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The Role of Ergonomics for Construction Industry Safety and Health Improvements

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Introduction

The construction industry is one of the most hazardous and accident-prone working environments and one of the highest risk businesses as far as its activities are concerned. Building workers are exposed to excessive construction site dangers that can result in injuries or even death. They face different kinds of safety and health hazards whilst working in their work sites every day.

The recent literature report that construction workers experience two times more work-related injuries and illnesses than the average for all other industry workers [1,2]. The World Health Organization (WHO) has characterised "work-related" diseases as multifactorial to indicate that a number of risk factors such as physical, work organisational, psychosocial, individual, and socio-cultural issues contribute to causing these diseases [3]. The sum of these challenges affects the working capacity and decreases the satisfaction of the individual worker.

With increasing development of the construction process, building workers seem to be constantly exposed to unfavourable ergonomic challenges by its wide range of activities. The highest worker injury and fatality rates from then construction industry make it as an extreme risk sector in regard to Work-Related Musculoskeletal Disorders (WMSDs) in particular [4,5]. The Musculoskeletal Disorders (MSDs) remain in the most prevalent form of occupational ill health, prompting examination of the reason to manage the problem that has been less successful than perhaps hoped [6].

MSDs are the most common work-related health problems. For instance, across the European Union (EU) countries, 25% of workers complain of a backache and 23% report muscular pains. MSDs are the biggest cause of absence from work in the United States [7]. In the US, the most common types of nonfatal occupational injuries that result in days away from work are musculoskeletal injuries such as sprains and strains. A similar problem had been observed in Brazilian workers. The most frequently affected body part was the shoulder (49%), followed by the neck (47%) and back (39%), respectively [7]. In the Swedish construction industry, more than one worker in five has reported WMSDs and these disorders constitute about 69% of all reported work-related injuries in 2005 [8].

Based on the findings of ergonomics study amongst South African construction management and workers, Smallwood concluded that the use of body force, reaching away from the body, reaching above the head, repetitive movements, bending or twisting the back, climbing and descending were common and constitute work related job problems [9]. The situation is worst in developing countries. Accident and injury rates in many of the developing countries such as Nigeria, Thailand, and Tanzania were considerably higher than in European countries. Every construction worker was likely to be temporarily unfit to work at some time as a result of moderately serious injuries or health problems after working on a construction site [10].

However, nearly all injuries and illnesses occurring in the field of construction industry seem to be preventable because the safety and health problems are closely related to the organisation of building projects and performance of manual tasks [11]. Most risks in the construction industry may result from an insufficient communication of site information and inadequate measurement technologies [11]. This means that construction companies can prevent such hazards and injuries from occurring if they are familiar with them and know how to identify all these potential dangers. At the same time, construction workers must be aware of their susceptibility to any harm or injury in their workplace. Therefore, if sufficient and adequate information of workplaces, manual tasks, and continued training and educations are provided, the safety and health performance in the construction industry could be significantly improved.

Construction Works and Ergonomic Concerns

Construction works and safety and health

Construction works typically require the adopting of awkward postures, lifting of heavy materials, manual handling of heavy and irregular-sized loads, frequent bending, bending and twisting of the body, working above the shoulder height, working below the knee level, staying in one position for a long period, climbing and descending, and pushing and pulling of loads [12]. These are all done under difficult circumstances. In most developing countries, safety consideration of construction workers in their construction project delivery is not given a priority and the employment of safety measures during construction works is considered a burden as it is not addressed [10].

Because of work types involved, WMSDs are one of the leading causes of occupational injuries in the construction industry [5]. Because the construction industry is by nature labour-intensive, it is difficult to avoid workers being exposed to manual tasks with forceful exertions and awkward postures [5]. Additionally, considering the presence of heavy equipment, physically demanding tools, and changing work environments, the job sites in the construction industry are more dangerous than any other business environments [13]. Specifically, WMSDs are responsible for about 34% of nonfatal injuries [14]; compared with other industries. Workers in the construction industry are more likely (approximately 50% higher risk) to suffer from WMSDs [4]. As a result, increased health care and compensation costs for disabled workers are frequently invested in construction companies

[15]. For example, the annual cost of WMSDs to the Canadian economy is approximate $20 billion [16].

Currently, construction industries have focused more on improving productivity over ensuring safety and health issues of the construction workers such as conducting ergonomic analysis [17]. As a result, project managers should be aware that the economic outcome of increased productivity may be counterweighed by the increased medical and compensation costs caused from WMSDs. But, ergonomic analysis for the WMSDs is not sufficiently addressed by construction companies [5]. The planning stage is of great importance because it is the phase when engineers design how construction projects work in detail. Therefore, preventive measures by considering any safety problem and/or risk should be offered from a planning stage or phase. This precautionary approach may potentially reduce majority accidents in the construction industries [18,19].

Ergonomics Contribution in the Construction Industry

Overall commitments

Ergonomic resolutions have contributed to preventing injuries and fatalities and facilitate safety and health practices for the construction workers [20-22], but there seem to be great potentials for more widespread applications. For example, more than 90% of the US construction companies ranging in size from 6 to 3,000 workers have a written safety program, but only a third have an ergonomic program [23]. Management and employees at all levels of the industry state that construction work is just hard and there is simply no way to avoid wear and tear issues on workers' bodies [23]. Existing research mainly provides invaluable information on kinds of tools used, the repetitive actions, the body positions, how jobs are planned and implemented, and the introduction of tools, processes, and technologies that can mitigate strain and sprain-type hazards. There is little research on the actions or specific messages that can move the construction industry to change ergonomic practices, equipment, and policies.

Prevention of injury and illness amongst the construction workers requires dissemination, adoption, and implementation of effective interventions, or research to practice [24,25]. Regulations may require employers to make changes, but knowledge, attitudes, and work practices can evolve significantly even without regulations. A recent study identified seven levels of changing behaviours with respect to intervention measures in the construction industry: being aware of the intervention, understanding it, wanting it, intending to buy/lease it, the ability to use it, using it, and continuing to use it [26]. According to the conclusion from the study, an obstacle arising on every level can cause an actor that is not to proceed in the changing process.

However, the barriers to implementing more feasible solutions will require participation and cooperation of all levels of construction industries, contractors, unions, and workers [27]. If the principles of ergonomics are integrated into all phases of the construction works such as bidding, engineering, pre-planning, purchasing, materials handling, job site management, and training of supervisors and workers, the construction industry can take the burden off workers, mitigate hazards, and reduce WMSDs [28]. Therefore, future ergonomics research for the construction safety and health should explore this contradicting issue in-depth.

Ergonomic campaigns for the construction WMSDs

The recent literature reports that a successful strategy for a social marketing campaign for ergonomics in the construction industry must address business diversities with different materials and specific crafts [27,29]. Rather than focusing on a single message, the campaign would need to develop explicit components for construction managers, union staff, and workers, and focus on definite themes such as an introduction of new tools. The following campaign is recommended for the prevention of WMSDs by a recent study [30]:

- Document cause/effect relationships: Information that lays out the relationship between specific types of solutions and positive end results is necessary so those contractor representatives and unions can justify investing resources in the programs for WMSD prevention.
- Standardise terminology, without using the term "ergonomics: Developing a standard and consistent terminology that contractors, unions and workers can all be related would be very helpful for training and outreach practices.
- Develop separate campaigns for contractors and workers. For contractors, messages would be increasing productivity and saving money. Whilst, for workers and unions, messages would be more personal, addressing how staying healthy and working "smarter" would benefit not only to them but to their families.
- Develop contractor success stories: A positive way to promote different types of control strategies for ergonomics is to use peer-to-peer messages. Researching which strategies have been most effective in reducing WMSDs and developing testimonials that feature stories from contractors themselves would be a credible way to encourage other contractors to take actions.
- Directly address the resistance to change: This is a tradition-bound industry, so change needs to be framed in a way that builds a transition from the "old ways" rather than overturning them.
- Include explicit framing: Any campaign needs to frame prevention of WMSDs in a way that speaks to workers' strengths, skills, and productivities, and that overcomes the view it is a weakness to take actions to prevent injury.

Construction contractors, workers, and unions need to work together to find actions that work within the boundaries of their working environments. To change their attitudes, ergonomists should provide them specific examples of how construction workers can be impacted by cumulative injuries. Ergonomists also need to create a picture of what construction workers will be like in the future if they don't take care of themselves in the current working conditions [30].

For unions, ergonomic operations can provide information to make representatives more aware of the benefits from ergonomic solutions offer for both business health and to protect their members and keep them productive. Ergonomic interventions can make sure apprenticeship programs have information on training materials. Contractors need research and hard data to show that ergonomic programs truly reduce injuries without having a negative impact on production. They need to understand how it pays them in the long run to protect their skilled workforce [30].

Creating a safety culture for making an ergonomic change requires the skills and ingenuity of the workers who are on the construction front lines dealing with day-to-day and real-world issues. Ultimately, they are the problem solvers, the planners, the people responsible for making worksites safer, and the people who are getting injured [30].

The insights they disclosed seem to be valuable to understand their needs and conditions that inform a social marketing approach. They would be one of the best options to making ergonomics a success story for the construction workers [31].

Conclusion

Construction works are a physically demanding process and building activities expose workers to numerous ergonomic challenges. Many studies report that occupational ergonomics should provide design modifications of the workplace and the organisation of work to match the workers and aim to decrease injuries at the workplace and increase productivity.

In a recent review of epidemiological studies for WMSDs [32], there is clear evidence of an association between MSDs and certain work-related physical factors. Substantial data show that WMSDs are a major cause of construction injuries requiring compensation to be paid. A large volume of existing research also identified the affiliation of construction injuries to different construction trades [4,33,34]. Continuous research efforts show significant impacts on the reduction of accidents against construction works. Findings from the literature markedly confirm that the increased awareness of ergonomic interventions is required to the construction industry. Baseline knowledge on the prevention of injuries and fatalities from the construction works suggests that architects, builders, and safety researchers need to consider in their designs how to decrease and eliminate construction work-related injuries such as WMSDs.

A great deal of research results also proposes that there is a need for an increase in training programs to reduce the onset of WMSDs amongst the construction workers. Although there have been significant improvements to the acquirement of fundamental information, the demand to establish further enhancements of safety and health practices is still required to the construction industry. There is need to detect early signs of any risk and/or illness on building workers so that sustained intervention actions should be taken to reduce incidents and prevent permanent health damage of work-related sicknesses due to construction works.

In this sense, ergonomists and ergonomics research should promote the importance of ergonomics in the construction sector as they need to protect their employees in relation to the menace that impairs workers' body systems during construction activities. In addition, the construction process should be reengineered and reviewed to improve its active environment against WMSDs.

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