Review on risk factors related to lower back disorders at workplace

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Abstract. This review examines the evidence of the occurrence of risk exposure on work-related lower back disorders in the workplace. This review also investigates potential interactions between the risk factors in the workplace which include heavy physical work risk factor, static work postures risk factor, frequent bending and twisting risk factor, lifting risk factor, pushing and pulling risk factor, repetitive work risk factor, vibration risk factor, psychological and psychosocial risk factor that may be associated with symptoms of musculoskeletal disorders of lower back. These risk factors can reinforce each other and their influence can also be mediated by cultural or social factors. A systematic review of the literature was carried out by searching using databases and the searching strategy was used combined keyword for risk factors, work-related lower back disorders, heavy physical work, static work postures, frequent bending and twisting, lifting, pushing and pulling, repetitive work, vibration, psychological and psychosocial risk factor. A total of 67 articles were identified and reviewed. The risk factors identified that related for low back disorder are seven which are heavy physical work, static work postures, frequent bending and twisting, lifting, pushing and pulling, repetitive work, vibration, psychological and psychosocial risk factor. A total of 67 articles were identified and reviewed. The risk factors identified that related for low back disorder are seven which are heavy physical work, static work postures, frequent bending and twisting, lifting, pushing and pulling, repetitive work, vibration, psychological and psychosocial risk factor. The result confirms that, existing of higher physical and psychosocial demand related to reported risk factors of low back disorders. The result also showed that previous reviews had evaluated relationship between risk factors of low back disorders and specific types of musculoskeletal disorders. This review also highlights the scarves evidence regarding some of the frequently reported risk factors for work related lower back disorders.

1. Introduction
A Socio-psychological factor was affected by various diseases such as back pain [1-3]. Personal, psychological, biomechanical factors and various occupational risk factors are an effective factors related to low back pain [4–7]. Epidemiologic on the role of manual materials handling related to low back disorder was evaluated [8]. Low back pain is a very common health problem [9] that affecting performance. Several risk factors have been identified such as occupational posture, depressive moods, obesity, body height and age. The causes still remain and difficult to analysis [10]. The impact of low back to society can be figured in epidemiologic studies and can be evaluate the prevalence and...
incidence of the conditions [11]. During the working hours, 81.6% of which consisted of low back pain [12]. Highest prevalence of Musculoskeletal Disorders (MSD) was low back pain [13]. This review examines the evidence of the occurrence of risk exposure on work-related lower back disorders in the workplace and investigates potential interactions between the risk factors in the workplace.

2. Methods
This review was identifying the prevalence risk factors for low back disorders at workplace. Relevant literature was obtained from the following strategy. Keywords were identified after a scoping study and were then cross-searched with general terms including risk factors, lower back disorders, heavy physical work, static work postures, frequent bending and twisting, lifting, pushing and pulling, repetitive work, vibration, psychological, psychosocial risk factor and level of evidence such as strong, moderate, limited, insufficient and no evidence.

To identify published research, several databases were using for searching related to keyword with low back pain. Full papers were obtained for papers based on the criteria that they included new data or results and systematic review. Two steps were used to assess the level of evidence and strength of association. First, level of evidence was determined based on the number, quality, and outcome of the studies. The strong evidence is when the findings in more than one of high quality studies, while the moderate evidence provides consistent findings in one high quality study. Limited evidence is findings with one or more low quality studies. Then, the insufficient evidence is one moderate quality study with inconsistent findings across multiple studies.

The next step is categorization of the strength of the association is considered according to a method used by Hartvigsen et al. Based on this method, three categories have been included which are, no statistically significant positive association with (p>0.05) or Odd Ratio (OR) or Relative Ratio (RR) less than or 95% of Confidence Interval (CI) below or straddling 1.00, moderate association with OR or RR between 1.01 and 2.00 and (0.01<p<0.05) and strong association with the OR or RR value more than 2.00 or (p<0.01). The independent data collected were extracted, and any dissimilarities of opinion between the team members were identified and resolved in a discussion. The outcomes of the discussion and consensus are presented as the research findings in the form of summary table in spread sheets and are discussed further in the discussion section.

3. Results
According the risk factors identified were organized according to (1) heavy physical work risk factor, (2) static work postures risk factor, (3) frequent bending and twisting risk factor, (4) lifting risk factor, pushing and pulling risk factor, (5) repetitive work risk factor, (6) vibration risk factor, (7) psychological and psychosocial risk factor and the level of evidence supporting the relationship with lower back disorders such as strong, moderate, insufficient, limited and no evidence. Table 1 presents an overview of the scientific evidence for risk factors of work-related lower back disorders.
Table 1: The scientific evidence for risk factors of work-related lower back disorders

| Type of risk factors                        | Variables                        | Level of evidence* | Strength Association* | References |
|--------------------------------------------|----------------------------------|--------------------|------------------------|------------|
| Heavy physical work                       | Standing                          |                   |                        |            |
|                                            | Heavy lifting                     | (OR= 1.12, CI = 0.48-2.59) | 43.37%                 | 11         |
|                                            | **Physical/ mental workload**     | **P<0.05**        |                        |            |
|                                            | Longer period                     | **P < 0.01**      |                        | 13         |
|                                            | Sedentary                         | 95% CI 1.5–409    |                        | 14         |
|                                            | Heavy work                        | 95% CI 0.3–23.7   |                        |            |
|                                            | Longer period                     | odds ratios of 0.55| 95% CI: 0.33–0.90 | 15         |
| Static work postures                      | **Prolonged movement**            | **58%**           |                        | 13         |
|                                            | Simultaneous lifting with straight knees | OR 6.1, 95% CI 1.3–27.9 | 14         |
|                                            | **Lifting**                       | **OR 2.16, 95% CI 1.0–4.7** | 14, 23    |
|                                            | **Forceful movements**            | **Strong evidence** |                        | 14         |
|                                            | **Duration**                      | **Moderate**      |                        | 27         |
|                                            | **Low back disorders**            | **Strong evidence** |                        | 14, 28     |
|                                            | Male drivers                      | **Strong evidence** |                        | 29         |
|                                            | **Prolonged sitting and certain work postures** | **Strong evidence** | 30         |
|                                            | **Musculoskeletal disorders**     | **Moderate evidence** |                        | 31-32      |
|                                            | **Job dissatisfaction**           | **Strongly associated** |                        | 36         |
|                                            | **Low social support**            | **Strong evidence** |                        | 37         |
|                                            | **Awkward posture, gender, workload** | **Strong evidence** |                        | 41         |
|                                            | **Low support from supervisor and co-workers** | **Strong evidence** | 37, 48     |
|                                            | **Musculoskeletal with low support from supervisor** | **Limited evidence** | 49         |
|                                            | **Work schedule with musculoskeletal** | **Strong evidence** | 52         |
|                                            | **Age with physical capacities**  | **Strong evidence** | 56.58           |
|                                            | **Age with low back pain**        | **Strong evidence** | 59         |
|                                            | **Vibration with gender**         | **Strong association** | 61         |
|                                            | **Higher education with low back pain** | **OR: 1.9; 1.2–3.0** | 15         |

*Strong Evidence: Consistent findings in multiple >1 of quality studies; Moderate Evidence: Consistent findings in one high quality studies and >1 low quality studies or in multiple low quality studies; Limited Evidence: One or more low quality studies; Insufficient Evidence: One moderate quality study inconsistent findings across multiple studies. Strength of Associations: No statistically significant: (p>0.005) or Odd Ratio (OR) less than 95% of Confidence Interval (CI) below or straddling 1.00; Moderate Association: (0.01<p<0.05) or Odd Ratio (OR) between 1.01 and 2.00; Strong Association: (p<0.01) or Odd Ratio (OR) is more than 2.00.
4. Discussion
Heavy physical work can be defined as work that needed of energy with measurement scale for physical strength [8]. There are an evidence that low back pain was not predicted by having a job with heavy lifting and much standing (OR= 1.12, CI = 0.48-2.59) [14] and the prevalence of musculoskeletal disorders related with low back was 43.37%. The relationship between workload and the prevalence of low back pain has a significant relationship between physical/mental workload with low back pain (P<0.05) [4]. Posture was defined as the position of different parts of your body. Awkward posture happens when muscle, tendons and ligaments can be stressed and in hard working condition in this posture [15]. This position occurs when any joint of your body bends or twists extraordinary movements [16]. Working in static posture for longer periods during work was also associated with low back pain (P < 0.01) [17]. In comparison, sedentary had increased the degenerative of disc with ORs of 24.6 (95% CI 1.5–409). Besides that, heavy physical work also increased the same risk of disc degeneration with sedentary OR of 2.8 (95% CI 0.3–23.7) [18]. Sedentary occupation was negatively related with long-lasting low back pain at baseline with an OR of 0.55 (95% CI: 0.33–0.90) [19].

Bending can be described as flexion of the trunk, usually in the forward or lateral direction while twisting can be defined as trunk rotation. An awkward posture is condition at extreme positions and angles. Frequency of prolonged forward bending and twisting the body was significantly associated with LBP (P < 0.001) [17]. The highest prevalence was observed in lifting and twisting movement together with straight knees (OR 6.1, 95% CI 1.3–27.9) [18]. Manual handling is activities that require use of the force exerted by a person to push, pull, carry, lift, move, lower and hold [20]. The manual material handling (MMH) including lifting, holding, carrying, or moving heavy objects in the workplace [12,21]. MMH usage is suggested over machineries because of high flexibility and being relatively low in cost [22-23]. Previous studies show a significant relationship between manual handling and musculoskeletal injury if the tasks are not carried out safely [24-26]. Lifting can define as moving a load from another place or level to another one (place/level) and also related with back disorder [27] with (OR 2.16, 95% CI 1.0–4.7) [18, 28]. High force imposed in lifting, grasping, pushing, or pulling causes muscle and tendon overloaded and exposes workers to the risk factors of MSDs [29]. There are three types of activity that require force which are lowering, carrying or lifting, and activities of pulling or pushing, excessive gripping is forcing the muscles [25] to contract harder than normal, leading to stress on the muscle, tendons, and joints [16]. Strong evidence has showed that low-back disorders are related with lifting activities and forceful movements [18]. Pushing and pulling also an occupational risk factor for low back pain [30-31]. Those employees that not crane operators and had no record in frequent lifting activities was not related with low back pain (OR 0.70, 95% CI 0.14–3.5) [18].

Repetitiveness is the average number of movement or energy exertion used to perform the same work, using the same body parts at a new intervals rest time repeatedly [32]. There is higher relationship between repetitive work with awkward posture in back, shoulder, wrist and elbow [33]. Strong evidence relationship showed between exposures to Whole Body Vibration (WBV) and low-back disorder [18]. Both of the epidemiologic and experimental evidence suggest that WBV may happens in combination with other risk factors can increase the risk of LBP. Exposure to WBV is an occupational risk factor that cause on health in drivers and there is strong evidence that WBV are related with work-related low back pain [34]. There is strong prevalence of whole body vibration between low back pains with about 92.2 of group response rate among male tractor drivers [35]. Furthermore, strong evidence that WBV is a risk only in combination with other factors, which are prolonged sitting and work postures [36]. Vibrations cause damage to organ on the body by being buffeted from the high vibration levels at relatively low frequencies and breakdown the body tissues [16]. There is moderate evidence that highlights the relationship between low back pain and MSD [37-38]. This risk factor also became major social and economic impact on society [19]. There are an evidence exist which indicates that social and psychosocial factors play an important role in the symptom related with low back pain [39]. Occupational health consists of an encompassed job stress,
job satisfaction, and organizational support from supervisors and co-workers [40]. Psychosocial risk factors are classified into two categories. The first category is associated with WMSDs which is dedicated to workers in the workplace which is poor social support at workplace and the second category is associated with individuals such as depression. Working stress also can be defined as stress that the demands exceed one’s capacity to cope at work [28]. Physical environment and complexity of individual and group tasks are the factors that can be effected stress at workplace [41]. In addition, job dissatisfaction is also found to be strongly associated with work stress [42]. Strong evidence was showed in low social support at the workplace [43].

A workload can be divided into two which are physical or mental commonly connected together and cannot be separated when a subject forms a particular task [44]. Human operators are important elements of several of the systems and maintaining their performance. They are usually found in control workplaces, often working there for several years [45]. Usually, the more demanding the task, the more the operators must work to accomplish the task [46]. There is strong evidence that supports the relationship between awkward posture, gender and workload [47]. There are three types of supervisor support such as an emotional, informational and instrumental [48]. The social support literature has shown that when supervisors are supportive, employees feeling more courage and it will help the supervisor to achieve the goals [49-50]. Supervisor support also provides employees with an important resource to handle the stress at workplace and maintain job performance [51]. Co-worker support was defined as ‘employees’ global beliefs concern for their co-workers attitudes towards them [52]. In most cases, co-worker support is crucial in order to complete the work-related task as it also influences overall morale [53]. There is strong evidence that shows low support from supervisors and co-workers caused to back pain [42, 54]. While there limited evidence to associate MSDs with low support from supervisors [55]. Personal and job resources can be reduce the negative effects of work schedule demands on health [56-57]. The work schedule can affect the level of risk of WMSDs. In the event of an extension of working hours a day, the workload will increase and the rest period required by an individual will be shortened. There is strong evidence that associates work schedule with work-related, MSDs [58]. Age is considered as a variable or constant change that affects a person’s employability, because health and muscle pain are affected with age [59-60]. In terms of WMSDs, there are three changes associated with age, which are changes in joint mobility, muscle strength and reduction in reaction and movement time [61]. There is strong evidence that associates age with changes in physical capacities [62-64]. There is strong evidence among older in age has a higher reports of low back pain [65].

Several studies have found that men appear to have more conflicts in a workplace than women (Work Environment Statistics, 2012).Other studies have found that women are more relationship oriented and more attuned to relationships with others than men [66]. Work-related MSDs symptoms heavy lifting, and hand arm vibration are found to have strong association with gender [67]. Parents with higher education also can increase the risk of low back pain at workplace (OR: 1.9; 1.2 –3.0) [19].

5. Conclusion
This review confirmed some of the findings from the previous reviews have evaluated relationships between risk factors and types of MSDs. There is lack of an evidence to establish a relationship between a factor and work-related lower back disorders. Further investigations are required to examine this relationship and all of the risk factors need to be determined in order to improve the working productivity in various industry. The information on lower back disorders is available in the literature that may suffer from lack of comparability because of the variability of the definitions. Thus, this review paper is helpful to prevent the risk factors related for low back disorders occur at workplace.

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