REVIEW ARTICLE

CHALLENGES IN DETERMINING OCCUPATIONAL RELATED CHRONIC LOW BACK PAIN AMONG EMPLOYEES: A REVIEW OF THE LITERATURE

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ABSTRACT

Chronic low back pain is a common preventable occupational health illness affecting most workers. Large amount of financial and benefit cost had been spent by the developed countries to prevent, treat and rehabilitate a large number of workers who are exposed to hazards that are attributed to low back pain. Efforts on primary prevention of low back pain had been challenging due to difficulties in affirming work- relatedness of chronic back pain among workers. As such, efforts have to be focused on existing literatures to propose acceptable variables to develop the definition of work-relatedness specific to chronic low back pain. Such identified variables or factors could be used to develop a set of criteria in defining work- related chronic back pain. Literature search using specific work- related and chronic low back pain key words were used. Comparable articles were judged and a summarized result was obtained. These variables could be grouped into individual characteristics, health behaviours, physical conditions at work, work organizations and ergonomic factors. With proper methodology and statistical analysis, tools could be developed to aid physicians in determining work- related chronic low back pain among employees.
***KEYWORDS**: chronic low back pain; work- relatedness; occupational; definitions*

INTRODUCTION

Over the years, the diagnosis of musculoskeletal illnesses or disorders had been challenging to occupational physicians. Signs and symptoms have involved physical and psychological components that would vary from one clinical visit to another. Among various reasons could be due to the reversible effects at the preclinical stage or lack of proper assessment tools, standardization or imaging findings[1]. For instance, the definition of low back pain had been so varied until the World Health Organization (WHO) had to propose a set of criteria for diagnosing chronic low back pain. These included the assessment of the spinal motility (modified Shober's test); pain measurement via Visual Analog Scale, Oswestry disability, modified Zung and modified somatic perception questionnaires[2].

It has always been physically challenging in measuring exposures at workplace when identifying musculoskeletal hazards. Ergonomic factors have to be measured and assessed via an ergonomic risk assssment. Depending on standards based on the experience of the ergonomists, a single parameter may be measured by a variety of equipments. Meanwhile, the dynamic environment setting at work potentiates various forms of biases that needed to be minimised to acceptable levels. With more study methods proposed in pre- defining exposure parameters, such as using digital video recording prior to data collection; physicians may now have better ideas or principles to measure the physical exposures at work and document them in their workplace assessment[3]. Similarly, development of psychosocial definitions and measurements had always been challenging.

Among the developed nations, intervention and programs to prevent the workers from chronic spinal injuries had been emphasized. Workers had not only been given long periods of absence from work, but also secondary preventive programs at preclinical and return to work programs. Instead of being laid- off from work, more and more workers in the United States have been shifted to lighter duty jobs[4]. In Malaysia, a majority of the reported injuries were due to accidents occurring at work or during commuting to work[5]. Such cases are often subjected to surgical interventions and their conditions and beneficial applications would be reviewed by a non- governmental agency in Malaysia, commonly known as the Social Security Organization (SOCSO).

In such scenario, the social enforcement and security departments would scrutinize closely whether such chronic back pain is work- related or vice versa. Work- related definitions and conclusions would serve to acknowledge the relevant parties accountable for the back illness and improvements at work be made to prevent similar incidences from occurring on other healthy workers. Therefore, there was a need to develop a standardized definition of occupational chronic low back pain.

However, work- related definition process is far from easy at this current moment. The paradigm is grey enough with large number confounders from pre- existing congenital malformations, spinal injuries at a young age to degenerative changes of the elderly. Therefore, the work- related decision should best be assessed in the form of scale, weighing all probabilities before arriving at a summarized conclusion. Such decisions should not deviate from principles considering the specific effect, exposure, time sequence and differential diagnosis[6]. As such, this review aims to identify what are the current factors available in deciding work- related chronic low back pain and the challenges in deciding work- relatedness in an objective manner.

MATERIALS AND METHODS

Scientific studies were searched using electronic databases such as PubMed, Springerlink, ScienceDirect, and OvidMedline for journals, books and conferences proceedings related to chronic back pain due to work. The scope of reviewed was **occupational related chronic low back pain among employees.** The criteria for this review was published articles and books from 1990 till 2010 with the following keywords such as: "Work-related AND chronic back pain", "Chronic back pain AND work", "Chronic back pain AND employees OR workers", "factors at work AND chronic back pain", "work- related back pain AND questionnaire" and "musculoskeletal AND questionnaire" were used to identify the relevant journals via the electronic database. All abstract articles were retrieved and judged their suitability in referring to the objectives of the review. The full text of the selected documents were retrieved, saved and printed. A total of sixty three journals, three systemic reviews, two chapters from books and a conference document were obtained for the purpose of this review.

RESULTS

Factors associated with work- related chronic low back pain.

Researchers could divide work- related factors into physical and pyschosocial attributes[4,7-8]. However, physical attributes could be further divided into specific ergonomic hazards at work and the overall work organization settings that are related to back pain. The psychosocial component should be addressed as a contributary or aggravating factor to existing physical factors rather than a direct cause. Thus, factors that predisposes employees to develop back pain exists in both working and non-working environments. Attributes that were involved in addressing work- relatedness could be proposed into five domains; individual characteristics, employee health behavior, employee pyschosocial conditions at work, work organization and ergonomic factors[9].

a) Individual characteristics

Individual characteristics and health behaviors are the two domains that would confound the relationship between the ergonomic factors, work organization factors and psychosocial attributes at work with back pain due to work. For example; age of onset, gender predominance, level of education, level of income, individuals' with passive coping mechanism towards their back pain, obesity and history of past injury or medical illness are factors associated with individual characteristics[9-14,63].

With regards to age, the highest prevalence of low back pain among Japanese manufacturing workers in 1992 involved workers aged 40- 49 years old men compared to 50- 59 years old women[15-16]. After this age, degenerative changes of the spine would make work- relatedness approval to decrease gradually, making an association of back pain due to work to be less likely[17]. However, some studies have found there is no association between age, gender, marital status, education levels and years of service among individual's with low back pain[11,18-21]. On another note, obesity was associated with chronic back pain (OR= 1.8, 95% CI: 1.2- 3.0)[22]. Interestingly, these literatures summarized that employee characteristics that would influence work- relatedness perceptions.

b) Health behaviors

Besides the individual characteristics, it has been found that the employee's health behaviors have an influence in the association between back pain with factors due to work. Attributes such as frequency of exercise, physical fitness and smoking status were found to have an association with disabling back pain[9,10,23-25]. Recreational exercise did not show any association between recreational exercises with low back pain disability[26]. Nevertheless, recreational exercise was measured in terms of the average hours per week, their frequent involvement in walking or doing back exercises with one or more light, moderate, or strenuous sport or recreational physical activities.

Recent interventional studies introduced an effective exercise program that improved the back health significantly[27-28]. The exercise consists of cycling, treadmill, aerobic exercises and stretching in the span of thirty to forty five minutes per

session, three days per week for twelve weeks. In view of the research's positive result, such exercise definition would be a better objective assessment of the employees' natural health behaviors. With regards to smoking, there was no association between smoking employees with disabling low back pain in their systematic review[18]. Such findings had conflicting results with recent studies showed significant associations (adjusted OR: 1.89 (95% CI= 1.92- 2.97))[29]. This study defined smoking exposure as daily smoker (current or former daily smokers and had smoked more than one hundred cigarettes in their lifetime), occasional smokers (smokers that did not fulfilled the latter definition) and non- smokers. Therefore, it would be important to consider the employees pre- morbid health status that had proven by literatures that influences the onset of chronic back pain.

c) Psychosocial conditions at work

Psychosocial attributes to be comprised of personal job satisfaction and social support received by the employee among his/ her colleagues[9]. There was a systematic review that concluded that high job dissatisfaction or physical work demands did not predict worsening outcomes of low back pain[18]. This result conflicted with many earlier studies[30-32]. Such disparity could be due to selection bias, differences in dependant variables measurement and the varibility of the measurements used in the respectives studies itself that would have influenced the results in evaluating work- related psychosocial factors attributing to chronic back pain among employees[32]. Therefore, to reduce such information biases, it would be best to develop some form of definition standardization of pyschosocial attributes; workplace social support to be defined in accordance to the modified Apgar Score method while job satisfaction using Job Diagnostic Survey (JDS)[16,32].

d) Work organizations

Work organization in the form of job demands, work pace and control at work are found to be associated with work- related back pain[9,13,23,31-33]. Job demands refer to the expection at work that need to be fulfilled by the employee. Pace of work refers to the task at work that need to be completed within a stipulated time frame while work control refers to the coping ability of the employee while doing the work task. However, effort has to be spend to derive and to develop a concensus on the specific scope at work, definitions and questions involved that would associate their relationship towards development of back pain before actually measuring these variables during the data collection later. Therefore, the common challenge in measuring the presence of exposure in occupational health is to developed these standardized questions and definitions.

e) Ergonomic factors

To date, many researches[9,14,23-24,31,34] would relate occupational awkward postures, frequent bending, manual lifting or carrying, prolonged standing or walking, strenous workload, twisting, and whole body vibration syndrome exposures with chronic back pain. However, any worker would be exposed to all the hazards at various points or episodes during work cumulatively and repetitively.

In recent research[3], a ten to fourteen minutes video recordings were created as baselines on half of 1800 cohort of workers by defining the exposures at work. By doing so, the work hazard involved, exposure and severity had been defined into isokinetic lifting strength & lifting $\geq$ 10kg or $\geq$ 25kg at work; static endurance & trunk flexion $\geq$ 30^o at work, and maximum flexion of the spine & trunk flexion $\geq$ 30^o or $\geq$ 90^o at work. Indirectly, hazards related to manual lifting, prolonged standing with bending, awkward postures and strenous workload had been included. For twisting, there were studies that defined the exposure as twisting > 40^o for > half an hour per working day or twisting > 20^o for > two hours working day[42].

As for whole body vibration, the exposure was identified by type of occupation or job task that the subjects face at work[35]. To date, studies that specifically define whole body vibration remain limited with regards to low back pain. However, some studies actually measured the vibration frequencies that their cohort was exposed to and divided them into low to high vibration exposures[36]. Their model projected the maximal prevalence of low back pain after a year long exposure of the vibrations at work. Such variables could not be obtained even from the ergonomic assessment due to difference in specific objectives and presence of the hazard. Nevertheless, a measurement indication or effort of these vibration frequencies should be introduced to improve future documentations. Therefore, even though the data would be limited, this study would proposed similar parameters (exposure frequency) to be included in our research to standardise our requirements[3].

Recent studies had shown that majority of the ergonomic factors only fulfilled certain aspects of Bradford- Hill criteria of causality[37-39]. The poor

causality relationships noted were due to relatively weaker study designs, failure in discussion of biological plausability and failure in confounding adjustments. They also recommended specific detail description of these hazards in relation to low back pain to improve future studies whereby efforts to define specifically the known imbalance or descrepencies of physical capacity and exposure to work- related physical factors that existed in the real world are needed[3]. To summarize, the ergonomic evidences were still rather conflicting and would require stronger research methodology than the usual literature reviews.

DISCUSSION

Over the years, many questionnaires had been developed with regards to assessing low back pain. With regards to any research related to low back pain, there were numerous existing questionnaires that had been used or were being developed for their respective objectives. There were a few popular questionnaires which include the Nordic Musculoskeletal Questionnaires (NMQ), Roland-Morris Disability Questionnaire (RMDQ), and Oswestry Low Back Pain Questionnaire (OLBPQ) that assess the symptoms of low back pain while some questionnaires are designed in determining work- relatedness of non- specific low back pain (WNBP) [43] and the Back pain Risk score for Office Workers (BROW) questionnaire from Thailand[44]. In a similar note, the WHO had taken the effort to develop criteria which included both physical and psychosocial assessments to diagnose low back pain. According to Ehlirch[2], the criteria involved;

a) History and physical examinations including the assessment of spinal motility (modified Shober's test);
b) Pain measurement via Visual Analog Scale (VAS),
c) Oswestry disability,
d) modified Zung, and
e) modified somatic perception questionnaires.

These tools ranged from work- relatedness, diagnosis of low back pain, low back pain with disability, recovery from disability, prognosis after treatment of back illness and identifying predictive values for the types of employees who could return to work. The summary of the various questionnaires available are as listed in Table 1 to 3. With regards to determine work- relatedness, a new novel questionnaire would be needed to achieve such objectives. Newly evolved instruments measuring both physical and work-related social attributes would improve the decision- making of work- relatedness injuries[7,25,40-41]. Such criteria would aid other occupational health physicians to reach similar consensus in determining occupational chronic low back pain. Both government and non- government organizations such as Social Security Organization (SOCSO) on the other hand has similar objectives to provide an avenue to recognize work-relatedness in these claims for review. These reviews would ensure high quality rehabilitation programs such as fitness to work, cognitive-behavioral therapies and temporary disability benefits be provided. The final outcome is to rehabilitate workers to return to the workforce without being totally ruled out as invalid because it is a waste to the overall labor force of the country[5].

Table 1: Nordic Musculoskeletal Questionnaires (NMQ)

No.	Questionnaire	Statement
1.	Nordic Musculoskeletal Questionnaire (NMQ)	a) A project funded by the Nordic Council of Ministers among the Scandinavian countries. b) There were two main sections of the questionnaire; identifies the affected body region with musculoskeletal disorders for the past 12 months that lasted for seven days and on detail accounts in terms of accident related incidents at work or at home. c) NMQ cater for a broad spectrum of musculoskeletal disorders that would not specifically identify individual problems that would change the management of the patient's condition with a single specific joint or muscular problem. d) Its main purpose was to serve as an epidemiological tool in a population of workers to identify the prevalence of ergonomic-related disorders.

Table 2: Questionnaires in low back pain assessment.

No.	Questionnaires	Statements
a)	Pain Visual Analog Scale (VAS)	a) Most frequently used pain measurement in numerous randomized and non- randomized clinical trials. b) Pain intensity measured by VAS with clinical significance has been proven to be effectively measured and documented[47-48]. c) Patients with higher baseline pain scores with large reductions in VAS scores would consider themselves markedly improved compared to patients with lower baseline scores. d) Fritz & George[49] documented the receiver- operator characteristics (ROC) curve in patients with acute work- related low back pain to be 0.71 (95% CI: 0.60- 0.83). e) VAS has its limitation in terms of chronic pain which would require multiple dimensions (e.g. physical functioning or emotional impact)[50]. Many patients have difficulty in understanding and completing VAS compared to other available pain measurements (e.g. Numerical Rating Scales, Verbal Rating Scale and Revised Faces Pain Scale)[51].
b)	Oswestry Low Back Pain Questionnaire (OLBPQ)	a) Validated self- assessment instrument designed 30 years ago by researchers from United Kingdom for patients with chronic low back pain[52]. b) Index changes with functional status that is measured in terms of level of disability as its final outcome. c) It is also used for post- surgical assessment and monitoring of functional improvement. d) Deutsch[53] even used the Oswestry Disability Index (ODI) to predict the prognosis of a patient who underwent lumbar disc arthroplasty (higher ODI score > 60 gave poor prognosis).
c)	Roland- Morris Disability Questionnaire (RMDQ)	a) Developed based from the Sickness Impact Profile (SIP) in 1981[54]. b) Measures disability outcome changes due to chronic low back pain or before and after spinal surgery[55]. c) RMDQ has Cronbach Alpha (internal consistency) of 0.71 to 0.87 and convergent coefficient of 0.82 (construct validity) with OLBPQ. d) The ROC was reported to be 0.68 (95% CI: 0.56- 0.80)[49,56]. e) RMDQ provided the changes that occur by comparing previous assessment levels; a feature of importance among therapists.
d)	Modified Zung questionnaire	a) Recommended by WHO in establishing chronic low back pain; is commonly known as Zung Self- Rating Depression Scale (ZSDS). b) Depression risk ranking of the individual from normal to severe and finally extreme depression. c) Noted to be reliable, validated by different studies[48,57-58] and translated to other languages for research purposes.

Detailed and precise measurements on the duration, intensity and frequency of work exposure were excellent objective academic parameters that unfortunately seemed to have little role in the relatively subjective history and exposure assessment among physicians in the clinical environment and their extensive effects to the individual in developing low back pain[42-44]. On another note, some researchers wonder whether guidelines derived from such epidemiological data may be of use due to discrepancies in administrative data, working environment, reporting cultures and worker pain thresholds[42, 45]. More importantly, the developed criteria should be user friendly among the clinicians while at the same time easily understood by the layman to ease

and promote effective risk communication which would prevent unnecessary misunderstandings. However, there are without doubt differences in standards, legislation and benefit practices between the developed and developing countries (Table 4). However, the basis definition of chronic low back pain has to be consistent with existing scientific standards as recommended by international institutions such as WHO or Institute for Clinical Systems Improvement (ICSI)[64].

Table 3: Questionnaires in establishing occupational (work- related) low back pain

No.	Questionnaires	Statements
a)	Work- relatedness of non-specific low back pain (WNBP) questionnaires.[43]	a) Netherland researchers had developed a set of criteria and guidelines in effort to determine work- relatedness in 2004. b) Provided three steps when determining work- relatedness; diagnosis, inventory of risk factors and finally the probability of work- relatedness[43]. c) Most variables that were included were only physical factors as scientific evidence on non- work related factors and dose- response effects were insufficient.
b)	Back Pain Risk Score for Office Workers (BROW) questionnaire	a) Contained six items with scores that ranged from 0 to 9. b) The criterion validity; sensitivity was found to be 80% and specificity 58% of work- relatedness with a cut-off score at ≥4. c) The positive predictive value and negative predictive value were both at 70%[44]. d) In terms of content, the BROW questionnaire was much simpler as compared to WNBP. e) Lack both psychosocial factors and ergonomic dose- response attributes.

CONCLUSION

In the quest to develop guidelines or criteria in determining work- relatedness of low back pain, the proper approach would be to identify evidence based variables from various disciplines that would aid other physicians and policy makers to make scientific based decisions in terms of awarding benefits and compensations on a case per case basis. The factors that were related to occupational back pain were workplace ergonomics, organization guidelines and policies, psychological factors at work, employee characteristics and their health behaviours. Due to limited time and resources for such a voluminous task to study on all the work- related chronic back pain variables, selected scientifically significant attributes that had been identified would therefore be included in the criteria.

Moreover, the specific research aimed to propose a set of criteria would need to be statistically tested. Finally, it would be important to acknowledge that such research should be impartial towards any future decision making or implementation measures by relevant agencies such as Department of Occupational Safety and Health (DOSH) or SOCSO of Malaysia which exist in other countries around the world. In fact, the final prerogative and responsibility on the definition of work-relatedness and its appropriate measuring tools should belonged to the appropriate appointed agencies in a collective manner rather than based on individual single assessment by physicians. Efforts developed should aid to reduce the burden on these physicians at the primary care setting operating alone.

Table 4: Comparasion of Social Security Services

	Categories/ Aspects	Developed Nations	Developing Nations
1.	Standards	Low back pain was the second most frequent cause of sickness absence in industrial populations in Canada[59].	Back related injuries are the second most commonly reported injury to SOCSO, Malaysia in 2009[5].
2.	Legislation and research development	Questionnaires in assesing work- relatedness had been done in Sweden a decade ago[43]. Besides, physical factors, psychological factors had been considered[21,60].	Questionnaire for office workers with back pain ahd been attempted in Thailand, recently[44].
		In the United States, the Bureau of Labor Statistics (BLS) reported that the back is the most often affected musculoskeletal disorder region of the body in the form of sprains and strains[4].	In Malaysia, agencies involved include the Department of Safety and Health (DOSH), Ministry of Human Resources, Malaysia and Social Security Organization (SOCSO), Malaysia to achieve recognizable socio- medical standards. Legislations are enforced through Occupational Safety and Health Act 1994 in Malaysia.
3.	Compensation	Countries such as New Zealand, Australia, United Kingdom, Sweden, Canada and United States spend billions of dollars on compensation or cost related to low back pain[15,27,61]. For example, the United States spend a staggering USD 11.4 billion[62] on compensation cost alone.	The SOCSO annual report acknowledged that although cases were reported, but there was still under-reporting noted[5].

ACKNOWLEDGEMENT
This work was supported by National University of Malaysia, Kuala Lumpur, Malaysia.

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