appetite.
8. Sleep disorders	Insufficient sleep	x			SCW3: Due to family issues, I get to bed very late and do not get enough sleep.
Sub-total No. Excerpts (16)		7	4	5	
Emotional Stress Symptoms					
1. Anxiety		x			SCW3: My stress symptoms include anxiety, worrying, and getting upset and angry.
2. Anger		x			SCW6: When I am under stress, I lose my temper, get upset, and use vulgar language.
				x	However, after work my stress disappears.
				x	CS2: CWs often lose their temper. If you criticize them, they argue with you and quit their job.
				x	CS6: CWs become irritable when under stress.
3. Tension		x			SCW6: CWs are tense and we have to spend a lot of emotional energy on thinking about our safety. This is because we know that we will be hurt or killed if we are not careful.
			x		GCW 6: I felt tense.

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4. Listlessness	x			SCW4: I am usually <i>listless</i> , as I get bored by my job.
	x			SCW5: It is very <i>rare for CWs to enjoy</i> what they are doing. They just have to do what they have to do.
		x		GCW6: I have got accustomed to it, and my job makes me feel <i>numb</i> .
5. Worrying	x			SCW1: I <i>continuously worry</i> at work.
		x		GCW1: I <i>worry</i> about money.
		x		GCW3: I just <i>worry that girls don't like CWs</i> .
		x		GCW6: I worry, and this normally lasts for over a week.
			x	CS10: CWs may also <i>worry</i> at work because they don't have job security. They may work on one site today but on another site the next.
<hr/>				
Sub-total No. Excerpts (14)	6	5	3	
Total No. Excerpts (30)	13	9	8	

Note: SCWs = skilled CWs; GCWs = general CWs; CS = CWs' supervisors; x = excerpt

Table 3 Summary of CWs' Performance

Performance		Group			Excerpts from the transcripts
		SCWs	GCWs	CS	
1. Task	1. Quality of work	x	x	x	SCW3: My quality of work is low.
					GCW5: I keep my job quality as high as possible, if I feel no stress.
					CS3: I am not satisfied by CWs’ performance.
					CS4: Dissatisfaction. <i>Stress definitely affects CWs’ performance.</i> Stress distracts CWs, upsets them, leading to work of poor quality.
	2. Work speed	x	x	SCW4: When I am <i>tense</i> , my work speed slows down. My boss will then criticize me, and that increases my stress.	
				GCW2: <i>I don’t feel any stress.</i> I can finish my tasks on time and well.	
Sub-total No. Excerpts (6)		2	2	2	
2. Interpersonal	Interpersonal relationships	x	x	x	SCW5: Stress <i>definitely affects my interpersonal relationships.</i> When I am stressed and worried, I do not want to speak, I often argue with my colleagues, and I use a lot of bad language.
					GCW2: <i>I don’t feel any stress, and therefore have close relationships with my colleagues.</i>
					CS2: CWs also <i>fight</i> on construction sites.
Sub-total No. Excerpts (3)		1	1	1	
3. Organizational	Intention to leave	x		x	SCW1: When <i>I am under stress</i> , I want to leave the company and find another job.
					CS2: If you criticize them, they will argue against you and even <i>quit their job</i> .
					CS3: Because of all the job opportunities there are, CWs will <i>quit if they are criticized</i> .
Sub-total No. Excerpts (3)		1		2	
4. Safety	Accidents	x	x	x	SCW6: When I am <i>under stress</i> , I rush things at work, which increases the <i>risk of an accident</i> .
					SCW1: Both <i>physical and mental health problems lead to more accidents</i> .
					GCW4: <i>Feeling stressed</i> at work also results in accidents.
					GCW6: <i>Insufficient sleep</i> leads to accidents.
					CS9: CWs always want to make thing easy and reduce their own <i>workload, and therefore often engage in unsafe practices</i> .
Sub-total No. Excerpts (5)		2	2	1	
Total No. Ref.		6	5	6	

Note: SCWs = skilled CWs; GCWs = general CWs; CS = CWs' supervisors; x = excerpt

Table 4 Mean of Coping Behaviors, Stress, Performance and Safety for Construction Workers

Coping Behaviors, Stress, Performance & Safety	SCWs			GCWs		
	FG (no. of excerpt)	Questionnaire Mean	S.D.	FG (no. of excerpt)	Questionnaire Mean	S.D.
Problem-based coping						
1. Instrumental support seeking	1	5.50	1.08		3.30	1.96
2. Confrontive coping	1	4.43	1.72		2.60	2.30
3. Positive reappraisal	1	4.93	1.21		2.50	1.54
4. Active coping	2	4.64	1.21	2	3.20	1.15
Sum (FG) / Average (Ques.)	5	4.88		2	2.90	
Emotion-based coping						
5. Emotional discharge	2	4.19	1.15	6	2.93	1.37
6. Emotional support seeking	1	5.05	1.77	1	4.27	1.99
7. Escape	2	4.00	1.91		3.00	1.73
Sum (FG) / Average (Ques.)	5	4.41		7	3.40	
Physical stress						
8. Physical pains	4	3.86	1.56	4	2.78	1.31
9. Breath problem	1	4.14	2.48		2.00	1.26
10. Dizziness		3.57	2.15		2.33	1.75
11. Lost appetite	1	3.17	1.72		2.17	1.47
12. Sleep problem	1	3.86	2.19		2.50	2.07
Sum (FG) / Average (Ques.)	7	3.61		4	2.35	
Emotional stress						
13. Tension	1	3.29	1.70	1	2.17	1.47
14. Listlessness	2	2.57	1.51	1	2.33	1.51
15. Worry	1	3.43	2.23	3	2.67	1.51
Sum (FG) / Average (Ques.)	4	3.10		5	2.39	
Performance						
16. Task performance	2	4.52	0.94	2	3.28	0.93
17. Interpersonal performance	1	4.10	0.50	1	4.61	0.65
18. Turnover intention	1	3.90	1.47		1.83	1.33
Sum (FG) / Average (Ques.)	4	4.17		3	3.24	
Safety						
19. Unsafe behaviors & accidents	2	3.14	1.23	2	2.58	0.83
Sum (FG) / Average (Ques.)	2	3.14		2	2.58	

Note: FG = Focus group; SCWs = skilled CWs; GCWs = general CWs; CSs = CWs' supervisors

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Figure 1 Propositional Coping Behaviors–Stress–Performance Model for CWs
Note: E = Excerpt

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19-Sep-2017

Date

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19th September 2017

College of Science and Engineering

Department of Architecture and Civil Engineering

Journal of Construction Engineering and Management

Dear Sir /Madam,

A FOCUS GROUP STUDY TO EXPLORE CRITICAL FACTORS FOR MANAGING STRESS OF THE CONSTRUCTION WORKERS

Further to your letter dated 31st August 2017 regarding the captioned paper, we have amended the paper in accordance to the reviewers' comments. A summary of our responses to these comments is listed as below.

	Reviewer's comments	Responses
	<u>Reviewer 1</u>	
1	The manuscript has been improved and most comments have been addressed.	Thanks a lot for your comment.
2	It is suggested to adopt more research methods, and conduct additional research work (e.g. model validation using questionnaires).	<p><u>Revised 'Short Questionnaire Survey' section (see page 10)</u></p> <p><i>"In order to cross-validate the qualitative data generated in the focus group, a short questionnaire survey was also conducted after the group discussion. The questionnaire was designed based on extensive literature review, and includes various validated scales for measuring coping behaviors, stress, performance and safety (e.g., Cardena et al. 2000; Folkman et al. 1986; Leung et al. 2015, 2016). A seven-point Likert scale, ranging from 1 (never/extremely disagree) to 7 (always/extremely agree), was used by the participants to reflect their individual opinion on the coping behaviors, stress, performance and safety factors. SPSS 22 was used to statistically analyze the collected data from questionnaire survey."</i></p> <p><u>Revised 'Model Validation with Results of Short Questionnaire Survey' section (see pages 23-24; also see Table 4)</u></p> <p><i>"The results of the short questionnaire survey are shown in below Table 4, including the mean value of the CWs' coping behaviors, stress, performance and safety. For the easy comparison in the results between focus group study and the short questionnaire survey, the number of excerpts resulting from focus group study regarding specific factor were also included in the Table 4. The comparison shows that the number of excerpts in focus group basically matches with the mean value in questionnaire survey (i.e., more excerpts associated with higher mean value for SCWs and GCWs, respectively). For instance, the SCWs, who have reported more physical stress than emotion stress in focus group (i.e., 7 vs 4 excerpts), shown higher mean value in physical stress than in emotional stress in questionnaire survey (i.e., 3.61 vs 3.10; see Table 4); and the GCWs, who reported more emotion-based coping than problem-based coping in focus group study (i.e., 7 vs 2 excerpts), rated higher in emotion-based coping than in problem-based coping in questionnaire survey (i.e., 3.40 vs 2.90).</i></p> <p>Although there are five excerpts in focus group for both SCWs' problem-based and emotion-based coping behaviors, the mean value of their problem-based coping is slightly higher than the mean value of emotion-based coping (i.e., 4.88 – 4.41=0.47). It is obvious that the 'Instrumental Support Seeking' (5.50) largely contributes to the little differences. In fact, the high frequent adoption of 'Instrumental Support Seeking' by SCWs is understandable when taking their realistic situation into consideration. On one hand, the construction industry has long been adopting the mentor–mentee program among CWs, which allows CWs learn from others; on the other hand, the SCWs almost always work on</p>

similar/same tasks on the construction site, and the junior SCWs may encounter problems that were facing the senior SCWs before. Therefore, seeking instrumental support from experienced SCWs should be one effective and frequent way for SCWs to resolve problems.

< Table 4 >”

Revised ‘Research Limitations and Future Directions’ section (see page 2)

“The data for this study was gathered from focus group studies, composed of SCWs, GCWs, and CSs groups. Given that every research method has potential biases (Webb et al. 1981), various actions were taken in current study to ensure the reliability of the research results: (1) a purposive sampling technique was used to ensure the suitability of the participants (e.g., they needed to have a certain amount of experience and have a specific trade); (2) standardized questions and procedures were applied to ensure comparability of the among groups; (3) the policy regarding confidentiality was announced at the beginning of the focus group sessions, so that the participants felt free to express their opinions; (4) to prevent some voices dominating, the mediator/researcher gave the participants equal opportunities to speak; (5) multiple resources were used to record the evidence, including note-taking during the sessions, voice recording, worksheets, and so on; (6) the participants were relatively homogeneous in each group, so that they had similar experiences of specific issues; (7) the purpose of the research was explained to the participants at the beginning of each focus group session, so they had a good understanding of what the mediator/researcher wanted to learn from them; and (8) the focus group studies involved skilled CWs, general CWs and their supervisors with different background (e.g., organization, employment types and project types), which ensures the representativeness of the study. *In addition, the proposed propositional model has been validated by a short questionnaire survey study with quantitative data (i.e., between-methods triangulation; Berg 2001).* In view of above, it is confident that the results of current study are reliable.”

Reviewer 3

1	The paper is well revised according to the comments in general.	Thanks a lot for your comment.
2	It is desirable to mention briefly the contents of "Psychological Stress and the Coping Process" so that readers can compare these with those of this study.	<p><u>Revised ‘Coping Behaviors’ section (see page 4)</u></p> <p><i>“Individuals normally experience appraisal processes in which they evaluate their capability, availability and resources to cope with stressful events, and proponents of the classical transactional model of stress and coping claim that appropriate coping behaviors can shield individuals from stress (Lazarus and Folkman 1984). Coping behaviors have been viewed as individuals’ conscious efforts to manage conflicts between the demands on them and their resources (Haynes and Love 2004; Weiten and Lloyd 2009). Commonly identified coping behaviors in professions other than CWs (e.g., construction professionals, nurses and salesmen) include avoidance of stress, confrontive problem solving, emotional discharge, support seeking and so on (e.g., Haynes and Love 2004; Leung et al. 2015a).</i></p> <p><i>During the coping process, several factors may influence an individual’s selection of coping behaviors; these factors include personality, socioeconomic status, past experience, perceived level of stress, and occupation (Leung et al. 2006, 2014; Ursin and Eriksen 2004). As stressful situations for CWs in real life are extremely complicated, it is hard to predict their coping behaviors simply from their work characteristics, stress levels and backgrounds...”</i></p> <p><u>Revised ‘Stress’ section (see page 5)</u></p> <p><i>“Stress is defined as the non-specific body response which appears as a result of frequent and/or continuous discrepancies between the demands on an individual and his/her ability to cope with the demands (Ganster and Rosen 2013; Lazarus 1990; Selye 1956). Stress can induce internal adjustments of the human body, and the adjustments may further develop into physical stress</i></p>

symptoms in response to chronic exposure (Ganster and Rosen 2013). *Common physical stress symptoms in individuals include physical pain (headaches, back pain, etc.), eyestrain, and respiratory ailments (Nixon et al. 2011; Schat et al. 2005). It has also been claimed that various emotional stress symptoms, such as anxiety, tension, and depression, can also manifest in human beings as a result of continuously facing stressful events (e.g., Bryant 2013; Meliá and Becerril 2007)."*

Revised 'Coping Behaviors of CWs' section (see pages 11-12)

"The results show that unlike their supervisors (e.g., project managers who used to adopt problem-based coping behaviors; Aitken and Crawford 2007; Leung et al. 2015a), the CWs generally tend to adopt more emotion-based (10 types; 25 excerpts) than problem-based coping behaviors (five types; seven excerpts) when suffering from stress. Moreover, it is interesting to find that only the CWs (both the SCWs and GCWs) reported that they adopt problem-based coping behaviors to cope with stress; while according to the CSs who are the CWs' supervisors, CWs only adopt emotion-based coping behaviors (see 'x' columns for SCWs and GCWs; and '0' excerpts reported by CSs in Table 1). This finding uncovered the realistic situation that the CWs generally have very limited resources at work (e.g., less/no power to make their work favorable for them; Stattin and Jarvholm 2005) and private life (e.g., low socioeconomic status; Ursin and Eriksen 2004), which prevents them from adopting problem-based coping."

Revised 'Problem-based Coping Behaviors' section (see pages 13-14)

"It was found that—contrary to the public image of CWs as being passive, rude, and straightforward—CWs actively resolve their problems (i.e., actively address the sources of stress). While engaged on construction tasks, CWs "try to find a good way to resolve [problems]" (GCW5) and/or "negotiate with other CWs and try to resolve the problems" (SCW3; also mentioned by GCW2). Moreover, it is interesting to find that CWs understand the negative influence of the demanding construction tasks and the hostile construction site environment, and therefore intentionally make themselves relax..."

Revised 'Problem-based Coping Behaviors' section (see pages 16-17)

"Physical pains are the most widely reported physical stress symptoms (eight excerpts; see Table 2); these include pains in the leg (two excerpts), waist (two excerpts), back (three excerpts), and fingers (one excerpt; GCW2, GCW4, GCW6, SCW2, and SCW6). Previous studies have regarded the pain experienced by CWs as a sign of musculoskeletal disorders (MSDs) and have attributed MSDs to strenuous physical activities, awkward work postures, and so on (e.g., Hess et al. 2004; Spielholz et al. 2006); however, it is interesting to know that physical pain may also be a manifestation of stress and this fact is supported by the observations of the focus group participants. The SCW and CS groups tried to explain how these physical stress symptoms are induced. One project manager (CS2) thought that heavy workloads cause the onset of back pain in CWs; and a skilled worker (SCW6) explained that "under stress, I unconsciously use excessive force, resulting in pain in the fingers". A CW may make bodily adjustments in response to external forces; for example, exerting more force with the leg in order to work faster. Long-lasting bodily adjustments without proper breaks may cause physical stress symptoms in the form of pains."

3	This research results could be the basis for practical stress management model in the future, even if there is the limitation of validation applying to the real construction projects as case studies for the propositional model in this research.	Thanks a lot for your comments. In fact, the exploratory focus group study has laid the ground and set a necessary basis for future study.
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1 We believe that the above response is sufficient at present and all of editor's comments have been responded.
2 Please don't hesitate to contact me at any time should you have any queries. I look forward to receiving your
3 positive response at your earliest convenience.
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5 Yours faithfully,
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Mei-yung Leung
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15 Encl. – A paper entitled “A Focus Group Study to Explore Critical Factors for Managing Stress of the Construction
16 Workers”.
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