EFFECTS OF PARTICIPATORY ERGONOMIC INTERVENTION PROGRAM TO REDUCE OCCUPATIONAL RISKS AMONG HOSPITAL ORDERLIES

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บทคัดย่อและแฟ้มข้อมูลฉบับเต็มของวิทยานิพนธ์ตั้งแต่ปีการศึกษา 2554 ที่ให้บริการในคลังปัญญาจุฬาฯ (CUIR)
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ผลของโปรแกรมการมีส่วนร่วมตามหลักการยศาสตร์เพื่อลดปัจจัยเสี่ยงทางด้านอาชีวอนามัยของพนักงานเคลื่อนย้ายผู้ป่วย

นายวิทยา ชาญชัย

จุฬาลงกรณ์มหาวิทยาลัย
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วิทยานิพนธ์นี้เป็นส่วนหนึ่งของการศึกษาตามหลักสูตรปริญญาวิทยาศาสตรดุษฎีบัณฑิต
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By	Mr. Withaya Chanchai
Field of Study	Public Health Sciences
Thesis Advisor	Associate Professor Wattasit Siriwong, Ph.D.
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วิทยา ชาญชัย : ผลของโปรแกรมการมีส่วนร่วมตามหลักการยศาสตร์เพื่อลดปัจจัยเสี่ยงทางด้านอาชีวอนามัยของพนักงานเคลื่อนย้ายผู้ป่วย (EFFECTS OF PARTICIPATORY ERGONOMIC INTERVENTION PROGRAM TO REDUCE OCCUPATIONAL RISKS AMONG HOSPITAL ORDERLIES) อ.ที่ปรึกษาวิทยานิพนธ์หลัก: วัฒน์ สิทธิ์ ศิริวงศ์, อ.ที่ปรึกษาวิทยานิพนธ์ร่วม: วันเพ็ญ ทรงคำ, 231 หน้า.

หลักการยศาสตร์แบบมีส่วนร่วม (PE) ได้รับความนิยมใช้กันอย่างแพร่หลายในการปรับปรุงสภาพแวดล้อมการทำงานซึ่งวัตถุประสงค์ในการศึกษาครั้งนี้คือการพัฒนาโปรแกรมการเรียนรู้แบบมีส่วนร่วมตามหลักการยศาตร์(PEIP) เพื่อลดปัจจัยเสี่ยงทางด้านอาชีวอนามัยของพนักงานเคลื่อนย้ายผู้ป่วยและประเมินผลโปรแกรมการเรียนรู้แบบมีส่วนร่วมตามหลักการยศาตร์(PEIP)สามารถลดปัจจัยสิ่งแวดล้อมการทำงานและสุขภาพของพนักงานเคลื่อนย้ายผู้ป่วย โดยการศึกษาครั้งนี้เป็นแบบการทดลองแบบสุ่มและมีกลุ่มควบคุม (RCT) ได้ดำเนินการที่โรงพยาบาลระดับตติยภูมิระหว่างเดือนกรกฎาคมถึงเดือนธันวาคมของปี พ.ศ.2557 โดยการศึกษาครั้งนี้มีผู้ร่วมวิจัยจำนวน 100 คน โดยแบ่งออกเป็น 2 กลุ่มคือกลุ่มทดลองจำนวน 50 คนและกลุ่มควบคุม 50 คน โปรแกรมการเรียนรู้แบบมีส่วนร่วมนี้เป็นโปรแกรมแบบบูรณาการ ประกอบด้วยการประชุมแบบปฏิบัติการ,การประชุมกลุ่ม,การฝึกอบรมภายใต้สถานการณ์ทำงานจริง, การสนับสนุนกิจกรรมจากฝ่ายบริหาร, สามการประชุมเชิงปฏิบัติการได้ดำเนินการไปยังที่อยู่การศึกษาการฝึกอบรมกลุ่มการฝึกอบรมในสถานที่, การสนับสนุนการจัดการ, การเสริมสร้างความสามารถในการการทำงานของผู้ที่ส่วนร่วมกิจกรรม, การปรับปรุงเทคนิคการปฏิบัติงานในการเคลื่อนย้ายผู้ป่วยและโปรแกรมการออกกำลังกาย เก็บรวมรวมข้อมูลโดยแบบสอบถามโดยมีการวัดผลก่อนเริ่มการทดลอง, หลังจากโปรแกรมเสร็จสิ้นเดือนที่2 และเดือนที่4 วิเคราะห์ข้อมูลเพื่อเปรียบเทียบผลต่างของคะแนนสิ่งแวดล้อมการทำงานและสุขภาพของสองกลุ่มโดยใช้สถิติ t-test การวิเคราะห์ความแปรปรวนแบบวัดซ้ำ และสถิติ Mann-Whiney U

ผลการศึกษาพบว่า สิ่งแวดล้อมการทำงานด้านกายภาพในกลุ่มทดลองลดลงอย่างมีนัยสำคัญทางสถิติในช่วง 2 เดือนและ 4 เดือนหลังได้รับโปรแกรมเมื่อเปรียบเทียบกับกลุ่มควบคุม ($p < 0.02$) สำหรับสิ่งแวดล้อมการทำงานด้านจิตสังคมพบว่าความก้าวหน้าในการทำงาน,อิทธิพลในที่ทำงาน, ความเป็นไปได้ในการพัฒนางาน, ความหมายของการทำงาน, ความมุ่งมั่นในการทำงาน, การคาดการณ์เกี่ยวกับงาน, ความชัดเจนในหน้าที่, ความขัดแย้งและภาวะผู้นำ เพิ่มขึ้นอย่างมีนัยสำคัญทางสถิติเมื่อเปรียบเทียบกับกลุ่มควบคุม ($p < .01$) และแรงสนับสนุนทางสังคมของหัวหน้างานเพิ่มขึ้นอย่างมีนัยสำคัญทางสถิติเมื่อเปรียบเทียบกับกลุ่มควบคุม ($p < .05$) ส่วนผลต่อสุขภาพ พบว่า ความชุกของการเกิดอาการผิดปกติของกล้ามเนื้อและกระดูกในช่วง 7 วันและ 3 เดือนที่ผ่านมาในกลุ่มทดลองไม่ลดลงหลังได้รับโปรแกรมในกลุ่มทดลองไม่มีรายงานเกี่ยวกับการขาดงานเนื่องจากอาการผิดปกติของกล้ามเนื้อและกระดูก แต่พบการขาดงานในลักษณะดังกล่าวจำนวน 2 วันในกลุ่มควบคุม สำหรับการประเมินท่าทางในการทำงานโดยQuick Exposure Check (QEC) นั้นพบว่าหลังจากโปรแกรมการทดลองเสร็จสิ้น 2 เดือนสามารถลดระดับคะแนนความเสี่ยงลงในส่วนของหลัง(ที่มีการเคลื่อนไหว) ($p < .005$) และคอ ($p = .001$) และระดับคะแนนมีการเปลี่ยนแปลงจากระดับความเสี่ยงสูงเป็นระดับปานกลาง นอกจากนั้นยังพบว่า 4 เดือนจากโปรแกรมเสร็จสิ้น ยังคงลดระดับคะแนน ความเสี่ยงลงในส่วนของหลัง (ที่มีการเคลื่อนไหว) ($p < .005$) สำหรับระดับความสามารถในการทำงาน พบว่า มีการเพิ่มขึ้นเล็กน้อยในกลุ่มทดลอง เมื่อประเมินในช่วง 2 เดือนและลดลงใน 4 เดือนหลังได้รับโปรแกรม โดยสรุปแล้วผลการศึกษาชี้ให้เห็นว่าโปรแกรมการเรียนรู้แบบมีส่วนร่วมตามหลักการยศาสตร์สามารถลดจัดปัจจัยเสี่ยงของสิ่งแวดล้อมด้านกายภาพ และช่วยเพิ่มปัจจัยสนับสนุนของสิ่งแวดล้อมด้านจิตสังคม อย่างไรก็ตามผลของโปรแกรมต่อสุขภาพของบุคลากรเคลื่อนย้ายผู้ป่วยที่ชัดเจนนั้น ควรทำการประเมินในช่วงระยะเวลาที่ยาวนานขึ้นหลังการได้รับโปรแกรม

สาขาวิชา วิทยาศาสตร์สาธารณสุข ลายมือชื่อนิสิต .....

ปีการศึกษา 2558 ลายมือชื่อ อ.ที่ปรึกษาหลัก .....

ลายมือชื่อ อ.ที่ปรึกษาร่วม .....

5479055453 : MAJOR PUBLIC HEALTH SCIENCES
KEYWORDS: PEIP PROGRAM, WORK ENVIRONMENTS, HEALTH OUTCOME, THAI HOSPITAL ORDERLIES

WITHAYA CHANCHAI: EFFECTS OF PARTICIPATORY ERGONOMIC INTERVENTION PROGRAM TO REDUCE OCCUPATIONAL RISKS AMONG HOSPITAL ORDERLIES. ADVISOR: ASSOC. PROF. WATTASIT SIRIWONG, Ph.D., CO-ADVISOR: WANPEN SONGKHAM, Ph.D., 231 pp.

Participatory Ergonomic (PE) initiatives have widely been used to improve work environments. The aim of this study was to develop a Participatory Ergonomic Intervention Program (PEIP) and assess its effects on the work environment and health of hospital orderlies. A randomized control trial (RCT) was conducted at a tertiary care hospital between July and December of 2014. 100 hospital orderlies participated in the study. 50 orderlies were assigned to the intervention group and 50 were assigned to a control group. The PEIP program consisted of multifaceted training sessions. Three workshops were conducted to address education, group training, supervised onsite training, establishment of management support, participant capacity strengthening, patient transfer techniques, and exercise programs. Data collection took place via self-reported questionnaires at baseline, two months, and four months post-intervention. Comparative analysis of the work environment and health outcomes was conducted through a t-test. Repeated measure analyses of variance, as well as Mann-Whiney U test, were also used.

Results showed that physical work environment risk factors decreased in the intervention group when compared to the control group at two and four months post-intervention ($p < .02$). With regards to the psychosocial work environment: work pace, influence at work, possibilities for development, meaning of work, commitment to the workplace, predictability, role clarity, role conflicts, quality of leadership, and social support from supervisors all had p-values $< .001$; while social support from colleagues had a p-value $< .05$. The PEIP program resulted in increases to psychosocial promotion factors that were observed four months post-intervention. Increases were observed in: work pace, cognitive demands, demands for hiding emotions, commitment to the workplace, predictability, rewards, and social community at work (all p-values $< .05$). A questionnaire based on the Quick Exposure Check (QEC) was used to calculate work-related musculoskeletal risks. Two months after intervention, the PEIP program decreased risk exposure level scores including for the back (moving) ($p < .005$) and neck ($p = .001$). Mean scores from the QEC for the neck among the intervention group changed dramatically, from high to moderate. The PEIP program continued to decrease risk exposure scores four months after completion of the intervention. The reduction in score for the back (moving) ($p < .005$) was found to be significant. The intervention group requested no sick leave, while the control group had 2-day sick leave due to musculoskeletal problems. A slight increase in work ability in the intervention group was observed two months post-intervention, with a decrease four months post-intervention. In conclusion, findings demonstrated that the PEIP program contributed to a reduction of physical risk factors in the workplace. However, a longer-term study is needed to properly evaluate effects on health outcomes.

Field of Study: Public Health Sciences
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Student's Signature .....
Advisor's Signature .....
Co-Advisor's Signature .....

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LIST OF ABBRIVATION

Abbreviation	Term
CDC	Centers for Disease Control and Prevention
OSHA	Occupational Safety and Health Administration
NIOSH	National Institute of Occupational Safety & Health
HSE	Health and Safety Executive
PEIP	Participatory Ergonomics Intervention Program
ILO	International Labour Organization
MSDs	Musculoskeletal Disorder
NMQ	Nordic Musculoskeletal Questionnaire
PAOT	Participatory Action-Oriented Training
COPSOQ	Psychosocial Questionnaire
WMSDs	Work-related musculoskeletal disorders
PAOTHN	Participatory-Action-Oriented Training for Hospital Nurses
HUG	Healthy Unit Guidance
QEC	Quick exposure check technique
PE	Participatory ergonomics

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CHAPTER I

INTRODUCTION

1.1 Background and Rationale

Recently many studies have shown that work-related musculoskeletal disorders (WMSDs) are a considerable concern for the healthcare workforce. A number of studies over the past decades documented that healthcare workers encountered WMSDs [1] often resulting in pain, sickness-related absenteeism and disability leave.

Healthcare is a substantial and growing sector of the US economy consisting of over 95,800 establishments that provide some 14.3 million jobs and accounts for 1 in 11 US workers [2]. Healthcare professionals are at higher risk of suffering an occupational musculoskeletal disorder (MSD) than most other workers. Nursing aides, orderlies and attendants have an MSD rate of 252 cases per 10,000 workers, which is 7 times the national average for all occupations. The prevalence of self-reported MSDs among healthcare professionals is related to the perceived physical demands of tasks which are influenced by work postures, and tasks involving awkward positions are most strongly associated with reported MSDs at all body sites. A survey of 1,163 registered nurses in the United States (94% were female, 46% were hospital nurses and 54% were staff nurses) found that tasks requiring moderate physical

demands raised the odds ratio (OR) for an MSD to between 1.4 and 3.6, and those requiring a high physical demand raised the OR for an MSD to between 4.4 and 12.0 [3]. Research on 113 healthcare workers in 15 hospital wards in Italy found that 71% reported at least 1 MSD, and the MSD prevalence was highly associated with work-related awkward postures (71%) and greater than that observed among hospital workers exposed to manual lifting (21%)[4].

In Asian countries, studies found that of 162 Korean female nurses working in various hospital settings 56.8% reported an MSD symptom [5]. A study of 5,269 Taiwanese nurses reported that 91.6% experienced MSDs and pain in different body parts was related to different ergonomic risk factors, especially bending, twisting of the waist, and standing for extended periods of time [6]. A survey of 361 Chinese doctors found that the 12 months MSD period-prevalence for any region of the body was 67.5% and the prevalence by body region was lower back (43.7%); neck (42.3%); shoulder (37.8%); and upper back (29.0%), and women were more susceptible to an MSD than men (OR: 3.05) [7]. However, in the absence of ergonomics regulations at the national level, limited financial support, and lack of numerous ergonomists experts, practical ergonomics approaches that are built on local achievements and that focus on participatory training methods have been confirm to be useful for facilitating concrete workplace improvements to the existing conditions [8, 9]. Direct participation of workers and employers has been promoted in ergonomics training aimed at immediate solutions and continuous improvement [10].

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Patient handling activities subject health workers to high biomechanical loads [11, 12]. Frequent lifting has been shown to be associated with earlier onset of back injury compared to infrequent lifting, irrespective of medical orderly occupation [13]. A meta-analysis reported that the annual incidence MSDs among patient handling nurses was between 40% and 50% [14].

Ergonomic-related prevalent cases in Thailand during the years 2000-2012 were reportedly only 9% of the total injury cases [15]. According to the report of the Social Security Office, Ministry of Labor and Social Welfare, Thailand there was an ergonomic-related injury cases in the industrial sector. In 2008, 2,346 injury cases were caused by manual material handling, which 1,547 cases in 2009, of which 2010 were caused by unnatural working postural in 5,047 and 3,246 in 2011[16-18]. It may be that ergonomics-related injury cases caused by handling and unnatural working posture were not welt known among employers and employees with consequently less recognition or interest in this matter. Therefore reports of ergonomics-related injury cases were considerably lower than expected

Consequently, this study was focus on effects of the intervention program (PEIP) can reduce occupational risks among hospital orderlies called participatory ergonomics intervention program (PEIP), based upon the principle of PE approach expected the sustainable program driving by hospital orderlies themselves and all levels of stakeholders. It is also expected that an effective of intervention will helps to strengthen orderlies workforce ability to manage their work environment problems

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associated with MSDs and information obtained from this study was useful for other hospital setting in order to develop an participatory ergonomics intervention program can the occupational risks among hospital orderlies in the future.

1.2 Research Question

Does the participatory ergonomic intervention program can reduce the occupational risks among hospital orderlies?

1.3 Research Objective

1.3.1 General Objective

1. To develop the participatory ergonomic intervention program (PEIP) for reduce the occupational risks among hospital orderlies

2. To assess the effects of the participatory ergonomic intervention program (PEIP) can reduce the work environments and health outcome among hospital orderlies

1.3.2 Specific Objective

To evaluate the effect of work environments and health outcome among hospital orderlies in regard to :

1. Reduce the mean scores of physical load index
2. Reduce the mean scores of workplace environment
3. Reduce the mean scores of psychosocial work environment
4. Reduce musculoskeletal disorders rate

5. Reduce sick leave
6. Increased work ability

1.4 Research Hypothesis

The participatory ergonomic intervention program (PEIP) can effectively reduce the occupational risks among hospital orderlies.

1.5 Scope of the Research

This study were conducted with the hospital orderlies of the tertiary care hospital. Participants were males working at Siriraj hospital, residing in the center part of Thailand.

1.6 Conceptual Framework

A literature review that included Krash's [19] integrated model showed that there were three dominant factors contributing to the development of occupational risks. These contributing factors were individual factors, physical demands, and psychosocial demands. Hospital settings, and the complexity of their tasks, make hospital orderlies vulnerable to these risk factors. As a result, hospital orderlies are at higher risk of presenting MSD complications. Interactions with patients and hospital work environments present ergonomic risk factors that make hospital orderlies one of the top ten professions most affected by MSDs. As such, implementing an efficient

intervention model must be considered to curb the prevalence of MSDs among hospital orderlies.

An approach that would mitigate risk factors and reduce WMSDs would be Participatory Ergonomics (PE). PE has been characterized by multifaceted intervention aimed at creating human centered work environments. PE also provides practical measures that improve physical and psychosocial factors. Improving the work environment will, in turn, positively affect worker health.

This study found that the PE pathways of change, and corresponding evaluations, presented by Rivilis et al. [20] provide an applicable framework for understanding the consequences of a Participatory Ergonomic Intervention Program (PEIP). PEIP presents a targeted PE intervention program for hospital orderlies. PEIP is comprised of a series of workshops built on Participatory Action-Oriented Training (PAOT). The PAOT method focuses on establishing management support, strengthening participant capacity, and work improvement evaluations. PEIP initiatives are expected to reduce exposure to MSD risk factors and promote work environment improvements. These changes would result in reduced sick leave, improved ability to work, reduction of occupational risks, reduced exposure to individual risk factors, and promotion of beneficial change. The conceptual framework of this study is shown in Figure 1.

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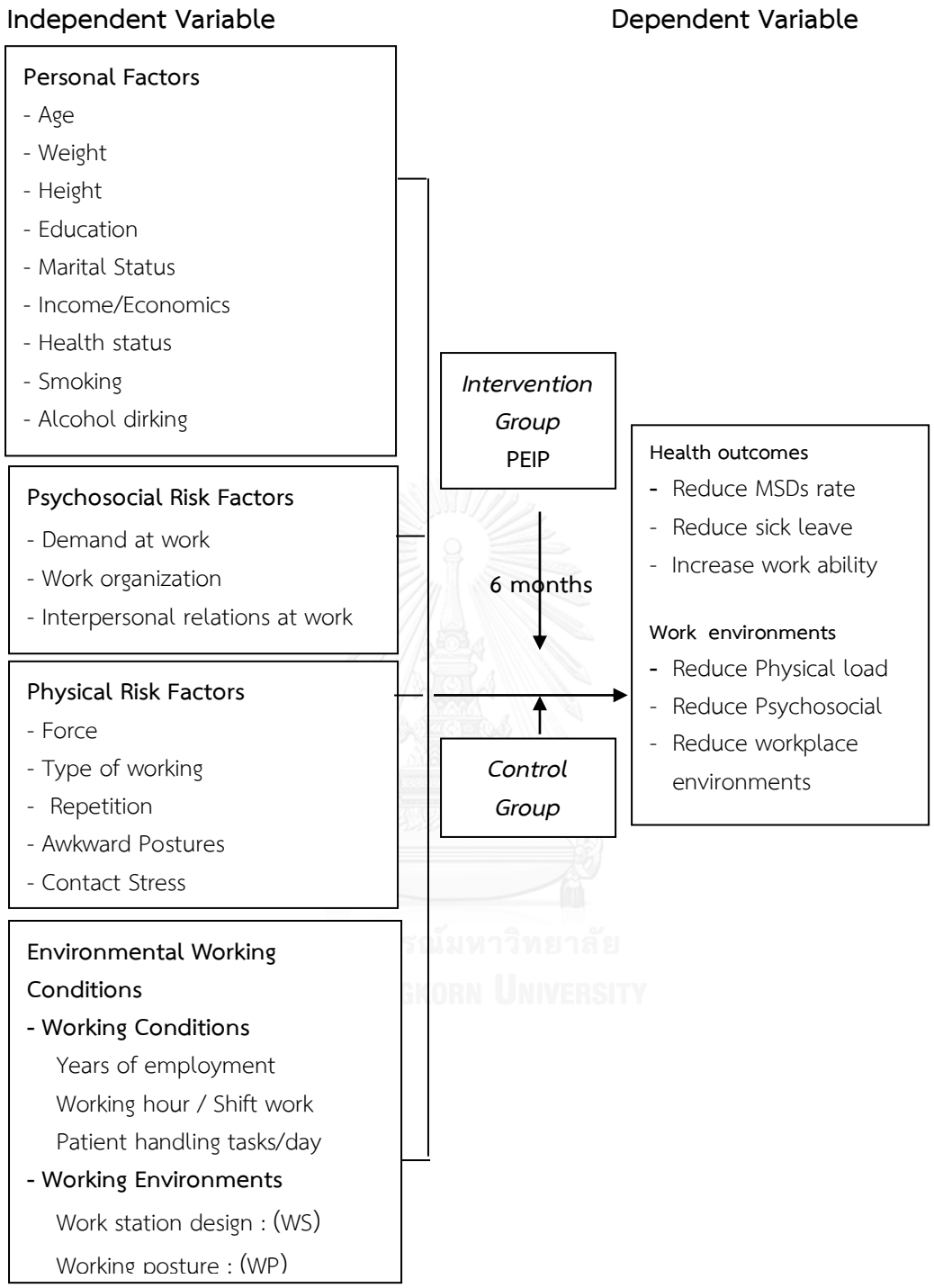

Figure 1 The conceptual framework

1.7 Term definitions

Participatory Ergonomics Intervention Program (PEIP) refers to a process of the intervention that the researcher provided to orderlies working at hospital setting in order to improving their work environments and health outcomes. The program is developed based on participatory ergonomics concept and literature review. The PEIP comprised a series of training workshop including establishing management support, strengthening participant's capacity, and evaluating work improvement achievements.

Hospital orderlies are male persons who work under the supervision of nurses. In addition to assisting with everyday tasks, they help transport patients by wheelchair or gurney to the operating room, x-ray department, dining room, and other locations around the facility.

Health outcomes include musculoskeletal symptoms, sick leave and work ability of hospital orderlies.

Occupational Risks are defined as factors that influence occupational risks occurrence among orderlies including personal factors, psychosocial risk factors, physical risk factors and environmental working conditions that can contribute to either individual health outcomes and working environments or in combination to the development of MSDs.

Musculoskeletal symptoms refer to a group of conditions that include aches, pain, and discomfort which involve the nerves, tendons and muscles of

orderlies measured by the Nordic Musculoskeletal Questionnaire (NMQ) which was available from the original paper by Kuorinka et al. [21].

Sick leave refers to the amount of days which hospital orderlies away from work resulting from musculoskeletal symptoms measured by self-report questionnaire.

Participatory Action-Oriented Training (PAOT) refers to the training process designed to encourage and help hospital settings to undertake low-cost measures to improve work environments. The approach focuses on planning and practical implementation. It focuses on achievements, builds on local practice, uses a learn-by-doing method, encourages the exchange of experiences and promotes orderlies involvement.

Physical risk factors are defined as factors associated with the use of force in terms of pull, push, moving or transferring materials or patient and working position of the hospital orderlies. This also included their perception on workplace environment where they belong (e.g. lighting, noise, temperature and odor).

Psychosocial risk factors are defined as conditions that influence work-related stress, including demands at work, work organization, and interpersonal relationship at work.

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CHAPTER II

LITERATURE REVIEW

This study aims to evaluate participatory ergonomics intervention program (PEIP) can reduce the occupational risks among hospital orderlies. The theories and relevant researches are reviewed in the following topics:

2.1 Hospital orderlies

Hospital orderlies, directed by the nursing and medical staff, perform a wide range of tasks. Orderlies comprise the front line of patient care. They perform demanding tasks that include lifting patients and transporting patients between hospital departments. Orderlies and nurses comprise a subsystem of the healthcare workforce. Together, they provide numerous services that share common attributes across the globe. Orderlies and nurses care for, comfort, and support clients; they continuously assess and monitor health needs; they are advocates, educating clients and the community; they identify care gaps and develop the appropriate responses. In short, orderlies and nurses coordinate care services across the whole of the care spectrum.

The scope of work conducted by nurses also benefits other healthcare services. Nurses ensure the successful implementation of interventions that welcome

life and promote or restore health. They also assist in providing the means to a peaceful, dignified, and pain-free death. Alongside nurses, hospital orderlies conduct various physically demanding tasks that must be completed without delay, regardless of how physically demanding the task may be. Physical constraints are not only limited to heavy loads, awkward postures and movements also affect the work of orderlies. The nature of their work means that nurses and orderlies are constantly in awkward positions, standing for prolonged periods of time, and lifting heavy loads [22]

Emergency situations pose added challenges to the work of nurses and orderlies. These professionals are often working alone and exerting extreme effort under stressful conditions. Working with disabled patients, in intensive care units, or emergency units further compounds these stresses. All these factors make the challenges faced by nurses and orderlies clear. Considering these risk factors, along with poor work environments in hospitals with poor equipment and challenging architectural features, it is clear that nurses and orderlies are at high risk of work related illness and injury.

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2.2 Information on ergonomics

2.2.1 Concepts of ergonomics

Ergonomics as a science, a technology, and an art must be used in developmental process of industrializing countries. Ergonomics is a multidisciplinary

science with four major areas of specialization; anthropometry, work physiology, occupational biomechanics, and human factors engineering (sometimes call engineering psychology).

The principal objectives of ergonomics are as follows

1) To enhance physical and mental we-being, in particular contributing to the prevention of occupational injuries and diseases, reducing physical and mental workload, and promoting the acceptability work and job satisfaction.

2) To promote social well-being by improving the quality of social contracts and the way in which work is organized.

3) To increase the efficiency of the human/machine system by contributing to a rational balance between technical, economic, anthropological and cultural aspects of the system.

To obtain those objectives, ergonomics should deal with the following issues:

1) Energy (nutritional status): adequate nutrition as the source of a worker' s energy to complete his or her tasks throughout the working period is a must.

2) Application of forces: exerting muscular force in an optimal and efficient way, by designing work and training of workers to keep the stress on the worker to a minimum.

3) Posture: poor working postures and too much overtime work can lead to musculoskeletal strain and negative effects on health. To prevent such a situation, the positioning of the head, body and limbs needs to be considered in relation to

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work and the work space.

4) Environmental conditions: heat, light, noise and vibration need to be assessed to prevent physical and mental strain.

5) Time-related conditions: to minimize fatigue and its effects on workers' well-being, studies must be carried out, including rest pauses, holidays and shift patterns.

6) Social conditions: the reward for work, how the work is organized, and the quality of social interactions among workers often need to be reconsidered because of changing technology. Work that deprives the worker of self-esteem and satisfaction leads to psychological stress and consequent health problems.

7) Information conditions: the amount and quality of information needed by a work in order to perform his or her job satisfactorily can be evaluated. Physical and mental strain can develop if the information demands of a job exceed a worker's capacity.

8) Man/machine interactions: determining exactly what the worker and the machine should be doing, how the worker affects the machine by the use of controls, and how the worker reacts to the machine's operations can be analyzed. A mismatch between the work's capacities and the demands placed on the worker by the machine can led to adverse health consequences.

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2.3 Occupational Risk Factors and Ergonomic Risk Factors in Hospital Orderlies

2.3.1 Musculoskeletal Disorders

Musculoskeletal disorders (MSDs) refer to a group of conditions that involve the nerves, tendons, muscles, and supporting structures of the body such as intervertebral discs [23]. Often attributed to, or exacerbated by, the work environment, these disorders are also referred to as work-related musculoskeletal disorders (WMSDs) and are most commonly reported in the lower back, neck, and upper extremities [23]. These disorders can cause symptoms such as aching, pain, numbness, discomfort, and tingling. WMSDs also lead to reduced worker productivity, lost time from work, and temporary or permanent disability [23]. Nelson, Fragala, and Menzel (2003) indicated that the prevalence of work-related back injuries in orderlies is among the highest of any profession [24].

When discussing MSDs, back injuries are the primary concern as they can be severely debilitating to healthcare workers. However, other musculoskeletal injuries are also concerning. Injuries can present themselves in other body parts such as the neck, shoulders, wrists, and knees [25]. Having studied Korean healthcare workers, Kee and Seo (2007) [5] found that the prevalence of MSDs in one body part over a 12-month period ranged from 45.7 to 56.8%. Furthermore, they found that shoulders were the most susceptible body part, followed by the knees, lower back, hands/wrists, neck, ankles/feet, and fingers. These findings were consistent with those of Tongpoon (2009) [26] who found that shoulder pain was the most common

among healthcare worker, followed by knees and back pain.

2.3.2 Occupational Risk Factors in Hospital orderlies

Karsh's (2006) [19] integrated model helps explain the complexities associated with intervention efforts to curb the prevalence of WMSDs. A literature review showed that there were three dominant risk factors contributing to MSDs; individual factors, physical (biomechanical) factors, and psychosocial demands [19, 27]. Assessing the deeper roots of MSDs it becomes apparent that these disorders encompass a wide variety of conditions related to ergonomic risk factors [28]. The word 'ergonomics' is derived from the Greek 'ergos,' meaning work, and 'nomos,' meaning laws, thus, the laws of work [29, 30]. While several authors have provided definitions for ergonomics, Keysling [31] defined ergonomics as the study of humans at work to understand the complex interrelationships among people, their work environment (such as facilities, equipment, and tools), job demands, and work methods. Warren [30] provided a succinct definition by stating that ergonomics is the study of how to fit work to the worker. Ergonomics is concerned with matching work and job design to fit the capabilities of most workers by adapting the product to fit the user. However, the design of work environments should be flexible enough to consider the need for individual variation [29].

The focus regarding ergonomics has been constructing human-centered work environments that account for physical and psychosocial work demands [10]. The intricacies associated with these relationships means that clearer definitions are

needed to better understand the linkages between ergonomics and MSDs.

2.3.2.1 Physical Work Demands

Ergonomics, particularly as regards physical (biomechanical) work, can present various risk factors that include physical stresses and workplace conditions that increase the risk of musculoskeletal related injury or illness [32]. Several biomechanical tasks have been recognized by various organizations to increase the risk of injury. These tasks are those characterized by awkward postures, forceful exertions, repetitive motion, localized contact stress, vibration, and extreme temperature changes caused by poorly designed workstations, tools and equipment, and improper work methods [29, 31-33]. Details of each factor are presented below.

1) Awkward Postures

Awkward posture at any joint may cause transient discomfort and fatigue. Sustaining awkward postures for a prolonged period may contribute to debilitating injuries and disorders resulting from damage to musculoskeletal tissue and/or peripheral nerves. Awkward trunk postures increase the risk of back injuries. Elbow movement above the shoulder or reaching for objects located behind the torso can lead to musculoskeletal problems in the neck and shoulders. Overextension when reaching down into bins or up to high shelves, or reaching overhead or in front of the body to operate machines and equipment may all result in awkward body postures.

Muscle and joint use is determined by body posture. Posture will also determine the force or stresses that will be generated and how the body will

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tolerate them. Lifting, lowering, and handling objects is more arduous, and places more stress on spinal discs, when done with a bent or twisted back. Bending and twisting is also a concern when considering wrists, knees, hips, or shoulders, as these movements place added stress on the joints. Conducting tasks that require frequent work over shoulder height also result in added stress. Finally, holding a position for a prolonged period may also result in muscle damage and restricted blood flow.

2) Forceful exertions

Muscles, tendons, ligaments, and joints are exposed to increased forces when conducting tasks that involve exertions such as lifting, pushing, and pulling. These tasks require an increased effort that results in a higher degree of muscle exertion. Forceful exertion of the hand may occur from tasks that involve using knives, scissors, securing electrical connections, and manipulating small object like screws. These activities can lead to disorders such as tendonitis or carpal tunnel syndrome. When these tasks are combined with a lack of rest and/or recovery periods the result can be fatigue and musculoskeletal disorders.

3) Repetitive Motion

Tasks that require constant repetition over prolonged periods of exertion are associated with ergonomic risk factors. Conditions including fatigue, irritation, muscle and tendon strain, and nerve pressure are more likely to occur when conducting repetitive tasks over a long period such as a work shift. These conditions tend to improve with recovery periods. However, repetition, combined with awkward posture

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and forceful exertion, make recovery more challenging.

4) Localized Contact Stress

Concentrated pressure due to contact with an object or tool can result in local mechanical stress. Constant, repetitive, contact of this nature with sharp work surfaces or hard tool handles can lead to increased pressure on specific body parts like the forearms or fingers. Pressure arising from localized contact stress can reduce blood flow and damage nerves, tendons, and tendon sheaths.

5) Vibration

Powered hand tools and other machinery can expose the body to local vibrations. Localized vibration from powered hand tools can lead to certain hand-arm vibration syndromes, such as vibration white finger. Standing or sitting on vibrating surfaces or objects, such as heavy-duty machinery, can be a factor contributing to back pain.

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6) Extreme temperature

Temperature plays a modifying role in the biomechanical risk factors discussed above and their linkages to MSDs. This is especially true of cold temperatures. Of particular interest is the role temperature plays in vibration related MSDs complications. Cold temperatures lead to hand and foot discomfort. Exposure to cold temperatures for an extended period leads to decreased manual dexterity. Exposure to cold temperatures is also known to affect tactile sensitivity and reaction time, thus reducing the ability to perform complex tasks. Research has found that

exposure to cold at 15.5^{0}C for several hours leads to loss of flexibility and dexterity in workers' hands; after exposure to cold at 7^{0}C workers lost up to 20% dexterity.

Lorusso, Bruno and Abbate 2007 [34] concluded that physical workload was found to be significantly associated with low back pain in most studies that investigated physical risk factors. It should be noted that physical exposure levels were assessed by measuring the frequency of the execution of high-risk tasks involving manual handling and fixed or awkward postures, or ascertained based on work category and working area. Hospital orderlies often conduct heavy physical work activities such as lifting heavy loads, working in awkward postures, transferring patients, and operating hazardous equipment.

2.3.2.2 Psychosocial Work Demands

Psychosocial work demands refer to stressful conditions that are thought to be threatening, harmful, or bothersome. These are also conditions that result in physiological adaptation responses from employees [35]. Psychosocial factors include quantitative work demands, availability of social support, job ambiguity, conflict, job control, job strain, job satisfaction, and job security [36].

The importance of linkages between psychosocial variables and work-related injuries and illness was identified in Karasek et al.'s demand control model [37]. When viewed through this model, high levels of psychological job demands may contribute to the development of WMSDs in settings where workers have little ability to decide what tasks to perform, or how to perform them. The issue is compounded

when workers are not given an opportunity to use existing, or develop new, job skills. These adverse effects are thought to occur more frequently in work environments in which there is little social support from co-workers or supervisors [23].

A number of literature reviews have concluded that work-related psychosocial risk factors (such as high job demand, job dissatisfaction, stress, low social support and perceived control at work) also play a significant role in developing MSDs [34, 38-41]. Josephson and Vingard (1998) found that exposure to adverse psychological work conditions, combined with physical demands, increased the risk of MSDs [42]. Psychosocial factors like low job satisfaction and lack of social support have been linked to lower back pain and neck/shoulder pain among nurses [43]. Studies have indicated that psychosocial factors, such as high perceived exertion and high job demand, may have a closer link to neck pain than lower back pain [1].

2.3.2.3 Individual Factors

Genetics, age, gender, smoking habits, length of employment and other individual factors may also cause, or contribute to, MSDs [41]. Employee age and length of employment have been shown to be among the most important individual risk factors, with length of employment, regardless of age, being linked to lower back pain. The risk of lower back problems was found to be equally high in both younger and older nurses. Multiple logistics modeling showed that nurses ranging from 41 to 50 years old (OR 2.95, 95% Cl 1.02 - 8.52) were significantly associated with persistent shoulder pain [25]. Studies investigating the relationship between gender and injury

showed females to be at greater risk of lower back pain. Conversely, no association was found between back pain and anthropometric variables, smoking, sporting activity, and motherhood [34].

A study by Skillgate et al. (2009) suggested that smoking is a risk factor contributing to long-term sick leave resulting from back or neck pain[44]. Tweedy (2005) found that nurses working on 12 hour rotating shifts suffered from insufficient sleep, conducted more frequent patient handling tasks, and experienced more frequent pain or discomfort in the lower back, thigh/knee, lower leg, and ankles/feet [41]. Symptoms in over half of the body regions analyzed were significantly associated with patient handling tasks and type of work conducted during a shift.

Physical (biomechanical) risk factors associated with work at the individual level do not represent the full spectrum of possible risks [28]. Moreover, the effects of physical and psychosocial risk factors may be amplified by extreme environmental conditions. In addition, ergonomic hazards may arise from poor job design and faulty organizational factors including excessive work hours, shift work, imbalanced work-to-rest ratios, and a poorly adapted work environment [28, 32].

The amount of exposure to the various factors mentioned earlier, including duration and frequency of exposure, and the scales of exposure all determine employee risk levels [45]. Consequently, all risk factors encountered by employees in hospital settings account for the prevalence of MSD complications.

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2.4 Basic system approach of ergonomics

The ergonomics perspective considers the industrial setting to be comprised of four components:

1) Human: the person or group of people engaged in a purposive activity.

2) Task: the series of actions necessary for the human(s) to accomplish the activity.

3) Machinery/equipment: the hardware and devices provided to the human(s) to assist in preforming the activity.

4) Environment: the overall arena in which the purposive activity takes place, including not only the physical factors temperature, lighting, noise, etc. but the organizational and psychological factors that can affect human performance.

Any ergonomics evaluation considers the interaction of these four components as a "human/task/machinery/environment" system. The primary objective of ergonomics is to attain and maintain balance in the system seeks to determine if imbalances exist between the elements of elements of the system and to identify the sources of the imbalance.

Corrective measures can then be devised. If risks of physical injury are found, the corrective measures generally focus on:

1) Improved postures

2) Reduced force demands

3) Reduced frequency of activity

2.5 Approaches to system safety

System safety conditions can be controlled and improved by ergonomic, organizational, and personal factors. Examples are as follows :

2.5.1) Ergonomic design:

2.5.1.1)Optimizing the physical work environment, such as illumination, vibration, heat, noise, toxic material control.

2.5.1.2) Design of tools, machinery, workplaces and human-machine interfaces.

2.5.2) Organizational factors:

2.5.2.1) Allocation, sequencing and scheduling of task, work, and shift cycles.

2.5.2.2) Improving organizational attitudes and goals with respect to safety performance, such as safety policy formulation, monitoring safety performance, supervisory attitudes and practices concerning safety and communication of safety information.

2.5.3) Personal factors:

2.5.3.1) Physiological and psychological conditions such as vision, audition information processing, skill level, expertise, motor performance.

2.5.3.2) Person-environment fit: safety motivation, level of training and practice, safe/unsafe performance, workload, types and levels of stress.

2.6 Association with Strenuous Tasks on Healthcare worker

One problem NIOSH (2001) has identified in the health care industry is that risks from transferring and moving patients are not well defined and quantified [46]. NIOSH's Revised Lifting Equation has a disclaimer that it does not apply to "lifting people" [47]. However, the equation does set the maximum amount that should be lifted under ideal conditions at 51 pounds. Virtually all adult patients exceed this weight limit. When Leighton and Reilly (1995) surveyed 1134 British nurses about back pain, two-thirds of those reporting an annual back pain prevalence attributed their injuries to patient handling or movement. Of nurses in this group, 48% identified the precipitating incident involved "positioning a patient in bed as opposed to performing a patient transfer task". Through biomechanical studies and estimates of perceived exertion, several individual patient handling tasks at high-risk for causing WMSDs have been identified, such as turning a patient, pulling a patient up in bed, and transferring a patient from bed to stretcher or bed to chair or toilet and back again [48, 49]. As Kumar (1990) put it, "Considerable attention has been paid to the peak stresses at which the injuries precipitate." Owen & Garg (1989) and others have looked at these tasks individually and determined that by themselves, some present a risk to the caregiver by increasing compressive forces on the L5/S1 spine above the 3.4 kN level acceptable to NIOSH for spinal loading [46, 49, 50]. For example, Owen and Garg (1991) found that transferring a patient from wheelchair to toilet exceeds NIOSH action limits for L5/S1 spinal loading each time it is performed. This type of

task puts the caregiver at-risk for a back injury every time he or she performs it [50].

Although WMSDs are considered cumulative trauma injuries/illnesses, there has been only limited research on the risk associated with the frequency that these activities are performed during the course of a hospital orderly workday, workweek, work year, or career. Stobbe et al, 1988 demonstrated that frequency of lifting was related to the incidence of back injury [13]. Kumar (1990) found a positive relationship between cumulative load and back pain in nursing aides[51]. Kelsey, et al. (1984) found a relationship between lifting frequency and prolapsed intervertebral disc [52]. The hazardous weight threshold was 25 pounds if the lift was performed more than 25 times a day. Nurses handle and move many times that weight, often in an awkward posture. The nurse's total workload, which encompasses the frequency that he or she performs a variety of care giving tasks in a normal workday (8-12 hour shift), increases the dose, over and above simply performing one hazardous patient handling activity.

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According to Smith and Carayon-Sainfort's (1989) Balance Theory of Job Design, the work system imposes physiological and psychological loads on the individual, resulting in challenges to physical, psychological, and biological resources, such as energy and strength [53]. Not only are the individual's perceptions of the load important, but also the load's "objective physical properties independent of the perception of the properties". In a more recent article, the same authors (Carayon & Smith, 2000) explain the cumulative trauma model this way: "When the

load becomes too great, the person displays stress responses, which are emotions, behaviors, and biological reactions that are maladaptive [53]. When these reactions occur frequently over a prolonged time period, they lead to health disorders." If the workload of a nurse is higher than safe limits, this may lead to an imbalance.

2.7 Strategies to Prevent and Control Ergonomic Risk Factors

Frameworks for ergonomically based injury-prevention programs are comprised of administrative, work practice, and engineering controls [29, 30, 32] Administrative controls refer to changes in the methodology used to assign and schedule work. These changes should aim to reduce the magnitude, frequency, or duration of exposure to ergonomic risk factors. Administrative strategies that can be implemented to mitigate MSD risk factors are employee rotation, broadening of tasks, providing alternative tasks, and allowing for changes in work pace. These approaches can act as effective measures to reduce work related injury.

Work practice controls refer to changes in the way employees perform physical work activities. These controls include postural improvement, proper body mechanics, pacing, timely rest stops, use of personal protective equipment, economizing of movements, getting assistance from others, and on-the-job stretching exercises. Job design and its associated processes determine how workers will physically operate and move when conducting work related tasks. This area of risk mitigation is viewed as the responsibility of the employee once proper training and

engineering controls are in place.

Engineering controls include design of workstations, tools, proper maintenance, environmental layout, mechanical assistance for material handling, and alterations in processes. Properly designed working environments, tools, and processes can act as the primary deterrents to workplace injury. Adequate design can effectively exclude ergonomic hazards from the work environment. Increased mechanization, automation, and safety campaigns have been effective in improving safety in the workplace, particularly reducing the risk of traumatic injury. However, MSD conditions continue to be problematic. Increased mechanization and automation have resulted in an increased need of fixed positions, body stasis, intense concentration, and highly repetitive movements. These physical and mental stresses are well recognized and merit a strategic position in the concept of ergonomics. For illustration, an ergonomics equation may be presented as follows.

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Demands of job = Human functional capacity

Productivity and efficient outcomes are achieved when the psychophysical demands of work are balanced with human psychophysical capacity. As such, ergonomics should aim to achieve an optimum fit between work and worker. The optimum fit and balance can be achieved through adjustments to the left side of the equation that result from engineering improvements that include mechanization,

hoists, lifts, conveyors, robotics, air quality, noise, temperature, lighting, walking surface, etc. Expecting only changes to the right side of the equation through work practice changes is unfeasible. Structural characteristics of the work environment directly influence how workers use physical and mental resources. While engineering interventions on their own can remedy existing hazards immediately, it is also the case that expensive changes in the workplace may not reduce risk of injury. The right side of this ergonomics equation also presents opportunities for improvement.

Work practice changes can have a positive effect on worker health and productivity. These changes can sometimes prove to be less expensive than engineering changes [30]. A study in the United States suggested that simple ergonomic and engineering solutions could be adopted to improve the work environment of healthcare workers. However, a successful ergonomic program designed to prevent or reduce work-related musculoskeletal disorders must involve a clear understanding of the work and responsibilities of healthcare workers [54].

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2.8 Participatory Ergonomics

Participatory ergonomics (PE) is the use of various forms of workplace participative techniques. PE was defined by Nagamachi (1995) as "the workers' active involvement in implementing ergonomic knowledge and procedures in their workplace." Supervisors and managers support worker efforts in order to improve their working conditions and product quality [55]. Kuorinka (1997) defined PE as

practical ergonomics with the participation of the necessary actors in problem solving. Regarding a systemic approach, Wilson and Haines (1997) defined PE as “the involvement of people in planning and controlling a significant amount of their own work activities, with sufficient knowledge and power to influence both processes and outcomes in order to achieve desirable goals”[56, 57]. In short, PE refers to providing workers with the opportunity and power to apply their knowledge and skills to address ergonomic problems and find solutions relating to their own work activities.

PE has come to be viewed as a wide variety of methods and techniques aimed at improving the workplace. While varied in scope and approach, these methods are linked by active worker involvement. Fundamental ergonomic principals are passed on to workers who in turn are able to draw from their own experiences in order to achieve a healthier and safer work environment. PE not only requires that workers be allowed to participate, workers must also be given the power to influence decisions regarding their work environment.

The PE approach can lead to a wide range of changes. PE promotes participation in society and socio-technical organization of production principles. PE can also spur the development of ergonomics from a ‘micro’ level, involving individual design for a single user workstation, or a ‘macro’ level, which aims to resolve issues through a holistic approach [58]. While we have working definitions for PE, differences have emerged in the implementation of PE projects in various countries. In the United States, the focus has tended to be on the macro level with

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PE aimed at the development and implementation of new technologies (Holden et al., 2008). In Europe, the focus for PE projects has been stakeholder inclusion at all levels of ergonomic interventions [59]. Whereas in Asia, PE has been mostly applied through the PAOT method for workplace ergonomic improvement. Participatory steps that have been reviewed have been found to meet diverse ergonomic needs while following good practice approaches that are easily adjustable to the needs of workers while prioritizing low cost methods [9, 10, 60] There exist cultural and regional differences with regards to PE. Culturally sensitive approaches need to be developed to address these differences. However, the fundamental principles of participatory approaches to addressing the prevalence of MSDs transcend these differences and offers real possibilities to achieve improvements [59].

PE appears to be the most effective method of applying ergonomics in the workplace[9, 61]. PE has become an increasingly popular tool for improving working conditions, productivity, and product quality, without interrupting the work process [59, 62, 63]. Moreover, PE has a positive impact on musculoskeletal symptoms and is therefore used to reduce work related musculoskeletal disorders in the workplace, including in healthcare settings[20, 59, 60, 64-72]

Carrivick, Lee, and Yau (2002) found that participatory workplace risk assessment interventions were significantly associated with reductions in MSDs among hospital cleaners. Results showed reductions of: two-thirds in the musculoskeletal injury rate, 65% in workers' compensation claims cost per hour

worked, and 40% in work hours lost. Results also showed that cleaners experienced a significant two-thirds post-intervention reduction in non-musculoskeletal injury rates. However, the corresponding changes in severity rates were not significant. These interventions support the adoption of a participatory approach to reducing the rate and consequence of musculoskeletal injuries in the workplace [62].

PE, once applied to the workplace, has been found to have a number of positive effects. Anema et al. (2003) found that PE intervention had a positive impact on workers' return rates following injury (HR=1.7 [95% CI 1.2 to 2.3]; p=0.003). Workers that participated in PE interventions improved their functional status and saw greater reduction in pain intensity than workers who had not participated [73].

Ergonomic solutions have focused more on work and organizational design (58.9%) than on workplace and equipment design (38.9%). Close to half (48.9%) of implemented ergonomic solutions were completely or partially implemented within three months after the first day of sick leave. Most workers were satisfied about the PE program (median 7.8 on a 10-point scale).

PE initiatives did face some obstacles. According to ergonomists, the main obstacles to implementation were technical or organizational difficulties (50.0%) and the workers' physical disabilities (44.8%). PE had a positive effect on workers suffering from sub-acute lower back pain. These workers were able to return to work sooner than had the PE intervention not taken place. The compliance, acceptance and satisfaction related to the PE-program were good for all participants.

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A systematic review of Cole et al. (2005) on the effectiveness of PE interventions found a wide variety of measures aimed at improving health conditions. The authors described various ergonomic changes that were implemented with a focus on the physical designs of equipment and the workplace. Changes that were implemented included changing job tasks and/or job teams and reconsidering how work was being organized. Other changes involved establishing new policies aimed at improving health and safety training [74]. Nine of the ten studies reviewed reported that PE interventions had positive effects on health outcomes including the reduction of musculoskeletal symptoms, reduced workers' compensation claims, and a decline in absenteeism due to illness or injury. Furthermore, Tompa et al. (2009) found that PE intervention was associated with a significant reduction (at the 95% confidence level) of weekly indemnity claims and the number of denied workers' compensation claims which included claims for musculoskeletal injuries [75].

Positive outcomes of PE initiatives have been observed in hospital settings. Evanoff et al. (1999) conducted research to see if direct participation of orderlies in problem solving PE initiatives would improve job satisfaction, injury rates, reduce lost time, and lead to decreased musculoskeletal symptoms. The study found a 50% reduction in relative risk of injury and a reduction in total work days lost. Their survey found a statistically significant reduction in the proportion of workers with musculoskeletal symptoms [71].

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A review of Hignett, Wilson, and Morris (2005) showed various achievements regarding PE initiatives in the healthcare setting. The use of PE in risk management projects for MSDs was found to show “promise as an approach which could be used to evaluate changes in understanding and behavior of people at work as far as risk management is concerned”[59]. The most successful strategies involved changes to work organization programs, working practices, and the design of the work environment. Positive results after implementing PE initiatives included an overall reduction of 48% of patient transfer incidents, a 67% reduction in lost workdays, and a 32% reduction in costs during the first year, and 44% in the second year.

Studies have shown that 12 month ergonomic intervention programs in a home care setting improved working conditions and prevented declines the workers’ abilities to perform their jobs. Moreover, a study of a 5 year long PE intervention program showed a 36% reduction in musculoskeletal disorders, a 33% reduction in manual handling incidents, and an increase in risky action completion from 33 to 76%.

PE adds value to the work place well beyond the practical, and powerful, contributions of traditional ergonomics. This value can be seen across a wide range of situations, spanning many cultures and diverse problems. Imada and Nagamachi (1995) stated that ergonomics alone can not solve all issues. Without improved organizational support, team processes, team building, role definition, role clarity, communication, management commitment, and a supportive culture, the successes

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of programs will be limited. There is no ‘best-one-and-only’ method to problem solving [55].

Participatory practice speaks to the importance of the process rather than any single event or approach. Participatory processes and expert consultant interventions might result in similar outcomes. However, participatory processes have clearer benefits and effects on those who participate. The most notable benefit can be said to be the ownership of ergonomic ideas, the acceptance of the proposed solutions, the confidence and competence to solve problems, satisfaction with the outcome, and willingness to change. These outcomes are particularly beneficial in environments where change is continuously driven by technology, changing customer needs, quality initiatives, and competitive demands for continuous improvement. Therefore, the scope needs to be expanded beyond the physical level and should begin to address the psychosocial and organizational facets of work.

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In the future, addressing injuries and improving productivity may come to depend more on macro ergonomic variables. As a result, ergonomics must develop as a multidisciplinary field, able to continuously expand and redefine its frontiers. Hignett’s (2003) systematic review of interventions used to reduce musculoskeletal injuries associated with patient handling tasks found that the best results were obtained when multifactor intervention strategies included worker participation. The review conducted a quality appraisal for each paper, ranking intervention strategies. The most successful strategies involved changes in work organization, working

practices and the design of the working environment [14].

Another area of concern is how best to involve employees in the decision making process. A number of authors have suggested typologies for employee participation. Approaches include: top-down approaches, with information flowing from management to workers on action plans; gathering of information and experience from workers; consultation where workers can make suggestions and present points of view; negotiations in formalized committees; and, joint decision-making involving all parties. These approaches highlight the importance of worker involvement in decision-making as well as in all levels of an organization. It is interesting to note that the longevity of ergonomic input was ranked as the lowest, suggesting that ergonomic input is perhaps project specific rather than a permanent organizational role [59].

Participatory ergonomics interventions generally involve the development of ergonomics teams consisting of management and employees of an organization. These teams seek ways to reduce workplace health risk exposure through a redesigning of processes, tools, and equipment. The team should include participants from various departments and various levels within the organization in order to ensure that those who have first-hand experience about the issues being investigated have a say in how to address them [56]. Furthermore, all stakeholders potentially influenced by these changes should be included in the decision making process [75].

Hignett, Wilson, and Morris (2005) have found that most participatory

ergonomics projects have both macro and micro dimensions and involve many levels of staff [59]. PE programs can be multifaceted and their scope will be determined by specific industry needs, problems being addressed, and geographical location. Most workplace PE interventions involve forming ergonomics teams that guide the intervention process. This group usually includes employees, managers, ergonomists, health and safety personnel, and research experts. The team typically undergoes training to familiarize them with ergonomic principles. Combining outside expertise with the organization's unique experience makes it possible to devise ergonomic interventions tailored to the needs of that particular workplace, increasing the likelihood that intervention will be successful [74]. Moreover, the success of PE can be attributed to the involvement of workers in the entire process, from identifying the risks and hazards, to recommending solutions, to implementing the solutions and evaluating the outcomes [61].

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2.9 Factors for success in participatory ergonomics

Effective participatory ergonomic (PE) programs require: the creation of teams with proper representation, the identification of clear facilitators and barriers, participation of appropriate stakeholders from the workplace, relevant ergonomic training, appointment of a PE champion to guide the process, clear participant roles and responsibilities, and decision making through group consultation [68] .

1) Creation of teams

The literature recognized the relevance of teams when implementing PE initiatives. Successful PE programs were typically characterized by the creation of some form of team. Teams in PE programs can take on various forms depending on the specific needs of each workplace. The type of team that is created, be it a steering committee or cross-departmental team, is not necessarily relevant. However, the members that make up the team must represent workers, supervisors, and advisors. Creating a representative team can be a facilitator in PE programs. A good team, in combination with a PE champion, can facilitate communication during the implementation period.

2) Addressing key facilitators and barriers

Identifying potential facilitators and barriers to implementation was beneficial when initiating a PE program. The most common facilitators and barriers included: management support of the PE intervention, ergonomic training, resources such as staff time, funds or materials, creating an appropriate team, communication levels, and organizational training and knowledge in general areas such as team-building skills. While these examples are common it is important to note that facilitators and barriers will vary depending on specific workplace risk factors.

3) Participation of appropriate stakeholders from the workplace

PE teams will rely on the participation of other members of the workplace for comments, suggestions, or advice regarding the PE program. Determining who will be

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involved in this consultation process is important. Workers alone are not sufficient, bringing in supervisors and special advisors to assist in the consultation process will aid implementation as they bring with them a wide set of skills and knowledge.

4) Ergonomic training

Ergonomic training was a key factor described as a facilitator, or a barrier when training was not provided. Ergonomic training presents the opportunity to identify facilitators in the PE process such as detailed plans of the initiative, identifying simple changes, and establishing clear ideas regarding work responsibilities and production priorities. Ergonomic training, provided by an ergonomist or other specialist, can be tailored to specific workplace needs. Training makes it possible for stakeholders to grasp workplace hazards and the associated ergonomic solutions aimed at reducing risks and improving health conditions [29].

5) Appointment of a PE champion

PE champions were appointment in most PE interventions. The role was typically given to an ergonomist, though others in the workplace can take on the responsibility. The PE champion is tasked with providing guidance and monitoring the PE intervention process.

6) Identify clear participant roles and responsibilities

Setting clear roles and responsibilities for participants in the PE process promoted efficiency. Roles and responsibilities were varied but tended to include: identifying the problems in the workplace, developing solutions, and implementing

the necessary changes. Participants were less involved in initiating, guiding, and monitoring the PE process as these were considered the responsibilities of the PE champion.

7) Decision making through group consultation

Group consultation characterized most decision-making processes. As such, groups would arrive at a decision regarding the PE process and later managers would get involved to determine resources and implementation measures. Facilitators such as communication, good working relations, and a positive workplace climate were key to the decision-making process. Another two key components to consider in a comprehensive ergonomic program, as identified by Clark (2004) were the safety committee and ergonomics team [32].

1) Safety committee

PE interventions need strong safety committees capable of enforcing their policies and procedures. This becomes particularly relevant when considering that an organization's focus on production can stand in conflict with its position on safety matters. Weaker commitments to safety tend to formulate when safety measures are regarded as less of a priority than either productivity or services. However, the costs associated with workers' compensation for musculoskeletal disorders (MSD) have made organizations begin to look more towards finding a balance between production and employee well-being. Process safety management, the process of integrating safety with operations, has emerged as an approach to bridge the gap

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between manufacturing goals and employee health and injury prevention. Safety committees, paired with an understanding of how to manage safety processes and reduce risks, help reduce injuries in the workplace.

2) Ergonomics Team

Working as part of the safety committee, or independently, ergonomics teams oversee all issues related to ergonomics and MSDs. As many factors play into ergonomic science, the ergonomics team must consist of members of management, labor, engineering, maintenance, human resources, health and safety personnel, and consulting specialists. It is imperative that production workers play an active role, as they are the stakeholders most affected by any outcome.

At its core, the ergonomics team must work to identify ergonomic risk factors and hazards and develop processes to mitigate those risks. In some organizations it might be necessary to contract an ergonomist consultant in order to ensure the ergonomics team is set up properly. A consultant can provided training that would allow the ergonomics team to become skilled in problem analysis, planning, managing medical conditions, identifying risks, and become capable of providing training to stakeholders.

PE processes have led to success in Asia. In view of these successes PE initiatives should continue to: focus on local self-help initiatives based on good practices; develop tools aimed at supporting local trainers; and promote facilitator roles for ergonomists [76]. Trainers, acting in facilitator roles, have been found to

initiate management and worker involvement, leading to immediate improvements in the workplace [77]. Trainer led participatory approaches were most successful when they incorporated local good practice, a wide range of basic ergonomics principles, and feedback regarding progress.

Training and education formed the final essential component of PE interventions aimed at reducing MSDs, with positive outcomes supported by the literature [60, 63, 65, 78]. Wu, Chen, and Chen (2009) studied the effects of ergonomics training to reduce MSDs among wafer handlers, calculating the risk factor ratio (IRFR) and workers' MSD symptoms before and after the training [78]. Pre and post training IRFR results indicated that training significantly increased safe behavior in the workplace. The study also found a significant decrease of 19.3% ($p < 0.05$) in MSDs in the legs post training. Other, not statistically significant, decreases in MSDs were found in the lower back (12% decrease) and feet (6.5% decrease) post training. The study concluded that one-year after training had been completed the only significant decrease of MSDs was in the leg. The training intervention was considered successful in reducing improper work postures and methods. However, little data could be found that validated the effectiveness of training in reducing all MSD problems. Some studies have suggested post intervention follow ups should occur between four and 12 months after the intervention is completed [79], studies that conduct follow-ups more than 12 months after intervention run the risk of workers no longer being employed at a particular organization.

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In recent years several participatory approaches, including the Participatory Action Oriented Training (PAOT) program, have emerged. Originally developed by Thurman, Louzine, and Kogi (1988, cited in Khai, Kawakami, and Kogi, 2005), PAOT emphasizes that both workers and employers that participate in trainings can communicate lessons learned to the whole of the organization and field of work [10]. This approach was designed to emphasize voluntary participation in improvement programs through a system of active participation and dialogue between management and workers. Effective PAOT programs can reach low-cost solutions to problems causing workplace injuries [65, 77, 80, 81]. The features of training tools are presented in Table 1.

Several successful programs have integrated PAOT, including WISE (Work Improvement in Small Enterprises), WIND (Work Improvement in Neighborhood Development), and WISH (Work Improvement for Safe Home) [81]. The WISE method adopts a shop-floor approach focused on planning and practical implementation. WISE promotes low cost approaches to increasing productivity and improving the work environment by promoting worker participation, local good practices, and responsiveness to feedback. The WISE method empowers trainees to identify improvements to the work environment and increase productivity, all the while with the aim of achieving low cost solutions.

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Table 1 Features of training tools and their merits for achieving workplace improvements

Training tools	Features	Main Merits
1. Action checklists	Guide workers on how to identify existing good points and available low-cost improvements	Help users rapidly select locally practicable improvements using local resources
2. Local good practice	Present local good practices as means of reducing occupational risks in healthcare work	Promote the use of low-cost improvements for problem solving
3. Group work methods	Prioritize immediate improvements and help amalgamate different ideas	Facilitate participatory steps to plan and implement priority low-cost improvements
4. Training manuals	Guide trainers and workers on practical methods for conducting participatory action-oriented training	Support the organization of participatory multifaceted action training events by local trainers

In their 2009 study, Tongpoon et al. presented an action checklist for workplace improvements in healthcare settings [26]. Focusing on the Phattalung Province of Thailand, the checklist consisted of 31 items divided into four categories:

biological hazards, chemical hazards, ergonomic hazards, and job related stress. However, the checklist was not designed to specifically address musculoskeletal problems present among the sample nursing population.

Building on the PAOT approach, Koo et al. (2006) conducted a Participatory Action-Oriented Approach Program (PAOAP). The PAOAP program was designed to decrease the prevalence of MSDs among healthcare workers and proved to be a successful intervention program to curb the rate of MSDs in hospital settings [82].

With a focus on preventing MSDs among hospital nurses, Kim and Lee (2010) developed the Participatory Action Oriented Training for Hospital Nurses (PAOTHN) [60]. PAOTHN brought together a multidisciplinary team to conduct workshops with the aim of developing effective intervention strategies. The PAOTHN approach was successful in yielding a series of practical and cost effective solutions to reducing workplace risk factors. This approach developed a 43 item checklist divided into five categories: patient care and treatment; safe handling of drugs, medical devices, and equipment; workstation design; physical environment; and welfare facilities and administration. The PAOTHN intervention program was successful in imparting nurses with the self-help skills to assess risks and implement solutions. Ultimately, PAOTHN aimed to create long-term solutions by increasing the amount of nurse participants able to assess their workplace conditions and act as agents for positive change.

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2.10 Evaluation of Participatory Ergonomic Intervention

2.10.1 Process Evaluation

Evaluation of PE intervention processes is key to understanding how changes occur in the workplace, and both qualitative and quantitative research has been conducted on process evaluation[56, 83]. The literature also addresses the effectives of PE interventions in improving work environments and reducing MSD risk factors. Cole et al. (2005) indicated that detailed information on PE processes and biomechanical exposure was necessary in order to better assess improvements to health outcomes [74]. Randomized control trial testing has shown a reduction to various biomechanical exposure indicators [84]. Economic evaluations have also been conducted to assess the efficiency of workplace interventions in improving worker health and production outcomes [85]. Economic approaches to evaluation provide cost-benefit analysis of PE interventions, while scientific approaches focus on specific aspects of PE interventions. Figure 2 presents the pathways of change that can act to improve employee health and productivity [20].

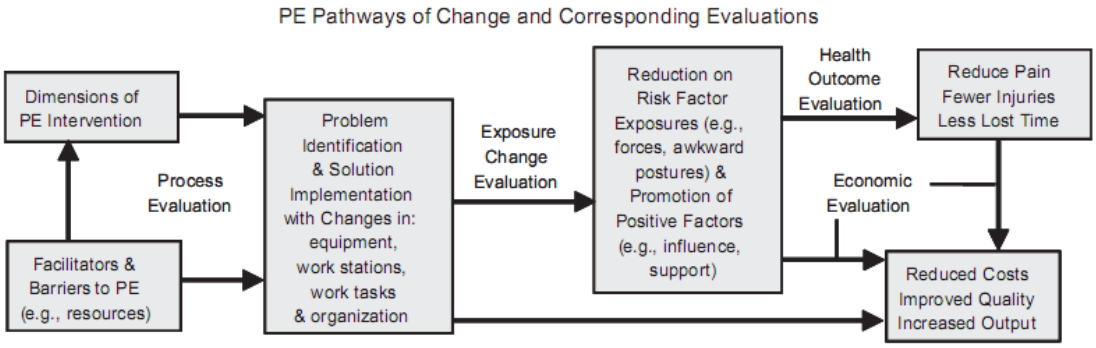

Figure 2 Participatory ergonomics pathways of change and corresponding evaluations

Participatory frameworks tend to advance through a progression of tools. However, this progression is typically spurred on by an expert ergonomist capable of identifying problems and testing possible solutions. The progression can be characterized by quantitative and qualitative problem analysis and real world data collection [59]. The Participatory Ergonomics Framework (PEF), developed by the United Kingdom Health and Safety Executive, can act as the foundation for producing actionable guidance for PE programs [86]. PEF, developed based on the work of several ergonomists, is comprised of nine dimensions. These dimension are presented in Table 2.

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Table 2 The participatory ergonomics framework (PEF)

Categories	Categories
Permanence	Ongoing-Temporary
Involvement	Full direct-Partial direct-Representative
Level of influence	Entire organization-Department/work group
Decision-making	Group delegation-Group consultation-Individual consultation
Mix of participants	Operators-Supervisors-Middle Management Union Personnel-Specialist/Technical Staff-Senior Management
Requirement	Compulsory-Voluntary
Focus	Designing equipment or tasks-Designing jobs, teams of work organization-Formulating policies or strategies
Remit	Process development-Problem identification-Solution generation-Solution evaluation-Solution implementation-Process maintenance
Role of ergonomics specialist	Initiates and guides process-Acts as a team member-Trains participants-Available for consultation
Specialist	participants-Available for consultation

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2.10.2 Outcome Evaluation

1) Work Environments

A variety of methods are currently used to assess work environments and exposure to MSD risk factors. Among these methods are self-reporting, observational methodologies, and direct measurements [87]. Diaries, surveys, and questionnaires are three approaches to self-reporting that allow for the collection of physical and psychosocial data in the workplace. Data collection of this kind has typically been conducted through written methods to gather demographic, symptom, and exertion variables for analysis. An advantage to these approaches is their low cost and wide applicability [87].

Systematic recording methods have been developed to gather, and record on pro-forma sheets, workplace exposure data for assessment, Differing techniques are used to gather data on a number of exposure factors such as posture assessments for various body parts or assessment of critical exposure factors. Among these methods is the Quick Exposure Check (QEC). The QEC is used by occupational health and safety specialists to assess work related musculoskeletal disorders (WMSD) risk exposure and to later provide ergonomic intervention strategies. With its low impact and low cost, QEC is applicable to a wide range of work environments and can be used to evaluate intervention effectiveness [87]. QEC does present the drawback of relying on highly technical support from trained practitioners. As such, QEC works best when recording and analyzing simulated activities, not conducting practical

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workplace assessments [87].

The Dortmunder model and physical workload index has emerged as the preferred self-report questionnaire for use in hospital settings [88]. This model was designed based on biomechanical aspects as modified by Hollmann et al. [89]. The main stumbling block with these self-report assessments is that workers can have inaccurate, less than reliable, perceptions of their exposure to risks.

Created by Karasek (1979), the Job Content Questionnaire (JCQ) has been the most widely used self-administered assessment tool, with its validity having been assessed in many languages, including Thai [37, 90]. The basis for the JCQ is the job demand-control-support (JDCS) model. The JDCS consists of three sections that aim to describe the psychosocial work environment, these are: psychological demand, job control or decision latitude, and social support. A series of factors comprise psychological demands in the workplace including workload related stress, organizational constraints, and conflicting demands. Job control, or decision latitude, refers to the freedom workers are given with regards to how to perform their tasks and is measured through a combination of skill discretion and decision authority. This model has pointed out that workers with high skill levels have greater control over how to accomplish tasks and make decisions that will reduce negative psychological effects. Social support consists of the level of positive and helpful interaction that exists between workers and their supervisors [91]. However, with its main focus on task completion and quantitative demands, the JCQ is not best suited for use in

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hospital settings [92]. Needing a tool more suitable for a service environment in which emotional demands were also relevant, Aust et al. developed the Copenhagen Psychosocial Questionnaire (COPSOQ-1). While COPSOQ-1 was suited to measuring the psychosocial work environment of hospital workers it failed to account for rewards at work. COPSOQ-II, developed by Kristensen et al. (2005) addressed this issue[93].

Physical work demands and their assessment have also been considered. Hollman et al. (1999) tested the validity of using questionnaires to assess physical work demands [89]. Acceptable test–retest reliability when used in a healthcare setting (r = 0.65) was found and convergent and discriminant validity was satisfactory. This questionnaire had also been used in numerous studies [88]. COPSOQ was tested as a method for assessing the psychosocial work environment with the majority of the scales showing satisfying results in internal consistency (α> 0.70). Only two scales, possibilities for development (α= 0.65) and demands for hiding emotions (α= 0.47) had alphas of less than 0.70 [92]. COPSOQ was determined to be a suitable instrument for measurement of the psychosocial work environment of hospital workers. This study, to ensure that all risk and positive factors have been accounted for, will develop a work environment questionnaire based on the physical workload index, COPSOQ-I, COPSOQ-II and literature reviews.

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Health Outcomes

A systematic review on the effectiveness of PE interventions to improve health outcomes was carried out by Rivilis et al. (2008) who identified three categories of health outcomes: symptoms of MSD-related pain and/or discomfort, injury records in-plant or lost time claims for workers' compensation, and general sick leave or lost workdays specifically due to MSDs [20]. The most commonly taken measurements were those related to MSD symptoms. This was likely the result of high frequency, as all participants reported a symptom score, and the increased sensitivity for scores to change following PE intervention. A series of questionnaires was used to collect data on a variety of MSD related symptoms such as frequency, severity, intensity of pain, and location of pain on the body. Administrative databases were used to collect data on changes in injuries and lost time from work. Few studies included more than one health outcome, both symptoms and injury data, or both symptoms and sick leave, or all three.

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Additional studies indicated that common chronic conditions affect employee ability to work. Of the chronic conditions analyzed, mental disorders and coronary heart disease were found to most affect ability to work. Depression, back and neck problems, and hypertension were found to have less significant effects on individuals, however, as these conditions were common they were found to result in more population wide decreases in ability to work. Studies have found that MSDs affect perceived abilities to cope at work [94].

In this study, as regards literature reviews, health outcomes, including MSD rates, sick leave, and ability to work among hospital orderlies will be considered.

The Instrument for Measuring MSDs

A popular tool for assessing MSD prevalence in work environments is the Nordic Musculoskeletal Questionnaire (NMQ). Originally developed by Kuorinka et al. (1987), the NMQ is a questionnaire that can be self-administered or used in interviews and is used to screen for MSD related ergonomic risks. The NMQ is suitable for studying MSD prevalence and disabilities in occupational settings [21]. The questionnaire focuses on the most common symptoms, including Lower back, neck, and shoulder symptoms . While the questionnaire has been found to be reliable, the NMQ is susceptible to recall bias, particularly as questions focus on a 12-month period prior to the questionnaire. Yet, the validity and reliability of the questionnaire was found to be acceptable [21, 95].

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Quick Exposure Check (QEC)

This exposure tool has been designed to assess the change in exposure to musculoskeletal risks before and after an ergonomic intervention. Before making the risk assessment, a preliminary observation of the job should be made for at least one work cycle. Record all information as listed at the top of the exposure tool form [87].

The Instrument for Measuring Work Ability and Sick Leave

Work Ability consists of the relationship between work demands and the resources of the individual [94]. The concept of 'work ability' used in this case must be seen in a preventive context in which interventions ensure proper accommodations, minimal alienation, reduced disability, and decrease premature retirement. It is important to determine how factors such as work conditions affect employability, where 'employability' is understood as "the behavioral tendency directed at acquiring, maintaining and using qualifications that are aimed to enhance the ability to cope with a changing labor market during all career stages" [96].

Costa and Sartori (2002) found that nurses had lower work ability mean scores in all age groups when compared to biologist-technicians and physicians [97]. This effect became clearer with aging. In line with these findings, the work ability index predicts the risk of work disability or the future ability to cope and remain at work, especially in ageing people [98]. Outcomes related to these factors in this study's sample of nurses were alarming. Declining health and its consequences on managing work responsibilities are a major concern for nurses, regardless of age.

The Work Ability Index (WAI) was developed in the early 1980's by researchers from the Finnish Institute of Occupational Health (FIOH). The WAI evaluates worker performance levels and how performance will be affected by future demands, health, and mental resources [99]. The WAI model consists of four factors: job demands and environment (28% of explanation rate), work organization

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and work community (20%), professional competence (15%), and life style (13%) [98]. These factors significantly influence performance and how workers use resources available to them. Feedback mechanisms are set in place to model and improve employee motivational factors.

The WAI can be used as a monitoring tool for both individuals and groups and is suitable in healthcare settings. The WAI has been proven to be helpful in high stress level detection and prevention [100]. Additionally, the WAI is a predictor for disability pension and mortality [98, 99] and a good indicator of occupational risk factors for early retirement. The WAI consists of seven dimensions each of which presents one or more question. The seven dimensions are: current work ability compared with the best during one's lifetime, work ability in relation to the demands of the job, number of diagnosed diseases, subjective estimated work impairment due to diseases, sickness absence or sick leave during past year, own prognosis of work ability two years later, and mental resources. It has been translated into 15 languages including Thai and is highly applicable for cross-cultural comparisons

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CHAPTER III

METHODOLOGY

This chapter focuses on the methodological approach description including research design, population sample, protection of human rights, intervention protocol, research instruments, and procedures for data collection and analysis.

3.1 Research Design

This study was participatory ergonomic (PE) approach with a randomized controlled trial (RCT), two-group pretest-posttest design and measurement was taken before and after the experimentation to evaluate the differences in work environments and health outcomes of hospital orderlies who received and not received the participatory ergonomic intervention program (PEIP). Timeframe and flow chart of study from recruitment for data collection and intervention are shown as below and Figure 3.

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	Baseline		**Posttest at 2 months** **Post intervention**	**Posttest at 4 months** **Post intervention**
Intervention Group	O_{I1}	X	O_{I2}	O_{I3}
Control Group	Oc1		Oc2	Oc3

O_{I1} and O_{C1} refer to scores of work environments and health outcomes prior to participating in the PEIP program for the intervention (O_{I1}) and the control (O_{C1}) participants, respectively.

X refers to the PEIP program which will be given to the intervention group.

O_{I2} and O_{C2} refer to scores of work environments and health outcomes at 2 months after the completion of the intervention for the intervention group (O_{I2}) and the control (O_{C2}) participants, respectively.

O_{I3} and O_{C3} refer to scores of work environments and health outcomes at 4 months after the completion of the intervention for the intervention group (O_{I3}) and the control (O_{C3}) participants, respectively.

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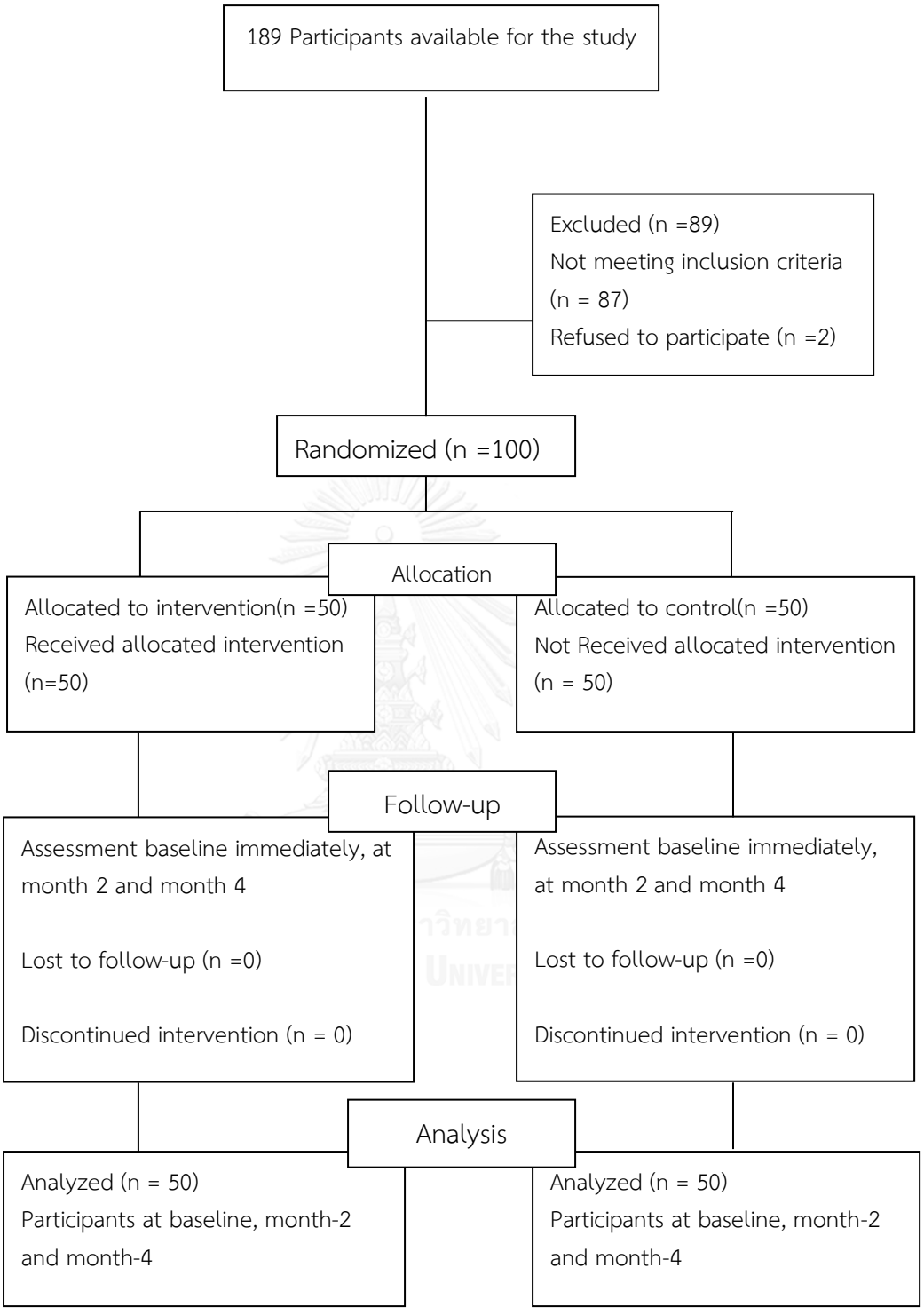

Figure 3 Flow chart of study from recruitment of participants during the study

3.2 Study size

3.2.1 Design of study size

The study was conducted at the tertiary care hospital setting at 13 unit of patient transfer service department Siriraj hospital (2,221-beds hospital). The study size as follows

3.3.1.1 Station of patient transfer service

- Center of building outpatient department
- Center of building outpost patient department
- Center of building outpatient department, floor 2-7
- Center of inpatient department service
- Center of diagnostic imaging centers.
- Center of building Chaofah Maha Chakri
- Center of building 72 year, floor 1
- Center of emergency service
- Center of building Syamindra, floor 1
- Center of building Syamindra, operating room floor 1
- Center of building 100 years Somdet Prasrinagarin
- Center of building Atsadang
- Center of building 10 years

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3.3 Study subject

The study were base consisted of all the orderlies and they were chosen for the study because historical data showed high rates of back, knee, and shoulder injuries associated with lifting, moving, and transporting patients throughout the hospital. At baseline (in all the orderlies were invited to complete a self-administered questionnaire). The work environment and job content also seemed to be similar and comparable between the groups. To control the threat of internal validity, only male orderlies were selected in order to achieve similarity of participants' work task characteristics and environments.

3.3.1 The duties of a hospital orderly

- Lift Patients
- Transport Patients
- Delivery messenger center lab
- Coordination of each point
- Oxygen withdrawal
- Machine maintenance
- Messenger

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3.3.2 General work activity

The general work activity of hospital orderlies department in patient transfer service Siriraj hospital of the year 2013 see in Table 3 (Department of patient transfer service Siriraj hospital, 2013).

Table 3 The General work activity of hospital orderlies

Description	No. of hospital orderlies		
	Morning shift	Afternoon shift	Night shift
Shift work	154	21	14
Total		**189**	

3.3.3 General equipment's for work activity

The general equipment's for work activity of hospital orderlies department in patient transfer service Siriraj hospital of the year 2013 see in Table 4 (Department of patient transfer service Siriraj hospital, 2013).

Table 4 The general equipment's for work activity of hospital orderlies

Description	No. of Equipment/Day	
	wheeled stretchers	Wheelchairs
Equipment's	310	503
Total	**813**	

3.4 Inclusion Criteria

The selection criteria were as follows:

- 18 years of age or older
- Healthy
- Full-time working and working for at least 1 year on working at the hospital before receiving the intervention and willing to participate in this research
- Had the moderate disability of the position and the muscular fatigue section base on an outline diagram of the body to indicate the body areas that currently discomfort or fatigued section (Corlett and Bishop, 1976) [101] (Appendix A).

3.5 Exclusion Criteria

Participants with any of the following conditions were ineligible:

- Had a medical history of serious injury, spinal surgery or severe disability by physician.

3.6 Sample Size

The sample size was determined based on a result from previous effects of participatory ergonomics intervention study (Bradley, 1999), which indicated that 72% of the subjects had a successful outcome of reducing MSDs symptoms. If we observe a 30% (effect size) absolute improvement for those on this study intervention, with a power (1-β) of 0.80 and α = 0.05 at two-tailed test, the sample sizes can be calculated as follows (Kasiulevicius *et al*., 2006):

$$n \text{ (size per group)} = \frac{P1(1- P1) + P2(1 - P2) \times (Z_\alpha+Z_\beta)^2}{(P1 - P2)^2}$$

Where P_1 = 0.72 and P_2 = 0.48, Z_α = 1.96 when α = 0.05, and Z_β = 0.84 when β = 0.20.

$$n/\text{group} = \frac{[0.72 (1 - 0.72) + 0.48 (1 - 0.48)] \times (1.96+0.84)^2}{(0.72 - 0.48)^2}$$

$$= 42.8$$

$$\approx 43 \text{ samples/group}$$

A sample size of 86 was needed to test the effectiveness of the PEIP program. However, we are also allow 20% drop-out rate following the total of 100

voluntary participants who met the inclusion criteria were recruited into this study. Fifty participants were assigned into the intervention and 50 participants were assigned into the control group.

3.7 Research instruments

Data were collected by self-reported and face to face questionnaire which separate into four part including participants' demographic and working data, muscular discomfort situation, musculoskeletal symptoms, work ability index and sick leave (Appendix B,C).

Part 1. Demographic, occupational risks, prevalence exposures and working data includes age, height, weight, marital status, educational level, income, smoking, alcohol consumption, health status, job title, years of employment, working hour, shift work, patient handling tasks/day and received ergonomic training.

Part 2. Work environments were measured by questionnaire which was separated into two parts include physical and psychosocial work environment.

The physical work environment part was assessed by Thai version of physical work load index (Songkham et al, 2011)[33] with developed based on the physical workload index modified by Hollmann et al. (1999) and Janowitz et al. (2006) [88, 89]. A questionnaire with 19 items was presented as pictograms. Five of the items described postures of the trunk: straight, upright (T1) (trunk bent 5 degrees forward), slightly inclined (T2) (trunk bent 45 degrees forward), strongly inclined (T3) (trunk

bent 75 degrees forward), twisted (T4), and laterally bent (T5). Three items were asked for the following positions of the arms: 2 arms below shoulder height (Al), 1 arm above shoulder height (A2), and 2 arms above shoulder height (A3). Five items were asked for positions of the legs: sitting (LS), standing (L2), squatting (L3) (trunk bent 15 degrees forward), kneeling on one or both knees (L4), and walking or moving (L5). Six items were described the lifting of weights. Three were concerned lifting with the trunk upright (Wul-Wu3) and 3 with the trunk inclined 60 degrees (Wil-Wi3). Each set of 3 items were asked for lifting, pushing, pulling or carrying of light weights (<10 kg; Wu2 & Wi2), medium weights (10-20 kg; Wu2 & Wi2) and heavy weights (> 20 kg; Wu3 & Wi3).

Participants were asked to record their physical work environment with an average frequency of occurrence of body positions or the handling of loads during ordinary daily work. The answers were given on a 5-point rating scale ranging from "never" to "very often". The weighting factors from a biomechanical model were multiplied by the item scores of the corresponding body postures reported in the questionnaire and then added to an index of physical work load. Index of physical work load = 0.974 x score of T2 + 1.104 x score of T3 + 0.068 x score of T4 + 0.173 x score of T5 + 0.157 x score of A2 + 0.314 x score of A3 + 0.405 x score of L3 + 0.152 x score of L4 + 0.152 x score of L5 + 0.549 x score of Wul + 1.098 x score of Wu2 + 1.647 x score of Wu3 + 1.777 x score of Wil + 2.416 x score of Wi2 + 3.056 x score of Wi3. The item scores were coded as follows: "never" = 0, "seldom" = 1, "sometimes"

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= 2, "often" = 3, "very often" = 4. Total yield score is between 0 (the best physical work environment) and 56.2 (the worst physical work environment). Moreover, the perception on workplace environment (e.g. noise, lighting and temperature) were given on a 5-point rating scale ranging from "never" to "very often". Total yield score of workplace environment is between 0 (the best physical work environment) and 4 (the worst physical work environment).

The questionnaire on psychosocial work environment part were developed based on the Copenhagen Psychosocial Questionnaire (COPSOQ version I and II) modified by Kristensen and Borg (2003) and Aust et al (2007) [92, 93]. The 57-item questionnaire, 17 scales, cover three main areas of the psychosocial work environment: 1) demands at work, 2) work organization, and 3) interpersonal relations at work. For the demand at work area, quantitative demands (3 items), work pace (1 item), cognitive demands (4 items), emotional demands (4 items) and demands for hiding emotions (3 items) was used. The work organization area includes influence at work (4 items), possibilities for development (4 items), meaning of work (3 items) and commitment to the workplace (4 items). Whereas the interpersonal relations at work comprises predictability (2 items), rewards (5 items), role clarity (3 items), role conflicts (4 items), quality of leadership (4 items), social support from supervisor (3items), social support from colleagues (3 items) and social community at work (3 items).

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The scale was built on 1–5 items (questions). All items had 5 response categories. There are two kinds of categories set depending on the direction of each question: 1) always, often, sometimes, seldom, never/hardly ever and 2) to a very large extent, to a large extent, somewhat, to a small extent, to a very small extent. Scales were built by summing up the numerical values attached to the response categories of the items. All scales were transformed to a range from 0 to 100: the weights are 0, 25, 50, 75, and 100, to make the scoring on the different scales comparable. Directions of the scores follow the label of the scale; i.e. a high score on the emotional demand scale indicates high emotional demands, a high score on the predictability scale indicates high predictability, and so on.

Part 3. Musculoskeletal symptoms were measured by questionnaire which was modified from the Nordic Musculoskeletal Questionnaire (NMQ) (Kourinka et al., 1987) and Quick exposure check (QEC) technique [21].

3.1 Nordic Musculoskeletal Questionnaire (NMQ) 45-item questionnaire provides the workers to identify areas of the body causing musculoskeletal problems. Completion is aided by a body map to indicate nine symptom sites being neck, shoulders, upper back, elbows, low back, wrist/hands, hips/thighs, knees and ankles/feet. Respondents are asked if they have had any musculoskeletal trouble (such as ache, pain, discomfort and numbness) in the last 12months, 3 months, and 7 days which has prevented normal activity. The prevalence rate of musculoskeletal symptoms could be computed by using the

following equation:

$$\text{MSDs rate} = \frac{\text{all new and pre-existing MSD cases during a time period}}{\text{Population during the same time period}} \times 100$$

3.2 Quick exposure check (QEC) technique (David ; 2005) were used to assess the level of exposure to MSDs risk factors [87]. The technique includes the assessment of the back, shoulder/arm, wrist/hand, and neck in regard to their postures and repetitive movement. This exposure tool has been designed to assess the change in exposure to musculoskeletal risks before and after an ergonomic intervention. Before making the risk assessment, a preliminary observation of the job should be made for at least one work cycle. Record all information as listed at the top of the exposure tool form.

Exposure assessment for the back

Back posture (A1-A3)

The assessment for the back posture should be made at the moment when the back is most heavily loaded. For example, when lifting a box, the back may be considered under highest loading at the point when the person leans or reaches forward to pick up the load.

• The back can be regarded as “Almost neutral” (Level A1) if the person is seen to work with his/her back flexion/extension, twisting, or side bending less than 20°, as shown in Figure 4.

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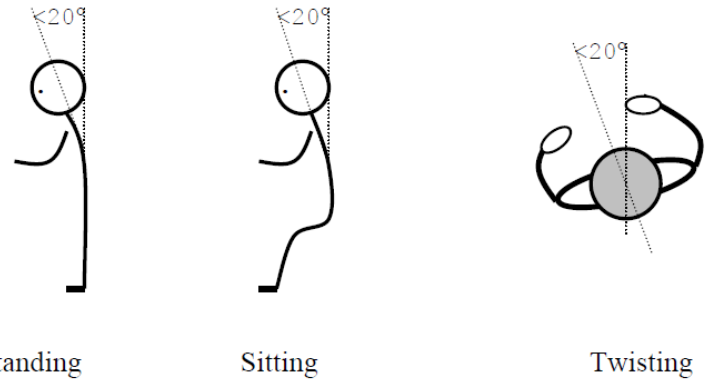

Figure 4 The back is “almost neutral”

The back can be regarded as “Moderately flexed or twisted” (Level A2) if the person is seen to work with his/her back flexion/extension, twisting or side bending more than 20° but less than 60°, as shown

in Figure 5.

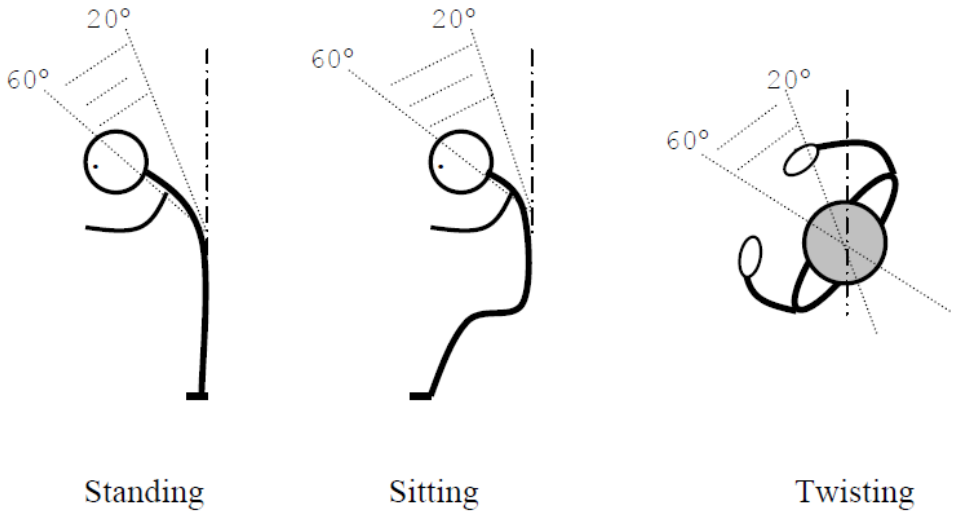

Figure 5 The back is “flexed or twisted”

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The back can be regarded as “Excessively flexed or twisted” (Level A3) if the person is seen to work with his/her back flexion or twisting more than 60° (or close to 90°), as shown in Figure 6.

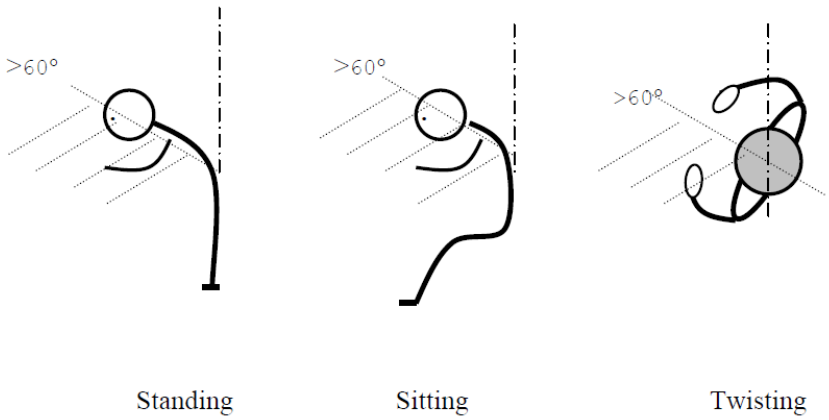


Figure 6 The back is “excessively flexed or twisted”

Back movement (B1-B5)

For manual material handling tasks, assess B1-B3. This refers to how often the person needs to bend, rotate his/her back when performing the task. Several back movements may happen within one task cycle.

For tasks other then manual handling, such as sedentary work or repetitive tasks performed in standing or seated position, ignore B1-B3 and assess B4-B5.

Exposure assessment for the shoulder/arm

Shoulder/arm posture (C1-C3)

Assessment should be made when the shoulder/arm is most heavily loaded during work, but not necessarily at the same time as the back is assessed. For example, the load on the shoulder may not be at the highest level when the person bends down to pick up a box from the floor, but may become greater subsequently when the box is placed at a higher level. Shoulder/arm movement (D1-D3)

The movement of the shoulder/arm is regarded as

"Infrequent" if there is no regular motion pattern.

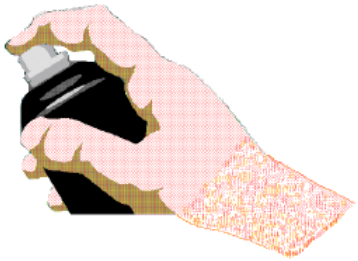
"Frequent" if there is a regular motion pattern with some short pauses.

"Very frequent" if there is a regular continuous motion pattern during work.

Exposure assessment for the wrist/hand

Wrist/hand posture (E1-E2)

This is assessed during the performance of the task at the point when the most awkward wrist posture is adopted, include wrist flexion/extension, side bending (ulnar/radial deviation) and rotation of the wrist around the axis of the forearm. The wrist is regarded as "almost straight" (Level E1) if its movement is limited within a small angular range (e.g. <15°) of the neutral wrist posture (Figure 7). Otherwise, if an obvious wrist angle can be observed during the performance of the task, the wrist is considered to be "deviated or bent" (Figure 8).



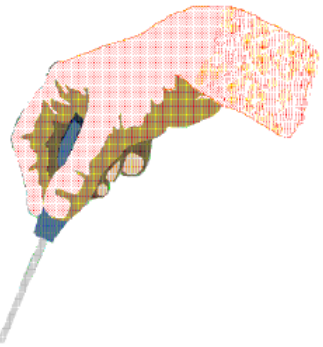


Figure 7 The wrist is almost straight **Figure 8** The wrist is deviated or bent

Wrist/hand movement (F1-F3)

This refers to the movement of the wrist/hand and forearm, excluding the movement of the fingers. One motion is counted every time when the same or similar motion pattern is repeated over a set period of time (e.g., 1 minute).

Exposure assessment for the neck

The neck can be considered to be “excessively bent or twisted ” if it is bent or twisted at an obvious angle (or more than 20°) relative to the torso.

Worker’s assessment of the same task

After the observer’s assessment is made, ask the worker to answer the questions as shown on the second page of the tool. Explain the meaning of the terms to him/her when necessary.

Calculation of the total exposure scores

The total exposure scores can be obtained by combining the assessments from the ‘observer’ (A-G) and the ‘worker’ (a-e). Ensure that the correct combined scores have been determined before adding them into the total.

Additional points:

• For group work, ensure a sufficiently representative number of individual workers are assessed.

• Workers whose daily pattern of work and job demands are variable, should be observed more than once

The exposure level standards for back, shoulder, wrist and neck are presented in Table 5.

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Table 5 Exposure level standards for back, shoulder, wrist and neck

	Exposure level			
Score	**Low**	**Moderate**	**High**	**Very high**
Back (static)	8-15	16-22	23-29	29-40
Back (moving)	10-20	21-30	31-40	41-56
Shoulder/arm	10-20	21-30	31-40	41-56
Wrist/hand	10-20	21-30	31-40	41-56
Neck	4-6	8-10	12-14	16-18

Part 4. Work ability and sick leave was measure by the work ability index (WAI) which has been developed by the Finnish Institute of Occupational Health (FIOH) [99]. The WAI questionnaire entails seven dimensions, each covered by means of one or more questions: current work ability compared with the best during one's lifetime, work ability in relation to the demands of the job, number of diagnosed diseases, subjective estimated work impairment due to diseases, sickness absence or sick leave during past year, own prognosis of work ability two years later and mental resources. The result of the work ability level is being a score of 7-49 (the worst rating is 7 and the best rating is 49). The scoring of the responses is shown in table 6-7.

Table 6 Items covered by the work ability index, the number of questions used to evaluate each item, and the scoring of the responses.

No	Item	Number of questions	Scoring of the responses
1.	current work ability compared with the lifetime best	1	0-10 points (value circled in the questionnaire)
2.	work ability in relation to the demands of the job	2	score weighted according to the nature of the work (formula for the calculation appears below Table 3)
3.	number of current diseases diagnosed by a physician	1	at least 5 diseases = 1 point, 4 diseases = 2 points, 3 diseases = 3 points, 2 diseases = 4 points, 1 diseases = 5 points, No disease = 7 points
4.	estimated work impairment due to diseases	1	1-6 points (value circled in the questionnaire; the worst value should be chosen)

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Table 7 Items covered by the work ability index, the number of questions used to evaluate each item, and the scoring of the responses. (Cont')

No	Item	Number of questions	Scoring of the responses
5.	sick leave during the past year (12 months)	1	1-5 points (value circled in the questionnaire)
6.	own prognosis of work ability two years from now	1	1,4 or 7 points (value circled in the questionnaire)
7.	mental resources (note: item 7 refers to the worker's life in general, both at work and during leisure time)	3	the points of the question series are added together and the sum is modified as follows: sum 0-3 = 1 point, sum 4-6 = 2 points, sum 7-9 = 3 points, sum 10-12 = 4 points

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In item 2 work ability is assessed in relation to both the physical and mental demands of the job. The response to the question is weighted according to whether the work is primarily physical or mental. The term "work ability score" refers to the number of the response circled in the questionnaire

Due to sick leave is one of the WAI dimensions, the amount of this variable could be counted by this questionnaire. However, the number of sick leave within the last three months was added in the demographic data form in terms of monitor

short term effects of an intervention program.

Validity and reliability of the questionnaire in Thai version

Validity

The questionnaire was assessed for content validity by a panel of experts who are the specialists in occupational health and safety including, one occupational physician and two nurse professors who specialized in psychosocial work. The contents were adjusted according to their comments and suggestions. The content validity index (CVI) was 0.99

Reliability

The questionnaire was tested with 10 orderlies working in same hospital. The internal reliability coefficient of the questionnaire (Cronbach's alpha) was 0.80.

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3.8 Participatory ergonomics intervention protocol

A participatory ergonomics intervention program was developed based on the Participatory Action-Oriented Training for Hospital Nurses (POATHN) model. Drawing from Kim and Lee's extended work on PAOTHN, and the Healthy Unit Guidance (HUG) program developed by Songkham et al. (2011), allowed for the creation of a well-rounded Participatory Ergonomic Intervention Program (PEIP) [33]. The objective of the intervention program was to encourage behavioral change among orderlies, making them more aware of occupational hazards and work related musculoskeletal

disorders (WMSD). The intervention program also educated orderlies on proper posture, with the aim to reduce workplace risk factors. The intervention program was divided into three phases. The first phase consisted of posture training and techniques for lifting and moving patients. The second phase consisted of techniques for safely transporting patients via gurney and establishing a basic exercise program. Finally, work-related risk factors and WMSDs were addressed.

The PEIP consisted of series of workshops. Workshops were conducted to address: education, group training, supervised onsite training, establishment of management support, participant capacity strengthening, adjusting and improving patient transfer techniques, and establishing a basic exercise program. The program was conducted over a period of two months. Details on each component are presented below.

1) Workshop 1: Establishing Management Support

The aim of the first workshop was to identify and train intervention facilitators. A facilitator team was created consisting of ten volunteer orderlies. The facilitator team received training on the basic principles of ergonomics in a healthcare setting. The volunteers were introduced to Participatory Action-Oriented Training (PAOT) methodologies and reviewed training on the use of a basic ergonomics manual, simple and practical low-cost improvements, and the basic roles of facilitators. Following completion of the educational segment of the workshop, the orderlies were given time to discuss the development of a basic ergonomics

manual with a focus on their line of work. Finally the orderlies discussed educational materials that could be beneficial to participants.

2) Workshop 2: Participant's Capacity Strengthening

A six-hour workshop, based on the PAOT approach, was conducted. The first session of the workshop consisted of outlining the program and communicating the pervasive nature of MSDs and the urgent need for intervention. In the second session participants began to address items on an action checklist. The checklists were customizable to best address participant needs. Session three consisted of presenting improvement principles and local good practices by other hospital orderlies. This was followed by a group discussion. Participants were asked to identify three positive points and three areas for improvement in the action checklist. This approach was used to address all five areas of concern. The final hour of the workshop was used to develop short-term (one to two month) and long-term (three to six month) improvement plans for each unit.

Researchers visited each working unit to monitor progress and encourage improvements with the aim to make strategies developed during this workshop sustainable. As the first set of improvements was completed within three months of the workshop, follow up visits were conducted within the first to third month following the workshop. This workshop stressed the importance of participant involvement in identifying and mitigating risks in the workplace.

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3) Workshop 3: Evaluation of Improvements and Achievements

A three-hour follow-up workshop was conducted to assess the achievements of workplace improvements. Participant representatives conducted presentations outlining short-term improvements. Presentations helped foster communication and knowledge sharing among participants. All relevant stakeholders were invited to attend this workshop. The workshop was concluded with a contest to reward achievements.

3.9 Training Program

The program was developed specifically for the orderlies with a focus on what was relevant to workers in this tertiary care hospital. An important idea guiding the program was that of learning through group conversation and acting within the context of the work environment. Twelve sessions, with nine different subjects, were held during a two-month period. The PEIP was conducted over a period of one hour, consisting of 15 minutes of didactics, 15 minutes of discussion, and test time. The didactic sessions focused on: knowledge regarding occupational risk factors; musculoskeletal problems; physical, psychosocial, work-organizational and individual risk factors; basic ergonomic principles; and, coping with musculoskeletal symptoms. The discussion session focused on both individual solutions and how to obtain an optimal work environment both organizationally and technically. The PEIP was covered in Table 8. (Appendix J)

Category 1: Individual Health

This didactic session focused on the individual's health in relation to occupational risk factors.

Category 2: Task and Working Environments

This didactic session focused on task completion and working environment.

Category 3: Promotion Factor

This didactic session focused on physical activity, and the work as a positive factor and basic exercise program

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Table 8 The topic of the 9 session in the training program

I Individual Health	
1. Occupational risks	Focused on risk factors and consequences for occupational risks
2. Coping with occupational risks	Focused on what individuals can do to prevent occupational risks and what type of support is available at work
3. Physical activity for a healthy life	Focused on taking responsibility for one's own health
4. Job demands, Job control and Social support	Focused on Psychosocial factors as predictors of MSDs
II Task and Working Environments	
5. Work as a source of health	Focused on the importance of hospital orderlies and their work as a positive factor
I Individual Health	
6. Working technique	Focused on working positions and working posture (e.g. lifting, moving, and transporting patients)
7. The work station	Focused on the work , improvement of work station and work environments
III Promotion Factor	
8.Work-a source of health	Focused on physical activity, and the work as a positive factor
9.Work adjustment	Focused on establishing a basic exercise program

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3.10 Research procedures

There were 3 step of carrying out the study :

Step 1 : Analysis of the problems and needs and planning participatory ergonomic intervention program (PEIP) for reduce the occupational risks among hospital orderlies

1. Coordinating with the Siriraj hospital, division of the patient transfer service, Bangkok Thailand, to get the permission to study and to get the cooperation from the personnel as well as getting the support in regard to materials and venues for implementing the research activities.

2. Collaborating with the Director of the division of the patient transfer service to inform the objectives and procedures of the research project.

3. Collaborating with the Director of the Institute of Working Safety to get assistance and support of resource persons and materials for the training program.

4. Meeting with the research assistant to inform the research assistant to inform the research's objectives, to demonstrate the steps of activities that will be implemented in accordance with the participatory learning program developed and to clarify the data collection methods for mutual understanding and practices.

5. Studying the problems regarding occupational risks that occurred in the orderlies by interviewing and questionnaire.

6. Analyzing the data collected in order to find the problems with the

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officers and the workers.

7. Analyzing the program by considering the feasibility, orderlies' needs and being able to solve the problem.

8. Using the data derived from problem analysis and the guideline for planning a program and implementing the activities in accordance with the participatory ergonomics intervention program for improvement and reduce the occupational risks among hospital orderlies

Step 2 : Building capacity of the orderlies by using participatory action oriented training process.

After the analysis of the problems and needs were done the researcher develop an intervention period of 2 months and measurements at baseline and after 2 and 4 months of follow-up.

Step 3 : Summarizing the outcomes of the learning and evaluating the participatory learning program organized.

After the program were implemented the researcher organized a meeting with the orderlies in order to conclude the learning outcomes and to evaluate the program. The data collected were analyzed by computing statistics.

3.11 Intervention Instruments for the Participatory Action-Oriented Training

A series of materials were used during the PAOT program to assess exposure to risks and encourage problem solving. Workshops and several tools were used to

evaluate the intervention process. Explanations for each instrument used during training are presented below (Appendix D).

3.12.1 Basic Ergonomics Manual

The basic ergonomics manual consisted of a series of cartoons designed to assist participants in the development of improvement methods. The manual presented principles, a question and answer section, and remarks on the principles. Local good practices were also included to further assist participants in understanding principles. The manual is presented in (Appendix F).

3.12.2 Photographs

Multifaceted Participatory Ergonomics (PE) interventions result in improvements that might not be the same for every workstation. As a result, photographs have been found to play a key role in documenting improvements. Photographs were taken before and after intervention to help properly document evidence of change.

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3.12.3 Participatory Ergonomics Evaluation Form

An evaluation form for use by the investigator was designed based on the Participatory Ergonomics Framework (PEF) [86]. The form was used to determine the degree to which PE initiatives were being implemented by each group of participants. The form consisted of nine dimensions: permanence of initiative, involvement, level of influence, decision-making, mix of participants, requirements, focus, remit, and role of ergonomics specialist.

3.12.4 Participant Comment and Evaluation Form

Comment and evaluation forms were used to collect participant thoughts on the usefulness of each intervention initiative. Data collected through these forms allowed the investigator to evaluate perceived usefulness of the intervention.

3.12 Participatory ergonomic intervention program implementation

3.12.1 Top management support

Prior to the implementation of the participatory ergonomic intervention program (PEIP) with the orderlies, meetings with the top managers, the head safety officer of the Human Resource Section, and the heads of the hospital orderlies were held to obtain full support and to sustain the program. A brief explanation of the potential participatory ergonomics intervention program (PEIP) gives equal priority to health and wellbeing, production, quality, and safety (Appendix K).

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3.12.2 Training, and health out come

The training and health outcome begins with a meeting of the top managers and the head of the hospital orderly. The intervention sessions will cover improving work methods, training in working posture, safety awareness, health education and training.

3.12.3 Field observations

Each individual observation assess the change in exposure to musculoskeletal risks before and after an ergonomic intervention were took about 30-45 min. The same observers also secretly performed the field observation with the body chart checklist. These workers was not told what day they would be observed. A total of 100 orderlies were selected to be observed once before training. It take around 40 min for each individual observation in order to completely identify the risk factors for the worker.

The observers, were specially trained by the author who met them regularly to maintain the quality and consistency of the field observation throughout this project. Before formal observations, were asked to observe 25 hospital orderlies for testing their inter-rater reliability. It was confirmed that each observer are familiar with the standard check procedure and follow the identical evaluation criteria. In order to prevent workers from modifying their behaviors for the observers (Hawthorne effect), the workers was not told what day they would be observe. Also, the observers were blinded to intervention status of the workers. The field observations were arranged in 2 month after the training session. Four month immediately after the training, the field observations were performed again for evaluating the training effect

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3.13 Data Collection

Data collection were done after receiving permissions from the administrator of the hospital. The description of data collecting procedures in the intervention and the control group is summarized as follows:

3.13.1 Intervention Group

Fifty participate in the participatory ergonomic program who is able to participate in the intervention program received a package of documents including an invitation letter, the description of the study, the study consent form, and the researcher's address and telephone number. The researcher were asked the participants to return the consent form within two weeks after receiving the package. Participants were informed about their rights that they could ask any question related to the study or refuse to participate in the study. Within two weeks after receiving informed consent, the questionnaire were distributed to the participants in order to assess their baseline data. The program intervention was begin after baseline data of all participants has been collected completely. The same questionnaire was used again for follow-up assessment, 2 and 4 months after the program intervention was done.

3.13.2 Control Group

Participant was received a package of documents including an invitation letter, the description of the study, the study consent form, and the researcher's address and telephone number. The researcher were asked the participants to return

the consent form within two weeks after receiving the package. Within two weeks after receiving informed consent, the questionnaire were distributed to the participants in order to assess their baseline data. The same questionnaire were used again for follow-up assessment, 2 and 4 months after the first enrollment.

3.14 Evaluation of the PEIP Program

The results before and after the PEIP program were evaluated and compared by scores of health outcomes and scores of working environments to determine if there were improvements and a reduction of occupational risk and WMSDs.

3.15 Protection of Human Rights

The study were reviewed and approved by the Ethics Review Committee of Siriraj Insitutional Review Board, Faculty of Medicine Siriraj Hospital, Mahidol University, Thailand (COA No.Si296/2014). The participants were informed in the cover letter of human subject protections about the main purpose of the study, right of the subjects, confidentiality, potential risks, and benefits of participation. All of participants were signed the consent by wiliness to participate in the study before starting baseline assessment (Appendix D).

3.16 Data Analysis

The data were analyzed by two major statistical methods, as follows.

1. Descriptive statistics

1.1) Percentage, mean and standard deviation

- General information

- Occupational risks and prevalence among hospital orderlies

2. Inferential statistics

2.1) Dependent samples

- To compare health outcomes and working environments in the experimental before and after the PEIP.

- To compare health outcomes and working environments in the control before and after the non- PEIP.

2.2) Independent groups

- To compare health outcomes and working environments of the experimental and control group (before the PEIP)

- To compare health outcomes and working environments of the experimental and control group (after the PEIP)

2.3) Chi-square test

- Chi-square test was used to test between intervention and control groups in categorical variables.

2.4) One-way ANOVA

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- The different of those mean scores among the intervention and control groups at each point of measurement was tested using the one-way ANOVA

2.5) ANOVA with Bonferroni pair wise comparisons

The mean difference of work environment and health outcomes score within groups at the baseline, 2-month and 4-month after the intervention was tested

The statistical with 95 percent confidence intervals and level of significance was set at $p < 0.05$.

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CHAPTER IV

RESULTS AND DISCUSSIONS

This chapter presents the findings of a participatory ergonomic (PE) approach with a randomized controlled trial (RCT) which aimed to examine the effects of the participatory ergonomic intervention program (PEIP) on work environments and health outcomes among hospital orderlies. Discussion on effects of the participatory ergonomic intervention (PEIP) program on work environments and health outcomes is presented in this chapter as well. The results of this study are presented in five sections as follow:

Part I Demographic and Work Characteristics of Participants

Part II Work Improvement Achievement

Part III Comparison of work environment scores at baseline, two months and four months after completing intervention

Part IV Comparison of health outcome scores at baseline, two months and four months after completing intervention

Part V Intervention Feedback from Participants and Facilitators

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4.1 Demographic and Work Characteristics of Participants

Study participants were males working in the Department of Patient Transfer Service of a tertiary care hospital in Bangkok, Thailand. A total of 189 hospital orderlies were reviewed, only 100 participants met inclusion criteria. The demographic characteristics of participants are shown in Table 9-10.

Table 9 Demographic Characteristics of the hospital orderlies (n=100)

Characteristic	*n* (%)
Age (mean ± SD) yrs = 34.6 ± 8.48	100 (100)
BMI (mean ± SD) = 24.9 ± 4.89	
Gender	
Male	100 (100.0)
Educational Level	
High school	83 (83.0)
Diploma degree	11 (11.0)
Bachelor degree	6 (6.0)
Income (Thai Baht,THB*)	
≤10,000	47 (47.0)
>10,001	63 (63.0)

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Table 10 Demographic Characteristics of the hospital orderlies (n=100) (Cont')

Characteristic	*n* (%)
Marital status	
Single	56 (56.0)
Married	40 (40.0)
Divorced/Separated	4 (4.0)
Alcohol drinking	
No	29 (29.0)
Yes	71 (71.0)
Current smoking	
No	39 (39.0)
Yes	61 (61.0)

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Fifty participants were assigned into an intervention group and 50 participants were assigned into a control group. Demographic and work characteristics of all participants are presented in Table 4.2 and 4.3.

The age of participants in the intervention group ranged from 21 to 57 years, with a mean age of 34.3 years (SD = 7.3). The average height and body mass index of participants were 160 cm (SD = 5.9) and 24.9 kg/m^2 (SD = 4.4), respectively. The

mean hour of household physical activity among this group was 12.2 hours per week (SD = 11.5). The education level for the majority of participants was lower than a bachelor's degree (88%). Close to 50% of participants were not married and 60% had an income equal or greater than 10,000 baht per month. Data showed that 52% of participants exercised more than three times per week. About one fourth of participants had reported drinking alcohol (20%) and more than half of them (66%) reported smoking.

Data from the control group showed similar demographic characteristics as the intervention group. The age of participants ranged from 21 to 56 years, with a mean of 34.9 years (SD = 9.5). The average height and body mass index of participants in this group was comparable with the intervention group. The mean hours of household physical activity per week among participants in the intervention group was slightly higher than those in the control group (12.18 hours/week, SD = 11.5). Most of the participants had an education level lower than a bachelor's degree (94%) and 62% were single. More than half of participants (54%) had an income equal to or less than 10,000 baht per month. Approximately 62% of participants exercised more than three times per week. About 68% of participants reported drinking alcohol and 52% of participants reported smoking

A comparison of demographic characteristics of participants in the intervention and control groups found that there were no statistical differences in most of characteristics except marital status and exercise. The demographic

characteristics of participants in both groups are shown in Table 11-13.

Table 11 Demographic Characteristics of Participants

Continuous variables	Intervention group (n=50) Mean(SD)	Control group(n=50) Mean(SD)	*p*-value[a]
Age, y	34.3(7.3)	34.9(9.5)	.725
Range	21-57	21-56	
Height, cm	160(5.9)	159(5.6)	.292
Range	160-185	159-183	
Body Mass Index, kg/m2	24.9(4.4)	24.8(5.3)	.961
Range	17.3-38.6	19.3-42.3	
Household physical activity, hr/wk	12.18(11.5)	9.8 (9.1)	.238
Range	0-45	0-50	

[a] t-test

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Table 12 Demographic Characteristics of Participants (Cont')

Categorical variables	Intervention group (n=50) Mean(SD)	Control group(n=50) Mean(SD)	*p*-value[b]
Education level			
< Bachelor degree	44(88.0)	47(94.0)	
≥ Bachelor degree	6(12.0)	3(6.0)	.229
Marital status			
Single	25(50.0)	31(62.0)	
Married	24(48.0)	16(32.0)	
Divorced/Separated	1(2.0)	3(6.0)	.231
Exercise			
< 3 times/week	24(48.0)	19(38.0)	
≥ 3 times/week	26(52.0)	31(62.0)	.317
Income, baht/month			
< 10,000	20(40.0)	27(54.0)	
≥ 10,000	30(60.0)	23(46.0)	.164

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Table 13 Demographic Characteristics of Participants (Cont')

Categorical variables	Intervention group (n=50) Mean(SD)	Control group(n=50) Mean(SD)	*p*-value[b]
Alcohol drinking			
No	13(26.0)	16(32.0)	
Yes	37(74.0)	34(68.0)	.537
Current smoking			
No	17(34.0)	24(48.0)	
Yes	33(66.0)	26(52.0)	.197
Perceived health status			
Good-Very good	29(58.0)	22(44.0)	
Poor-Fair	21(42.0)	28(56.0)	.059

[b] χ^2-test

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The years of employment among participants in the intervention group ranged from 1 to 37 years, with a mean of 7.31 years (SD =7.1). That figure was slightly lower than the average year of employment of participants in the control group (9.2 years, SD = 9.6). The mean working hours per week in the intervention and the control groups were 49.3 (SD = 11.2) and 51.6 (SD = 11.5), respectively. The study

found a high number of participants conducting shift work, 76% of participants in the intervention group and 74% in the control group. Most participants carried out 30 or more patient handling rounds per day, 82% in the intervention group and 78% in the control group. Most participants had a number of patient handling rounds per day equal or less than 30, 74% in the intervention group and 70% in the control group. A comparison of work characteristics of participants in the intervention and control groups found that both groups had no statistical difference in all characteristics. The work characteristics of participants in both groups are presented in Table 14-15.

Table 14 Work Characteristics of Participants

Continuous variables	**Intervention group (n=50) Mean(SD)**	**Control group (n=50) Mean(SD)**	***p*-value**[a]
Year of employment, y	7.31(7.1)	9.2(8.6)	.230
Range	1-37	1-33	
Working hour per week	49.3(11.2)	51.6(11.5)	.762
Range	40-75	40-75	

[a] t-test

Table 15 Work Characteristics of Participants (Cont')

Categorical variables	Intervention group (n=50) n (%)	Control group (n=50) n (%)	p-value[b]
Performed Shift work			
Day Shift	38(76.0)	37(74.0)	
Afternoon-Night Shift	12(24.0)	13(26.0)	.159
Patient handling round per day, case			
< 30	9(18.0)	11(22.0)	
≥ 30	41(82.0)	39(78.0)	.621
Patient transfer round per day, case			
< 30	37(74.0)	35(70.0)	
≥ 30	13(26.0)	15(30.0)	.504

[b] χ^2-test

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Two months after the completion of the PEIP intervention orderlies in the intervention group had carried out 28 work improvement achievements in 13 units of the Patient Transfer Service Department. These achievements were categorized into five technical areas of improvement. The highest degree of change was shown on

welfare facilities and administration (10 tasks, 35.7%), followed by patient care (7 tasks, 25.0%), and workstation design (5 tasks, 17.8%). Examples of work improvement achievement in each technical area are presented in Table 16-17.

Table 16 Work improvements achievement covering the five areas undertaken by hospital orderlies

Technical area	Work improvements	
	n	%
I. Patient care	7	25.0
- Use a mechanical lift or transfer device (e.g., portable lifting device, digital wheelchair scale)		
- Apply team lifting to transfer a patient to or from the bed		
- Use a mechanical device for repositioning the patient in the bed (e.g., roller sheets)		
- Properly position yourself with sufficient space		
- Reduce awkward postures when lifting and transferring the patients		
- Reduce awkward postures when patient handling		
- Use correct lifting procedures that avoid overly twisting or bending your body		
II. Safe handling and transferring of patient, medical devices, and equipment	4	14.3
- Use carts to transfer heavy or bulky loads		
- Use a step or ladder when patient handling to address height difficulties		
- Use medical devices and equipment with large, low-rolling-resistance wheels		
- Use devices that are lightweight and easily handle.		

Table 17 Work improvements achievement covering the five areas undertaken by hospital orderlies (Cont')

Technical area	Work improvements	
	n	%
III. Workstation design	5	17.8
- Minimize the working distance		
- Design a workstation with an optimal access zone		
- Ensure that transport pathways remain clear		
- Ensure that transport pathways are spacious and open		
- Provide a chair with a backrest		
IV. Physical environment	2	7.2
- Label the weight on heavy loads		
- Use a step designed for specific work tasks		
V. Welfare facilities and administration	10	35.7
- Provide room for resting and education.		
- Assign a person to be in charge of safety and health in the unit		
- Teach stretching exercises to prevent fatigue		
- Educate new hospital orderlies about preventing musculoskeletal disorders		
- Provide medical treatment and follow-up if musculoskeletal disorders occur		
- Establish safety and health policies		
- Organize a prevention team in each unit		
- Keep logs to allow accidents and absences to be tracked		
- Take breaks when working		
Total	**28**	**100**

4.2 Comparison of Work Environment Scores at Baseline, Two Months, and Four Months After Intervention

The work environment score in this study was split into two parts: physical work environment and psychosocial work environment. The physical work environment was defined as risk factors associated with musculoskeletal disorders. The lower the indicated score the better the physical work environment. The psychosocial work environment score consisted of risk factors and positive factors associated with MSDs. Comparison of work environment scores at baseline, two months, and four months after completing intervention in the intervention and control groups are presented as follows.

4.2.1 Physical Work Environment

The effect of the PEIP program on the physical work environment was measured using Hollmann's physical load index. With regards to each point of evaluation, the study found that, at baseline, the physical work environment score of the intervention group was higher than the control group. Therefore, directions of the scores are between minus (the best physical work environment) and plus (the worst physical work environment).

However, the physical work environment score of the intervention group decreased from baseline to month two (-5.4) and slightly increased at month four

(+1.1). The physical work environment score of the intervention group appeared to be lower than the control group at the two (+4.8) and four month (-1.7) marks (Figure 9).

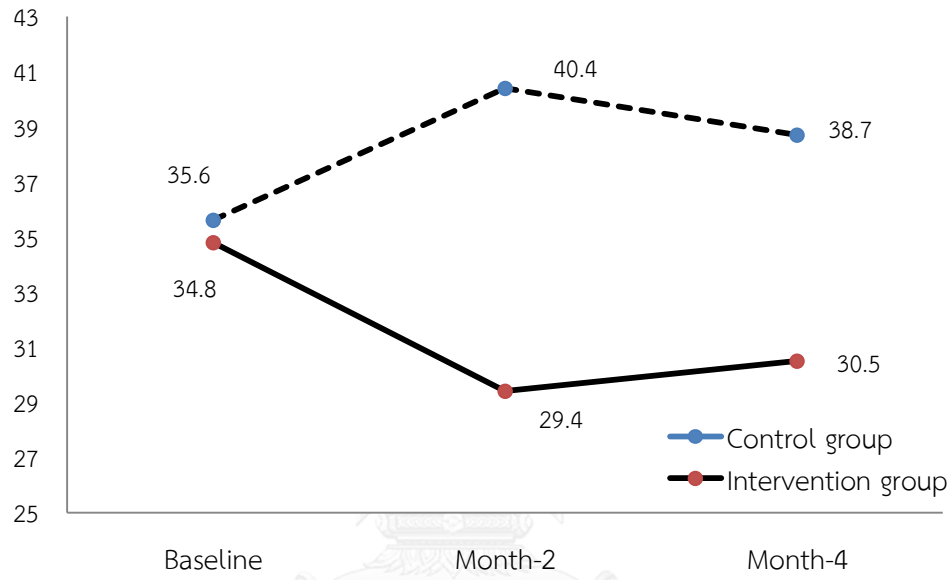

Figure 9 Changes in physical work environment of intervention and control group at baseline, month-2 and month-4

As physical work environment scores of control and intervention groups were in normal distribution, an independent-samples t-test was used to test for mean difference over time. After exploring the effect of the PEIP program on the physical work environment score, it was found that mean score of physical work environment among the intervention group reduced significantly compared with the control group at month two ($p = .002$) and month four ($p = .002$). Results are shown in Table 18.

Table 18 Comparison the mean score of physical work environment by group

PWE	Mean(SD)		t	df	*p*-value[a]
	Control group (n=50)	Intervention group (n=50)			
Baseline	35.6(7.9)	34.8(10.1)	0.403	98	0.688
Month-2	40.4(6.7)	29.4(8.9)	6.987	98	0.002*
Month-4	38.7(5.5)	30.5(6.6)	6.784	98	0.002*

PWE = Physical Work Environment, *p-value < .001, **p-value < .05, [a] t-test

A repeated measures analysis of variance was used to compare the mean scores of each group. Results show a significant difference between the two groups ($F = 7.42$, $p < 0.05$). Results are shown in Table 19.

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Table 19 Effects of PEIP program on physical work environment

Source of variation	df	MS	SS	F	*p-value*
Between subjects					
Intervention	1	203.363	811.722	7.429	0.008***
Error	98	18.809	10708.6060		
Within subjects					
Time	2	16264.462	132.407	129.743	0.001**
Intervention*Time	2	939.115	83.487	7.491	0.007***
Error	196	12285.183	74.107		

SS = Sum Square; df = degree of freedom; MS = Mean Square

** p-value < 0.01 *** p-value < 0.05, ANOVA with Bonferroni pair wise comparisons

Additionally, the mean score for perception of workplace environment (e.g. lighting, noise, temperature, and odor) was assessed by a separate questionnaire. The workplace environment score of the intervention group did not change from baseline to month two, but slightly declined from month two to month four. The score of workplace environment in the control group showed no difference over time (Figure 10). A T-test for independent samples was used to test for mean difference of workplace environment scores between the intervention and the control group. The study found no significant difference between the two groups in workplace environment at baseline, month two, and month four in Table 20.

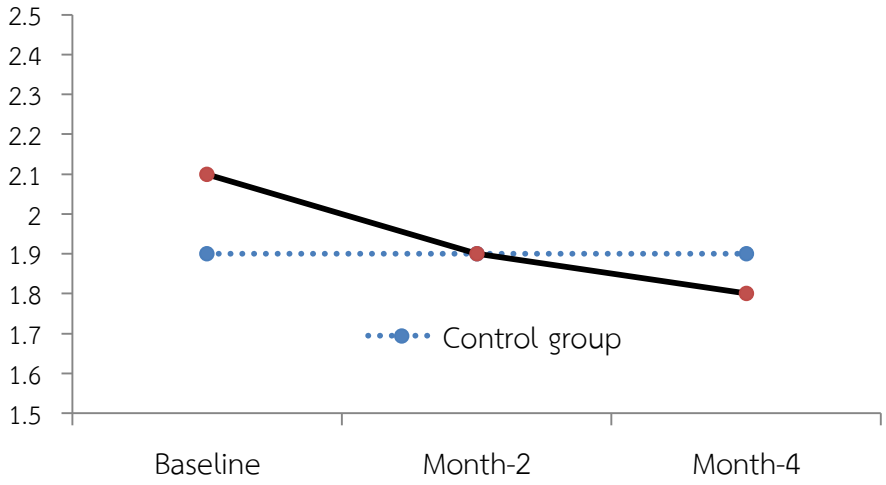

Figure 10 Changes in workplace environment of intervention and control group at baseline, month-2 and month-4

Table 20 Comparison the mean score of perception on workplace environment by group

Workplace Environment	Mean(SD) Control group (n=50)	Intervention group (n=50)	t	df	*p*-value[a]
Baseline	1.9 (0.7)	2.1 (0.9)	-0.855	98	0.398
Month-2	1.9 (0.7)	1.9 (0.8)	0.601	98	0.549
Month-4	1.9 (0.7)	1.8 (0.7)	0.805	98	0.423

[a] t-test

4.2.2 Psychosocial Work Environment

The psychosocial work environment score following the PEIP intervention was measured through a questionnaire developed based on the Copenhagen Psychosocial Questionnaire (COPSOQ). The questionnaire covered three main scales of psychosocial work environment including demand of work, work organization, and interpersonal relations at work. Therefore, directions of the scores are between minus (the best psychosocial work environment) and plus (psychosocial work environment). The details of all findings are shown in Tables 21 and 22.

When compared to the control group, the intervention group had no significant scores at baseline measurement. Two months after the completion of the PEIP intervention program, the mean scores of psychosocial work environment among the intervention group changed dramatically in all three main scales. The mean scores for the five demands at work scales decreased among the intervention group. These included qualitative demands (-8.1), work pace (-5.5), cognitive demands (-3.7), emotional demands (-2.3), and demands for hiding emotions (-2.6). Of these factors, only the work pace score had significantly decreased when compared with the control group ($p = .001$). Mean scores on three of the four work organization scales increased among the intervention group, including influence at work (+4.6), possibilities for development (+6.9), and meaning of work (+4.3). Scores for all of the factors, including influence at work, possibilities for development, and meaning of work significantly increased when compared with the control group (all p-

values < .001). Of these factors, only commitment to the workplace had significantly decreased when compared with the control group (p = .001). Mean scores on four of seven positive factors of interpersonal relations at work scales increased, including rewards (+4.1), social support from supervisor (+3.8), social support from colleagues (+4.7), and social community at work (+5.0). These factors increased among the intervention group. Factors of predictability, role clarity, quality of leadership, social support from supervisors (all p-values < .001), and social support from colleagues, significantly increased when compared with the control group (p = .005). The mean score of negative factors of interpersonal relations at work (i.e. role conflicts) showed a slight decrease (-1.2), but was not significantly different when compared with the control group. All mean scores of psychosocial work environment for the intervention and the control groups at baseline and month two are presented in Table 21.

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Table 21 Comparison the mean score of psychosocial work environment between the intervention and the control groups at baseline and month-2

Psychosocial work environment	At baseline		*p*-value (95%CI)	Month-2		*p*-value (95%CI)
	Control group Mean(SD)	Intervention group Mean(SD)		Control group Mean(SD)	Intervention group Mean(SD)	
Demand at work						
Quantitative demands	45.6(14.4)	46.3(13.4)	0.781	43.2(15.5)	38.2(13.6)	0.087
Work pace	66.0(30.3)	65.0(30.3)	0.442	68.0(24.2)	59.5(28.5)	0.001*
Cognitive demands	57.8(18.0)	57.1(18.9)	0.866	62.1(16.4)	53.4(19.3)	0.104
Emotional demands	47.1(19.9)	43.9(17.5)	0.396	49.8(19.4)	41.6(18.0)	0.740
Demands for hiding emotions	55.3(31.9)	54.3(13.4)	0.460	59.3(28.9)	51.7(15.5)	0.412
Work organization						
Influence at work	53.2(19.2)	49.8(19.6)	0.375	53.3(19.1)	54.4(20.7)	0.001*
Possibilities for development	71.3(12.5)	67.0(18.0)	0.174	73.0(11.3)	73.9(17.8)	0.001*
Meaning of work	79.8(12.6)	78.1(16.3)	0.555	79.5(13.6)	82.4(16.7)	0.001*
Commitment to the workplace	60.9(17.3)	56.9(14.4)	0.221	59.0(20.0)	53.0(12.2)	0.001*
Interpersonal relations at work						
Predictability	69.5(17.0)	65.8(15.3)	0.136	64.8(19.0)	71.3(17.5)	0.001*
Rewards	68.3(22.8)	72.8(11.1)	0.225	43.3(38.2)	76.9(14.3)	0.513
Role clarity	67.3(15.1)	68.2(14.5)	0.779	63.3(16.8)	75.3(17.4)	0.001*
Role conflicts	63.9(14.4)	62.5(11.8)	0.582	63.9(13.8)	61.3(11.2)	0.363
Quality of leadership	66.1(12.4)	64.7(12.4)	0.227	68.8(12.8)	73.1(16.5)	0.001*
Social support from supervisor	54.3(13.4)	50.5(14.7)	0.176	53.0(16.8)	54.3(16.3)	0.001*
Social support from colleagues	51.7(15.4)	51.0(15.9)	0.405	52.0(15.0)	55.7(19.6)	0.005*
Social community at work	60.3(15.6)	61.3(12.8)	0.326	59.0(15.6)	66.3(14.8)	0.252*

*p-value < .001, **p-value < .05, t-test

In summary, two months after completing the intervention, the PEIP program had the effect of increasing the scores of promotion factors of psychosocial work environment, including: work pace, influence at work, possibilities for development,

meaning of work, commitment to the workplace, predictability, role clarity, role conflicts, quality of leadership, social support from supervisors (all p-values < .001), and social support from colleagues (all p-values < .05).

Table 22 presents the mean scores of all scales among the intervention and the control groups at the four-month mark following the PEIP intervention. Decreases were observed in the mean scores for the five demands at work scales among the intervention group, including: qualitative demands (-0.5), work pace (-8.5), emotional demands (-0.8), cognitive demands (-7.8), and demands for hiding emotions (-2.1). However, the scores for work pace, cognitive demands, emotional demands, and demands for hiding emotions had a significant difference when compared with the control group (all p-values < .005). Mean scores on all work organization scales increased in the intervention group, ranging between +0.5 and +7.7. However, only the commitment to the workplace score had significantly increased when compared with the control group (p = .025). An increase was observed among mean scores for five of seven positive factors of interpersonal relations at work scales, including: rewards (+2.8), quality of leadership (+2.3), social support from supervisors (+8.7), social support from colleagues (+1.7), and social community at work (+1.2). Among these factors the study found that the predictability (p = .003), rewards (p = .028), and social community at work scores had significantly increased when compared with the control group (p = .042). The mean score for the negative factor of interpersonal relations at work scales (i.e. role conflicts) showed a slight decrease (-

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1.5), but was not significantly different when compared with the control group.

In conclusion, four months after completing the intervention, the PEIP program still had the effect of increasing scores of promotion factors of the psychosocial work environment. These included work pace, cognitive demands, demands for hiding emotions, commitment to the workplace, predictability, rewards, and social community at work (all p- values < .05).

When compared to the control group, the intervention group at 2-month and 4-month measurement. Two months after completing the intervention, the PEIP program had the effect of increasing the scores of promotion factors of psychosocial work environment, including: work pace, influence at work, possibilities for development, meaning of work, commitment to the workplace, predictability, role clarity, role conflicts, quality of leadership, social support from supervisors (all p-values < .001), and social support from colleagues (all p-values < .05). Four months after completing the intervention, the PEIP program still had the effect of increasing scores of promotion factors of the psychosocial work environment. These included work pace, cognitive demands, demands for hiding emotions, commitment to the workplace, predictability, rewards, and social community at work (all p- values < .05).

In conclusion, after completing the intervention, the PEIP program still had the effect of increasing scores of promotion factors of the psychosocial work environment. The details of all findings are shown in Tables 23

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Table 22 Comparison the mean score of psychosocial work environment between the intervention and the control groups at baseline and month-4

Psychosocial work environment	At baseline			Month-4		
	Control group Mean(SD)	Intervention group Mean(SD)	*p*-value (95%CI)	Control group Mean(SD)	Intervention group Mean(SD)	*p*-value (95%CI)
Demand at work						
Quantitative demands	45.6(14.4)	46.3(13.4)	0.781	48.1(17.6)	45.8(12.7)	0.472
Work pace	66.0(30.3)	65.0(30.3)	0.442	70.0(23.1)	56.5(26.6)	0.008*
Cognitive demands	57.8(18.0)	57.1(18.9)	0.866	60.0(16.0)	49.3(20.1)	0.004*
Emotional demands	47.1(19.9)	43.9(17.5)	0.396	48.8(16.5)	43.1(15.7)	0.080
Demands for hiding emotions	55.3(31.9)	54.3(13.4)	0.460	63.8(27.1)	52.2(11.6)	0.006*
Work organization						
Influence at work	53.2(19.2)	49.8(19.6)	0.375	49.6(21.9)	57.5(19.1)	0.057
Possibilities for development	71.3(12.5)	67.0(18.0)	0.174	70.8(10.4)	67.5(14.4)	0.199
Meaning of work	79.8(12.6)	78.1(16.3)	0.555	77.3(13.6)	79.4(17.7)	0.511
Commitment to the workplace	60.9(17.3)	56.9(14.4)	0.221	59.0(18.3)	52.0(11.8)	0.025*
Interpersonal relations at work						
Predictability	69.5(17.0)	65.8(15.3)	0.136	65.0(16.4)	75.3(17.4)	0.003*
Rewards	68.3(22.8)	72.8(11.1)	0.225	62.5(40.0)	75.6(10.7)	0.028*
Role clarity	67.3(15.1)	68.2(14.5)	0.779	64.3(16.3)	69.7(14.2)	0.084
Role conflicts	63.9(14.4)	62.5(11.8)	0.582	62.9(13.9)	61.0(10.9)	0.444
Quality of leadership	66.1(12.4)	64.7(12.4)	0.227	68.3(12.2)	67.0(11.8)	0.605
Social support from supervisor	54.3(13.4)	50.5(14.7)	0.176	52.3(16.2)	59.2(18.9)	0.055
Social support from colleagues	51.7(15.4)	51.0(15.9)	0.405	51.3(14.7)	52.7(14.8)	0.655
Social community at work	60.3(15.6)	61.3(12.8)	0.326	56.0(19.1)	62.5(11.7)	0.042*

*p-value < .001, **p-value < .05, t-test

Table 23 Comparison the mean score of psychosocial work environment between the intervention and the control groups at month-2 and month-4

Psychosocial work environment	Month-2			Month-4		
	Control group Mean(SD)	Intervention group Mean(SD)	*p*-value (95%CI)	Control group Mean(SD)	Intervention group Mean(SD)	*p*-value (95%CI)
Demand at work						
Quantitative demands	43.2(15.5)	38.2(13.6)	0.087	43.2(15.5)	38.2(13.6)	0.087
Work pace	68.0(24.2)	59.5(28.5)	0.001*	68.0(24.2)	59.5(28.5)	0.001*
Cognitive demands	62.1(16.4)	53.4(19.3)	0.104	62.1(16.4)	53.4(19.3)	0.104
Emotional demands	49.8(19.4)	41.6(18.0)	0.740	49.8(19.4)	41.6(18.0)	0.740
Demands for hiding emotions	59.3(28.9)	51.7(15.5)	0.412	59.3(28.9)	51.7(15.5)	0.412
Work organization						
Influence at work	53.3(19.1)	54.4(20.7)	0.001*	53.3(19.1)	54.4(20.7)	0.001*
Possibilities for development	73.0(11.3)	73.9(17.8)	0.001*	73.0(11.3)	73.9(17.8)	0.001*
Meaning of work	79.5(13.6)	82.4(16.7)	0.001*	79.5(13.6)	82.4(16.7)	0.001*
Commitment to the workplace	59.0(20.0)	53.0(12.2)	0.001*	59.0(20.0)	53.0(12.2)	0.001*
Interpersonal relations at work						
Predictability	64.8(19.0)	71.3(17.5)	0.001*	64.8(19.0)	71.3(17.5)	0.001*
Rewards	43.3(38.2)	76.9(14.3)	0.513	43.3(38.2)	76.9(14.3)	0.513
Role clarity	63.3(16.8)	75.3(17.4)	0.001*	63.3(16.8)	75.3(17.4)	0.001*
Role conflicts	63.9(13.8)	61.3(11.2)	0.363	63.9(13.8)	61.3(11.2)	0.363
Quality of leadership	68.8(12.8)	73.1(16.5)	0.001*	68.8(12.8)	73.1(16.5)	0.001*
Social support from supervisor	53.0(16.8)	54.3(16.3)	0.001*	53.0(16.8)	54.3(16.3)	0.001*
Social support from colleagues	52.0(15.0)	55.7(19.6)	0.005*	52.0(15.0)	55.7(19.6)	0.005*
Social community at work	59.0(15.6)	66.3(14.8)	0.252*	59.0(15.6)	66.3(14.8)	0.252*

*p-value < .001, **p-value < .05, t-test

A repeated measures analysis of variance was used to compare the mean scores of each group. Results show a significant difference between the two groups on work pace ($F = 14.37$, $p < 0.01$), influence at work ($F = 9.24$, $p < 0.05$), possibilities

for development (F = 47.08, p <0.01), meaning of work (F = 41.15, p <0.01), commitment to the workplace (F = 15.19, p <0.01), predictability (F = 9.20, p <0.01), role clarity (F = 10.90, p <0.01), quality of leadership (F = 25.93, p <0.01). Results are shown in Table 24-29.

Table 24 Effects of PEIP program on psychosocial work environment

Source of variation	df	MS	SS	F	*p-value*
Quantitative demands					
Between subjects					
Intervention	1	351.361	351.361	.807	.371
Error	98	435.614	42690.166		
Within subjects					
Time	2	1327.050	2254.167	10.793	.001**
Intervention*Time	2	250.474	425.463	2.037	.001***
Error	196	122.959	20468.519		
Work pace					
Between subjects					
Intervention	1	20008.333	20008.333	14.375	.001**
Error	98	1391.837	136400.000		
Within subjects					
Time	2	8703.013	12629.167	18.302	.001**
Intervention*Time	2	9874.517	14329.167	20.765	.001**
Error	196	475.528	67625.000		

SS = Sum Square; df = degree of freedom; MS = Mean Square

** p-value < 0.01 *** p-value < 0.05, ANOVA with Bonferroni pair wise comparisons

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Table 25 Effects of PEIP program on psychosocial work environment (Cont')

Source of variation	df	MS	SS	F	*p-value*
Cognitive demands					
Between subjects					
Intervention	1	2455.787	2455.787	4.589	.035
Error	98	535.090	52438.831		
Within subjects					
Time	2	566.361	1077.286	2.406	.096
Intervention*Time	2	673.788	1281.626	2.863	.062
Error	196	235.380	43876.620		
Emotional demands					
Between subjects					
Intervention	1	503.755	503.755	.822	.367
Error	98	613.013	60075.302		
Within subjects					
Time	2	797.893	1417.698	5.019	.010***
Intervention*Time	2	335.510	596.135	2.110	.130
Error	196	158.982	27683.042		
Demands for hiding emotions					
Between subjects					
Intervention	1	650.231	650.231	.503	.480
Error	98	1291.974	126613.426		
Within subjects					
Time	2	1054.531	2058.796	7.280	.001**
Intervention*Time	2	1610.845	3144.907	11.121	.001**
Error	196	144.845	27712.963		

SS = Sum Square; df = degree of freedom; MS = Mean Square

** p-value < 0.01 *** p-value < 0.05, ANOVA with Bonferroni pair wise comparisons

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Table 26 Effects of PEIP program on psychosocial work environment (Cont')

Source of variation	df	MS	SS	F	*p-value*
Influence at work					
Between subjects					
Intervention	1	5283.603	5283.603	9.248	.003***
Error	98	571.346	55991.914		
Within subjects					
Time	2	5826.272	9278.552	14.697	.001**
Intervention*Time	2	6599.724	10510.302	16.648	.001**
Error	196	396.432	61870.596		
Possibilities for development					
Between subjects					
Intervention	1	16781.380	16781.380	47.083	.001**
Error	98	356.423	34929.427		
Within subjects					
Time	2	9078.611	14627.344	83.375	.001**
Intervention*Time	2	11703.486	18856.510	107.481	.001**
Error	196	108.889	17193.229		
Meaning of work					
Between subjects					
Intervention	1	17005.250	17005.250	41.156	.001**
Error	98	413.194	40493.055		
Within subjects					
Time	2	16977.601	32034.829	134.905	.001**
Intervention*Time	2	18515.152	34936.014	147.122	.001**
Error	196	125.849	23271.305		

SS = Sum Square; df = degree of freedom; MS = Mean Square

** p-value < 0.01 *** p-value < 0.05, ANOVA with Bonferroni pair wise comparisons

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Table 27 Effects of PEIP program on psychosocial work environment (Cont')

Source of variation	df	MS	SS	F	*p-value*
Commitment to the workplace					
Between subjects					
Intervention	1	8968.067	8968.067	15.198	.001**
Error	98	590.083	57828.179		
Within subjects					
Time	2	3140.831	6153.759	31.181	.001**
Intervention*Time	2	2350.840	4605.946	23.338	.001**
Error	196	100.730	19341.170		
Predictability					
Between subjects					
Intervention	1	4672.853	4672.853	9.209	.003***
Error	98	507.438	49728.877		
Within subjects					
Time	2	12633.264	25052.915	79.955	.001**
Intervention*Time	2	10674.664	21168.832	67.559	.001**
Error	196	158.006	30707.253		
Rewards					
Between subjects					
Intervention	1	1581.255	1581.255	2.227	.139
Error	98	710.020	69581.969		
Within subjects					
Time	2	27666.815	54054.656	42.104	.001**
Intervention*Time	2	1817.035	3550.073	2.765	.067
Error	196	657.102	125815.062		

SS = Sum Square; df = degree of freedom; MS = Mean Square

** p-value < 0.01 *** p-value < 0.05, ANOVA with Bonferroni pair wise comparisons

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Table 28 Effects of PEIP program on psychosocial work environment (Cont')

Source of variation	df	MS	SS	F	*p-value*
Role clarity					
Between subjects					
Intervention	1	4928.853	4928.853	10.900	.001**
Error	98	452.194	44315.034		
Within subjects					
Time	2	14095.610	24822.207	112.388	.001**
Intervention*Time	2	10809.577	19035.540	86.188	.001**
Error	196	125.419	21644.401		
Role conflicts					
Between subjects					
Intervention	1	263.203	263.203	.585	.446
Error	98	449.913	44091.448		
Within subjects					
Time	2	64.434	80.469	2.953	.079
Intervention*Time	2	7.715	9.635	.354	.601
Error	196	21.818	2670.313		
Quality of leadership					
Between subjects					
Intervention	1	9352.083	9352.083	29.593	.001**
Error	98	316.024	30970.313		
Within subjects					
Time	2	9451.934	15415.625	119.662	.001**
Intervention*Time	2	11516.172	18782.292	145.795	.001**
Error	196	78.989	12625.000		

SS = Sum Square; df = degree of freedom; MS = Mean Square

** p-value < 0.01 *** p-value < 0.05, ANOVA with Bonferroni pair wise comparisons

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Table 29 Effects of PEIP program on psychosocial work environment (Cont')

Source of variation	df	MS	SS	F	*p-value*
Social support from supervisor					
Between subjects					
Intervention	1	2045.370	2045.370	4.214	.043
Error	98	485.317	47561.111		
Within subjects					
Time	2	1320.754	2393.056	6.598	.002***
Intervention*Time	2	1931.945	3500.463	9.652	.001**
Error	196	200.162	35541.667		
Social support from colleagues					
Between subjects					
Intervention	1	1233.565	1233.565	2.233	.138
Error	98	552.442	54139.352		
Within subjects					
Time	2	2026.883	2489.352	7.838	.004***
Intervention*Time	2	1732.859	2128.241	6.701	.007***
Error	196	258.583	31123.148		
Social community at work					
Between subjects					
Intervention	1	267.593	267.593	.502	.480
Error	98	532.880	52222.222		
Within subjects					
Time	2	216.327	381.019	1.309	.271
Intervention*Time	2	509.669	897.685	3.083	.055
Error	196	165.323	28536.111		

SS = Sum Square; df = degree of freedom; MS = Mean Square

** p-value < 0.01 *** p-value < 0.05, ANOVA with Bonferroni pair wise comparisons

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4.3 Comparison of Health Outcome Scores at Baseline, Two Months and Four months after Completing Intervention

In this study, the findings related to health outcomes, including musculoskeletal symptoms, sick leave, and work ability of hospital orderlies, are presented separately.

4.3.1 Musculoskeletal Symptoms

The 12-month prevalence rates of musculoskeletal symptoms in the intervention group and the control group were 98.8% and 97%, respectively. Lower back symptoms were the most common MSD, affecting 72% of hospital orderlies in the intervention group. This was followed by MSD symptoms in the hip/thighs/buttocks (70%), upper back (64%), and knees (60%). Results among the control group showed that the most common MSD symptoms were reported at the lower back (74%), followed by hip/thighs/buttocks (70%), upper back (58%), and knees (50%). The details of MSDs in each part of body for the two groups are shown in Figure 11.

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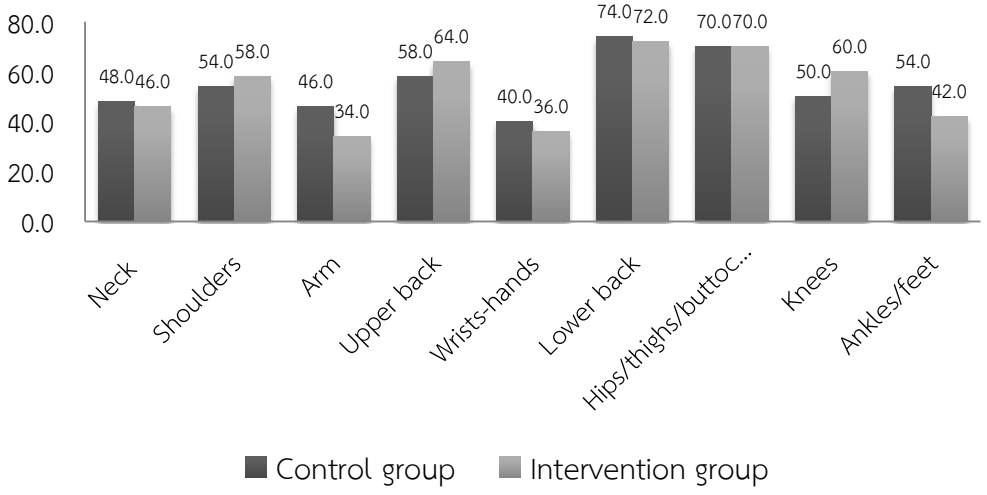

Figure 11 Rate of musculoskeletal symptoms in the past 12 months among the intervention and the control group

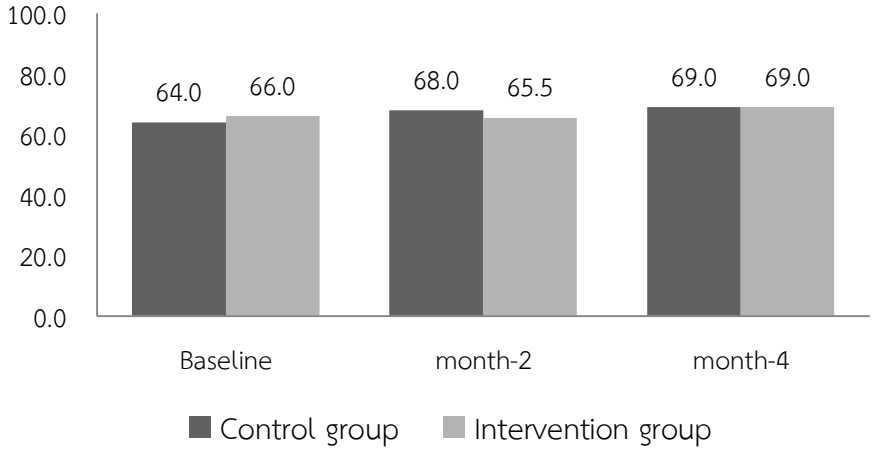

Figure 12 Rate of musculoskeletal symptoms in the last 3 months between intervention and control group at baseline, month-2 and month-4

The baseline prevalence rate of musculoskeletal symptoms for the intervention group and the control group were 66% and 64% respectively. At the

two-month mark following intervention, the control group reported a prevalence rate of 68%, a score higher than its pre intervention rate. At the two-month mark following intervention, the intervention group reported a prevalence rate of 65.5%, a score lower than its pre intervention rate. Regarding findings at four-month mark following intervention, the MSD rate among the intervention group was higher than that at the time of the baseline assessment. Still, it slightly deceased compared with the two-month mark post intervention. There were no changes to the MSD rate at the two and four month marks post intervention among the control group (Figure 12).

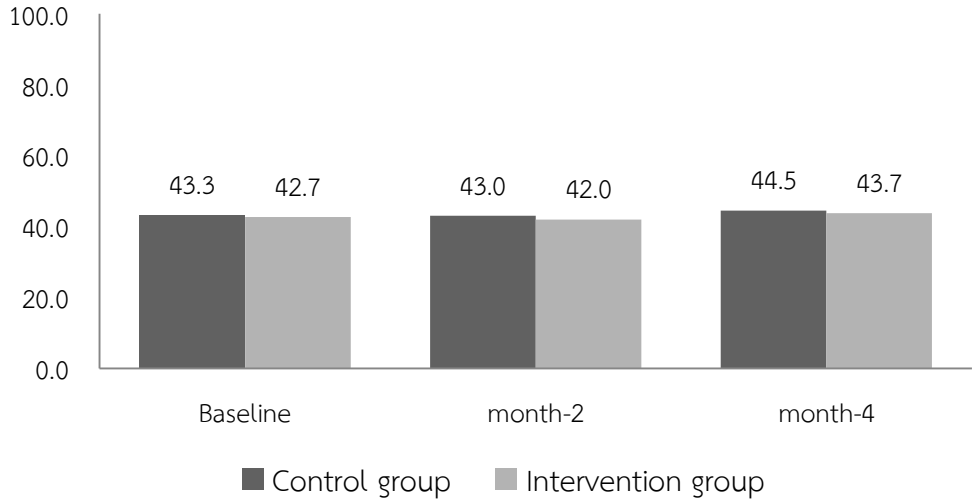

Figure 13 Rate of musculoskeletal symptoms in the last 7 days between intervention and control group at baseline, month-2 and month-4

With regards to the seven-day prevalence rates of musculoskeletal

symptoms, the intervention group reported MSD rates lower than the control group at the baseline measurement. Additionally, the MSD rate among participants in the intervention group was reported at the two and four-month mark after the intervention had been completed. In contrast to the control group, results showed that the rate of MSDs decreased at the two-month mark and increased at the four-month mark (Figure 13).

4.3.2 Quick Exposure Check for work-related musculoskeletal risks

An evaluation of risk exposure levels following the PEIP program was conducted for different body regions. Risk exposure levels were calculated via a questionnaire based on the Quick Exposure Check (QEC) for work-related musculoskeletal risks. The questionnaire focused on five main body regions, including: back (static), back (moving), shoulders/arms, wrists/hands, and neck.

The results of the study indicated that orderlies in the control group had very high-risk exposure scores for the back (moving) (41.7 ± 7.9). Risk exposure scores for the shoulders/arms (36.5 ± 11.1), wrists/hands (33.5 ± 10.6), and back (static) (26.7 ± 6.7) were also high. Results of the QEC for the intervention group showed high risk exposure scores for the back (moving) (40.0 ± 8.5), shoulders/arms (35.9 ± 10.9), wrists/hands (34.2 ± 10.9), back (static) (26.6 ± 6.7), and neck (12.1 ± 3.2). Detailed findings are shown in Table 30.

Compared with the control group, the intervention group had no significant

scores at baseline measurement. Two months after completion of the PEIP program intervention, mean scores from the QEC among the intervention group changed dramatically in all five body regions. Mean scores in the intervention group for the five body regions showed reductions: back (static) (-1.2), back (moving) (-2.6), shoulders/arms (-1.4), wrists/hands (-1.7), and neck (-2.3). Significant reductions were found in the back (moving) ($p < .005$) and neck ($p = .001$) when compared with the control group. All mean scores from the QEC at baseline and two months after intervention are presented in Table 31.

In summary, two months after intervention, the study found that the PEIP program had an effect on decreasing risk exposure scores for different body regions. Significant decreases were observed in the back (moving) ($p < .005$) and neck ($p = .001$). The mean scores from the QEC for the neck among the intervention group changed dramatically, from high to moderate.

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Table 30 Comparison the mean score of quick exposure check (QEC) between the intervention and the control groups at baseline and month-2

Score	At baseline		*p*-value[a] (95%CI)	Month-2		*p*-value[a] (95%CI)
	Control group Mean(SD)	Intervention group Mean(SD)		Control group Mean(SD)	Intervention group Mean(SD)	
Back (static)	26.7(6.7)	26.6(6.7)	0.976	26.7(6.2)	25.4(6.3)	0.267
Back (moving)	41.7(7.9)	40.0(8.5)	0.287	42.1(7.6)	37.4(8.4)	0.005*
Shoulder/arm	36.5(11.1)	35.9(10.9)	0.828	36.2(11.0)	34.5(11.4)	0.408
Wrist/hand	33.5(10.6)	34.2(10.9)	0.746	36.5(11.4)	32.5(11.8)	0.083
Neck	12.1(3.4)	12.1(3.2)	0.952	12.1(2.4)	9.8 (3.4)	0.001*

*p-value < .05, t-test

Table 31 presents the mean risk exposure scores for all body regions in the intervention and control groups four months after the intervention. Mean scores decreased for the intervention group four months after intervention. Score reduction was of: back (static) (-1.2), back (moving) (-3.6), and shoulders/arms (-0.7). However, only back (moving) showed a significant decrease when compared with the control group (p< .005). All mean scores from the QEC for the intervention and control groups at baseline and two months post intervention.

In conclusion, four months after completion of the intervention, the PEIP program still had the effect of decreasing risk exposure scores for different body regions. The reduction in score for the back (moving) (p < .005) was found to be

significant.

Table 32 presents the mean risk exposure scores for all body regions in the intervention and control groups two and four months after the intervention. The study found that the PEIP program had an effect on decreasing risk exposure scores for different body regions. Significant decreases were observed in the back (moving) ($p < .005$) and neck ($p = .001$). The mean scores from the QEC for the neck among the intervention group changed dramatically, from high to moderate. Four months after completion of the intervention, the PEIP program still had the effect of decreasing risk exposure scores for different body regions. The reduction in score for the back (moving) ($p < .005$) was found to be significant.

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Table 31 Comparison the mean score of quick exposure check (QEC) between the intervention and the control groups at baseline and month-4

Score	At baseline		*p*-value[a] (95%CI)	Month-4		*p*-value[a] (95%CI)
	Control group Mean(SD)	Intervention group Mean(SD)		Control group Mean(SD)	Intervention group Mean(SD)	
Back (static)	26.7(6.7)	26.6(6.7)	0.976	27.8(6.2)	25.4(6.3)	0.051
Back (moving)	41.7(7.9)	40.0(8.5)	0.287	40.6(7.3)	36.4(9.0)	0.013*
Shoulder/arm	36.5(11.1)	35.9(10.9)	0.828	33.4(11.0)	35.2(10.5)	0.407
Wrist/hand	33.5(10.6)	34.2(10.9)	0.746	33.7(12.3)	35.1(12.3)	0.578
Neck	12.1(3.4)	12.1(3.2)	0.952	12.1(2.5)	12.1 (3.1)	0.171

*p-value < .05, t-test

A repeated measures analysis of variance was used to compare the mean scores of each group. Results show a significant difference between the two groups. Results are shown in Table 33-35 .

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Table 32 Comparison the mean score of quick exposure check (QEC) between the intervention and the control groups at month-2 and month-4

Score	Month-2		*p*-value[a] (95%CI)	Month-4		*p*-value[a] (95%CI)
	Control group Mean(SD)	Intervention group Mean(SD)		Control group Mean(SD)	Intervention group Mean(SD)	
Back (static)	26.7(6.2)	25.4(6.3)	0.267	27.8(6.2)	25.4(6.3)	0.051
Back (moving)	42.1(7.6)	37.4(8.4)	0.005*	40.6(7.3)	36.4(9.0)	0.013*
Shoulder/arm	36.2(11.0)	34.5(11.4)	0.408	33.4(11.0)	35.2(10.5)	0.407
Wrist/hand	36.5(11.4)	32.5(11.8)	0.083	33.7(12.3)	35.1(12.3)	0.578
Neck	12.1(2.4)	9.8 (3.4)	0.001*	12.1(2.5)	12.1 (3.1)	0.171

*p-value < .05, t-test

Table 33 Effects of PEIP program on mean score of quick exposure check (QEC)

Source of variation	df	MS	SS	F	*p-value*
Back (static)					
Between subjects					
Intervention	1	128.053	128.053	1.199	.276
Error	98	106.817	10468.093		
Within subjects					
Time	2	15.305	22.747	1.344	.260
Intervention*Time	2	50.294	74.747	4.417	.023
Error	196	11.387	1658.507		

SS = Sum Square; df = degree of freedom; MS = Mean Square

** p-value < 0.01 *** p-value < 0.05, ANOVA with Bonferroni pair wise comparisons

Table 34 Effects of PEIP program on mean score of quick exposure check (QEC)

Source of variation	df	MS	SS	F	*p-value*
Back (moving)					
Between subjects					
Intervention	1	925.763	925.763	5.624	.020
Error	98	164.606	16131.367		
Within subjects					
Time	2	166.165	264.740	7.709	.002***
Intervention*Time	2	74.017	117.927	3.434	.045***
Error	196	21.554	3365.333		
Shoulder/arm					
Between subjects					
Intervention	1	2.430	2.430	.007	.932
Error	98	329.225	32264.033		
Within subjects					
Time	2	126.513	184.380	5.266	.013***
Intervention*Time	2	117.209	170.820	4.878	.017***
Error	196	24.026	3431.467		
Wrist/hand					
Between subjects					
Intervention	1	31.363	31.363	.097	.756
Error	98	324.315	31782.833		
Within subjects					
Time	2	13.502	23.707	.313	.703
Intervention*Time	2	246.334	432.507	5.709	.006***
Error	196	43.145	7423.787		

SS = Sum Square; df = degree of freedom; MS = Mean Square

** p-value < 0.01 *** p-value < 0.05, ANOVA with Bonferroni pair wise comparisons

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Table 35 Effects of PEIP program on mean score of quick exposure check (QEC) (Cont')

Source of variation	df	MS	SS	F	*p-value*
Neck					
Between subjects					
Intervention	1	62.563	62.563	3.108	.081
Error	98	20.132	1972.940		
Within subjects					
Time	2	60.014	96.980	11.987	.001**
Intervention*Time	2	59.907	96.807	11.965	.001**
Error	196	5.007	792.880		

SS = Sum Square; df = degree of freedom; MS = Mean Square

** p-value < 0.01 *** p-value < 0.05, ANOVA with Bonferroni pair wise comparisons

4.3.3 Sick leave

There was no sick leave reported by the intervention group before or after intervention. However, the study found that 2% of the control group had taken 2-day sick leave as a result of musculoskeletal problems at the two and four month marks following intervention. These findings are shown in Table 36.

Table 36 Comparison day of sick leave among the control and the intervention group

Sick leave	Control group (n=50)		Intervention group (n=50)	
	n	%	n	%
Baseline	0	-	0	-
Month-2	1	2	0	-
Month-4	1	2	0	-

4.3.4 Work ability

Figure 14 shows the mean score of work ability for the intervention and control groups at baseline assessment. The mean score for the intervention group was of 38.0, while that of the control group was of 38.21. The mean score of work ability in the intervention group showed a slight increase two months after intervention (+0.42) and four months after intervention (+0.37). Scores for the control groups also showed slight increases two months after intervention (+0.08) and four months after intervention (+0.07).

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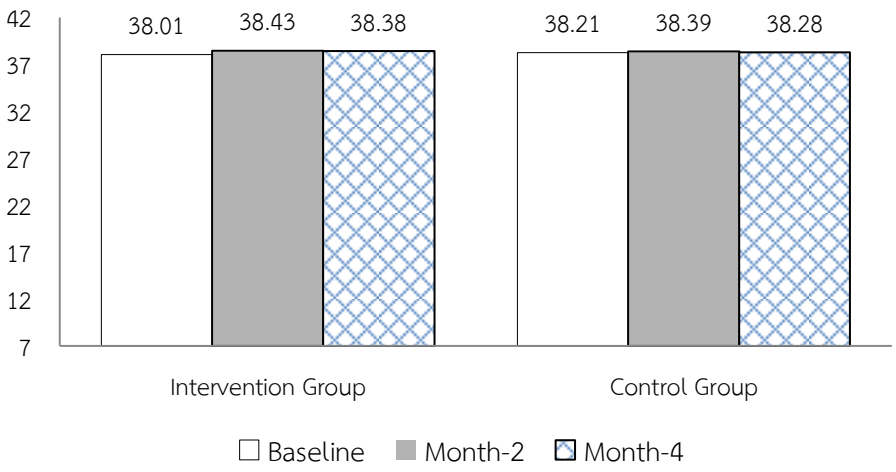

Figure 14 Mean score of work ability of the intervention and control group

A repeated measures analysis of variance was used to compare the mean scores of each group. Results show a significant difference between the two groups. Results are shown in Table 37.

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Table 37 Effects of PEIP program on mean score of quick exposure check (QEC) (Cont')

Source of variation	df	MS	SS	F	*p-valu*
Between subjects					
Intervention	1	203.363	203.363	10.812	0.001**
Error	98	18.809	1843.273		
Within subjects					
Time	2	90.786	132.407	175.097	0.001**
Intervention*Time	2	57.244	83.487	110.404	0.001**
Error	17	142.927	74.107		

SS = Sum Square; df = degree of freedom; MS = Mean Square

** p-value < 0.01 *** p-value < 0.05, ANOVA with Bonferroni pair wise comparisons

4.4 Discussion

In the present study, the authors investigated the effects of the Effects of Participatory Ergonomic Intervention Program (PEIP) program, a tailored participatory ergonomic intervention, for hospital orderlies in enhancing their work environments and health outcomes. The effects of PEIP program on all outcome variables are discussed as follow:

4.4.1 Effect of the Participatory Ergonomic Intervention Programs on the work environment

This study aimed to replicate existing results regarding the effects of participatory intervention programs on the workplace. Findings from the study demonstrated that hospital orderlies that participated in the program saw more work environment improvements that orderlies that did not participate in the program. A comparative analysis of physical and psychosocial exposure risks among orderlies in the intervention group and orderlies in the control group showed significant differences in all scores, with the exception of decision latitude. All other factors analyzed showed positive results for the intervention group. Other areas that showed a significant difference between both groups after the intervention was completed were: work pace, influence at work, possibilities for development, meaning of work, commitment to the workplace, predictability, role clarity, role conflicts, quality of leadership, and social support from supervisors.

In previous studies, results have indicated that participatory approaches play a role in increasing perceptions in the workplace [102]. Other studies have shown that engaging workers through participatory approaches can help reduce the physical workload [69] and improve the psychosocial work environment by encouraging social support from supervisors and colleagues (Ikeda, 2009). With the exception of one study [103], all work in the field considered modifications to the physical design of equipment and the workplace. Several studies took changes in work tasks into account [104, 105], others considered job teams or work organization [105-107], and others addressed policy making [104]. Studies included other aspects that were more challenging to incorporate into distinct categories, including: creating a stretching and

exercise program [106], improving the physical conditioning of workers [103], identifying improved maintenance procedures for existing equipment [71], designing and implementing new rooms for rest-breaks [106] ,and working with suppliers to change the glue on existing packaging[103].

The relationship between the PEIP program and effects on the work environment appeared to be direct. Practical training did lead to improvements in working conditions and safer working methods.. Previous studies [14, 67] had documented that successful intervention programs were characterized by changes to work organization, working practices, and the design of work environments. As was the case in this study, previous studies focused on changes to the work environment through the designing of equipment or tasks, thus resulting in post-intervention improvements.

The participatory training approach not only improved physical aspects, it also led to improvements in the psychosocial work environment. Actively participating in the initiative motivated workers and resulted in improved perceptions of their influences on the work environment. Participatory approaches, such as those aimed to create healthier work environments, can result in increased familiarity between colleagues and supervisors, improved human relations, and can also raise social support at work.

4.4.2 Effect of the PEIP program on health outcomes

The second aim of this study was to investigate the effects of the PEIP program on health outcomes. Expectations were that an effective Participatory Ergonomic (PE) program would reduce the rate of musculoskeletal symptoms,

reduce sick leave, and increase work ability among hospital orderlies.

Musculoskeletal Symptoms

The PEIP program aimed to prevent musculoskeletal disorders among participants. As such, complaint rates were used as the outcome variable to evaluate the intervention program. The expected result was a decrease in musculoskeletal symptoms following completion of the intervention program. However, reports of musculoskeletal symptoms among the intervention group did not decrease at either the two or four month mark following intervention. The time between completion of the intervention program and the measurement may have influenced the results as previous studies have questioned the ability to measure decreases in musculoskeletal symptoms within one year of an intervention [108].

This study found no decrease in symptoms within six months of completing the intervention. These results are in line with previous studies that stress that while PE interventions are an effective tool to reduce musculoskeletal symptoms, symptom reduction will be observed after one year of completing the program [59, 62, 109]. This study, consistent with the work of Coel et al. (2005), found partial evidence that the PE intervention had a small, positive, impact on musculoskeletal symptoms in short-term evaluations [74]. Still, six months or less following the completion of the intervention program is insufficient time to clearly observe changes to musculoskeletal symptoms.

Interestingly, orderlies in both the intervention and control group reported an increase in musculoskeletal symptoms two months after completing the program. Previous studies have indicated that an increased awareness of, and familiarity with,

musculoskeletal issues may result in increased reporting [23]. Workload changes may have also played a part in the increased reporting of symptoms two months after the intervention. This study did not record data on the specific number of daily patient handling tasks, a musculoskeletal risk factor that may have affected symptom reporting during the follow-up period. Taking these activities into account would benefit future research.

Sick leave

Several studies have taken into account the effect of intervention programs on sick leave. In their study of a United Kingdom central government department, Bond and Bunce found that improvements to job control through reorganization efforts allowed for more discretion and choice. These changes were seen to improve mental health and decrease rates of sick leave one year after the intervention had been completed. Mikkelsen et al. conducted a study of a short-term participatory intervention program in Norwegian healthcare institutions and found that intervention resulted in positive, yet limited, effects on work related stress. Furthermore, the intervention program also seemed to initiate a beneficial change process. Kawakami et al., in their study of a large intervention group in an electrical company, found decreased rates of depression and sick leave one year after organizational changes had been implemented. Finally, Lund et al. (2006) found that the physical work environment and factors like uncomfortable working positions and tasks involving lifting, carrying, pushing, or pulling loads increased the risk of long-term sick leave among female and male employees in Denmark.

This study found that sick leave among orderlies in the intervention group did not decrease. An explanation for the lack of decreased sick leave is that physical risk factors were addressed during the intervention period. Furthermore, the intervention program resulted in improved psychosocial work environment conditions. However, as the follow-up assessment was conducted six months following the intervention, more time was needed to observe any changes. Analyzing sick leave is further complicated by the variety of individual and organizational factors that affect the decision of an employee to request sick leave [108].

Work ability

This study found that the mean score for work ability among hospital orderlies in the intervention group increased slightly following the PEIP program. Work ability is the balance between an individuals resources and demands at work. Research has consistently shown that factors that can influence work ability are high mental work demands and lack of autonomy. Recent research has shown significant associations between these factors and work ability. Results from this study have shown that poor work ability scores can be improved through a PEIP intervention aimed at positively changing the physical and psychosocial work environment. Results indicated a significant increase in WAI scores in both the intervention and control groups. A six-month intervention study involving 50 hospital orderlies showed no improvement in WAI scores, even though the physical and psychosocial work environments showed improvement. These findings are consistent with the work of Pohjonen et al. (1998) who found that a 12-month ergonomic intervention program for home care work led to improved physical and mental work conditions and

prevented a decline in work ability in the intervention group [70]. Previous research has shown that musculoskeletal symptoms, and other chronic diseases, can decrease work ability as much as a poor physical or psychosocial work environment [70, 94]. The more that work environment factors improve the more that work ability scores should increase.

4.5 Intervention Feedback from Participants and Facilitators

Participant and facilitator comments on the PEIP program were collected via questionnaires at the end of the intervention. The questionnaires consisted of open-ended questions aimed at assessing the feelings and ideas of participants towards the intervention program. Participants identified a series of positive elements and elements in need of improvement.

4.6 Process Evaluation of PAOT Method

1) Positive Points of the Participant Training

Most participants expressed that they gained knowledge from the training. Comments provided after training reflected this point. Some examples of comments provided include:

"We are committed to providing our excellent patient transfer service."(I.D.1)

"We are committed to providing our excellent patient transfer service."(I.D.3)

"We seek further diversification for better service excellence." (I.D.6)

"We perform our tasks with love and devotion." (I.D. 12)

"Tiredness has become nothing as we work in harmony." (I.D.20)

"Have fun." (I.D.31)

"Every day is full of happiness and enjoyment." (I.D.35)

"We are proudly committed to providing impressive services." (I.D.37)

"A little time can heal those patients." (I.D.39)

"Excellent service always comes with tiredness and happiness." (I.D.42)

"Assisting patients is another way of making merits." (I.D.46)

"Although it is a hard job, we never give up." (I.D.50)

2) Points in Need of Improvement

Most of the participants suggested that this form of training should be made available to all hospital orderlies. Participants also expressed the need for more time to participate in group activities.

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4.7 Process Evaluation of the PEIP Program

Process evaluation of the PEIP program was conducted through the Participatory Ergonomics Framework (PEF). The evaluation was conducted to clarify dimensions of the organizational structure that might have influenced improvements. A Follow-up visit four months after the PAOT training had been completed found that most of the Patient Transfer Service Department (twelve of the thirteen units, 92.3%) were continuing to improve their working conditions and working environment. Direct involvement by all facilitator hospital orderlies was seen in ten

units (76.9%). The PE intervention was seen to have influenced the entire organization. Group consultation had emerged as the preferred method for decision-making (50%). Hospital orderlies were the largest group of participants in the program (70%). Only one unit claimed that participation in the program was compulsory. Work improvement mostly focused on designing equipment and tasks (80%), followed by designing jobs and work teams (60%). Participants were involved in solution implementation (100%), solution planning (70%), and problem identification (60%). All facilitators acted as team members. Eight of the ten facilitators were found to be acting as guides helping initiate activities. Results from the PEIP evaluation are shown in Table 38-40.

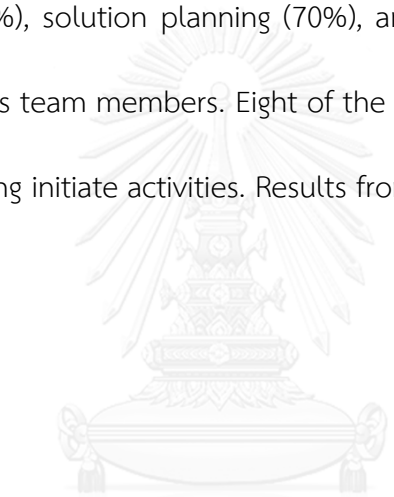
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Table 38 Process evaluation of PEIP program by facilitators (n=10)

Dimension	n	%
Permanence		
Ongoing	8	80.0
Temorary	2	20.0
Involvement		
Full direct	6	60.0
Partial direct	3	30.0
Representative	1	10.0
Level of influence		
Entire organization	10	100.0
Department/work group	0	0.0
Decision-making		
Group delegation	1	10.0
Group consultation	5	50.0
Individual consultation	4	40.0

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Table 39 Process evaluation of PEIP program by facilitators (n=10) (Cont')

Dimension	n	%
Mix of participants Staffs		
Staffs	2	20.0
Staffs - Head orderlies	7	70.0
Staffs - Head orderlies - Supervisor	1	10.0
Requirement		
Compulsory	2	10.0
Voluntary Focus	9	90.0
Focus		
Designing equipment or tasks	8	80.0
Designing jobs, teams of work organization	6	60.0
Formulating policies or strategies	2	20.0
Remit		
Problem identification	6	60.0
Solution planning	7	70.0
Solution implementation	10	100.0
Solution evaluation	3	30.0

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Table 40 Process evaluation of PEIP program by facilitators (n=10) (Cont')

Dimension	n	%
Role of facilitator		
Initiates and guides process	8	80.0
Acts as a team member	10	100.0
Train participants	2	20.0
Available for consultation	9	90.0

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CHAPTER V

CONCLUSIONS AND RECOMMENDATIONS

This chapter is organized into four sections: findings and conclusion, implication of finding, limitations, and recommendations for further research.

5.1 Findings and Conclusion

A randomized controlled trial (RCT), with a two-group pretest-posttest design, was conducted to examine the effects of a Participatory Ergonomic Intervention Program (PEIP) program on the work environment and health outcomes of hospital orderlies. Participants consisted of 100 male orderlies working in a tertiary care hospital (2,221-beds hospital) in Bangkok, Thailand. Orderlies were part of the 13-unit Patient Transfer Service Department of the facility. Participants from the selected hospital were randomized by SAV number and allocated into an intervention group (n = 50). Participants allocated to the control group (n = 50) received usual practice. The work environment and health outcomes (e.g. musculoskeletal symptoms, sick leave, and work ability) were measured by self-reported questionnaires at baseline, two, and four months after the completion of the intervention. Data collection was conducted from July to December 2014.

Findings of the study are summarized as follows:

1) Physical work environment, in terms of physical demands at work among the intervention group, reduced significantly when compared with the control group at the two and four month marks following the PEIP intervention ($p = .002$).

2) Effect of PEIP program on physical work environment was a significant difference between the two groups ($F = 7.42$, $p < 0.05$).

3) Workplace environment scores (e.g. lighting, noise, temperature, and odor) among the intervention group did not change from baseline to the two month mark. However, a slight decreased was observed from the two to the four-month mark. Workplace environment scores showed no difference over time in the control group. No significant difference was found between the two groups in workplace environment at the baseline, two month, and four month marks.

4) Two months after intervention was completed, the PEIP program increased psychosocial work environment promotion factors. A significant increase in promotion factors was observed in the intervention group when compared with the control group. These factors included: work pace, influence at work, possibilities for development, meaning of work, commitment to the workplace, predictability, role clarity, role conflicts, quality of leadership, social support from supervisors) (all p-values $< .001$) and social support from colleagues (all p-values $< .05$).

5) Four months after the intervention was completed the PEIP program had

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the effect of increasing psychosocial work environment promotion factors. Increases were observed in: work pace, cognitive demands, demands for hiding emotions, commitment to the workplace, predictability, rewards, and social community at work (all p- values < .05).

6) Effect of PEIP program was significant difference between the two groups on work pace (F = 14.37, p <0.01), influence at work (F = 9.24, p <0.05), possibilities for development (F = 47.08, p <0.01), meaning of work (F = 41.15, p <0.01), commitment to the workplace (F = 15.19, p <0.01), predictability (F = 9.20, p <0.01), role clarity (F = 10.90, p <0.01), quality of leadership (F = 25.93, p <0.01).

7) Seven-day and three-month prevalence rates of musculoskeletal symptoms among the intervention and the control groups did not decrease when compared to pre-intervention rates.

8) Two months after intervention, the PEIP prgram decreased risk exposure level scores for different body regions, including the back (moving) (p < .005) and neck (p = .001). Mean scores from the QEC for the neck among the intervention group changed dramatically, from high to moderate.

9) Four months after completion of the intervention, the PEIP program still had the effect of decreasing risk exposure scores for different body regions. The reduction in score for the back (moving) (p < .005) was found to be significant

10) The intervention group reported no sick leave before, or after, intervention. The study found that 2% of the control group reported 2-day sick leave

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due to musculoskeletal problems during the two and four month marks.

11) Work ability among the intervention group slightly increased at the two and four month marks. Work ability for the control group was unchanged at the two-month mark, with a slight increase at the four-month mark. A statistically significant difference between the two groups was not found ($F = 0.56$, $p = .571$).

In summary, the PEIP program designed as a participatory ergonomic intervention, resulted in positive outcomes. Positive results were observed in the work environment, particularly in reducing physical work environment risk factors for musculoskeletal disorders and increasing promotion factors of psychosocial work environment. However, its effects on health outcomes were questionable and should have been observed over a longer-term period after intervention.

5.2 Implication of Findings

1) This study provides the implementation strategy for a participatory ergonomics intervention program aimed at improving the work environment and health outcomes of hospital orderlies. This strategy will benefit occupational health professionals seeking a practical, and effective, intervention strategy to improve workplace environments and prevent musculoskeletal disorders in hospital settings.

2) Healthcare staff education can be enhanced by further integrating learning activities into the curriculum. Activities of this nature would provide healthcare workers with the skills to better manage their work environment. These initiatives can

also help prevent work-related musculoskeletal disorders arising from workplace ergonomic hazards.

5.3 Limitation of the Study

The sole use of self-reported questionnaires posed limitations for this study as this measurement tool can result in recall bias. As a result, a surface electromyography machine was used to measure muscle load via a personal computer and software. Further studies should measure the electrical potential of muscle activity. All participants were males working at a large hospital. This limits the capability to generalize results to the broader workforce. While the sample size was appropriate for this study, future studies should work with larger sample sizes to obtain more precise findings.

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5.4 Recommendations for Further Research

1) This Participatory Ergonomic Intervention Program (PEIP) program was an effective intervention strategy for the hospital orderlies in this tertiary care hospital. The program can be replicated in other settings.

2) This study presented a new participatory ergonomic intervention program. The strategy used in this study can be used with larger sample sizes. Furthermore, future studies can also use this approach to compare results in various facilities.

3) Work environments are shaped by objective and subjective elements. As

such, evaluations of the work environment should incorporate objective assessment tools, such as questionnaires, and subjective tools, such as observation and air sampling.

4) A one-year follow-up evaluation should be conducted to assess the long-term effectiveness of the PEIP program on health outcomes.

5) Future research should explore the relationship between individual tasks and musculoskeletal discomfort. Such an analysis may find linkages that grouping high-risk tasks into levels could have obscured.

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จุฬาลงกรณ์มหาวิทยาลัย
Chulalongkorn University

APPENDIX

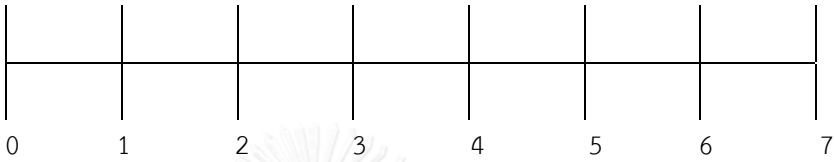
จุฬาลงกรณ์มหาวิทยาลัย
Chulalongkorn University

APENDIX A

QUESTIONNIAIR FOR SCREEN MUSCULAR DISCOMFORT

1. General bodily or discomfort

Please answer your feeling or general bodily fatigue into seven score



(Not fatigue) (Extreme fatigue)

Comfort Extreme discomfort

2. Local muscular discomfort

Please point to the body area which you are currently discomfort and give the level of discomfort score.

The level of discomfort score as following

0	means	Comfort
1-2	means	Slight discomfort
3-4	means	Moderate discomfort
5-6	means	High discomfort
7	means	Extreme discomfort

Left Right

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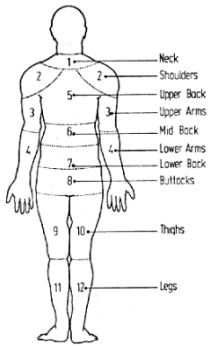

APENDIX B

PEIP QUESTIONNIRE IN THAI

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Chulalongkorn University

แบบสอบถามโครงการวิจัย
เรื่อง
ผลของโปรแกรมการมีส่วนร่วมตามหลักการยศาสตร์
เพื่อลดปัจจัยเสี่ยงทางด้านอาชีวอนามัยของพนักงานเคลื่อนย้ายผู้ป่วย

ในการเข้าร่วมการวิจัยครั้งนี้ ผลวิจัยใครขอให้ท่านตอบแบบสอบถามทั้งหมด ซึ่งแบ่งออกเป็น 4 ส่วน จำนวน 12 หน้า ดังนี้

ส่วนที่ 1 ข้อมูลส่วนบุคคล

คำชี้แจง โปรดทำเครื่องหมาย ☐ ลงใน ☐ หน้าข้อความที่ต้องการตอบ หรือเติมข้อความลงในช่องว่าง

1. อายุ.....ปี
2. การศึกษาสูงสุด
   - ☐ มัธยมศึกษาตอนปลาย
   - ☐ ประกาศนียบัตร
   - ☐ ปริญญาตรี
   - ☐ ปริญญาโท
3. สถานภาพสมรส
   - ☐ โสด
   - ☐ คู่
   - ☐ หม้าย/หย่า/แยกกันอยู่
4. ส่วนสูง.....เซนติเมตร
5. น้ำหนัก.....กิโลกรัม
6. ท่านทำงานในตำแหน่งนี้มานาน.....ปี.....เดือน
7. ปัจจุบันท่านทำงานในหอผู้ป่วยใด (ระบุชื่อหอผู้ป่วย).....
   ระยะเวลาการทำงาน.....ปี.....เดือน
8. ท่านทำงานเฉลี่ยสัปดาห์ละ.....วัน วันละ.....ชั่วโมง (รวมระยะเวลาทำงานล่วงเวลา)

9. ท่านทำงานกะบ่ายหรือดึกหรือไม่
   - ☐ ไม่ทำ
   - ☐ ทำ

10. ท่านต้องทำงานต่อเนื่องกันมากกว่าหนึ่งกะการทำงาน (กะเช้าต่อกะบ่าย หรือกะบ่ายต่อกะดึก) หรือไม่
   - ☐ ไม่
   - ☐ ทำ ประมาณ.....ครั้ง/สัปดาห์

11. ท่านมีรายได้ทั้งหมด (รวมเงินเดือน ค่างานกะและงานล่วงเวลา) กี่บาท/เดือน
   - ☐ < 5,000
   - ☐ 5,000 – 9,999
   - ☐ 10,000 – 14,999
   - ☐ 15,000 – 19,999
   - ☐ ≥ 20,000

12. ในหอผู้ป่วยที่ท่านทำงานอยู่มีการจัดเตรียมอุปกรณ์สำหรับยก/เคลื่อนย้ายผู้ป่วยอย่างเพียงพอหรือไม่
   - ☐ ไม่เพียงพอ
   - ☐ เพียงพอ

13. ท่านเคยได้รับการอบรม/คำแนะนาเกี่ยวกับเรื่องชีวกลศาสตร์ (biomechanics) หรือการยศาสตร์ (ergonomics) หรือ วิธีการทำงานที่ปลอดภัยในการยกหรือเคลื่อนย้ายผู้ป่วย และวัตถุ สิ่งของมาก่อนหรือไม่
   - ☐ ไม่เคย
   - ☐ เคย ได้รับจากแหล่งใด (ตอบได้มากกว่า 1 ข้อ)
   - ☐ หน่วยงานในโรงพยาบาล
   - ☐ เพื่อนร่วมงานหรือหัวหน้างาน
   - ☐ การค้นคว้าด้วยตนเองจากหนังสือ / สิ่งพิมพ์ต่าง ๆ หรืออินเตอร์เนต
   - ☐ อื่น ๆ โปรดระบุ.....

14. ท่านคิดว่าภาวะสุขภาพโดยทั่วไปของท่านในปัจจุบันเป็นอย่างไร
   - ☐ ดีมาก
   - ☐ ดี
   - ☐ ปานกลาง
   - ☐ แย่

15. ปัจจุบันท่านมีปัญหาสุขภาพหรือไม่
   - ☐ ไม่มี
   - ☐ มี โปรดระบุ.....

16. ท่านมีโรคประจำตัวในระบบโครงร่างกล้ามเนื้อที่ได้รับการวินิจฉัยจากแพทย์หรือไม่
    - ☐ ไม่มี
    - ☐ มี โปรดระบุ โรค.....เป็นมานาน.....ปี.....เดือน
17. ในช่วง 6 เดือนที่ผ่านมาท่านเคยได้รับการผ่าตัดในระบบโครงร่างกล้ามเนื้อหรือไม่?
    - ☐ ไม่เคย
    - ☐ เคย (ระบุ).....
18. ในช่วง 6 เดือนที่ผ่านมาท่านเคยหยุดงานเนื่องจากปัญหาในระบบโครงร่างกล้ามเนื้อหรือไม่
    - ☐ ไม่เคย
    - ☐ เคย (ระบุ.....วัน)
19. ท่านคิดว่าสมรรถภาพร่างกายของท่านในปัจจุบันเป็นอย่างไร
    - ☐ ดีมาก
    - ☐ ดี
    - ☐ ปานกลาง
    - ☐ แย่
20. หลังจากการทำงานในแต่ละวันท่านรู้สึกเหนื่อยแค่ไหน
    - ☐ ไม่เหนื่อยเลย
    - ☐ เหนื่อยเล็กน้อย
    - ☐ เหนื่อยปานกลาง
    - ☐ เหนื่อยมาก
21. ท่านเล่นกีฬา / ออกกำลังกายหรือไม่
    - ☐ ไม่ออกเลย
    - ☐ เล่นกีฬา/ออกกำลังกาย ระบุประเภท.....วันละ..... นาที จำนวน.....วัน/สัปดาห์
22. ก่อนหรือหลังจากทำงาน ท่านต้องทำกิจกรรมอื่นๆ เหล่านี้ คือ (ตอบได้มากกว่า 1 ข้อ)
    - ☐ ซักเสื้อผ้าด้วยมือ วันละ..... ชั่วโมง.....นาที สัปดาห์ละ..... วัน
    - ☐ รีดผ้า วันละ..... ชั่วโมง.....นาที สัปดาห์ละ..... วัน
    - ☐ ทำความสะอาดบ้าน วันละ..... ชั่วโมง.....นาที สัปดาห์ละ..... วัน
    - ☐ ทำกับข้าว วันละ..... ชั่วโมง.....นาที สัปดาห์ละ..... วัน
    - ☐ ทำสวน/ปลูกต้นไม้ วันละ..... ชั่วโมง.....นาที สัปดาห์ละ..... วัน
    - ☐ ขับรถ วันละ..... ชั่วโมง.....นาที สัปดาห์ละ..... วัน
    - ☐ ดูแลเด็ก/ผู้สูงอายุ วันละ..... ชั่วโมง.....นาที สัปดาห์ละ..... วัน
    - ☐ อื่นๆ โปรดระบุ..... วันละ..... ชั่วโมง.....นาที สัปดาห์ละ..... วัน

23. ท่านดื่มเครื่องดื่มที่มีแอลกอฮอล์หรือไม่
- ☐ ไม่ดื่ม
- ☐ ดื่มไม่บ่อย (ไม่เกิน 1 ครั้ง/เดือน)
- ☐ 2-4 ครั้ง/เดือน
- ☐ 2-3 ครั้ง/สัปดาห์
- ☐ เท่ากับหรือมากกว่า 4 ครั้ง/สัปดาห์

24. ท่านเคยสูบบุหรี่หรือไม่
- ☐ เคย ปัจจุบันยังสูบอยู่
- ☐ เคย ปัจจุบันเลิกแล้ว
- ☐ ไม่เคยสูบเลย

25. ปัจจุบันท่านใช้ยาประจำหรือไม่
- ☐ ไม่ใช้
- ☐ ใช้ (ระบุ).....

26. ในช่วง 6 เดือนที่ผ่านมาท่านเคยได้รับอุบัติเหตุหรือไม่
- ☐ ไม่เคย
- ☐ เคย (ระบุ).....

27. ลักษณะงานพื้นฐานของท่านเป็นอย่างไร
- ☐ เป็นงานที่ใช้ความคิด/จิตใจเป็นส่วนใหญ่
- ☐ เป็นงานที่ใช้แรงกายเป็นส่วนใหญ่
- ☐ เป็นงานที่ใช้ทั้งความคิด/จิตใจและแรงกาย

<u>ส่วนที่ 2 ข้อมูลสิ่งแวดล้อมการทำงาน</u>

คำชี้แจง: โปรดทำเครื่องหมาย ☐ ลงในช่องวางที่ตรงกับสิ่งแวดล้อมการทำงานของท่านมากที่สุดตามความเป็นจริง

ข้อ	ข้อมูล	บ่อยมาก	บ่อย	บางครั้ง	นานๆครั้ง	ไม่มี
1	ระดับเสียงในสิ่งแวดล้อมการทำงานดังรบกวนการทำงาน					
2	แสงสว่างในสิ่งแวดล้อมการทำงานไม่เหมาะสม เช่น มืด หรือ จ้าเกินไป					
3	อุณหภูมิในสิ่งแวดล้อมการทำงานร้อนหรือเย็นจนเกินไป					
4	มีกลิ่นรบกวนการทำงาน					

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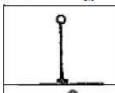
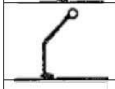
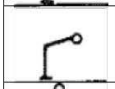
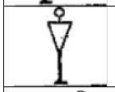
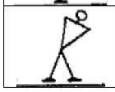
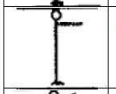
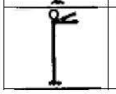
<u>คำชี้แจง</u> ในการปฏิบัติงานการเคลื่อนย้ายผู้ป่วยของท่านมีท่าทางการทำงาน และมีการยก ผลัก ดัน หรือ เคลื่อนย้ายสิ่งของ/ผู้ป่วยที่มีน้ำหนัก ตามรูปที่แสดงด้านล่างมากน้อยเพียงใด โปรดทำเครื่องหมาย ☐ ลงในช่องวางที่ตรงกับการปฏิบัติงานของท่านมากที่สุดตาม ความเป็นจริง

ในขณะปฏิบัติงานลำตัวของท่าน		ไม่เคย	นานๆ ครั้ง	บางครั้ง	บ่อย	บ่อยมาก
	อยู่ในแนวตรง					
	โน้มตัวไปข้างหน้าเล็กน้อย (ประมาณ 45 องศา)					
	โน้มตัวไปข้างหน้ามาก (ประมาณ 75 องศา)					
	มีการบิด/เอี้ยวตัว					
	โน้มตัวไปด้านข้าง					

ในขณะปฏิบัติงาน แขนของท่าน		ไม่เคย	นานๆ ครั้ง	บางครั้ง	บ่อย	บ่อยมาก
	อยู่ต่ำกว่าระดับไหล่ทั้งสองข้าง					
	ข้างใดข้างหนึ่งอยู่สูงกว่าระดับไหล่					
	อยู่สูงกว่าระดับไหล่ทั้งสองข้าง					

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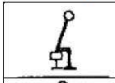
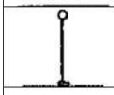
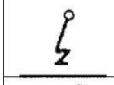
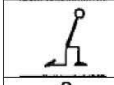
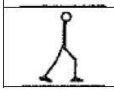
ในขณะปฏิบัติงาน ขาของท่าน		ไม่เคย	นานๆ ครั้ง	บางครั้ง	บ่อย	บ่อยมาก
	อยู่ในท่านั่ง					
	อยู่ในท่ายืน					
	อยู่ในท่าย่อเข่า					
	คุกเข่ากับพื้นข้างใดข้างหนึ่งหรือทั้งสองข้าง					
	เดิน หรือ เคลื่อนไหวไปมา					

น้ำหนักสิ่งของ/ผู้ป่วยที่ท่านต้องยก ผลัก ดัน หรือ เคลื่อนย้ายในขณะลำตัวอยู่ในแนวตรง		ไม่เคย	นานๆ ครั้ง	บางครั้ง	บ่อย	บ่อยมาก
	เบา (ต่ำกว่า 10 กิโลกรัม)					
	ปานกลาง (10-20 กิโลกรัม)					
	หนัก (มากกว่า 20 กิโลกรัม)					

น้ำหนักสิ่งของ/ผู้ป่วยที่ท่านต้องยก ผลัก ดัน หรือ เคลื่อนย้ายด้วยการก้มตัว		ไม่เคย	นานๆ ครั้ง	บางครั้ง	บ่อย	บ่อยมาก
	เบา (ต่ำกว่า 10 กิโลกรัม)					
	ปานกลาง (10-20 กิโลกรัม)					
	หนัก (มากกวา 20 กิโลกรัม)					

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คำชี้แจง โปรดพิจารณาข้อความเกี่ยวกับสิ่งแวดล้อมในการทำงานของท่าน และทำเครื่องหมาย □ลงในช่องที่ตรงกับความ คิดเห็นของท่านมากที่สุด

ข้อ	ข้อความ	ตลอดเว	บ่อยครั้	บางครั้ง	น้อย	ไม่เลย
1	งานที่ท่านทำมีการกระจายปริมาณงานไม่ดี งานจึง					
2	ท่านไม่สามารถทำงานให้เสร็จทันตามเวลา					
3	ท่านต้องทำงานล่วงเวลา					
4	ท่านต้องทำงานแข่งกับเวลา					
5	ท่านมีงานที่ต้องรับผิดชอบจำนวนมาก					
6	งานที่ท่านทำเป็นงานที่ต้องจดจำสิ่งต่างๆ					
7	งานที่ท่านทำเป็นงานที่ต้องใช้ความคิดสร้างสรรค์					
8	งานที่ท่านทำตองมีการตัดสินใจที่ยากลำบาก					
9	งานที่ท่านทำ ทำให้ท่านเกิดความยุ่งยาก รำคาญ					
10	ส่วนหนึ่งของงานที่ท่านทำจำเป็นต้องเกี่ยวข้องกับปัญหาส่วนตัวของบุคคลอื่น					
11	ท่านจำเป็นต้องปฏิบัติต่อคนอื่นๆ อย่างเท่าเทียม แม้ว่าท่านจะไม่ชอบทำแบบนั้นก็ตาม					
12	ท่านมีส่วนร่วมในงานที่ท่านทำในระดับสูง					
13	ท่านมีสิทธ์เลือกที่จะทำงานร่วมกับใครก็ได้					
14	ท่านสามารถกำหนดปริมาณงานที่ท่านทำได้					
15	ท่านมีส่วนในการกำหนดว่าท่านจะทำงานอะไร					
16	ท่านมักจะพิจารณามองหางานอื่นทำ					
17	หัวหน้าหอผู้ป่วยเต็มใจรับฟังปัญหาที่เกิดจากการทำงานของท่าน					
18	ท่านได้รับการช่วยเหลือและสนับสนุนจากหัวหน้าหอ					
19	หัวหน้าหอผู้ป่วยพูดชื่นชมท่านเกี่ยวกับงานที่ท่านทำ					
20	ท่านได้รับการช่วยเหลือและสนับสนุนจากเพื่อนร่วมงาน					
21	เพื่อนร่วมงานเต็มใจรับฟังปัญหาที่เกิดจากการทำงานของท่					

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ข้อ	ข้อความ	ตลอดเวลา	บ่อยครั้ง	บางครั้ง	น้อยครั้ง	ไม่เลย
22	เพื่อนร่วมงานพูดชื่นชมท่านเกี่ยวกับงานที่ท่านทำได้ดีบ่อยแค่ไหน					
23	บรรยากาศในการทำงานระหว่างท่านกับเพื่อนร่วมงานเป็นไปด้วยดี					
24	ท่านกับเพื่อนร่วมงานสามารถทำงานร่วมกันได้เป็น					
25	ท่านรู้สึกเป็นส่วนหนึ่งของหอผู้ป่วยที่ท่านทำงาน					

ข้อ	ข้อความ	ในระดับสูงมาก	ในระดับสูง	ในระดับปานกลาง	ในระดับต่ำ	ในระดับต่ำมาก
26	งานของท่านเป็นงานที่ต้องรองรับอารมณ์ผู้อื่น					
27	ท่านได้รับผลกระทบทางอารมณ์จากงานที่ท่านทำ					
28	งานที่ท่านทำเป็นงานที่ต้องซ่อนความรู้สึก					
29	ท่านจำเป็นต้องแสดงให้ทุกคนเห็นว่าท่านเป็นคนดี เป็นคนเปิดเผย ไม่ว่าคนอื่นจะแสดงออกต่อท่าน อย่างไร					
30	งานที่ท่านทำต้องการให้ท่านเริ่มอะไรใหม่ๆ					
31	ท่านมีโอกาสเรียนรู้สิ่งใหม่จากงานที่ท่านทำ					
32	ท่านสามารถใช้ทักษะหรือความชำนาญของท่านใน การทำงาน					
33	งานที่ท่านทำอยู่เปิดโอกาสให้ท่านได้พัฒนาทักษะของตนเอง					
34	งานที่ท่านทำอยู่มีความหมาย					
35	ท่านรู้สึกว่างานที่ท่านทำอยู่มีความสำคัญ					
36	ท่านรู้สึกกระตือรือร้นและมีส่วนร่วมในงานที่ท่านทำ อยู่					
37	ท่านสนุกกับการเล่าเรื่องในที่ทำงานของท่านให้คน					
38	ท่านรู้สึกว่าที่ทำงานของท่านมีความสำคัญต่อท่านมาก					
39	ท่านอยากจะแนะนำให้เพื่อนสนิทเข้ามาทำงานใน ตำแหน่งเดียวกับท่าน					

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ข้อ	ข้อความ	ในระดับสูงมาก	ในระดับสูง	ในระดับปานกลาง	ในระดับต่ำ	ในระดับต่ำมาก
40	ในที่ทำงานของท่าน ท่านได้รับการบอกล่วงหน้าเกี่ยวกับการตัดสินใจที่สำคัญ การเปลี่ยนแปลง และ แผนการดำเนินงานต่างๆ ที่จะเกิดขึ้นใน					
41	ท่านได้รับข้อมูลทุกอย่างที่ท่านต้องการ เพื่อให้การ ทำงานเป็นไปได้ด้วยดี					
42	งานของท่านได้รับการยอมรับและชื่นชมจากฝ่ายบริหาร					
43	ฝ่ายบริหารให้การยอมรับนับถือท่าน					
44	ท่านได้รับการปฏิบัติอย่างเป็นธรรมในที่ทำงาน					
45	งานที่ท่านทำมีความก้าวหน้าดี					
46	เงินเดือนที่ท่านได้รับเหมาะสมกับงานที่ทำ					
47	งานที่ท่านทำมีวัตถุประสงค์ชัดเจน					
48	ท่านทราบดีว่าท่านต้องรับผิดชอบงานในส่วนไหน					
49	ท่านทราบดีว่าอะไรคือสิ่งที่ท่านคาดหวังจากการทำงาน					
50	ท่านทำงานหลายอย่างที่ได้รับการยอมรับจากคนบางคน แต่ไม่ได้รับการยอมรับจากคนอื่นๆ อีกหลาย					
51	งานที่ท่านทำมีความขัดแย้งกัน					
52	บางครั้งท่านจำเป็นต้องทำงานบางอย่าง ทั้งๆ ที่งาน					
53	บางครั้งท่านจำเป็นต้องทำงานหลายอย่างที่ไม่มี ความจำเป็นต้องทำ					
ท่านจะพูดถึงผู้ตรวจการหรือผู้บริหารระดับสูงกว่าหัวหน้า						
54	☐ ทำให้คนทำงานแต่ละคนได้รับโอกาสในการพัฒนาที่ดี					
55	☐ ให้ความสำคัญกับความพึงพอใจในงาน					
56	☐ เก่งในการวางแผนงาน					
57	☐ เก่งในการแก้ไขปัญหาความขัดแย้งในงาน					

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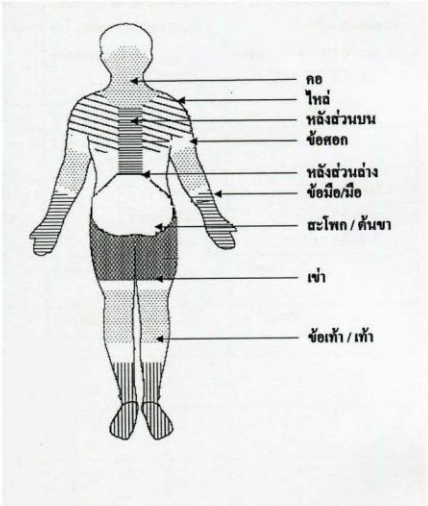
<u>ส่วนที่ 3 อาการผิดปกติในระบบโครงร่างกล้ามเนื้อ</u>

กรุณาใช้แผนภาพแสดงส่วนต่างๆ ของรางกายตอบคำถามในตารางตามลำดับ โดยทำเครื่องหมาย ☐ ลงในช่องที่ตรงกับส่วนของรางกายของท่านที่เกิดอาการ



	<u>ในช่วง 12 เดือนที่ผ่านมา</u> ท่านมีอาการผิดปกติของร่างกายเกิดขึ้น (เช่น อาการปวด	<u>ในช่วง 12 เดือนที่ผ่านมา</u> ท่านมีอาการผิดปกติจน ไม่สามารถทำกิจกรรม	<u>ในช่วง 12 เดือนที่ผ่านมา</u> ท่านต้อง ไปพบแพทย์ เพราะอาการ	<u>ในช่วง 3 เดือนที่ผ่านมา</u> ท่านมี อาการผิดปกติ ของร่างกาย	<u>ในช่วง 7 วันที่ผ่านมา</u> ท่านมี อาการผิดปกติ ของร่างกาย	โปรดระบุความรุนแรงของอาการผิดปกติที่เกิด
คอ	☐ไม่มี ☐ ☐ มี	☐ไม่มี ☐ ☐	☐ไม่มี ☐ ☐	☐ไม่มี ☐ ☐	☐ไม่มี ☐ ☐	
ไหล่	☐ไม่มี ☐ ☐ มี	☐ไม่มี ☐ ☐	☐ไม่มี ☐ ☐	☐ไม่มี ☐ ☐	☐ไม่มี ☐ ☐	
หลัง	☐ไม่มี ☐ ☐ มี	☐ไม่มี ☐ ☐	☐ไม่มี ☐ ☐	☐ไม่มี ☐ ☐	☐ไม่มี ☐ ☐	
ข้อศอก	☐ไม่มี ☐ ☐ มี	☐ไม่มี ☐ ☐	☐ไม่มี ☐ ☐	☐ไม่มี ☐ ☐	☐ไม่มี ☐ ☐	
ข้อมือ/มือ	☐ไม่มี ☐ ☐ มี	☐ไม่มี ☐ ☐	☐ไม่มี ☐ ☐	☐ไม่มี ☐ ☐	☐ไม่มี ☐ ☐	
หลัง	☐ไม่มี ☐ ☐ มี	☐ไม่มี ☐ ☐	☐ไม่มี ☐ ☐	☐ไม่มี ☐ ☐	☐ไม่มี ☐ ☐	
สะโพก/	☐ไม่มี ☐ ☐ มี	☐ไม่มี ☐ ☐	☐ไม่มี ☐ ☐	☐ไม่มี ☐ ☐	☐ไม่มี ☐ ☐	
เข่า	☐ไม่มี ☐ ☐ มี	☐ไม่มี ☐ ☐	☐ไม่มี ☐ ☐	☐ไม่มี ☐ ☐	☐ไม่มี ☐ ☐	
ข้อเท้า/	☐ไม่มี ☐ ☐ มี	☐ไม่มี ☐ ☐	☐ไม่มี ☐ ☐	☐ไม่มี ☐ ☐	☐ไม่มี ☐ ☐	

รับรอง
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เลขที่โครงการ 126/2557
COA No. 296/2014
วันที่รับรอง 19 มี.ค. 2557

<u>ส่วนที่ 4 ข้อมูลความสามารถในการทำงาน</u>

คำชี้แจง โปรดวงกลม ☐ รอบตัวเลขที่ตรงกับความคิดเห็นของท่าน

1. ท่านคิดว่าความสามารถในการทำงานของท่านปัจจุบันนี้อยู่ในระดับใด โดยเปรียบเทียบกับความสามารถในการ ทำงานสูงสุดที่ผ่านมาของท่าน (สมมุติให้ความสามารถในการทำงานระดับสูงสุด = 10)

0 1 2 3 4 5 6 7 8 9 10

ไม่สามารถทำงานได้ ความสามารถสูงสุด

คำชี้แจง โปรดเติมเครื่องหมาย ☐ลงใน ☐ หน้าข้อความที่ตรงกับความเป็นจริงหรือความคิดเห็นของท่าน

2. ความสามารถในการทำงานที่สัมพันธ์กับภาระงาน

2.1 ถ้าเป็นการทำงานที่ต้องใช้แรงกาย ท่านคิดว่าความสามารถในการทำงานของท่านปัจจุบันน้อยในระดับใด

☐ดีมาก ☐ ค่อนข้างดี ☐ ปานกลาง ☐ ไม่ค่อยดี ☐ ไม่ดีเลย

2.2 ถ้าเป็นการทางานที่ต้องใช้ความคิด ทานคิดวาความสามารถในการทางานของท่านปัจจุบันอยู่ในระดับใด

☐ดีมาก ☐ ค่อนข้างดี ☐ ปานกลาง ☐ ไม่ค่อยดี ☐ ไม่ดีเลย

3. ท่านเจ็บป่วยเป็นโรคอะไรบ้าง

☐ไม่ป่วย

☐ป่วย (โปรดระบุทุกโรค) โรคที่ได้รับการวินิจฉัยจากแพทย์.....

โรคที่ทราบด้วยตนเอง.....

4. การเจ็บป่วยหรือบาดเจ็บต่างๆ เป็นอุปสรรคต่อการทำงานของท่านในปัจจุบันอย่างไร

☐สามารถทำงานได้ตามปกติ เนื่องจากไม่มีปัญหาสุขภาพหรือการเจ็บป่วยใดๆ

☐สามารถทำงานได้ตามปกติ แต่มีอาการผิดปกติของร่างกายหรือการเจ็บป่วยเป็นบางครั้ง

☐สามารถทำงานได้ลดลง หรือต้องเปลี่ยนวิธีการทำงานเป็นบางครั้ง เนื่องจากการเจ็บป่วย

☐ต้องทำงานช้าลง หรือเปลี่ยนวิธีการทำงานบ่อยๆ เนื่องจากการเจ็บป่วย

☐ทำได้เฉพาะงานพิเศษ (ไม่สามารถรับงานประจำได้) เนื่องจากการเจ็บป่วย

☐ไม่สามารถทำงานได้อีกต่อไป เนื่องจากปัญหาสุขภาพหรือการเจ็บป่วย

5. ในรอบ 1 ปีที่ผ่านมาท่านต้องหยุดงานเนื่องจากปัญหาสุขภาพหรือการเจ็บป่วย หรือหยุดเพื่อไปรับการรักษารวมทั้ง สิ้นกี่วัน (ไม่นับการลาเพื่อคลอดบุตร)

☐ไม่เคยหยุดเลย

☐1-9 วัน

☐10-24วัน

☐25-99 วัน

☐100-365 วัน

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6.ประเมินจากภาวะสุขภาพของท่านในปัจจุบัน ท่านคิดว่าในอีก 2 ปี ข้างหน้าท่านจะสามารถทำงานที่ทำอยู่ในปัจจุบัน นี้ได้หรือไม่ อย่างไร

- ☐ ทำได้เหมือนเดิมแน่นอน
- ☐ ไม่ค่อยแน่ใจว่าจะทำได้เหมือนเดิมหรือไม่
- ☐ ทำได้ไม่เหมือนเดิมแน่นอน

7. ความรู้สึกมีความสุข ความกระตือรือร้นและความหวัง

7.1 ปัจจุบันท่านมีความสุขกับงานและการดำเนินชีวิตมากน้อยแค่ไหน

- ☐ บ่อยๆ
- ☐ ค่อนข้างบ่อย
- ☐ เป็นบางครั้ง
- ☐ นานๆ ครั้ง
- ☐ ไม่เคยเลย

7.2 ปัจจุบันนี้ท่านยังคงกระตือรือร้นและตื่นเต้นกับงานและการดำเนินชีวิตมากน้อยแค่ไหน

- ☐ ตลอดเวลา
- ☐ ค่อนข้างบ่อย
- ☐ เป็นบางครั้ง
- ☐ นานๆ ครั้ง
- ☐ ไม่เคยเลย

7.3 ปัจจุบันท่านรู้สึกว่าอนาคตยังเต็มเปี่ยมไปด้วยความหวัง

- ☐ เป็นประจำ สม่ำเสมอ
- ☐ ค่อนข้างบ่อย
- ☐ เป็นบางครั้ง
- ☐ นานๆ ครั้ง
- ☐ ไม่เคยเลย

ขอบคุณที่ตอบแบบสอบถาม

Observer's Assessment

Back

A **When performing the task, is the back**
(select worse case situation)

A1 Almost neutral?

A2 Moderately flexed or twisted or side bent?

A3 Excessively flexed or twisted or side bent?

B **Select ONLY ONE of the two following task options:**

For seated or standing stationary tasks. **Does the back remain in a static position most of the time?**

B1 No

B2 Yes

For lifting, pushing/pulling and carrying tasks (i.e. moving a load). **Is the movement of the back**

B3 Infrequent (around 3 times per minute or less)?

B4 Frequent (around 8 times per minute)?

B5 Very frequent (around 12 times per minute or more)?

Shoulder/Arm

C **When the task is performed, are the hands**
(select worse case situation)

C1 At or below waist height?

C2 At about chest height?

C3 At or above shoulder height?

D **Is the shoulder/arm movement**

D1 Infrequent (some intermittent movement)?

D2 Frequent (regular movement with some pauses)?

D3 Very frequent (almost continuous movement)?

Wrist/Hand

E **Is the task performed with**
(select worse case situation)

E1 An almost straight wrist?

E2 A deviated or bent wrist?

F **Are similar motion patterns repeated**

F1 10 times per minute or less?

F2 11 to 20 times per minute?

F3 More than 20 times per minute?

Neck

G **When performing the task, is the head/neck bent or twisted?**

G1 No

G2 Yes, occasionally

G3 Yes, continuously

* *Additional details for L, P and Q if appropriate*

* L

* P

* Q

Worker's Assessment

Workers

H **Is the maximum weight handled MANUALLY BY YOU in this task?**

H1 Light (5 kg or less)

H2 Moderate (6 to 10 kg)

H3 Heavy (11 to 20kg)

H4 Very heavy (more than 20 kg)

J **On average, how much time do you spend per day on this task?**

J1 Less than 2 hours

J2 2 to 4 hours

J3 More than 4 hours

K **When performing this task, is the maximum force level exerted by one hand?**

K1 Low (e.g. less than 1 kg)

K2 Medium (e.g. 1 to 4 kg)

K3 High (e.g. more than 4 kg)

L **Is the visual demand of this task**

L1 Low (almost no need to view fine details)?

*L2 High (need to view some fine details)?

* *If High, please give details in the box below*

M **At work do you drive a vehicle for**

M1 Less than one hour per day or Never?

M2 Between 1 and 4 hours per day?

M3 More than 4 hours per day?

N **At work do you use vibrating tools for**

N1 Less than one hour per day or Never?

N2 Between 1 and 4 hours per day?

N3 More than 4 hours per day?

P **Do you have difficulty keeping up with this work?**

P1 Never

P2 Sometimes

*P3 Often

* *If Often, please give details in the box below*

Q **In general, how do you find this job**

Q1 Not at all stressful?

Q2 Mildly stressful?

*Q3 Moderately stressful?

*Q4 Very stressful?

* *If Moderately or Very, please give details in the box below*

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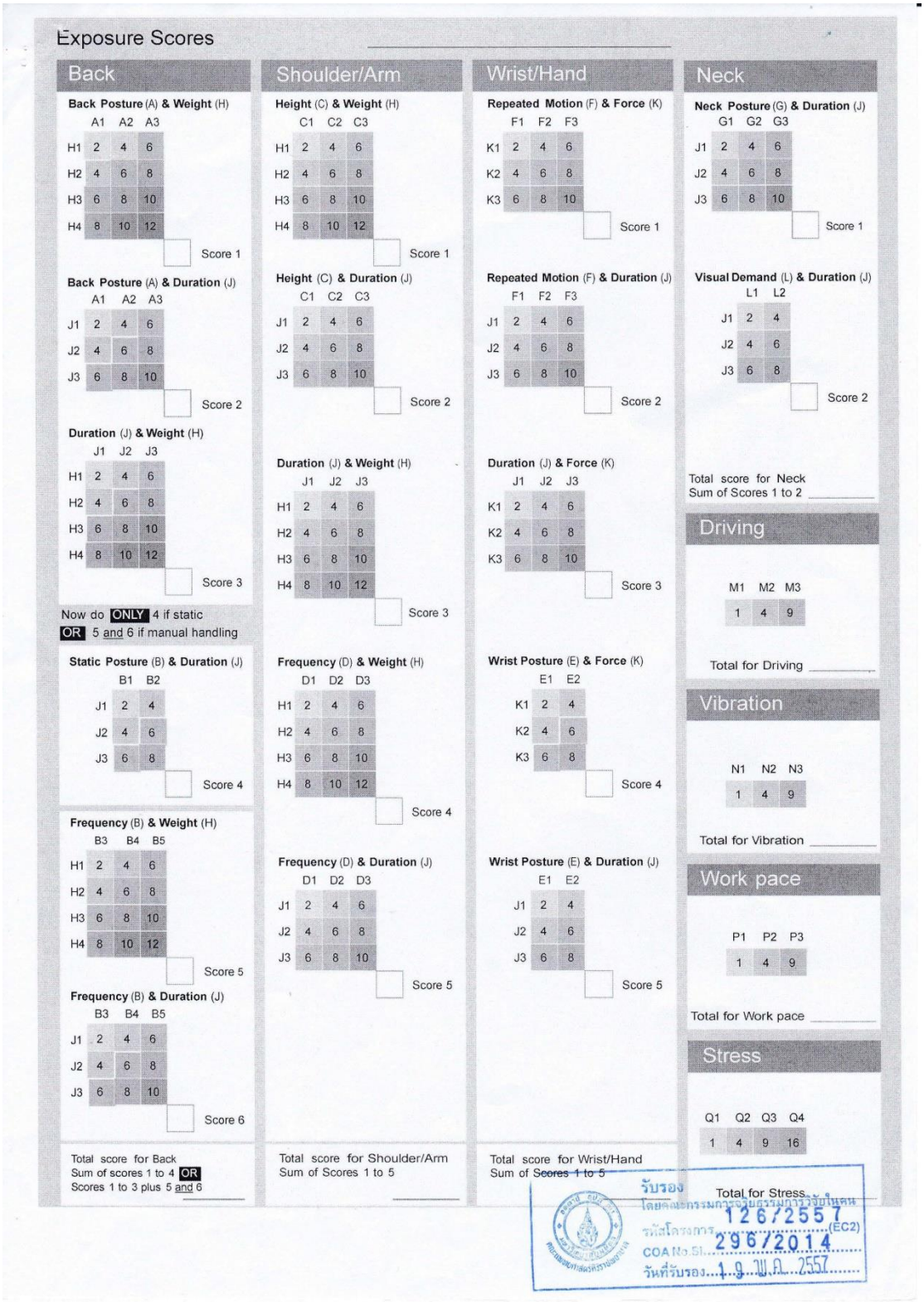
วันที่รับรอง 1 ธ.ค. 2557



Exposure Scores

Back

Back Posture (A) **& Weight** (H)

	A1	A2	A3
H1	2	4	6
H2	4	6	8
H3	6	8	10
H4	8	10	12

Score 1

Back Posture (A) **& Duration** (J)

	A1	A2	A3
J1	2	4	6
J2	4	6	8
J3	6	8	10

Score 2

Duration (J) **& Weight** (H)

	J1	J2	J3
H1	2	4	6
H2	4	6	8
H3	6	8	10
H4	8	10	12

Score 3

Now do **ONLY** 4 if static
OR 5 and 6 if manual handling

Static Posture (B) **& Duration** (J)

	B1	B2
J1	2	4
J2	4	6
J3	6	8

Score 4

Frequency (B) **& Weight** (H)

	B3	B4	B5
H1	2	4	6
H2	4	6	8
H3	6	8	10
H4	8	10	12

Score 5

Frequency (B) **& Duration** (J)

	B3	B4	B5
J1	2	4	6
J2	4	6	8
J3	6	8	10

Score 6

Total score for Back
Sum of scores 1 to 4 **OR**
Scores 1 to 3 plus 5 and 6 _____

Shoulder/Arm

Height (C) **& Weight** (H)

	C1	C2	C3
H1	2	4	6
H2	4	6	8
H3	6	8	10
H4	8	10	12

Score 1

Height (C) **& Duration** (J)

	C1	C2	C3
J1	2	4	6
J2	4	6	8
J3	6	8	10

Score 2

Duration (J) **& Weight** (H)

	J1	J2	J3
H1	2	4	6
H2	4	6	8
H3	6	8	10
H4	8	10	12

Score 3

Frequency (D) **& Weight** (H)

	D1	D2	D3
H1	2	4	6
H2	4	6	8
H3	6	8	10
H4	8	10	12

Score 4

Frequency (D) **& Duration** (J)

	D1	D2	D3
J1	2	4	6
J2	4	6	8
J3	6	8	10

Score 5

Total score for Shoulder/Arm
Sum of Scores 1 to 5 _____

Wrist/Hand

Repeated Motion (F) **& Force** (K)

	F1	F2	F3
K1	2	4	6
K2	4	6	8
K3	6	8	10

Score 1

Repeated Motion (F) **& Duration** (J)

	F1	F2	F3
J1	2	4	6
J2	4	6	8
J3	6	8	10

Score 2

Duration (J) **& Force** (K)

	J1	J2	J3
K1	2	4	6
K2	4	6	8
K3	6	8	10

Score 3

Wrist Posture (E) **& Force** (K)

	E1	E2
K1	2	4
K2	4	6
K3	6	8

Score 4

Wrist Posture (E) **& Duration** (J)

	E1	E2
J1	2	4
J2	4	6
J3	6	8

Score 5

Total score for Wrist/Hand
Sum of Scores 1 to 5 _____

Neck

Neck Posture (G) **& Duration** (J)

	G1	G2	G3
J1	2	4	6
J2	4	6	8
J3	6	8	10

Score 1

Visual Demand (L) **& Duration** (J)

	L1	L2
J1	2	4
J2	4	6
J3	6	8

Score 2

Total score for Neck
Sum of Scores 1 to 2 _____

Driving

M1	M2	M3
1	4	9

Total for Driving _____

Vibration

N1	N2	N3
1	4	9

Total for Vibration _____

Work pace

P1	P2	P3
1	4	9

Total for Work pace _____

Stress

Q1	Q2	Q3	Q4
1	4	9	16

Total for Stress _____

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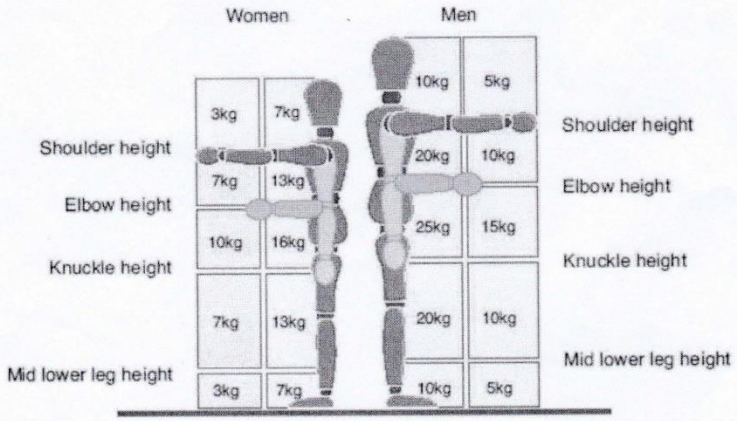
Ergonomic Risk Assessment

Quick Exposure Check

Table 1: Risk Assessment matrix

Risk Rating (RR)	Low	Moderate	High	Very High
	Assessment Scores			
Back:	10-20	21-30	31-40	41-56
Shoulder/Arm:	10-20	21-30	31-40	41-56
Wrist/Hand:	10-20	21-30	31-40	41-56
Neck:	2-6	7-10	11-14	15-18
Stable Base	1	4	9	
Vibration:	1	4	9	-
Work Pace:	1	4	9	-
Environment:	1	4	9	16

Table 2: Guidance Weights for lifting & Lowering



Where Operations are repeated	Figures should be reduced by
Once or twice per minute	30%
Five to eight times per minute	50%
More than 12 times per minute	80%

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APENDIX C

PEIP Questionnaire in English

PEIP Questionnaire

No.....

In order to participate in this study. you are required to complete the questionnaire which is separated into 4 part. Please follow the instructions of each part

Part 1 Demographic and Work data

Instruction : Please fill in the blank or check √ in the box.

1. Age.....years.

2. Level of education

☐ 1) Lower than Matayom 3 ☐ 2) Matayom 3

☐ 3) Matayom 6 ☐ 4) Diploma

☐ 5) Bachelor degree

3. Marital status

☐ 1) single ☐ 2) married

☐ 3) divorced / separated

4. Height.....cm.

5. Weight.....kg.

6. How long have you been working in this hospital ?.....years

7. How long have you been in the position?,.....years/ .....months/.....weeks.

8. How often have you over time worked

☐ 1) Every day ☐ 2) 1-3 days per week

☐ 3) 4-6 days per week ☐ 4) others.....

9. How many days per week do you work normally?.....days/week

10. Are you working in shift?

- ☐ Morning shift
- ☐ Afternoon shift
- ☐ Night shift

11. How about your salary per month

- ☐ < 5,000
- ☐ 5,000 – 9,999
- ☐ 10,000 – 14,999
- ☐ 15,000 – 19,999
- ☐ ≥ 20,000

12. Does your workplace provide sufficient mechanical life or transfer device?

- ☐ Yes
- ☐ No

13. Have you been received any training on biomechanical or ergonomics issue?

- ☐ Yes
- ☐ No

14. How is your health status in general?

- ☐ Good
- ☐ Reasonably good
- ☐ Not too bad
- ☐ Good
- ☐ Poor

15. Currently you have health problems or not.

- ☐ No
- ☐ Yes Please Specific.....

16. Do you have diseases in the skeletal system, muscles that have been diagnosed by a doctor or not.

☐ No

☐ Yes Please Specific.....How long.....Year.....Month

17. During the past six months, Do you had surgery in skeletal muscle or not.

☐ No

☐ Yes Please Specific.....

18. During the six months he had stopped work because of problems in the musculoskeletal system or not.

☐ No

☐ Yes Please Specific.....

19. Do you think about your current physical fitness.

☐ Very Good

☐ Good

☐ Not too bad

☐ Poor

20. After work each day, How you feel it.

☐ Not tired

☐ A little tired

☐ Moderate tired

☐ So tired

21. Play a sport / exercise or not

☐ No

☐ Yes Please Specific.....How long.....Year.....Month

22. How often do you do household physical activities.

- ☐ Wash by hand Per day..... Hour.....Minute Per week..... Day
- ☐ Iron out Per day..... Hour.....Minute Per week..... Day
- ☐ Cleaning house Per day..... Hour.....Minute Per week..... Day
- ☐ Cooking Per day..... Hour.....Minute Per week..... Day
- ☐ Garden Per day..... Hour.....Minute Per week..... Day
- ☐ Driving Per day..... Hour.....Minute Per week..... Day
- ☐ Preserve Child Per day..... Hour.....Minute Per week..... Day
- ☐ Other Per day..... Hour.....Minute Per week..... Day

23. How often do you drink alcohol?

- ☐ Never
- ☐ Once per month or less often
- ☐ 2-4 times per month
- ☐ 2-3 times per week
- ☐ 4 times per week or more often

24. Do you smoke or did smoke in the past?

- ☐ Yes, I'm smoking nowadays
- ☐ Yes, I did smoke in the past
- ☐ No, I never smoke

25. Do you currently use medication or not

- ☐ No
- ☐ Yes Please Specific.....

26. What is your basic job description

☐ It is a mind / soul majority

☐ It is mostly used physical force

☐ The idea is to use / mental and physical strength.

Part 2 Work Environments

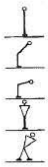
1.Physical work environment

Directions: The following statements concern your perception about your workplace environment. Please indicate the strength of your agreement by a in each statement box.

No.	Item	Very often	Often	Sometimes	Seldom	Never
1	The noise level in my work environment often makes it difficult to work					
2	The light level in my work environment often makes it difficult to work					
3	The temperature in my work environment is not acceptable					
4	There is strong odor in my work					

Directions : Please estimate. how often you have to work in the body posture displayed below. and how often you have to lift, push. pull or carry the weights indicated by putting a in each statement box:

Trunk



straight, upright

slightly inclined

strongly inclined

twisted

laterally bent

never	seldom	sometimes	often	Very often

Arms

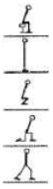
both arms below shoulder height

one arm above shoulder

both arms above shoulder height

never	seldom	sometimes	often	Very often

Legs



sitting

standing

squatting

kneeling with one knee or with both

walking, moving

never	seldom	sometimes	often	Very often

Weight, lifted / carried with upright trunk

light (up to 10 kg)

medium (10-20 kg)

heavy (more than 20 kg)

never	seldom	sometimes	often	Very often

Weight, lifted / carried with inclined trunk

light (up to 10 kg)

medium (10-20 kg)

heavy (more than 20 kg)

never	seldom	sometimes	often	Very often

PART 2. Psychosocial work environment

Directions **:** The following statements concern your perception about your work environment. There is no " right" or "wrong" answers. Your task is to indicate the strength of your agreement by putting a √ in each statement box. Take your time and consider each statement carefully.

No.	Item	Always	Often	Sometimes	Seldom	Never hardly ever
1	Is your workload unevenly distributed so it piles up ?					
2	How often do you not have time to complete all your work tasks ?					
3	Do you have to do overtime ?					
4	Do you have to work very fast ?					
5	Do you have to keep your eyes on lots of thing while you work ?					
6	Does your work require that you remember a lot of thing ?					
7	Does you work demand that you are good at coming up with new ideas ?					
8	Does your work require you to make difficult decisions ?					
9	Does your work put you in emotionally disturbing situations ?					
10	Do you have to relate to other people's personal problems as part of your work?					
11	Are you required to treat everyone equally, even if you do not feel like it ?					

No.	Item	Always	Often	Sometimes	Seldom	Never hardly ever
12	Do you have a large degree of influence concerning your work ?					
13	Do you have a say in choosing who you work with ?					
14	Can you influence the amount of work assigned to you ?					
15	Do you have any influence on what you do at work ?					
16	How often do you consider looking for work elsewhere ?					
17	How often is your nearest superior willing to listen your problems at work ?					
18	How often do you get help and support from your nearest superior ?					
19	How often does your nearest superior talk with you about how well you carry out your work ?					
20	How often do you get help and support from your colleagues ?					
21	How often are your colleagues willing to listen to your problems at work ?					
22	How often do your colleagues talk with you about well you carry out your work ?					
23	Is there a good atmosphere between you and your colleagues ?					
24	Is there good co-operation between the colleagues at work ?					

No.	Item	Always	Often	Sometimes	Seldom	Never hardly ever
25	Do you feel part of a community at your place of work ?					
26	Is your work emotionally demanding ?					
27	Do you get emotionally involved in your work ?					
28	Does your work require that you hide your feeling ?					
29	Are you required to be kind and open towards everyone - regardless of how they behave towards you ?					
30	Does your work require you to take the initiative ?					
31	Do you have the possibility of learning new thing through your work ?					
32	Can you use your skills or expertise in your work ?					
33	Does your work give you the opportunity to develop your skills					
34	Is your work meaningful ?					
35	Do you feel that the work you do is important ?					
36	Do you feel motivated and involved in you work ?					
37	Do you enjoy telling other about your place of work ?					

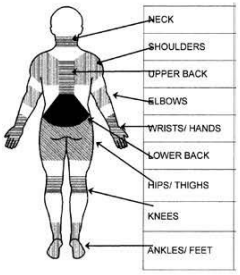
No.	Item	Always	Often	Sometimes	Seldom	Never hardly ever
38	Do you feel that your place of work is of great importance to you ?					
39	Would you recommend a good friend to apply for a position at your workplace ?					
40	At your place of work, are you informed well in advance concerning for example important decisions, changes or plans for the future ?					
41	Do you receive all the information you need in order to do your work well ?					
42	Is your work recognized and appreciated by the management ?					
43	Does the management at your workplace respect you ?					
44	Are you treated fairly at your workplace ?					
45	Are there good prospects in your job ?					
46	Is your salary fair in your effort at work ?					
47	Does your work have clear objectives ?					
48	Do you know exactly which areas are your responsibility ?					
49	Do you know exactly what is expected of you at work ?					
50	Do you do things at work, which are accepted by some people but not by others ?					

No.	Item	Always	Often	Sometimes	Seldom	Never hardly ever
51	Are contradictory demands placed on you at work ?					
52	Do you sometimes have to do things, which ought to have been done in a different way ?					
53	Do you sometimes have to do things, which seem to be unnecessary ?					
To what extent would you say that your immediate superior.....						
54	-makes sure that the individual member of staff has good development opportunities ?					
55	-give high priority to job satisfaction?					
56	-is good at work planning ?					
57	-is good at solving conflicts					

Part 3 Musculoskeletal Symptoms

3.1 Nordic Musculoskeletal Questionnaire (NMQ)

Please answer by putting a cross (X) in the appropriate box, one box, one box for each question. Please answer every question even if you have never had trouble in any parts of your body. This picture shows how the body has been divided. You should decide for yourself which part (if any) is or has been affected.



	Have you at any time during the last 12 months had trouble (such as ache, pain, discomfort, numbness)	During the last 12 months have you been prevented from carrying out normal activities (e.g. job, housework, hobbies) because of this trouble in:	During the last 3 months have you had trouble in:	During the last 7 day have you had trouble in:
NECK	☐ No ☐ Yes	☐ No ☐ Yes	☐ No ☐ Yes	☐ No ☐ Yes
SHOULDERS	☐ No ☐ Yes	☐ No ☐ Yes	☐ No ☐ Yes	☐ No ☐ Yes
UPPER BACK	☐ No ☐ Yes	☐ No ☐ Yes	☐ No ☐ Yes	☐ No ☐ Yes
ELBOWS	☐ No ☐ Yes	☐ No ☐ Yes	☐ No ☐ Yes	☐ No ☐ Yes
WRISTS/HANDS	☐ No ☐ Yes	☐ No ☐ Yes	☐ No ☐ Yes	☐ No ☐ Yes
LOWER BACK	☐ No ☐ Yes	☐ No ☐ Yes	☐ No ☐ Yes	☐ No ☐ Yes
HIPS/THIGHS	☐ No ☐ Yes	☐ No ☐ Yes	☐ No ☐ Yes	☐ No ☐ Yes
KNEES	☐ No ☐ Yes	☐ No ☐ Yes	☐ No ☐ Yes	☐ No ☐ Yes
ANKLES/FEET	☐ No ☐ Yes	☐ No ☐ Yes	☐ No ☐ Yes	☐ No ☐ Yes

Part 4. Work Ability

1. Current work ability compared with the lifetime best

Assume that your work ability at its best has a value of 10 points. How many points would you give your current work ability ?

(0means that you cannot currently work at all)

0	1	2	3	4	5	6	7	8	9	10
completely unable to work										work ability at its best

2. Work ability in relation to the demands of the job

How do you rate your current work ability with respect to the **physical** demands of your work ?

very good (5)	rather good (4)	Moderate (3)	Rather poor (2)	Poor (1)

How do you rate your current work ability with respect to the **mental** demands of your work ?

very good (5)	rather good (4)	Moderate (3)	Rather poor (2)	Poor (1)

3. Number of current diseases

☐ None

☐ .....diseases (please specify)

Diseases diagnosed by a physician.....

Diseases diagnosed by your own opinion.....

4. Estimated work impairment due to diseases

Is your illness or injury a hindrance to you current job ?

Circle more than one alternative if needed.

There is no hindrance/ I have no diseases.....(6)

I am able to do my job, but it causes some symptoms.....(5)

I must sometime slow down my work pace or change my work methods.....(4)

I must often slow down my work pace or change my work methods.....(3)

Because of my disease, I feel I am able to do only part-time work.....(2)

In my opinion, I am entirely unable to work.....(1)

5. Sick leave during the past year (12 months)

How many whole days have you been off work because of a health problem

(disease or health care or for examination) during the past year (12 month)

None at all .....(5)

At the most 9 days.....(4)

10 - 24 days.....(3)

25 -99 days.....(2)

100 - 365 days.....(1)

6. own prognosis of work ability two years from now

Do you believe that, from standpoint of your health, you will be able to do your current job two years from now ?

unlikely.....(1)

not certain.....(4)

relatively certain.....(7)

7. Mental resources

Have you recently been able to enjoy your regular daily activities ?

Often (4)	rather often (3)	sometimes (2)	rather seldom (1)	never (0)

Have you recently been active and alert ?

always (4)	rather often (3)	sometimes (2)	rather seldom (1)	never (0)

Have you recently felt yourself to be full of hope for the future ?

continuously (4)	rather often (3)	sometimes (2)	rather seldom (1)	never (0)

APPENDIX D

LETTER OF ASKING FOR RESEARCH PERMISSION

ที่ ศธ 0512.38 / 1129

วิทยาลัยวิทยาศาสตร์สาธารณสุข
จุฬาลงกรณ์มหาวิทยาลัย
ซ.จุฬาลงกรณ์ 62 ถนนพญาไท
แขวงวังใหม่ เขตปทุมวัน
กรุงเทพมหานคร 10330

24 กรกฎาคม 2556

เรื่อง ขอความอนุเคราะห์และอนุญาตให้นิสิตเก็บข้อมูล

เรียน ผู้อำนวยการโรงพยาบาลศิริราช

ด้วย นายวิทยา ชาญชัย รหัสประจำตัวนิสิต 5479055453 นิสิตหลักสูตรวิทยาศาสตรดุษฎีบัณฑิต สาขาวิทยาศาสตร์สาธารณสุข วิทยาลัยวิทยาศาสตร์สาธารณสุข จุฬาลงกรณ์มหาวิทยาลัย มีความประสงค์จะจัดทำวิทยานิพนธ์เรื่อง Effects of Ergonomics Intervention Program to Prevent Work-Related Musculoskeletal Disorders among Medical Orderly ที่เกี่ยวข้องกับการทำงานของพนักงานเวรเปลที่มีผลกับระบบกล้ามเนื้อ

การนี้ วิทยาลัยวิทยาศาสตร์สาธารณสุข จึงใคร่ขอความอนุเคราะห์จากท่านในการอนุญาตให้ นายวิทยา ชาญชัย เก็บข้อมูลเบื้องต้น ณ หน่วยงานเคลื่อนย้ายผู้ป่วย โรงพยาบาลศิริราช ระหว่างเดือนสิงหาคม 2556 – กรกฎาคม 2557 หากมีข้อสงสัย ติดต่อผู้รับผิดชอบคือ นายวิทยา ชาญชัย หมายเลขโทรศัพท์ 081-866-6229 หรือ email: witt@hotmail.com

จึงเรียนมาเพื่อโปรดพิจารณาให้ความอนุเคราะห์ด้วย จะเป็นพระคุณยิ่ง

ขอแสดงความนับถือ

(รองศาสตราจารย์ ดร. รัตนา สำโรงทอง)
รองคณบดี
ปฏิบัติการแทนคณบดีวิทยาลัยวิทยาศาสตร์สาธารณสุข

สำเนาเรียน หัวหน้าหน่วยงานเคลื่อนย้ายผู้ป่วย โรงพยาบาลศิริราช

คณะแพทยศาสตร์ศิริราชพยาบาล
สำนักงานรองคณบดีฝ่ายวิจัย
บางกอกน้อย กรุงเทพฯ 10700
โทร. 0 2419 2680

ที่ ศธ 0517.07/ ๐๗๔๐
วันที่ ๑๖ มิถุนายน 2557
เรื่อง ยินดีให้ความอนุเคราะห์ข้อมูลประกอบการทำวิทยานิพนธ์

เรียน คณบดีวิทยาลัยวิทยาศาสตร์สาธารณสุข จุฬาลงกรณ์มหาวิทยาลัย
อ้างถึง หนังสือ วิทยาลัยวิทยาศาสตร์สาธารณสุข จุฬาลงกรณ์มหาวิทยาลัย ที่ ศธ 0512.38/0100 ลงวันที่ 29 มกราคม 2557

ตามที่ วิทยาลัยวิทยาศาสตร์สาธารณสุข จุฬาลงกรณ์มหาวิทยาลัย ได้ขอความอนุเคราะห์ให้ นายวิทยา ชาญชัย รหัสประจำตัวนิสิต 5479055453 นิสิตหลักสูตรวิทยาศาสตรดุษฎีบัณฑิต สาขาวิทยาศาสตร์สาธารณสุข วิทยาลัยวิทยาศาสตร์สาธารณสุข จุฬาลงกรณ์มหาวิทยาลัย เข้าเก็บข้อมูลด้วยวิธีการตอบแบบสอบถามกับเจ้าหน้าที่เคลื่อนย้ายผู้ป่วย ที่มีอายุตั้งแต่ 18 ปีขึ้นไปและปฏิบัติงานเต็มเวลา เพื่อเป็นข้อมูลประกอบการทำวิทยานิพนธ์ เรื่อง "ผลของโปรแกรมการมีส่วนร่วมตามหลักการยศาสตร์เพื่อลดปัจจัยเสี่ยงทางด้านอาชีวอนามัยของพนักงานเคลื่อนย้ายผู้ป่วย" ความละเอียดดังแจ้งแล้วนั้น

คณะแพทยศาสตร์ศิริราชพยาบาล มหาวิทยาลัยมหิดล พิจารณาแล้วยินดีอนุมัติให้ นายวิทยา ชาญชัย เข้าเก็บข้อมูลได้ตามที่ขอความอนุเคราะห์มา ทั้งนี้ได้ผ่านการรับรองโครงการวิจัยจากคณะกรรมการจริยธรรมการวิจัยในคน คณะแพทยศาสตร์ศิริราชพยาบาล เมื่อวันที่ 19 พฤษภาคม 2557

จึงเรียนมาเพื่อโปรดทราบ

ขอแสดงความนับถือ

(ศาสตราจารย์ นายแพทย์ประสิทธิ์ วัฒนาภา)
รองคณบดี ปฏิบัติงานแทน
คณบดีคณะแพทยศาสตร์ศิริราชพยาบาล

สำเนาเรียน รองคณบดีฝ่ายวิจัย, ผู้อำนวยการโรงพยาบาล, หัวหน้างานเคลื่อนย้ายผู้ป่วย

APPENDIX E

ETIC CERTIFICATE OF APPROVAL

2 WAN LANG Rd. BANGKOKNOI
BANGKOK 10700

Tel. +66 2419 2667-72
Fax. +66 2411 0162

Siriraj Institutional Review Board

Certificate of Approval

COA no. *Si* 296/2014

Protocol Title : EFFECTS OF PARTICIPATORY ERGONOMIC INTERVENTION PROGRAM TO REDUCE OCCUPATIONAL RISKS AMONG HOSPITAL ORDERLIES

Protocol number : 126/2557(EC2)

Principal Investigator/Affiliation : Mr.Withaya Chanchai / College of Public Health Science Graduate School Chulalongkorn University

Research site : Faculty of Medicine Siriraj Hospital

Approval includes :

1. SIRB submission form
2. Participant Information Sheet
3. Informed Consent Form
4. Questionnaire
5. Quick Exposure Check (QEC)
6. Advertisement for recruitment
7. Curriculum vitae

Approval date : May 19, 2014

Expired date : May 18, 2015

This is to certify that Siriraj Institutional Review Board is in full Compliance with international guidelines for human research protection such as the Declaration of Helsinki, the Belmont Report, CIOMS Guidelines and the International Conference on Harmonization in Good Clinical Practice (ICH-GCP).

(Prof. Jarupim Soongswang, M.D.)
Chairperson

27 MAY 2014
date

(Clin. Prof. Udom Kachintorn, M.D.)
Dean of Faculty of Medicine Siriraj Hospital

- 2 JUN 2014
date

หน่วยพิมพ์โรงพยาบาลศิริราช 2341 / 3,000 แผ่น / พ.ย.56 / M / 2667 / Mat. 10023252

All Siriraj Institutional Review Board Approved Investigators must comply with the Following :

1. Conduct the research as required by the Protocol ;
2. Use only the Consent Form bearing the Siriraj Institutional Review Board "APPROVED" stamp ;
3. Report to Siriraj Institutional Review Board all of serious illness of any study subject ;
4. Promptly report to Siriraj Institutional Review Board any new information that may adversely affect the safety of the subjects or the conduct of the trial ;
5. Provide reports to Siriraj Institutional Review Board concerning the progress of the research, when requested ;
6. Conduct the informed consent process without coercion or undue influence, and provide the potential subject sufficient opportunity to consider whether or not to participate.

ขอเชิญชวนพนักงานเคลื่อนย้ายผู้ป่วยเข้าร่วมการวิจัย

ผลของโปรแกรมการมีส่วนร่วมตามหลักการยศาสตร์เพื่อลดปัจจัยเสี่ยงทางด้านอาชีวอนามัยของพนักงานเคลื่อนย้ายผู้ป่วย

ณ สำนักงานเคลื่อนย้ายผู้ป่วยโรงพยาบาลศิริราช ตึกผู้ป่วยนอก ชั้น 6

คุณสมบัติของผู้ร่วมโครงการวิจัย

- อายุครบ 18 บริบูรณ์หรือมากกว่า
- มีสุขภาพดี สมบูรณ์แข็งแรง
- ปฏิบัติงานเต็มเวลา
- ปฏิบัติงานมาอย่างน้อย 1 ปี

สอบถามรายละเอียดเพิ่มเติมได้ที่

นาย วิทยา ชาญชัย โทร. 081-866-6229

Email: wittt@hotmail.com

APPENDIX F

BASIC ERGONOMIC MANUAL

เวรเปลไทยใจเกินร้อย

คู่มือสำหรับพนักงานเคลื่อนย้ายผู้ป่วย

การจัดการตนเองเพื่อลดความเสี่ยงจากการประกอบอาชีพ

วิทยา ชาญชัย
วัฒน์สิทธิ์ ศิริวงศ์

การจัดการตนเองเพื่อลดความเสี่ยงจากการประกอบอาชีพ

ISBN :

ที่ปรึกษาคู่มือ

ศ.นพ. สุรศักดิ์ ฐานีพานิชสกุล คณบดีวิทยาลัยวิทยาศาสตร์สาธารณสุข จุฬาลงกรณ์ มหาวิทยาลัย

ผู้แต่ง

วิทยา ชาญชัย วิทยาลัยวิทยาศาสตร์สาธารณสุข จุฬาลงกรณ์ มหาวิทยาลัย
วัฒน์สิทธิ์ ศิริวงศ์ วิทยาลัยวิทยาศาสตร์สาธารณสุข จุฬาลงกรณ์ มหาวิทยาลัย

ผู้แต่งร่วม

วันเพ็ญ ทรงคำ คณะพยาบาลศาสตร์ มหาวิทยาลัยเชียงใหม่
อุมาพร ครองสกุลสุข กรมสวัสดิการและคุ้มครองแรงงาน

พิมพ์ครั้งที่ 1
จำนวนเล่ม 500 เล่ม
พิมพ์ที่ : ห้างหุ้นส่วนจำกัด เอส.ออฟเซ็ท กราฟฟิคดีไซน์ 63 ประชาอุทิศ 75 แยก 5 แขวงทุ่งครุ เขตทุ่งครุ กรุงเทพมหานคร 10140 TEL: 02-8736095-6 ,02-8735857 ,02-8736069 E-mail:s.offset@hotmail.com

ทีมงานสร้างคู่มือเวรเปลไทยใจเกินร้อย

คุณปรานอม เกตุสมพร, คุณปุณณ์รัตน์ สรรพกิจขาญชัย, คุณนุกูล ดอกบัว, คุณลัดดา แก้วจินดา, คุณณัฐชไม ไตรมาศ, คุณศิริพร บัวเหม, คุณมยุรี ทองเจริญ, คุณฉัตตริน สมนาม, คุณจุฑามาศ เจริญผล, คุณภัลลภ อำรงศรีสกุล, คุณพิศณุ เจาศรี, คุณอร่าม อุดมผล, คุณวินัย กล่ำศรี, คุณประวิทย์ วงษ์ละม้าย, คุณอรรถพล กระต่ายทอง, คุณอำพร จันทร์วิเชียร, คุณอนันต์ ทองใบ, คุณประสิทธิ์ จันทนะโสตถิ์, คุณสมญา พาชัยภูมิ, คุณนิพัฒน์ นิธากรณ์

เวรเปลไทยใจเกินร้อย

คู่มือสำหรับพนักงานเคลื่อนย้ายผู้ป่วย
การจัดการตนเองเพื่อลดความเสี่ยงจากการประกอบอาชีพ

วิทยา ชาญชัย
วัฒสิทธิ์ ศิริวงศ์

คำนำ

จากการศึกษาทั่วโลกมานานหลายทศวรรษพบอาการผิดปกติของกล้ามเนื้อและกระดูกที่เกี่ยวเนื่องจากการทำงาน (Work-related Musculoskeletal Disorders, WMSDs) เกิดขึ้นมากกับบุคลากรทางการแพทย์โดยเฉพาะพนักงานเคลื่อนย้ายผู้ป่วยหรือ "เวรเปล"

พนักงานเคลื่อนย้ายผู้ป่วยมีลักษณะการทำงานที่มีความเสี่ยงด้านการยศาสตร์หลายประการ อาทิเช่น การยกและเคลื่อนย้ายผู้ป่วย และการทำงานในท่าทางที่ไม่เหมาะสม กิจกรรมเหล่านี้ส่งผลให้เกิดอาการบาดเจ็บของกล้ามเนื้อและกระดูก ที่พบมากที่สุด ได้แก่ อาการปวดหลังซึ่งพบว่ามีความสัมพันธ์กับการยกและเคลื่อนย้ายผู้ป่วยบ่อย เพื่อ เป็นการป้องกันและลดการบาดเจ็บที่อาจเกิดขึ้น ผู้เขียนจึงได้จัดทำคู่มือเล่มนี้ ซึ่งมีเนื้อหาครอบคลุม เกี่ยวกับการลดปัจจัยเสี่ยงจากประกอบอาชีพของพนักงานเคลื่อนย้ายผู้ป่วย โดยใช้วิธี การเรียนรู้แบบมีส่วนร่วมตามหลักการยศาสตร์ เป็นกรอบแนวทางในการจัดทำคู่มือฉบับนี้ขึ้น เพื่อก่อให้เกิดความยั่งยืนต่อพนักงานเคลื่อนย้ายผู้ป่วย ในส่วนของตัวบุคคล และบุคลากรทุกระดับของโรงพยาบาล ที่จะช่วยเสริมสร้างความยั่งยืน ในการจัดการปัญหาความเสี่ยงจากการประกอบอาชีพ รวมทั้งสภาพแวดล้อมการทำงาน ของพนักงานเคลื่อนย้ายผู้ป่วยได้อย่างมีประสิทธิภาพ

ผู้เขียนขอขอบพระคุณผู้ที่มีส่วนร่วมทุกท่านในการจัดทำคู่มือเล่มนี้ โดยเฉพาะพนักงานเคลื่อนย้ายผู้ป่วยโรงพยาบาลศิริราช คณะแพทยศาสตร์ มหาวิทยาลัยมหิดล ผู้เขียนหวังเป็นอย่างยิ่งว่า คู่มือเล่มนี้จะเป็นประโยชน์ต่อพนักงานเคลื่อนย้ายผู้ป่วยและผู้ที่เกี่ยวข้องที่กำลังแสวงหาแนวทางในการจัดการตนเองเพื่อลดความเสี่ยงจากการประกอบอาชีพของพนักงานเคลื่อนย้ายผู้ป่วย รวมทั้งผู้สนใจทั่วไป หากมีข้อผิดพลาดประการใด ผู้เขียนยินดีน้อมรับข้อเสนอแนะเพื่อนำไปพัฒนาและปรับปรุงแก้ไขให้ดียิ่งขึ้นต่อไป

วิทยา ชาญชัย
วัฒน์สิทธิ์ ศิริวงศ์
มิถุนายน 2557

แนะนำตัวละครประจำหน่วยงานเคลื่อนย้ายผู้ป่วย

พี่จุ่น

·สนุกกับงานและมีความสุข

พี่เอี้ยง

·ได้ทำบุญกับคนไข้ชอบในงานบริการ มีความเป็นพี่น้อง

พี่บอล

·เหนื่อยแต่ไม่ท้อ ภูมิใจที่มีวันนี้กับงานบริการ·

พี่ตั้น

·รู้สึกดีใจที่ได้เป็นส่วนร่วมและได้เป็นส่วนหนึ่งของโรงพยาบาล

พี่เบิ้ล

·สุขกาย สุขใจ

พี่น้อย

·มีความสุขดีถึงแม้งานมันจะหนักและเหนื่อย·

1

ความเสี่ยงจากปัจจัยส่วนบุคคล

2


สวัสดีครับน้อง ๆเปลทุกคน วันนี้พี่ต้นมีเรื่องดี ๆมาบอก
วันนี้มีเรื่องอะไรมาอัพเดทครับท่านพี่
น้องรู้หรือไม่ว่ามีความเสี่ยงอะไรบ้างในการทำงาน
ที่อาจจะเกิดอุบัติเหตุในเวลาที่เรา
เคลื่อนย้ายผู้ป่วย???
มีอะไรบ้างครับท่านพี่
3


เรามาดูกันที่ละหัวข้อนะพี่จะสรุปให้ฟังแบบง่าย ๆ
อ่อมันเป็นแบบนี้นี่เองครับ
โดยสรุปแล้วปัจจัยที่เกี่ยวข้องกับปัจจัยส่วนบุคคลที่
ส่งผลทำให้เกิดความไม่ปลอดภัยในการทำงานได้แก่
น้ำหนักตัว
สุขภาพร่างกายและการเจ็บป่วย
การพักผ่อนไม่พอ
การดื่มเครื่องดื่มชูกำลังและเครื่องดื่มประเภทแอลกอฮอล์
การสูบบุหรี่
ขาดการออกกำลังกาย
ความเครียด เป็นต้น
ฉ้อยคำชวนคิด
ร่วมแรงแข็งขัน ทุกวันปลอดภัย
4

5

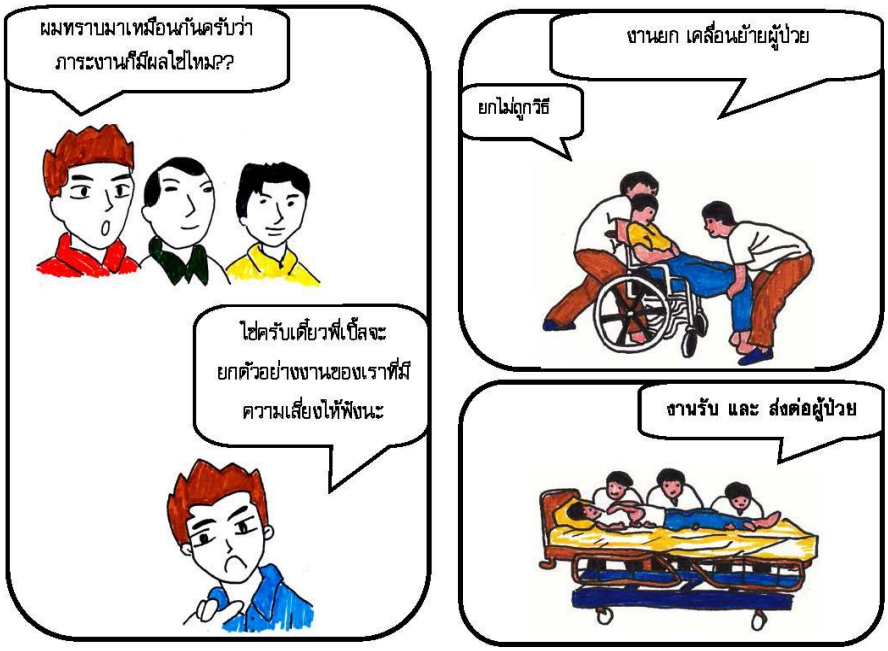
ส่วนหนึ่งของความรู้สึกดีๆ กับงานเคลื่อนย้ายผู้ป่วย "สุขกายสุขใจ"

บันทึกเคล็ดลับในการจัดการตนเองเพื่อลดความเสี่ยงจากปัจจัยส่วนบุคคล

6

ความเสี่ยงจากการปฏิบัติงาน

7



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ส่วนหนึ่งของความรู้สึกดีๆ กับงานเคลื่อนย้ายผู้ป่วย "อยากให้หน่วยงานเปลี่ยนแปลงไปในทางที่ดี อยากให้ทุกคนสนุกกับงานที่ดีกว่า"

โดยสรุปแล้วปัจจัยที่เกี่ยวข้องกับงานที่ส่งผลให้เกิดความไม่ปลอดภัยในการทำงานได้แก่

1. ลักษณะการทำงาน เช่น ภาระงานที่มีจำนวนมาก และ จำนวนผู้ป่วยที่มาใช้บริการจำนวนมาก ได้แก่
   - น้ำหนักผู้ป่วยมาก
   - การไม่ให้ความร่วมมือจากผู้มารับบริการ
   - ความเร่งรีบในการทำงาน
   - การทำงานกะ
2. พฤติกรรมการทำงาน เช่น การปฏิบัติพฤติกรรมที่ไม่ถูกต้อง เหมาะสม ได้แก่
   - การไม่ใส่อุปกรณ์ป้องกันอันตรายส่วนบุคคล
   - การยก/เคลื่อนย้ายผู้ป่วยผิดวิธี
   - ไม่ใช้อุปกรณ์ในการช่วยยก /เคลื่อนย้ายผู้ป่วย
   - เร่งรีบ ในการทำงาน จนลืมเรื่องความปลอดภัยในการเคลื่อนย้ายผู้ป่วย
   - การควบกะ
   - ขาดการทำงานเป็นทีม

น้องคำชวนคิด

ใส่ใจสักนิด...ชีวิตปลอดภัย

ส่วนหนึ่งของความรู้สึกดีๆ กับงานเคลื่อนย้ายผู้ป่วย "เหนื่อยแต่สู้ และดีใจที่ได้เป็นส่วนหนึ่งในงานได้ทำบุญด้วยรักงานมากๆ

ส่วนหนึ่งของความรู้สึกดีๆ กับงานเคลื่อนย้ายผู้ป่วย "รู้สึกมีความสุขเวลาทำงานถึงแม้จะเหนื่อยก็ตามแต่เดี๋ยวก็หายไปเอง

11

ส่วนที่เหลือความรู้สึกดีๆ กับการเคลื่อนย้ายผู้ป่วย "มีความสุขในทุกๆวัน"

บันทึกเกี่ยวกับในการดูแลการคนเองเพื่อลดความเสี่ยงจากการปฏิบัติงาน

12

ความเสี่ยงจากปัจจัยสิ่งแวดล้อม

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โดยสรุปแล้วปัจจัยสิ่งแวดล้อมที่ส่งผลทำให้เกิดความไม่ปลอดภัยในการทำงานได้แก่

- เส้นทางการเคลื่อนย้าย (คับแคบ, ไม่เรียบ, ลาดชัน)
- สถานที่ทำงาน (ขาดพื้นที่ในการจัดเก็บอุปกรณ์, จัดเก็บไม่เป็นระเบียบ)
- สภาพแวดล้อมอื่นๆ (แสงสว่างไม่เพียงพอ, การระบายอากาศที่ไม่ดี, อากาศร้อน, อากาศหนาว, ฝนตก)

ข้อยคำชวนคิด

มีสติ...มีความปลอดภัย

15

ส่งแฟนของความรู้สึกดีๆ กับงานเคลื่อนย้ายผู้ป่วย "รู้สึกได้เสียสละเวลาส่วนตัว เพื่อโรงพยาบาลเพียงน้อยนิด"

บันทึกเหตุการณ์ในการฝึกการลงมือเพื่อลดความเสี่ยงจากปัจจัยด้านสิ่งแวดล้อม

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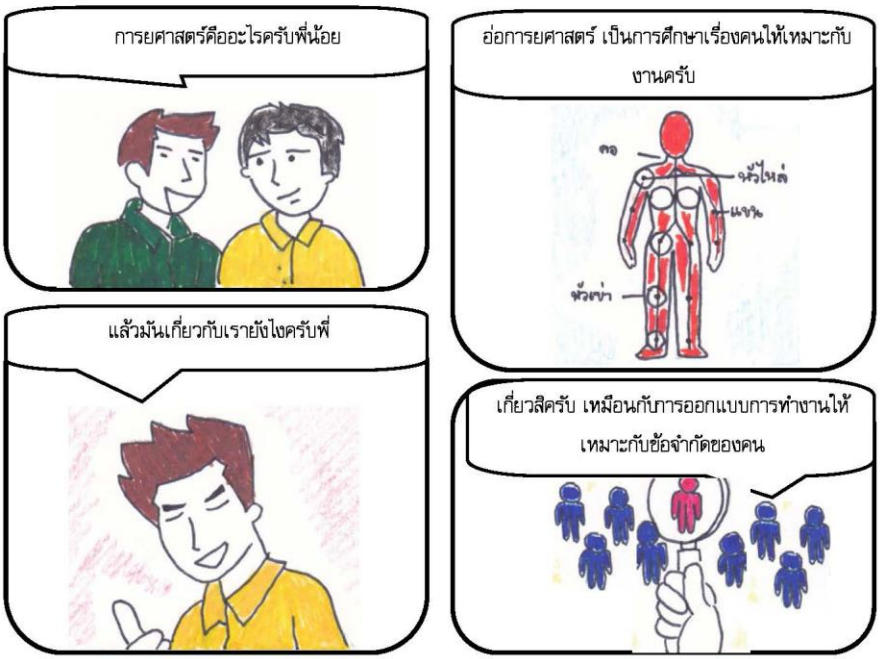
การยศาสตร์กับการทำงานแคล่อนย้ายผู้ป่วย

17



18

19

ส่วนหนึ่งของความรู้สึกดีๆ กับงานเคลื่อนย้ายผู้ป่วย "ได้ทำบุญกับคนใช้ชอบในการบริการ มีความเป็นพี่น้องกันความรู้สึกเหมือนครอบครัวใหญ่"

ฉ้อยคำชวนคิด

ความปลอดภัยไม่มีขาย
ถ้าอยากได้ต้องทำเอง

20

ส่วนหนึ่งของความรู้สึกดีๆ กับงานเคลื่อนย้ายผู้ป่วย "มีความสุขดีจังเมื่องานนั้นจบหน้าและเหนื่อย"

บันทึกภาระงานที่รับผิดชอบ

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สภาพการทำงานที่อาจทำให้เกิดผลกระทบต่อสุขภาพของพนักงานเคลื่อนย้ายตู้ปอย

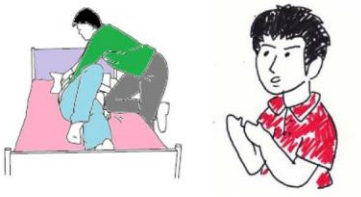
ด้านท่าทางการทำงานบิดงอตัน

(การยศาสตร์)

22

การเคลื่อนย้ายผู้ป่วยด้วยตนเองนั้น
ต้องปฏิบัติท่าทางที่ถูกต้องนะครับ

พิจารณาจากน้ำหนักตัวผู้ป่วยด้วยครับ



เพื่อป้องกันโรคกระดูกและกล้ามเนื้อที่จะตามมานะ
ครับ

ถ้าพิจารณาแล้วยกคนเดียวไม่ได้ให้เรียกคนอื่นมา
ช่วยนะครับ

23

นอกจากนั้น อุปกรณ์ ใกล้ตัวเช่น ผ้าห่ม สามารถใช้
เป็นตัวช่วยได้ครับ จัดท่าทางให้เหมาะสม โน้มตัวไป
ข้างหน้า

ทำการยกผู้ป่วยขึ้น
โดยอุปกรณ์ ให้หลังตั้งฉากตรงกับพื้น

ถ้อยคำชวนคิด

อย่าคิดว่าไหว เพราะอาจไม่
ปลอดภัยกับตัวเอง

24

การสร้างจิตสำนึกที่ดีต่องานเคลื่อนย้ายผู้ป่วย

25

26

ก้อยคำชวนคิด

ปลอดภัยไว้ก่อน

บันทึกความดีต่องานเคลื่อนเข้าสู่ผู้ป่วย

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ACC.Techniques for safer patient handling. [Online]. Source: http://www.acc.co.nz/PRD_EXT_CSMP/idcplg?IdcService=GET_FILE&dID=2714&dDocName=PI00294&allowInterrupt=1

Work safety BC.High Risk Manual Handling of Patients in Health Care. [Online]. 2005. Source: http://www.worksafebc.com/publications/health_and_safety/by_topic/assets/pdf/handling_patients_bk97.pdf

ขอขอบคุณ

วิทยาลัยวิทยาศาสตร์สาธารณสุข จุฬาลงกรณ์มหาวิทยาลัย

พนักงานเคลื่อนย้ายผู้ป่วยทุกท่านที่เข้ามามีส่วนร่วม

ช่วยเหลือสนับสนุน และเป็นแรงผลักดันให้คู่มือเล่มนี้เกิดขึ้นได้จริง

โดยเฉพาะงานเคลื่อนย้ายผู้ป่วย โรงพยาบาลศิริราช คณะแพทยศาสตร์ ศิริราชพยาบาล

มหาวิทยาลัยมหิดล

APPENDIX G

PARTICIPATORY ERGONOMIC WORKSHOP PHOTOS

Figure 15 The first workshop was conducted aims to form and train the facilitators.

Figure 16 The first workshop was conducted aims to form and train the facilitators.

Figure 17 The first workshop was conducted aims to form and train the facilitators.

Figure 18 The first workshop was conducted aims to form and train the facilitator

APPENDIX H

WORK PLACE IMPROVEMENT PHOTOS

Figure 19 Use a step or ladder when patient handling to address height difficulties

Figure 20 Design a workstation with an optimal access zone

Figure 21 Design a workstation with an optimal access zone

Figure 22 Reduce awkward postures when lifting and transferring the patient

APPENDIX I

BASIC EXERCISE PHOTOS

Figure 23 Warm-up basic exercises after work

Figure 24 Warm-up basic exercises after work

APPENDIX J

TRAINING PROGRAM PHOTOS

Figure 25 Group photo

Figure 26 Group discussion

Figure 27 Good points of the participant training

Figure 28 The participatory ergonomic training base on participatory ergonomics concept, and inspired by Participatory-Action-Oriented Training

APPENDIX K

FLOW CHART PRESENTATION TO DIRECTOR OF SIRIRAJ HOSPITAL

BY HEAD OF PATIENT TRANFER SERVICE DEPARTMENT

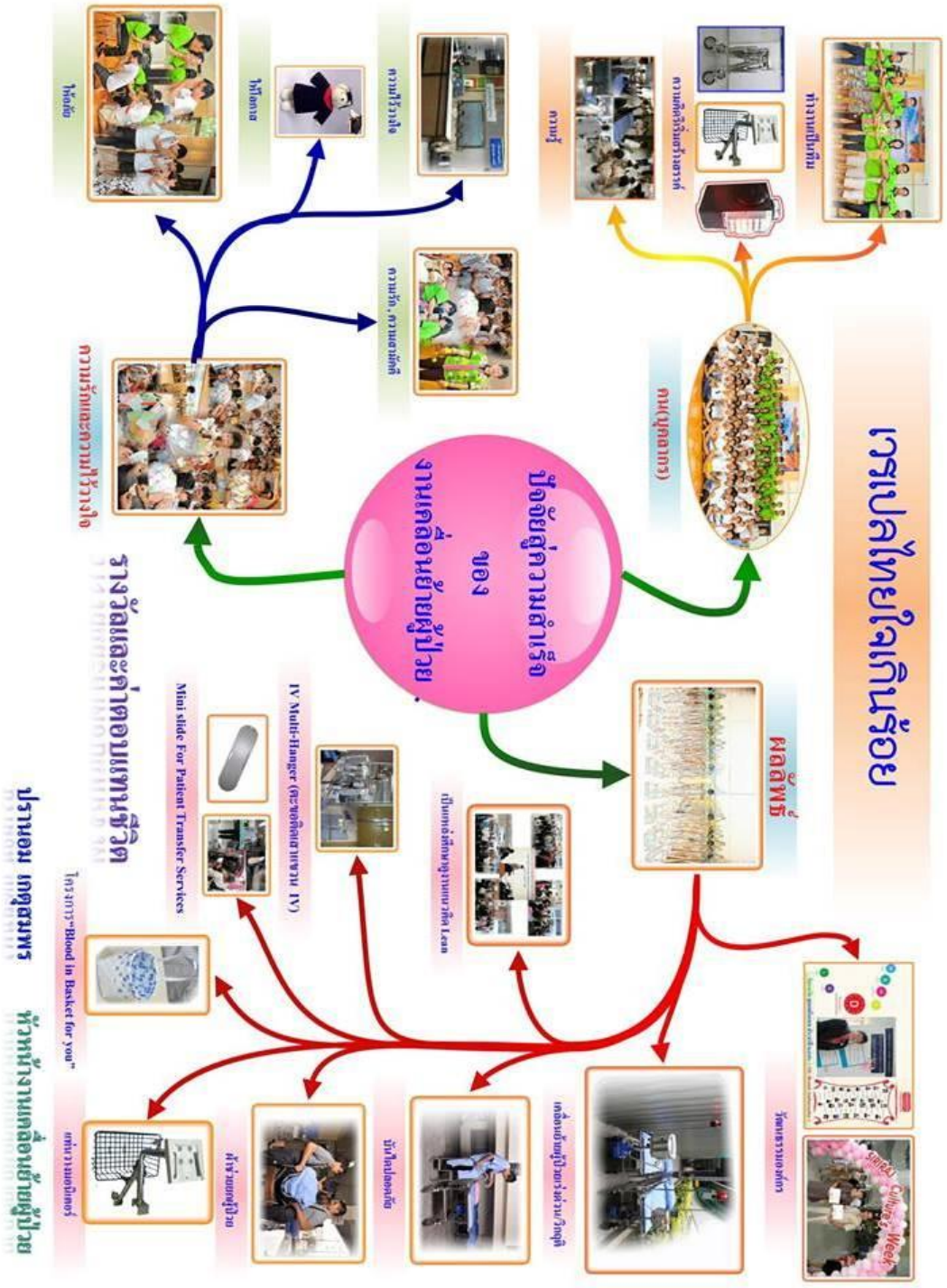

Figure 29 Flow chart of hospital orderlies task

VITA

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