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ORIGINAL ARTICLE

ASSESSMENT OF ERGONOMIC RISK LEVEL AND WORKING PERFORMANCE OF PRE-CAST CONSTRUCTION WORKERS IN SABAH

Muhamed Zainal Muktar[1], Shamsul Bahari Shamsudin[2], Khamisah Awang Lukman[1]and Mohammad Saffree Jeffree[1,3]

[1]Community and Family Medicine Department, Faculty of Medicine and Health Sciences, UniversitiMalaysia Sabah, 88400 Kota Kinabalu, Sabah, Malaysia.
[2]Centre of Occupational Safety and Health, UniversitiMalaysia Sabah, 88400 Kota Kinabalu, Sabah, Malaysia
[3]Rural Medicine Research Unit (RMRU), Faculty of Medicine and Health Sciences, Universiti Malaysia Sabah.

Corresponding author:
Shamsul Bahari Shamsudin, Email: shamsul@ums.edu.my

ABSTRACT

A cross-sectional study was conducted on 116 male pre-cast construction workers in Sipitang, Sabah to evaluate the association between Ergonomic Risk Level exposure and their working performances for 6 months (June to November 2014). Initially, a structured interview using a modified-Standardized Nordic Questionnaire was conducted on each study subject to determine the prevalence of Musculoskeletal Disorders (MSDs). The results showed that 93 out of 116 subjects (80.17%) complained of experiencing ache, pain or body discomfort during and after work with high percentage of MSDs prevalence affecting the wrist (78.5%), shoulder (73.1%), and lower leg (71.0%) regions of the body. Pictures and videos of workers performing their routine tasks were analyzed using Rapid Entire Body Assessment (REBA) tool to generate individual Ergonomic Risk Level classification. The results showed that all subjects were exposed to Medium (56.90%), High (29.31%) and Very High (13.79%) level of Ergonomic Risk. Pearson Correlation and One-way ANOVA test was conducted to determine the association between Ergonomic Risk Level and the subjects' individual working performances. The results indicated that there was a significant negative association between Ergonomic Risk Level and the workers' performances in terms of tendency to work overtime (p<.001, r=-.55) and the frequency of taking unpaid leaves (p=.038, r=.56). In conclusion, continuous exposure to significant Ergonomic Risk Level among the pre-cast construction workers has triggered the development of MSDs which eventually affected their working performances.

***Keywords**: Pre-cast construction, Ergonomic Risk Level, Rapid Entire Body Assessment, Musculoskeletal Disorders, Working Performances.*

INTRODUCTION

Musculoskeletal injuries are one of the most common occupational injuries at workplace. According to the Social Security Organization's (SOCSO) statistics, musculoskeletal injuries have been increasing rapidly for the past few years. There were only 40 cases reported in 2009 with the total cost of compensation of RM 1.04 million. Since then, it has increased rapidly to 153 cases in 2014 with the total compensation cost of RM 1.94 million[1]. These huge amounts of compensations have affected the employers a huge price to deal with. These injuries and costs could be reduced or prevented at an earlier stage by pro-actively identifying the potential risk factors, and implementing effective prevention programs at workplace[2]. According to Australian Institute of Occupational Hygienist (2012), the root- cause of musculoskeletal injuries was ergonomic hazards which are one of the major occupational hazards besides physical, chemical, psychological and biological hazard. In occupational hygiene field, these hazards categories are known as the stressors that may result in injury, impairment, illness or potentially affecting the well-being of workers and members of community[3]. Middlesworth (2015) further explained ergonomic hazard usually occurred when there is a physical stressor within the working environment which was harming the worker's body consciously or unconsciously. This condition is commonly indicated as strain[4]. Among the examples of ergonomic hazards are awkward postures, repetitive movements, frequent lifting, poor lighting, and poor adaptation to chair, table or other equipment's height, using vibrating tools, as well as exposure to extreme temperature. These ergonomic hazards were classified as ergonomic risk factors and there were an abundance of classifications existed. The most common classifications utilized in ergonomic research were physical factors, psychological factors and individual characteristics[7].

Continuous exposure to ergonomic risk factors is most commonly associated with the development of various types of Musculoskeletal Disorders (MSDs) in almost all industries. MSDs interfere with human body's movement or musculoskeletal system including muscles, ligaments, tendons, blood vessels and discs. Specific types of MSDs developed are mainly dependent on the nature of the jobs, and the body parts mostly burdened or most likely affected by the tasks performed[4]. In construction sites alone, ergonomic hazard was well known to cause sprains and strains due to the harsh nature of work activities. The construction industry in our country has been growing rapidly for the past few decades. This growth involves a huge injection of manpower supply, as well as the introduction of new technology and methods, including the pre-cast construction method. The application of pre-cast method has increased the production rate significantly compared to the classic *in situ* method. But the health risk impacts including ergonomic risk exposure on the workers remain unknown until today.

Therefore, the main aim of this research was to determine the level of ergonomic risk exposure from the application of pre-cast method at the construction site. Another goal is to improve the knowledge and create awareness among the employers in our country on the importance of having pro-active risk assessment at the early stage to prevent or reduce the occurrence of Musculoskeletal Disorders (MSDs). The findings from this research were utilized to formulate suitable risk controls to protect the highly exposed workers in order to prevent or reduce the development of Musculoskeletal Disorders among the pre-cast construction workers. In addition, it could provide a baseline for future ergonomic research in construction industry and other industries.

METHODOLOGY

A cross-sectional research was conducted from June to November 2014 in a pre-cast construction company located in Sipitang, Sabah, Malaysia. A total of 116 workers volunteered to take part in this research as study subjects. The minimum sample number required to fulfil the margin of error of 5% and a confidence level of 95%, is 89 samples. The inclusion criteria were male workers aged between 16 to 55 years working in either the production team or the installation team. The subjects must be assigned to one routine or specific task, and never received any ergonomic related training before. Machineries operators, skilled workers assigned to non-routine task, supervisory level and above, as well as ancillary or office workers, were excluded from this research. This research mainly consists of three stages: hazard identification stage, risk assessment stage, and risk control stage. The data were collected through workplace observation, structured interview with the workers using modified Standardized Nordic Questionnaire, individual posture evaluation using Rapid Entire Body Assessment (REBA) tools, as well as input from the human resource department.

Hazards identification stage involved daily observation on site, and general consultation with the workers. Individual structured interviews were arranged during lunch break and after work to collect all informative data required for this research. The set of questions enquired were based on the modified-Standardized Nordic Questionnaires (m-SNQ). The questionnaire was mainly divided into three sections: personal information, work information, and health information. The first section provided information on sociodemographic factors, such as age, gender, education level and country of origin. The second section provided information on specific position, duration of working, and work location assigned. The third section provided information on past occupational diseases or injuries, personal sensation of ache, pain or discomfort, specific body parts that were affected, past consultation or treatment as well as existing disabilities.

Initially, the actual Standardized Nordic Questionnaires (SNQ) was utilized in a pilot study with 12 subjects. This questionnaire was later modified to suit the subjects' level of understanding. The major modification was the language that was changed into Malay language since it was the common language spoken and easily understood by the majority of the subjects. But, there were some foreign workers who could not understand any of the English or Malay. Translator's assistance was required for these workers. Questions on work information were added and questions related to seasons were removed because it was not applicable. Questions on the severity of the symptoms were also removed.

In the risk assessment stage, pictures and videos of workers performing their routine tasks were taken to identify all normal body-posture deviations. These deviated postures were identified later analyzed using REBA tools to generate their respective Ergonomic Risk Level classification. The worker's individual pictures and videos were used to produce their anthropometry data respectively based on the angle of their body positioning during work using a goniometer. The angle value obtained from the individual pictures was inserted into individual REBA Worksheet by body parts movement and current position.

REBA worksheet comprised two parts: part A includes Neck, Trunk and Leg Analysis and part B includes arms and wrists analysis. The scores of these body parts were simplified in table A and B which was multiplied to produce table C. The score derived from table C was added with activity score to produce the final REBA score. From the individual REBA score generated, we are able to classify the workers to their ergonomic risk level. The highest REBA score identified representing each subjects individually were selected and compiled.

All the data were derived from the m-SNQ forms, and individual working performances record from human resource department were analyzed during this stage using both descriptive and inferential statistical methods in Statistical

Package for Social Science (SPSS) software version 19. The significance of association between Ergonomic Risk Level and Working Performances was also investigated during this stage. Pearson Correlation and one-way ANOVA test was utilized to determine the association between Ergonomic Risk Level and subject's individual Working Performances for the last 6 months. At risk control stage, activities which exposed the workers to high and very high Ergonomic Risk Level were identified and classified as high urgency. Immediate Corrective Actions was proposed to the top management in order to reduce the High Urgency activities to as low as reasonably practicable (ALARP) level.

Physical Risk Factor category was represented by awkward postures. The assessment of awkward postures using REBA tools produced REBA scores and ergonomic risk level for each subjects. Psychological Risk Factor was based on the workers' duration of working within pre-cast construction site. As explained by Jaffar et al. (2011), continuous exposure to the same type of work may cause the workers to develop mental stress due to monotonous work, low job decision freedom, job dissatisfaction, and inability to catch up with the work pace. Individual risk factors include age, gender, level of education, and health conditions. The individual's working performance was determined by the total hours of working overtime and total unpaid leave taken for the past six months derived from the human resource record. In order to investigate the effect of Ergonomic Risk Level on the worker's individual working performance, various tests were conducted on the Ergonomic risk Level classification and working performances. Pearson correlation test was conducted to determine the existence and strength of association between ergonomic risk level and total overtime for the past 6 months.

RESULTS

Ergonomic risk factors

This socio-demographic information derived from the modified-Standardized Nordic Questionnaires (m-SNQ) and REBA assessment is presented in Table 1. The physical risk factors were represented by awkward postures described in ergonomic risk level. The results showed that (56.90%) scored medium level and (43.10%) scored high level. The psychological risk factor was represented by the duration of exposure described in total months of working in pre-cast construction site. The mean of total months working with pre-cast construction method was (14.63±9.31). The individual risk factors included gender, age, education level, citizenship, and overall health condition. The mean value for age distribution among the subjects was 29.09±8.27. Citizenship data showed that the highest population of workers was Filipinos (58.6%) which were originally from the southern part of the Philippines, followed by local citizens of Malaysia (31.9%) and lastly, Indonesian workers (9.5%) from the Republic of Indonesia. As for the education level, the majority of the subjects never attended any formal education (65.5%), a total of 7.8% completed tertiary level of education, such as university and college, and 20.7% completed secondary level of education, while the remaining (6%) only attended primary level of education. The mean years of formal education were only 3.77±5.39. About 34.5% of the subjects have suffered occupational injuries in the past, while a majority of them, 65.5% never experienced any work-related injuries. Only one subject (0.9%) has natural-borne disability. As for past consultation with medical practitioners, only three of the subjects (2.6%) have consulted with medical practitioners concerning their occupational injury in the past.

Table 1: Socio-Demographic information

Category	**Risk Factors**		**Total (%)**	**Mean (SD)**
Physical Risk Factors	Awkward Postures	High Risk Level	50 (43.1)	
		Medium Risk Level	66 (56.9)	
Psychological Risk Factors	Working Duration (Months)			14.63±9.31
	Gender	Male	116 (100)	
		Female	0 (0)	
	Age			29.09±8.27
		Malaysian	37 (31.9)	
	Citizenship	Indonesian	11 (9.5)	
		Filipinos	68 (58.6)	
Individual Risk Factors	Education Level (Years)			3.77±5.39
	Past injuries	Yes	40 (34.5)	
		No	76 (65.5)	
	Past Consultation with medical practitioners	Yes	3 (2.6)	
		Never	113 (97.4)	
	Existing Disabilities	Yes	1 (0.9)	
		No	115 (99.1)	

N=116

Prevalence of Musculoskeletal Disorders (MSDs)

A majority of the subjects, 93 out of 116 (80.17%) complained that they have been experiencing ache, pain or body discomfort in various parts of their body which indicated that there was high prevalence of work-related MSDs symptom. All the subjects that admitted experiencing ache, pain or discomfort were further instructed to pin-point the specific body parts affected for comparison purpose. From the results shown in Table 2, there were 11 body parts affected with the highest percentage of ache, pain or discomfort complained was wrist area (78.5%), followed by shoulder region (73.1%), lower legs (71%), neck (62.4%) and upper arms (58.1%). The percentage of other body parts complained was relatively low (less than 50%).

Table 2: Distribution of MSDs prevalence by body parts

Experience Ache/Pain/Discomfort	Frequency (n)	Percentage (%)
Neck	58	**62.4**
Shoulder	68	**73.1**
Upper back	34	36.6
Lower back	30	32.3
Upper arm	54	**58.1**
Forearm	34	36.6
Wrist	73	**78.5**
Hip/buttocks	39	41.9
Thigh	29	31.2
Knee	41	44.1
Lower leg	66	**71**

N=93

Assessment of association between ergonomic risk factors and prevalence of Musculoskeletal Disorders (MSDs)

The first hypothesis tested was there is no significant association between ergonomic risk factors and prevalence of Musculoskeletal Disorders (MSDs) symptom among the pre-cast construction workers. The results shown in Table 3, only age ($p<.001$, $r=.82$) and having past injuries ($p=.004$, $RR=1.31$) were proven to have significant association with the prevalence of Musculoskeletal Disorders (MSDs) symptom.

Table 3: Correlations of Working Performances Variables and Ergonomic Risk Level

Variables	Ergonomic Risk Level
Total Overtime for 6 months (Hours)	-.546*
Total Unpaid Leaves for 6 months (Days)	.555*

**Significant p≤.05, N=116*

Rapid Entire Body assessment (REBA) Score and Ergonomic Risk Level

To evaluate the ergonomic risk level exposure among the subjects, REBA tool was utilised. The findings as stated in Table 1 revealed that the lowest REBA score was 5, which was categorised as medium risk level and the highest REBA score was 12, which was high level. More than half of the subjects (56.90%) scored less than 7 (medium level) and 43.10% scored between 8 to 12 (high level). The group of subjects exposed to high level of risk required immediate intervention to reduce the exposure among the pre-cast construction workers.

Ergonomic Risk Level and Working Performances

The second hypothesis tested was there is no significant association between ergonomic risk level and working performances among the pre-cast construction workers. Pearson correlation test results shown in Table 4 indicated that there was a significant negative association ($r=-.55$) between ergonomic risk level and the workers' tendency to work overtime. Table 4 also showed that there was a significant association ($r=.56$) between association between ergonomic risk level and total unpaid leaves taken for the past six months. The association was further analysed using One-way Analysis of Variance (ANOVA). The result in Table 5 showed that there was a significant association between the Ergonomic Risk Level and the workers' tendency to work overtime or extra hours for the past six months ($p<.001$). The association was further analysed using One-way ANOVA. The result in Table 6 showed that there was a significant association between Ergonomic Risk Level and total unpaid leaves taken by the subjects for the past six months ($p<.001$).

Table 4: Association between Ergonomic Risk Level and Total Overtime for 6 Months

Ergonomic Risk Level	n	Total Overtime Hours Mean (SD)	f-value (df)	p-value
Medium Level	66	111.30 (62.70)	37.678 (1)	<.001*
High Level	50	46.52 (46.44)		

**Significant p≤.05, N=116*

Table 5: Association between Ergonomic Risk Level and Total Unpaid Leaves for 6 Months

Ergonomic Risk Level	n	Total Unpaid Leave Mean (SD)	f-value (df)	p-value
Medium Level	66	2.56 (3.24)	43.212 (1)	<.001*
High Level	50	7.80 (5.30)		

**Significant p≤.05, N=116*

DISCUSSION

Ergonomic Risk Factors

The ergonomic risk factors distribution was categorised into physical, psychological and individual risk factors[7]. Physical risk factor was represented by awkward postures described in ergonomic risk level. The results showed that 56.90% scored medium level and 43.10% scored high level. All 116 subjects equally represented two different work groups: production group and installation group.

In the comparison of physical ergonomic risk factor by work groups, both the production and the installation groups showed significant symptoms of MSDs. The production group was exposed to various ergonomic hazards including heavy manual lifting, twist flexions of trunk, awkward postures, repetitive movements, hand-arm vibration, repetitive twisting of the wrist, repetitive bending, reaching overhead, as well as kneeling and bending.

The installation group on the other hand, was exposed to ergonomic hazards such as heavy pushing and pulling, whole-body vibration, manual heavy lifting, repetitive twist of neck and trunk, prolonged kneeling and repetitive climbing. In addition, both work groups were exposed to extreme temperature of hot weather and long walking distances that eventually exaggerated the effect of MSDs on themselves. All of these activities were most likely to cause impact on the workers' health condition. Most of the subjects complained that they tend to experience extreme fatigue and discomfort on their lower back, neck, shoulder and wrist region during work and after working hours.

Prevalence of Musculoskeletal Disorders (MSDs)

The prevalence of MSDs was identified during the structured interview sessions with all the participating subjects. The result showed that majority of the subjects, more than 80% have self-proclaimed of experiencing ache, pain or discomfort during and after working hour. These uneasy or uncomfortable feelings were among the symptoms of MSDs. The distribution by body parts showed that the most affected body parts were wrists, shoulder and lower legs region. According to Smallwood (2003), ergonomic problems were well known to the construction industry due to the extreme nature of routine tasks or activities that exposed the workers to rapid repetitive twisting, reaching overhead, frequent climbing and descending, extensive use of body force, prolonged awkward postures, vibration and heavy manual handling[8].

The most frequent body region with MSDs symptom reported in this research was the wrist region, which represents 78.5% of the subjects who admitted experiencing MSDs symptom in the first place. The main reason behind the high prevalence of MSDs in the wrist was due to the majority of the pre-cast construction workers were exposed to repetitive twisting of the wrist, and prolonged hand-arm vibration. Exposure to repetitive twisting of wrist occurred almost at all time during working hours especially workers involved in structural steelwork activities, while exposure to hand-arm vibration occurred when the workers operate power tools and pneumatic tools. Two most commonly used tools in this study were sand compactor and concrete vibrator. The sand compactor was used during soil compaction activity prior to laying down the pre-cast unit while concrete vibrators were used during concrete pouring into pre-cast mould.

The second most frequent MSDs symptom reported was shoulder region with 73.1% of the subjects complained they experienced shoulder pain during and after work. These findings were in line with an ergonomic research in construction sites in Southern Taiwan which

47.6% of their subjects were reported to experience MSDs symptom. The main contributor to this pain or discomfort was construction activities that require the workers to repeatedly reach overhead, prolonged work above shoulder level, and prolonged awkward postures. Repeated usage of arms above head level had exposed the workers to the risk of damaging their shoulders which will eventually cause pain and stiffness. Among the type of MSDs affecting the shoulder regions are rotator cuff injury or rotator cuff tendinitis, epicondylitis, radial tunnel syndrome, and thoracic outlet syndrome[9, 10].

The third most complained body region with MSDs prevalence was the lower leg region with 71% of the subjects that admitted experiencing ache, pain or discomfort during or after working hours. Among the examples of MSDs affecting this region are patellar synovitis, phlebitis, plantar fascitis, subpatellar bursitis and trochanteric bursitis.

Rapid Entire Body Assessment (REBA) Score and Ergonomic Risk Level

The main concern from the subjects' REBA score was the range of score between 8 and 15 at 43.1%. This range of score is highly alarming because in Ergonomic Risk Level classification, it is classified as high risk. This result showed that almost half of the pre-cast construction workers were exposed daily to a very high risk of ergonomic hazards which could amplify the development of MSDs. The type of tasks or job needed to be identified specifically, and immediate action must be taken to alleviate the risk. Among the immediate intervention action that could be applied is by introducing job rotation system, and regular breaks to reduce the level of exposure. These highly exposed subjects will most likely to develop MSDs if no intervention to be taken.

Ergonomic Risk Level and Working Performances

The subject's Ergonomic Risk Levels was analysed to determine the association with working performances. The working performances were measured through the total Overtime hours and total Unpaid Leaves taken for the past six months. The results showed that there was a significant negative association between Ergonomic Risk Level and total Overtime for six months which indicated that the level of risk perceived had affected the workers' motivation to work extra hours, and to gain additional income. The higher the risk level, the lesser the workers' tendency to work overtime because they needed time to recover their body in order to resume work normally the next day. This scenario indirectly reduced the productivity, as well as affecting the company's performance, by delaying the project's progress.

The calculation of Total Overtime hours in this research also included working on Sunday within the past six months. There were some workers who never worked on Sunday or only worked once in a while when there is an urgent request from the client. In contrast, some of the workers preferred to work on Sunday because the rate of payment is double compared to normal days. The overall findings from this research showed that the workers with higher total Overtime hours were the one exposed to medium level of risk with REBA score range from 4 to 7.

On the other hand, the workers with less or never worked extra hours were the ones that are exposed to very high in risk level with REBA score range from 11 to 15. These Ergonomic Risk Level indicated that the routine activities or tasks that the workers performed was exposing them to various physical risk factors including bended or twisted postures, heavy load or high forceful exertion, repetitive motion, and static postures. Campbell (2003) clarified that exposures to heavy load, more than 10kg, poor and unsafe grip, long duration of being in awkward postures, and high small range repetition, more than four times per minute were among the major causes of MSDs development, and reducing the workers' performances[11]. Due to these high risk exposures, the workers tend to feel weak, fatigue, pain and uncomfortable as a result of performing their routine task. It has indirectly lowered their motivation to work for extra hours. Even when there was an urgent instruction from the top management to work extra hours to increase productivity or catch up with progress, this group of workers refused the offer even though it was an opportunity to increase their income.

On the other hand, the association between Ergonomic Risk Level and Total Unpaid Leaves taken for the past six months showed that there was a significant association. The circumstances that had driven this association was the exposure of workers to a higher level of risk which caused them to skip work from time to time, either because they fell sick or feeling too tired. They were willing to accept the consequences that their salary had been deducted rather than forcing themselves to work in pain or discomfort feeling. This absenteeism trend was taken into serious consideration by the management team because it was affecting the company's daily performance.

The management team has taken a proactive approach to identify the main reason behind this high tendency of skipping work by joining the interview sessions with the subjects. From the outcome of those interview sessions, the management team was able to identify the main reasons were the workers were over-burden with the multi-tasks assigned to them, and they could not keep up with the work-pace to achieve the progress required by the client.

Another reason justified through this research was the workers were continuously exposed to high level of risk that caused them to develop discomfort, pain, numbness, tingling, burning and stiffness in certain parts of their bodies. That pain indicated that these workers were unconsciously developing MSDs, and if they were to continue performing the same task or activities, the effect would be irreversible and caused further damage to their musculoskeletal system. MSDs symptoms may be observed physically among the subjects through the swelling of soft tissues and restriction or limitation of movement which prevented the workers from performing their routine task or activities efficiently[9, 10].

The frequency of sick leave or unpaid leave taken was one of the most common indicators used by past researchers to describe the workers' performance. Amick (2003) investigated the association between sick leaves and production rate. He managed to convince a tax revenue collector employer to provide ergonomic-friendly workstation and ergonomic-related training to his workers. The results showed that the volume of tax revenues collected increased and the frequency of sick leaves reduced. The findings of his research proved that the provision of comfortable and ergonomic workplace design would eventually increase workers' performance and at the same time improved their motivation[13, 14].

Both working performance indicator showed that the workers exposed to high level of risk every day would eventually develope MSDs. The uncomfortable feeling and pain they experienced were greatly affecting their working capacity. When the individual performances of an organisation decreased, the organisation's overall performance and production rate would most likely to decrease as well. Another impact of MSDs development among the workers was the increase of turnover rate. The workers who felt uneasy or experiencing pain while performing their routine task would have felt demotivated and eventually they would quit and look for other jobs. This situation will cause the companies to lose one of their greatest assets which are competent and experienced workers. Both scenarios will incur additional cost for the management or employer to bear. The additional costs include re-hiring and re-training of new workers.

The re-hiring and re-training of new workers would take some time to achieve the same production rate as the previous workers which is not a good indicator in the construction industries as it would delay their progress. Moreover, the weather in construction sites could vary greatly from very hot to very cold due to heavy rain. These extreme surrounding conditions will exaggerate the MSDs symptoms experienced by the workers[14].

RECOMMENDATIONS

Several corrective actions was proposed and discussed with the work leaders, supervisors, engineers as well as Construction Managers to ensure that it is applicable on the tasks and suitable for the workers, as well as their work stations, without delaying the project's progress. Besides administrative controls, such as job rotation and regular breaks, engineering controls were among the effective way to reduce ergonomic hazard exposures among the workers. Most of the ergonomic problems were caused by poorly designed job tasks. The application of engineering control including the re-designing of work station, the arrangement or alteration of physical work environment, and modifying the existing tools or equipment.

Among the immediate corrective actions taken was the instruction to all workers to request for mechanical aids, such as cranes, excavators or loaders to lift and hold the mould into position instead of manually handling them. Another engineering control taken was the modifications of concrete spreader with longer handle so that the workers could perform this task in upright position. This modification eliminates the need for frequent bending. Other modification made was wrapping up the sharp edges of tools and equipment’s handle with rubber and cloth to reduce the forces that could damage the soft tissues in the hands and wrists.

CONCLUSION

In conclusion, the introduction of pre-cast method in construction sites may create various health and safety risks including ergonomic risks. However, the risks are a normal situation since the level of individual adaptation to the newly introduced method varies depending on their personal experiences and capabilities. Employers may accelerate the adaptation by providing sufficient instruction and training to the workers so that they could adapt to the new method without harming themselves. In order to reduce the level of ergonomic risk exposure, employer should provide full cooperation and support to the recommended actions formulated. The significant association between ergonomic risk levels and working performances specified that the high level exposure of ergonomic risks was reducing their motivation to work extra hours, as well as increasing their frequency of taking sick leaves or unpaid leaves. Poor working performances will most likely affect both the employers and the workers. Therefore, the employers and the employees should continuously upgrade their knowledge on ergonomic principles from time to time to improve their awareness.

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