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The impact of fatigue on workforce sustainability in the construction industry

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Abstract:
The construction industry is widely recognised as very demanding of its workers, and fatigue is a common result. Long working hours, unreasonable deadlines, heavy workloads, lack of resources, and a macho work culture are common features of industry practices internationally which can be seen to contribute to this. At the same time, there are widespread concerns around workforce sustainability. Developing and maintaining a skilled workforce is a challenge for many employers, particularly in the current situation with a large cohort of aging workers leading to an imminent need for workforce renewal. This paper presents the results of an exploratory study into the conditions leading to fatigue and its impact on construction workers in Auckland, New Zealand. Participants described fatigue-related effects such as damaged relationships and increased workplace conflict, job dissatisfaction and poor work-life balance, as well as specific health and safety issues such as deteriorated vision, mental exhaustion and impaired decision-making leading to accidents. Managing fatigue in the face of the demanding work environment is a specific health and safety concern for older workers, given the physicality of many construction industry roles. For younger workers, while health and safety is still an issue, a potentially more important factor is the effect of fatigue on workers' satisfaction and thus retention within the construction workforce, and how fatigue and its causes and consequences affect the image of the construction industry.

Keywords:
fatigue management, health and safety, work-life balance, work hours, worker retention

1 Introduction

In New Zealand, as in many developed countries, the construction industry is currently facing a skills shortage. Companies are struggling to retain skilled and experienced employees, and the recruitment of new entrants to the industry at all levels is not keeping pace with the demand for workers. At the same time, the impending retirement of the 'baby boomer' generation is adding further pressure in a sector that is experiencing strong and continued growth. Companies are seeking to capitalise on the current buoyant market, to enhance performance and improve productivity, to maintain financial health, attract investment, and satisfy the needs of stakeholders, while remaining competitive. These goals are threatened if the costs involved to manage employee retention and recruitment, health and safety and wider productivity are high. Poor management of these issues causes a significant knock-on effect to the industry, and therefore the economy. At an individual level, impacts are equally large, with wellbeing, income and family and community involvement all affected. Worker fatigue is an under-recognised factor in all of these issues, which originates with the individual, but has potential consequences at organisational through to national levels.

This paper presents the results of an exploratory study which sought to identify some of the issues facing the New Zealand industry regarding worker fatigue. A qualitative approach was taken, using in-depth interviews with a small self-selected sample of industry participants who have experienced fatigue in their daily roles. No attempt has been made to quantify any of the various experiences as representative of a particular type of role or industry discipline. Instead, the goal was to identify and describe experiences situations and influences that have affected the participants in relation to fatigue, and explore the potential implications of these on the wider industry.

No work on fatigue has previously been conducted in the New Zealand construction industry, but due to the requirements of the Health and Safety at Work Act (HSWA) 2015 it is an issue that is attracting increased attention. While health and safety is a valuable focus for the industry, it is important that it is not the only aspect of fatigue considered. International literature suggests that fatigue and its contributing factors have a wide range of impacts on construction workers and the industry as a whole, and this research demonstrates that these are of concern within the New Zealand environment as well.

2 Literature Review

Fatigue is a complex condition which can affect job performance, and may have a cumulative effect over time (Phillips, 2014). Depending on the individual, fatigue can present itself in different ways. Lingard (2010) and Phillips (2014) describe the personal and workplace effects of fatigue, including emotional exhaustion, psychological distress, anxiety and depression, absenteeism, poor work performance, increased risk or rate of accidents, and increased human error. Many of the undesirable characteristics of the construction industry, including exposure to extreme weather conditions, unpaid overtime, and tight deadlines, have been shown to increase the likelihood of worker fatigue (Morrison and Thurnell, 2012). Consequently, fatigue is a multi-faceted problem with many causes and consequences, which is particularly relevant to construction.

Fatigue is often seen as a consequence of the type of work carried out in the construction industry. Various studies have explored fatigue from this perspective, including the impacts of working at height (Chang *et al.*, 2009), the physical condition of project sites (Pheng and Chuan, 2006), and the contribution of other factors such as operation of construction machinery, hazardous materials, and weather (Haslam *et al.*, 2005). More commonly however, fatigue in the industry is attributed to the long hours worked by construction workers, whether resulting from working long stretches of time during a day with little or no break, or working many consecutive days without a day off to recover (Haslam *et al.,* 2005). Despite research demonstrating the negative consequences of consistently working long hours, the practice has been normalised within the industry (Goldenhar *et al.,* 2003), so that the resulting fatigue is often seen simply as an expected part of the job.

Much of the research on fatigue in the construction industry has been concerned with its effect on health and safety. Caruso (2006) performed a comprehensive workplace study which identified that fatigue can negatively impact the performance of any employee. Cognitive, sensory and motor functioning were shown to be increasingly impaired as work-time and thus fatigue increased, and fatigue has been shown to be a principal cause of accidents in the construction industry (Chan, 2011). Work Safe New Zealand (WSNZ) (2017) emphasises that fatigue management can minimise incidents and injuries, and effectively increases opportunities for companies to improve performance and reduce costs associated with accidents, as well as improving employee morale.

Although more difficult to define and quantify, subjective effects of fatigue on morale and individuals' perceptions of the industry are also an important consideration. Fatigue has been shown to be significant factor in burnout and work-life conflict in construction employees (Lingard, 2010), and so is a contributing factor in building a negative image of construction that deters people from entering or staying in the industry. Job satisfaction plays a big part in retaining skilled workers. Caruso (2006) argues that ongoing fatigue can force construction employees to leave their job, and Lingard et al. (2007) identifies a direct link between limiting work to a 5-day week and retention of salaried employees, with reduced fatigue, greater job satisfaction and less stress all contributing to higher rates of staff retention. However, there is clearly a socio-economic aspect that must be considered, as the same study identifies that wage earners were concerned about the resulting loss of net income. Francis and Lingard (2012) urge the construction industry to rethink traditional work patterns and work environments, and suggest that improving the working environment, including through fatigue management, could potentially assist with retaining skilled workers and attracting new recruits.

Management of work-life balance is another area where fatigue is an important element. With long work hours, weekend work and inflexible work schedules it is understandable that many construction workers experience work-life conflict (Morrison & Thurnell, 2012). Dual-earning households are now common, and the need to care for dependants both young and elderly is increasing. Therefore, non-work responsibilities provide workers with additional pressure within their home environment, often causing conflict. Fatigue, both physical and emotional, can be a direct result of trying to meet too many demands at work and at home.

3 Research Methodology

This research project was an exploratory study of the impact of fatigue on workers' experience of the construction industry, and how it contributes to their attitudes and perceptions of the industry. A qualitative survey approach was used, based on semi-structured interviews. A series of open-ended questions were prepared, with a variety of predetermined prompts to be used if necessary. As emphasised by Alvesson (2011), the value of using this type of interview structure is that it provides a framework so that specific issues can be addressed, but has the flexibility to allow in-depth exploration of the interviewees' varied opinions and experiences. This ensured that all participants discussed the core elements of the research topic, but also allowed them to describe their own experiences in a way that suited them. The intention of this approach was not to provide a representative view of how fatigue affects the construction industry, but rather to explore some of the experiences and attitudes of individuals involved in the industry to gain an awareness of their concerns. This individual-level view is a means of providing insight into performance issues within the construction industry (Phua, 2013).

Personal and industry networks were used to contact potential participants who were construction industry employees with personal experience of fatigue. The 16 individuals who were selected to participate were drawn from different companies across the Auckland region, and represented a wide range of characteristics: construction experience varied from new entrants (a few months) to 21 years in the industry; and a variety of site-based and office roles were represented. The sample included two participants in skilled trades roles, and the remainder were construction professionals such as quantity surveyors, construction managers and project managers. Some of the key features of the participants' employment characteristics are represented in Figure 1. Both male and female participants were included, with a variety of family situations; ages ranged from

19 to 62, with the majority of participants in their late 20s/early 30s; other personal details such as race and religion were not recorded.

All the participants clearly identified with at least one of the three main traits of fatigue: emotional, physical, and mental, with most participants identifying two or three of them. Many other potential participants who had been grossly impacted by fatigue expressed interest in the research, but were unable to participate due to time constraints.

An additional participant was included, not because of his personal experience with fatigue but because of what he had observed in his role as an assessor for WorkSafe, the organisation that oversees New Zealand's workplace health and safety system. He made clear that his responses were based on his own opinions and perceptions and did not represent the Work Safe position on the subject; however his involvement with workplaces across the industry added a valuable dimension to the study.

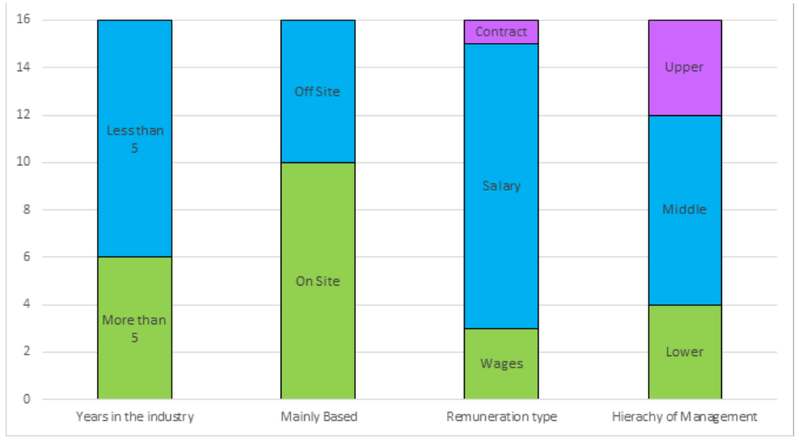

Figure 1. Participants' employment characteristics

4 Findings and Discussion

4.1 Causes of fatigue

Fatigue is a complex issue with many contributing elements and consequences. For the workers interviewed, there was no question that fatigue is a problem in construction, and they saw it as an intrinsic and systemic aspect of working in the industry. Many of the assumptions around fatigue in construction stem from the nature of the work, but only one participant mentioned the physical or environmental requirements of construction work as a contributing factor, giving examples of heavy lifting or being out in the sun all day and needing to keep hydrated. On the other hand, every participant spoke of experiencing long hours extending well past a standard working week, whether through long days or weekend work, or both. For most participants, however, the physical impacts of long hours alone were not the main cause of fatigue. Instead, they reported a feeling of pressure and unrealistic expectations that created both emotional and mental fatigue.

Participants described tight deadlines, overwhelming workload, a constant sense of urgency, and a feeling that they are expected to push themselves to the limit day after day workers to do everything that needs doing. Two phrases stood out in the interview data as they were so often repeated: "get the job done" and "overworked". In spite of feeling

constantly overloaded, construction workers either considered themselves that it was necessary to do whatever they possibly could to get the job done, or felt this expectation from managers and peers. One participant recounted that he had on occasion had to leave work early due to his overwhelming fatigue. He quickly modified this statement with an explanation that he was still expected to carry out his full contract hours that day, but he was no longer expected to work overtime. He further explained that the long hours were causing his fatigue, which was forcing him to take time off work, which increased his workload, which forced him to work longer hours. This is a vicious cycle that many participants seem familiar with.

Many participants showed pride in their ability to do extremely long hours for their project or company. Some identified that their workplace would be very supportive in allowing breaks or time off to manage fatigue, but in order to build or maintain their own reputation they would not be open with management regarding their experience of fatigue. Instead of seeking a solution for their fatigue, they remained 'tough' and focused on the project to 'get the job done'. This attitude has been characterized as part of the macho culture of the construction industry, and it appears that both men and women are reluctant to share their sense of weakness. Gascoigne et al. (2015) characterise construction as an 'extreme job', which they identify as having professionals and managers working in demanding roles requiring exceptionally long hours. They identify one of the central drivers of this environment as competitive masculinity. Construction employees typically believe they need to endure ailments such as fatigue as they do not want to be seen as incompetent or weak.

Only one participant went against this culture and said that he would not risk his health for the sake of his job. He shared his experiences with fatigue and told of how he almost lost everything, including his family, because of his blind loyalty to the project. He stated that he will never put himself through that again; now he will always put his family first, and that also means looking after himself. Other participants appeared defeated by their experiences and spoke of how they felt burnt out, but were powerless to do anything about it. One commented, "…people think you can pull a rabbit out of your hat all the time…" He explained that once a worker has shown a willingness to put in extra effort to deliver what is required in a particular situation, that level of effort then becomes a base-line expectation with no additional reward. Not meeting that expectation would result in the worker being considered weak, lazy or useless.

4.2 Experiences of fatigue

Every participant described experiencing some combination of emotional, physical, or mental fatigue traits. The commonly mentioned experiences are listed in Table 1. Typically for each participant there was no single impact, but they reported combinations of effects, for example, "everything was just too overwhelming, my vision deteriorated, it was difficult to manage everything, and I noticed I had a short temper. I felt sorry for my colleagues, I would snap at them whenever they asked a question." From this description, it is clear that the effects of fatigue go well beyond simple tiredness. The most commonly described traits related to mental fatigue; one participant was certain that the mental effects were more significant, stating that "mental exhaustion is way more difficult to manage than physical exhaustion," while another who had moved from a site role to an office role agreed, "it was easier when I was on site and more active."

Many felt that fatigue affects the way they relate to others they work with. Experiences of fatigue that involved colleagues were generally negative, with short tempers and a lack of patience the most common inter-personal responses. In some cases, however, positive

impacts were also felt. Several participants expressed empathy with colleagues facing the same situation, and described how the awareness of shared hardship created a sense of solidarity. Attitudes towards management were similarly mixed. Negative experiences were mostly related to the pressure put on by management in terms of meeting the project requirements, regardless of the impact on workers. Some managers were seen as sympathetic to the workers' situation but unable to help because they were in the same position themselves. One of the participants who held a management role expressed concern for his workers, saying "I worry that the guys on site aren't getting enough rest, enough time to recharge, and a lot of mental recharging as well, that's really important" and another identifying that "some people are sensitive, [you've got to] look out for your staff." They expressed support for staff who needed to manage their fatigue, but both also experienced the same situation themselves, with fatigue caused by "long hours on site from early morning to late evening. Feeling behind the program puts more pressure and more demand on you which adds to the feeling of exhaustion."

Table 1. Effects of fatigue

Physical	Mental	Emotional
Physical exhaustion	Mental exhaustion	Feeling emotional
Eye fatigue & deteriorated vision	Feeling drained	On a short fuse/ grumpy/short tempered
Aching muscles	Easily distracted/needing personal discipline to stay on task	Feeling irrational/overreacting
	Feeling pressured/stressed	Frustration
	Lacking concentration	Feeling overwhelmed
	Poor decision making	Impatience

Fatigue experienced at work does not only affect work environments and relationships. Many participants agreed that their fatigue had an impact on their behaviour at home. The most common effects described were grumpiness and frustration being taken out in their personal relationships. A few shared their feelings of inadequacy or resentment as they discussed how their relationships struggled as a direct result of their fatigue, whether through not having the energy to help with home duties such as cooking or childcare, or having no motivation to participate in sports or social activities. One participant summed it up succinctly: "it affects my personal life - I just want to sleep!"

4.3 Managing fatigue

Based on the experiences of these participants, fatigue management seems to be almost non-existent in the construction industry. When asked what strategies were in place to manage fatigue in their company, the majority of participants did not think there were any. One manager explained that their company" …doesn't have any systems in place that I'm aware of. As a manager I can't tell the workers what to do in regards to fatigue. They choose to work long hours because they need the money." The WorkSafe assessor stated: "I would go as far to say as fatigue is not "managed" at all. The reality of that is people haven't made the link between having well rested staff and higher productivity. When work is going well, people manage their own levels of fatigue and wellbeing. But as soon as work gets behind it is just expected in the construction industry that workers will just keep going until the job is done." One of the participants also alluded to research

that has shown that longer hours do not produce better project outcomes: "A lot of people have the idea that to get more done you need to put in more hours, but productivity drops so it has the opposite effect."

Several suggested that their companies made an attempt at fatigue management but it was either not taken seriously or not dealt with appropriately. Three respondents identified that their company had policies around limiting the number of hours worked per week. As one reported, "We use Time Filer, where worker hours are limited to a maximum of 60 hours per week. Though, this is not effective as I did 68 hours just last week. Deadlines make it difficult to accommodate fatigue." Some stated that they were expected to take breaks if they were fatigued, as another participant explained: "As part of our contract we are required to take a break, but I haven't seen it be effective yet." Another participant mentioned that in his company they talk about fatigue during toolbox talks, and encourage their staff to discuss it, but these approaches do not seem to have any impact on reducing fatigue. The other measure mentioned was being expected to report fatigue to management, but with unsympathetic responses this was also dismissed as ineffective.

Some participants alluded to the possibility of challenging their companies' expectations through reference to health and safety legislation, but had little conviction in taking this route. A few participants had encountered a bad response from their manager when attempting to manage their fatigue by requesting reduced hours or time off. One participant said "I wouldn't waste my breath telling my boss," while others recounted being told to "harden up" or "…just shut up, and get on with it". Several participants considered this to be part of the "old school mentality in the construction industry" because older managers have no recognition that this is an issue they need to be concerned about, however younger workers were seen as more aware of the problems associated with fatigue: "Just because you can't see it doesn't mean it's not there – older generations won't ever fully understand this concept."

4.4 Fatigue as a health and safety issue

Despite participants recounting many experiences that demonstrated the significance of fatigue in mental and emotional well-being, most perceived it primarily as a safety issue. When asked whether they felt fatigue was a health issue in the construction workplace, all participants immediately responded with reference to safety concerns. Hazardous situations such as driving and operating machinery, or working on ladders or scaffolds were listed as particular concerns with respect to fatigue. Even though the question used the word 'health', several of the office-based employees noted that for them it was not an issue because the risk of accident in the office environment was low. Only two participants identified the health aspects, and both likened fatigue to mental illness. However, rather than connecting it to personal wellbeing, one still went on to add, "It affects your ability to do the job well and safely."

This tallies strongly with the observations of the WorkSafe assessor, who noted that health risks in the industry were poorly recognized; "Even now with the older builders dying of asbestosis, most builders don't seem to care about asbestos and that is something that is more visible than fatigue or stress, so issues like fatigue and stress are even less understood. I think it ties in with other campaigns outside of work about mental health that at least people are aware of it. But they do not yet understand." He identified that from a WorkSafe perspective they do not identify why an accident or incident has occurred, "the focus has always been on the steps taken or didn't take, rather than going back to the root cause of why the poor decision was made in the first place." As a result, the inclusion of health and wellbeing into workplace health and safety legislation has not

made any significant difference, “We are still focussing on machine guards, slips,trips and falls, falls from height, site boundaries, rather than discussing and influencing duty holders in respect to fatigue.”

The impacts on health and happiness reported in the literature are clearly supported by the findings of this research. Undesirable effects of fatigue on work-life balance, work and personal relationships, and mental, emotional and physical health were all described by participants. These contribute negatively to job satisfaction and workers’ retention within the industry (Chih, *et al.*, 2016) and also the image that is presented of the construction industry. Brace and Gibb (2005) describe “ill health”, including fatigue, as being problematic for construction employees, with an impact on recruitment and job retention.

4.5 Fatigue as a workforce sustainability issue

Although it was not an issue at the forefront of participants’ minds, it was evident that fatigue affects their perceptions of the construction industry as a desirable occupation. Three of the participants had previously changed employers because of negative experiences with fatigue, and others spoke of seeing co-workers take extended leave, change employers, or burn out and leave the industry altogether. Several were quite negative about their chosen career path and cynical about their future in the industry. The likelihood of change in the near future was felt to be very low.

Younger workers tended to argue that companies needed to do more to reduce the demands on their employees. Suggestion actions that are needed include better resourcing with more staff on the job, changing schedules, and limiting hours. The attitude of managers was also called into question, with several participants challenging the mindset which viewed employees as just another resource. One participant argued that it was how he was treated that drove the feelings of fatigue rather than just the amount of expected of him “I had one manager who kept telling the workers to work harder and longer hours - I just left that job! A good manager who cares about the workers makes you want to work harder and do more for them.” This was reiterated by another who stated that “no one really cares about the people – they just want to get the job done.” Two participants also laid some of the responsibility on the clients, whose unrealistic expectations drove the high pressure environment. Again this came back to the companies, however, with one participant noting that while clients need to be made aware of the impact that their tight programmes have on workers’ health, productivity and quality, “the company needs to explain this to the client. But unless you are an extremely large company, it’s probably not likely!”

Older workers, while experiencing similar levels of fatigue, seemed to be more accepting that it was just part of how the industry is. They had fewer expectations of the companies or management, and felt that it was their own responsibility to manage their fatigue: “When you are as old as me, you learn to just deal with it on your own.” Government support was seen as necessary by several people across the age groups, though several cautioned that although government pressure was necessary to drive change, it could potentially make things more difficult if systems were required that did not match the needs of the industry.

The most common suggestion for change across all participants was the need for employees to speak up and help to change the mindset of the companies, to help shape the culture, and to work to make positive changes in the industry. Several described the need for a cultural shift, allowing for comfortable communication around fatigue in the workplace. Some, including the WorkSafe assessor, felt that management of fatigue

depended more on younger people coming into the industry rather than the older managers, “I believe it is a generational culture issue. You can keep telling people that getting tired makes it more dangerous, but unless they grow up believing that I don’t think we’re going to get any real change.”

With the small sample used in this study any gendered differences in the experience of fatigue have not been explored, but the gender imbalance in the construction industry is a well-recognised phenomenon. Sunindijo and Kamardeen (2017) found that fatigue and its contributing factors are stressors for both male and female construction professionals, and that female professionals may be more severely impacted. This potentially creates additional impacts on workforce sustainability if women are deterred from entering the industry, or leave as a result of their experiences with fatigue.

5 Conclusions and Further Research

All participants consider that fatigue is a significant issue with impacts on productivity and performance, work-life balance, and health & safety. The only positive aspect noted was that some workers found it heartening to know that they were part of a shared experience, as they see co-workers endure fatigue as well. Many felt that it was just an expected part of working in construction, but all believed that it had a negative impact on themselves, their families, their work environment and the projects they worked on. Most of the concern around fatigue, both in the literature and from the interviews, focuses on the health & safety aspects and the increased risk of accidents and injury on site. However, the experiences recounted by this group of construction employees indicates much wider cause for concern. Over half of the group had either changed jobs themselves or seen co-workers do so, as a result of fatigue and the factors that contribute to fatigue. Tolerance of these conditions appears to be lower in younger employees than in older workers. In order to successfully manage ongoing recruitment for renewal and expansion of the construction workforce, more attention needs to be given to addressing the root causes of fatigue, and improving the very negative conditions that workers are experiencing on a daily basis. Very few strategies were identified that were used by companies or workers to combat fatigue. The experience of most participants was that there were no strategies in place to help combat fatigue. Some who had experienced attempts to limit hours or introduce requirements for breaks or rest periods saw very little change in the way work was managed, so are yet to be convinced that there is a solution to the problem of fatigue.

The participants in this study were self-selected as being affected by fatigue in their daily roles, and their experiences as reported here are useful to illustrate the impacts of fatigue at an individual level. A future area of research that would be of value in the current tight employment market would be a similar investigation focusing specifically on workers who have recently changed jobs or left the industry, to attempt to identify the significance of fatigue and its contributing factors on employee retention and career choices. There is no doubt from the results presented here that fatigue is a real problem for construction employees. Investigating the extent and impact of that problem warrants further study.

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Work-related diseases in the Australian construction industry

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Abstract:

Work-related diseases in construction have not gained enough attention though they are as critical as work injuries. This study investigated the diseases recurrently suffered by construction workers in Australia and their severities. It was found that fatalities are primarily caused by occupational cancers, respiratory system diseases and circulatory system diseases. Similarly, most of permanent incapacities are caused by nerves system diseases at work. Chemicals, substances, heat and other environmental factors are found to be the primary agents of work-related diseases affecting construction workers. Proving occupational causes for diseases is challenging and as such obtaining fair workers compensation is at stake. The findings of this study establish the association between diseases and occupations within the construction industry in a bid to curtail the challenge and uncertainties facing construction workers. It is also recommended that if workplace health authorities maintain a nation-wide e-occupational exposure registry and mandates employers and employees to record their occupation and hazard exposure details whenever a new job role is assigned/assumed to/by an individual, it will further reduce the challenges and uncertainties surrounding workers' compensation for occupational diseases.

Keywords:
Work health and safety, work-related diseases, construction, workers compensation, Australia.

1 Introduction

The construction industry is vital for the economy of any country; it creates the physical infrastructure essential for the functioning of the nation, provides jobs for many residents and contributes significantly to GDP. Meanwhile, it is characterised by high rates of work-related fatalities, injuries and diseases globally (Cigularov et al. 2010). Riva et al. (2012) reported that the prevalence of work-related diseases in the construction industry is high, with a peak among the elderly, but also significant occurrences among young people. They further asserted that the percentage of workers with limited fitness to work, caused by work-related diseases, is high too. These diseases impose significant physical and economic sufferings on workers and the economy and thus need to be prevented. Much research has been conducted globally to investigate fatalities and injuries from different perspectives. However, work-related diseases have not gained enough attention due to their invisibility and the challenges involved in obtaining accurate data (Safe Work Australia 2017). Numerous challenges are associated with obtaining accurate data owing to the time lag between the exposure and the disease onset, as well as the possibility of multiple causes, both work-related and non-work related, for a single disease.