

# Prevention of Work Related Musculoskeletal Injuries in Construction Trades in Palestine

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## Abstract

Workers in construction trades experience high rates of injuries and illnesses, including work-related musculoskeletal disorders. Musculoskeletal disorders continue to be a major source of disability and lost work time. Understanding their causes that are work-related remains the key to primary prevention. The objective of this paper is to identify the nature of work-related disorders that are suffered by workers and their risk factors. Several construction projects in the Gaza Strip were investigated using a representative sample of 135 persons from the construction workforce. The survey instrument assessed the prevalence of work-related musculoskeletal symptoms and identified job factors that may contribute to those symptoms in construction field. In addition several interviews were held, and pre-site visit forms were filled to support the proposed study. The findings showed that back, shoulders, wrists/hands, and knees symptoms are the most prevalent problems among the workers. Awkward postures and working in the same position for long periods were identified as the leading causes of work-related musculoskeletal symptoms. The findings of this study can be used to formulate appropriate intervention strategies for the reduction of musculoskeletal symptoms for construction workers in the building trades. Strategies for preventing musculoskeletal disorders should be carried out to reduce the burden of high physical workload and repetitive work in construction projects and especially in masonry industry.

**Keywords:** Construction, disorders, ergonomics, musculoskeletal, strategy.

## 1. Introduction

Construction is a high-risk sector. It is not only affecting a worker's safety, but also his health. While there are well over a thousand workers killed each year in accidents in the construction sector, there are also many more who suffer ill health. Musculoskeletal disorders are some of the most common forms of ill health in construction (Bonde et al 2005). Musculoskeletal disorders are particularly prevalent across a range of construction industry trades which affect the workforces. Masonry industry (which includes brick masons, block, concrete, plastering, and other building construction activities) reports a high prevalence of work-related musculoskeletal disorders (WMSDs). Many of which can be prevented with identifying the reasons of such disorders then making appropriate changes in materials, work equipment or work practices (Geoffrey et al 2008) .

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Construction workers are exposed to many serious safety hazards. Prevention is difficult in this sector because the work environment is constantly changing. Different types of construction work are often associated with different types of injuries. For example, workers who do overhead work, such as painters and sheet metal workers, tend to have many more shoulder and neck problems (Caicoya et al 2010). Trades at the highest risk of shoulder problems include: scaffold erectors, insulators and painters workers who work at floor level and kneel while working, like floor layers and roofers, sheet metal workers and insulators have many more knee problems. Carpenters and other trades that require constant use of hand tools, have more hand and wrist problems. Tendonitis in construction workers is most common among roofers and sheet metal workers and masons. Working as a labourer or scaffold erector where heavy lifting and carrying is common, is associated with back problems. Each of these types of work exposes the construction worker to a different type of risk factor. Risk Factors are activities, actions, conditions or exposures that can increase the chance (risk) of developing a musculoskeletal disorder (Jim et al 2005).

Masonry industry workers perform many different jobs and tasks. The work is physically demanding, involving stocking and laying of block and brick, stocking and setting of tile, mixing and stocking of mortar and grout, and assembling scaffolds (Choobineh et al 2007). Lifting and carrying of materials is common, as well as repetitive motion, high hand force, reaching overhead, and bending of the back or neck, for certain tasks. These exposures can lead to WMSDs (Davis, 2002). Since Masons working with concrete masonry unit block have high rates of work-related musculoskeletal disorders associated with repetitively lifting and butting heavy block, the focus of this paper is on the concrete and masonry workers. This study is limited to housing construction projects. This paper aims also to investigate the implementation of a guidelines-based intervention and to determine whether it is effective for reducing work related musculoskeletal injuries.

## **2. Literature review**

The term musculoskeletal disorder denotes health problems of the locomotors apparatus, i.e. of muscles, tendons, the skeleton, cartilage, ligaments, and nerves (Alwin et al 2003). This was stated in other words by Lura and David (2004) that musculoskeletal disorders include a wide range of inflammatory and degenerative conditions affecting the previous parts. These include clinical syndromes such as tendon inflammations, nerve compression disorders, osteoarthritis, less well standardized conditions, low back pain and other regional pain syndromes not attributable to known pathology (Nimbarte et al 2010). Body regions most commonly involved are the low back, neck, shoulder, forearm, and hand. Musculoskeletal disorders include all forms of ill-health ranging from light, transitory disorders to irreversible, disabling injuries. The musculoskeletal disorder, which are included or aggravated by work and circumstances of its performance are supposed to be caused or intensified by work, though often activities such as housework or sports may also be involved ( Denisa et al 2008).

Work-related musculoskeletal disorders (WMSDs) are defined as impairments of bodily structures such as muscles, joints, tendons, ligaments, nerves, bones or a localized blood circulation system (Podniece, 2008). WMSDs are a common health problem and a major

cause of disability (Geoffrey et al 2008). As a result there has been an increasing effort in recent years to investigate the causes of WMSDs and to take action to prevent them. This has led to increasing recognition from workers, employers and government agencies that a strong relationship exists between factors within the working environment and the development of WMSDs. These conditions result in significant sickness absence and reduced productivity (Buckle, 2005). WMSDs can interfere with activities at work and can lead to reduced productivity, sickness absence and chronic occupational disability (Podniece, 2008).

Construction workers across most trades are at significant risk of musculoskeletal injury. The physically demanding nature of the work, awkward and static postures, vibration, harsh outdoor environment, and related risk factors help explain why strains and sprains are the most common type of work-related injury in construction (Pamela et al 2007). The physical job features that are frequently cited as risk factors for MSDs, based on both experimental science and epidemiologic investigations which include rapid work pace and repetitive motion patterns (Laura and David, 2004).

The cost to the worker of WMSDs is pain, along with loss of income through being unable to work (Ronald et al 2010). This results in significant cost to organizations through sickness absence or ill-health retirement, and to the government, that may have to support a person unable to work. Musculoskeletal disorders (MSDs) are widespread in many countries, with substantial costs and impact on quality of life (Silverstein and Clark, 2004). Working in the building and construction trades has been linked to serious and costly health risks, including risks for musculoskeletal disorders. Schroeder (2009) stated that in the United States it is estimated that the total economic cost of work-related injuries is \$160 billion per year. In 2005, \$80 billion was spent on wage and productivity replacement, \$31.3 billion in medical costs, and \$34.4 billion in administrative costs. In 2005, 60% of work injuries were musculoskeletal disorders (MSD).

Prevention and management of MSD in the workplace has been given much attention over the past years. The term “ergonomics” is sometimes used to describe the approach for addressing musculoskeletal disorders (Gervais et al 2003). Many approaches have been implemented by employers in an effort to control the costs associated with MSD. Using a physical therapist to develop and implement an ergonomics and first-aid program was successful in preventing and managing MSD. It illustrates how a combination of ergonomics and improved injury management tactics reduced clients MSDs by 75% and has maintained this reduction to the current date (Schroeder, 2009). Significant ergonomic improvements may be achieved by decreasing brick/block weight. Raising the brick/block supply and mortar supply off of the ground has been shown to significantly reduce lumbar compression, biomechanical stress, and energetic workload, while increasing bricklayer comfort (Henk et al 2005).

### **3. Research methodology**

This research was conducted as an exploratory study. Potential participants for this study comprised 135 individuals, randomly selected from 7 building construction sites and were

interviewed. The criteria adopted for selecting the working site was based on diversity of activities that were held. The interview sought information on demographic characteristics (including age), lifetime work history, current self-reported physical, psychosocial, organizational and environmental factors, and various health conditions. The present research reports only the data which was defined as the presence of any existing or acquired trouble (aches, pains, discomfort, and numbness) during the last two years. Binary choice (yes/no) questions were used to associate WMSDs with seven anatomical regions: neck, shoulders, elbows, wrists/ arms, back, knees, and ankles/feet. Seven job activities and related tasks performed by prevalence construction industry were identified. It includes formwork, building, concrete, tiling, plastering, transportation, and electrical activities. Several construction projects were randomly selected for this study. In-depth semi-structured interviews were conducted with construction workers, contractors, subcontractors, or inspectors working with specific construction projects selected for the study. The interviews were conversational and open-ended. The visit includes identifications of the work places, the principal factors of the risk, and the analysis of the work environment and the observation of the activities performing way in the building construction sites.

For each task, participants were asked to identify the following usual and variable features of the WMSD risk: (1) the body areas at risk for developing WMSDs and specific risk factor if possible, (2) the methods used in the scope of pain reduction, (3) the source of each risk factor, and the task conditions affecting the intensity of the risk factor (if it is not possible observation will take place). To perform the task effectively pre-site visit forms were prepared. These forms included the mentioned three parts of information in tabulated format. A suitable space was allowed for any additional comments from the participants. The collected data were analysed using SPSS for Windows 18.0 software package through descriptive analysis, relative importance index and ranks.

## **4. Results**

### **4.1 Prevalence of MSDs for each body region**

Table 1 presents the prevalence of MSDs symptoms in different body regions of the workers. As illustrated in Table 1, the highest prevalence was for the back (50%), followed by the neck (28%), shoulders (27%), knees (16%), wrists/arms (11%), and legs (7%). The lowest prevalence was for the elbows (3%).

According to the interviews with workers, the majority of workers across all seven occupational groups affirmed that the back, neck, and shoulder pains are the prevalent form of musculoskeletal pain that often came from performing their job tasks. However, the locations of pain such as wrists, elbows, and legs were rarely mentioned by workers. Welch, et al. (2009) has more common results. In their study 38% of the respondents had an upper-body musculoskeletal disorder, 37% had a low-back condition or sciatica, and 26% had lower-body musculoskeletal disorders. Another study conducted by Sobeih, et al. (2009) also has similar results; the highest prevalence was for the back (38%), but followed by the Knee/legs (14%). The neck and shoulders symptoms were not significant (7%).

**Table 1: Different locations of pains as reported in occupational groups**

Occupational group of workers		Body parts location of pains						
Occupational group	Number	Neck	Back	Elbow/s	Shoulder/s	Leg/s	Knee	Wrist/Arm
Formwork workers	40	17	20	1	11	0	4	2
Building works	16	0	8	0	6	1	0	1
Concrete workers	37	15	18	2	5	1	5	4
Tiling workers	4	0	3	0	1	1	2	0
Plastering workers	13	4	5	0	4	2	0	3
Transportation workers	20	2	9	1	8	4	8	2
Electricians	5	0	4	0	2	0	2	3
Total	135	38	67	4	37	9	21	15
Percentage		28%	50%	3%	27%	7%	16%	11%

## 4.2 Methods used to reduce pains

In the interviews, workers have expressed several control measures they used or applied in order to reduce or even prevent the musculoskeletal pains that interfered with their work. These measures are listed in Table 2 below. Many of those measures mentioned by workers are common to most of the seven occupational groups. Other control measures that came up in the interviews seemed to be significant to some workers groups, and not at all mentioned by other occupational groups.

**Table 2: Methods used to reduce pains by the interviews with construction workers**

Method used by group of workers	Occupational workers groups / Number of workers							
	Formwork	Building	Concrete	Tiling	Plastering	Transporting	Electricians	Total
Control measures	40	16	37	4	13	20	5	
Physical exercise after work	2	3	0	0	0	6	0	11
Rest on weekends	25	2	15	1	5	8	2	58
Keep upright work posture	5	3	3	1	3	0	2	17
Pain killers intake	5	5	7	1	2	2	1	23
Work rotation/change	1	1	3	0	0	2	0	7
Massage therapy	1	2	4	1	3	2	0	13
Others	0	0	5	0	0	1	0	6

These are some of the solutions or best practices applied in the construction workplace that have been known for reducing or eliminating the work-related musculoskeletal problem among workers. The results show that (43%) of the workers rely on weekend rests to reduce the effect of

work pain. However, (17%) of them prefer to use pain killer as fast and effective mean and (13%) of the workers used message therapy.

### 4.3 Observed work-related risk factor

According to the interviews, workers have indicated that there is a delicate balance between work requirements, the control over them and the resources available to achieve those work demands. Workers have expressed that work demands were often large while the human resources (construction workers) to achieve these demands are sometimes limited due to absenteeism within occupational groups working on the site in small numbers.

**Table 3: Observed Work-related factors influencing health in occupational groups of workers**

Work-related factors	Occupational workers groups / Number of workers							
	Formwork	Building	Concrete	Tiling	Plastering	Transporting	Electricians	Total
Control measures	40	16	37	4	13	20	5	
Awkward work posture	25	8	17	2	6	5	1	64
Weight handled	0	1	4	1	0	15	0	21
Lack of variation	3	2	0	2	3	7	1	18
Work cycle duration	19	3	6	0	4	4	2	38
High Work place	3	4	3	0	3	1	1	15
Little Work space	1	0	0	2	1	1	0	5
Inadequate work environment	0	1	1	1	4	2	0	9
Age factor	2	2	9	0	0	0	0	13
Improper work equipments	3	0	0	0	0	0	0	3
Heavy work load	5	6	2	3	0	7	0	23
Other factors	0	1	0	0	0	0	0	1

As illustrated in table 3, the majority in each group of workers awkward work postures had an impact on their musculoskeletal health. Working above shoulders, working on knees and static work led to awkward work postures. Some workers expressed that some awkward work postures are due to cramped workspaces or/and lack of appropriate hand tools and mechanical aids which restricted workers from performing their work tasks in a good work posture. The following risk factors were the long work cycle duration and heavy work load. The next factor was the handling of heavy materials since all workers groups except the machine operators stated that manual material handling was still a problem to their musculoskeletal health. These results are compatible with studies held by Jennifer et al. (2010). However, several workers in all occupational groups have acknowledged that

recently there has been a decrease in manual material handling due to more mechanical aids (such as lifts, cranes, carts, trolleys) being brought in on construction sites.

#### **4.4 Respondents previous experience with WMSDs**

135 workers who were interviewed, it was found that only 6 workers participated in previous events affected their life. Three masons had a history of back surgery; two of them returned back to work but not to their previous activities; they are now doing easier jobs. Unfortunately, the physical treatment and surgeries didn't achieve the perfect desired results. The third one has been stopped practicing work for 4 years and up to date he didn't come back to work. On the other hand, three participants were in work site and they are suffering from chronic disabilities. Their bend back were the main evidence of musculoskeletal disorders. Finally, the contractors and subcontractors in general complained from the repetitive absence of some workers. The majority of absentees ask for rest due to their chronic pains.

### **5. Conclusion and recommendations**

Tasks commonly performed by block, brick and tile workers in the masonry industry were reviewed, and those tasks with potential work-related musculoskeletal disorder (WMSD) hazard exposures. Hazard control examples for reducing these risk factor exposures were identified. The implication of this paper is to help employers and workers comply with the new rule by identifying masonry-specific WMSD hazards that may exceed the limits specified in the rule, and to suggest possible controls for those hazards. The study showed that symptoms from the musculoskeletal system were common among the construction workers studied. Back, shoulders, wrists/hands, and knees symptoms were found to be the most prevalent problems among the workers. High rate of shoulder problems could be attributable to awkward posture and high rate of back problems could be related to the long awkward posture of this region. These implies that any interventional program for preventing or reducing musculoskeletal problems among the workers should focus on reducing physical exposure to the MSDs risk factors of these regions.

Based on the results there were various factors that have been investigated as work-related ergonomics stressors for disorders, but it is the physical factors that are suggested to contribute most to incidence of symptoms. In respect of the physical factors, there is medium evidence of a causal association for kneeling/squatting and heavy lifting. The results also demonstrate that awkward working postures and repetitive work were found to be the major risk factor that the workers were encountered. Since the postural problems have been found to be largely causing factor, the following corrective measures could be taken in consideration for reducing exposure level and consequently preventing WMSDs among construction workers: using seats with appropriate heights, conducting workers training program on working posture and devising an appropriate work-rest cycle.

Based on the findings, it was concluded that WMSD occurred in high rate in construction work. Workers' level of exposure to WMSDs risks was high. Taking corrective measures for reducing risk level into consideration seemed essential. Any ergonomics intervention

program in the workplace should be focused on eliminating awkward postures of shoulders, back, and neck.

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