

A Path Analysis of the Effects of Biopsychosocial Factors on the Onset of Nonspecific Low Back Pain in Office Workers

Prawit Janwantanakul, PhD, Rattaporn Sihawong, PhD, Ekalak Sitthipomvorakul, PhD, and Arpalak Paksaichol, PhD

ABSTRACT

Objective: The purpose of this study was to develop a conceptual model for the association between various biopsychosocial factors and nonspecific low back pain (LBP) in a sample of office workers.

Methods: A 1-year prospective cohort study of 669 healthy office workers was conducted. At baseline, a self-administered questionnaire and standardized physical examination were employed to gather biopsychosocial data. Follow-up data were collected every month for the incidence of LBP. A regression model was built to analyze factors predicting the onset of LBP. Path analysis was performed to examine direct and indirect associations between identified risk factors and LBP.

Results: The onset of LBP was predicted by history of LBP, frequency of rest breaks, and psychological demand, measured by the Job Content Questionnaire. All 3 factors directly related to LBP; history of LBP was the strongest effector on the onset of LBP. History of LBP and frequency of rest breaks had indirect effects on LBP that were mediated through psychological demand, and frequency of rest breaks was the most influential effector on psychological demand.

Conclusions: Three risk factors were identified to predict onset LBP, including history of LBP, frequency of rest breaks, and psychological demand. Each factor had direct effects on the development of LBP. Also, history of LBP and frequency of rest breaks had indirect effects on LBP that were mediated through psychological demand. (*J Manipulative Physiol Ther* 2018;xx:1-8)

Key Indexing Terms: *Low Back Pain; Musculoskeletal Diseases; Computers; Etiology*

INTRODUCTION

Low back pain (LBP) has been reported to be a major problem for office workers, affecting 34% to 51% of workers annually.^{1,2} Between 14% and 23% of office workers reported a new onset of LBP during the 1-year follow-up.^{3,4} The annual prevalence of chronic LBP has been reported to range from 15% to 45%, with a point prevalence of 30%.⁵ Consequently, LBP in effect constitutes a great socio-economic burden on patients and society. In the United States, the total cost of LBP in 2006 exceeded US\$100 billion,⁶ whereas in the Netherlands the total cost

of LBP in 2007 was estimated at €3.5 billion.⁷ The cost of LBP to society is likely to increase, given that many developing nations have been industrializing their economy, thus increasing the number of workers in the office environment at the global level.

The etiology of musculoskeletal disorders is widely accepted to be of multifactorial origin, including individual, physical, and psychosocial factors. Different occupations are exposed to different working conditions, and the nature of work influences the health of workers.⁸ Predisposing factors for LBP are likely to be population specific. Research to identify the causal factors of a disease requires longitudinal research design, which permits the tracking of study participants' activities, health status, and exposures over time.⁹ However, there have been a small number of high-quality prospective studies on the association between risk factors and the onset of nonspecific LBP in office workers. Very few risk factors were found to predict the onset of LBP in office workers; these included history of LBP and the combination of postural risk factors and job strain (for females only).¹⁰

Department of Physical Therapy, Faculty of Allied Health Sciences, Chulalongkorn University, Bangkok, Thailand.

Corresponding author: Prawit Janwantanakul, PhD, Department of Physical Therapy, Faculty of Allied Health Sciences, Chulalongkorn University, Bangkok, Thailand. Tel.: +66 2 218 3767. (e-mail: prawit.j@chula.ac.th).

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To understand the etiology of LBP, a model to conceptualize the process involved in the development of LBP is required. Wahlström¹¹ proposed the conceptual model for the association between musculoskeletal disorders and computer work, which emphasizes the association between work organization, psychosocial factors, and mental stress, as well as physical demands and physical load. It is hypothesized that work technology and organization have a direct path to physical demands. Both physical demands from work and mental stress may increase the physical load, which in turn has a direct path to perceived muscular tension. Individual factors are hypothesized to be an effect modifier for the association between physical demands and physical load, as well as the association between work organization and mental stress. Perceived muscular tension, along with perceptions of comfort and exertion, is hypothesized to be an early sign of musculoskeletal symptoms, which arises as a result of work organizational and psychosocial factors, as well as physical load and individual factors.

The purpose of this study was to use path analysis to develop a model for the association between various biopsychosocial factors and nonspecific LBP in a sample of office workers whose work involves computers. The analytical approach, such as path analysis, is a useful tool to test a causal pathway for the development of disease. Path analysis, which is an extension of multiple regression, can predict more than 1 dependent variable and assess the relationships among both independent and dependent variables within that model.^{12,13} It shows a theoretical, directional relationship (both direct and indirect) between variables and offers a causal model of relationships.¹⁴

METHODS

Participants and Procedure

A prospective cohort study with a 1-year follow-up was conducted in a convenience sample of office workers recruited from 9 large-scale workplaces. Office workers were defined as those working in an office environment with their main tasks involving use of a computer, participation in meetings, presentations, reading, and phoning. The enterprises participating in this study were public transportation, infrastructure, energy, and health enterprises; a public university; a police station; and the head offices of 3 ministries. The study was approved by Chulalongkorn University Human Ethics Committee.

Volunteers were screened into the study using a self-administered questionnaire. The inclusion criteria were individuals aged 18 to 55 years and working full time. Participants were excluded if they had reported musculoskeletal symptoms in the spine in the previous 3 months with pain intensity greater than 30 mm on a 100-mm visual analog scale (VAS); reported pregnancy or had planned to

become pregnant in the next 12 months; had a history of trauma or accidents in the spinal region; or had a history of spinal, intra-abdominal, or femoral surgery in the previous 12 months. Participants who had been diagnosed with congenital anomaly of the spine, rheumatoid arthritis, infection of the spine and disks, ankylosing spondylitis, spondylolisthesis, spondylosis, tumor, systemic lupus erythematosus, or osteoporosis were also excluded from the study.

Office workers were approached and invited to participate in this study. At baseline, participants completed a self-administered questionnaire and underwent physical examination by trained physical therapists, according to standardized protocol. Participants then received a self-administered diary to record the incidence of LBP. The researcher returned to collect the diaries from participants every month over a 12-month period (Fig 1).

Outcome Measures

Nonspecific LBP is LBP (with or without radiation) without any specific systematic disease being detected as the underlying cause of the complaints.¹⁵ A picture of the body from the standardized Nordic questionnaire¹⁶ and the question "Have you experienced any LBP lasting >24 hours during the past month?" were included in a diary given to participants to assess onset of nonspecific LBP. If they answered "yes," follow-up questions about pain intensity, measured by a VAS, and the presence of weakness or numbness in the lower limbs were asked. In this study, participants were identified as cases if they answered "yes" to the first question, reported pain intensity >30 mm on a 100-mm VAS, and had no weakness or numbness in the lower limbs. Participants were followed until they became symptomatic, withdrew from the study, or completed the 12-month follow-up.

Biopsychosocial Risk Factors

The self-administered questionnaire and physical examination were used to assess potential biopsychosocial risk factors. The self-administered questionnaire comprised 3 sections designed to gather data on individual, psychosocial, and work-related physical factors. Individual factors included sex, age, marital status, educational level, frequency of regular exercise or sport, smoking habits, and number of driving hours a day. Work-related physical factors included current job position, number of working hours, years of working experience, frequency of using a computer, performance of various activities during work, and rest breaks. The questionnaire also asked respondents to self-rate the ergonomics of their workstations (desk, chair, and position of monitor) and work environment conditions (ambient temperature, noise level, light intensity, and air circulation). Psychosocial factors were measured

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