นิพนธ์ต้นฉบับ

(Original article)

Reducing ergonomic risk factors by workplace improvement based on ILO CHECKPOINTS among laundry workers

การลดความเสี่ยงด้านการยศาสตร์โดยการปรับปรุงสถานีงานตามหลักการของ ILO CHECKPOINTS ในกลุ่มคนงานซักรีด

Parvena Meepradit[1]*, Natchakhunporn Praditpruk[2], Tanongsak Yingratanasuk[3]

ปวีณา มีประดิษฐ์[1]*, นัฐชกุลพร ประดิษฐ์พฤกษ์[2], ทนงศักดิ์ ยิ่งรัตนสุข[3]

[1]Faculty of Public Health, Burapha University (parvena@go.buu.ac.th)

[1]คณะสาธารณสุขศาสตร์ มหาวิทยาลัยบูรพา

[2]IRPC Public Company Limited

[2]บมจ.ไออาร์พีซี บริษัท ไออาร์พีซี จำกัด

[3]Independent Scholar

[3]นักวิชาการอิสระ

***Corresponding author**

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ABSTRACT: The International Labour Organization checkpoints guideline constitutes a framework for the study's analysis and improvement of ergonomic risk factors. These guidelines are based on practical terms and low-cost ergonomic improvements. This study aimed to improve workstations in compliance with to lower ergonomic risks. Twenty samples satisfied the inclusion criteria and were evaluated. The Rapid Upper Limb Assessment for sorting workers, the Rapid Entire Body Assessment for workers who wash, spin, dry, iron, and fold products into plastic bags, and the revised NIOSH lifting equation for moving workers were among the data gathering methods used. After the intervention in seven processes, the results were found that the progressing with improvements gradually was advised. Setting priorities for the 1 1 elements in the ergonomic checkpoints is necessary. The findings demonstrated a significant reduction ($p < .05$) in the ergonomic risks for workers who perform tasks like washing, spinning, ironing, packing, and transportation. In order to address occupational health and safety, the results highlight the significance of work practices and station improvement.

Keywords: Reducing ergonomic risk; Workplace improvement; ILO checkpoint; Laundry workers

บทคัดย่อ: แนวปฏิบัติเกี่ยวกับจุดตรวจขององค์การแรงงานระหว่างประเทศ (International Labour Organization: ILO) ถือเป็นกรอบสำหรับการวิเคราะห์และการปรับปรุงปัจจัยเสี่ยงด้านสรีรศาสตร์ของการศึกษา แนวปฏิบัติเหล่านี้มีพื้นฐานมาจากคำศัพท์เชิงปฏิบัติและการปรับปรุงสรีรศาสตร์ที่ประหยัดต้นทุน การศึกษานี้มีวัตถุประสงค์เพื่อปรับปรุงสถานีงานให้สอดคล้องกับความเสี่ยงด้านสรีรศาสตร์ที่ลดลง กลุ่มตัวอย่าง 20 คนสอดคล้องกับเกณฑ์การคัดเข้า วิธีการรวบรวมข้อมูลที่ใช้ ได้แก่ การประเมินความเสี่ยงของท่าทางในการทำงานบริเวณแขนขาส่วนบนสำหรับพนักงานคัดแยก การประเมินความเสี่ยงของท่าทางในการทำงานทั่งร่างกายสำหรับพนักงานที่ซัก ปั่น อบแห้ง รีด และพับผลิตภัณฑ์ลงในถุงพลาสติก และการประเมินความเสี่ยงด้วยสมการการยกของ NIOSH สำหรับพนักงานที่มีการยกเคลื่อนย้ายวัตถุ หลังจากการปรับปรุงกระบวนการทั้ง 7 กระบวนการ ผลการศึกษาพบว่า มีกระบวนการทำงานที่ได้รับการปรับปรับภายหลังจากให้คำแนะนำ โดยดำเนินการตามคำแนะนำ ergonomic checkpoints 11 ข้อ ของ ILO ผลการวิจัยแสดงให้เห็นว่าความเสี่ยงด้านการยศาสตร์ลดลงอย่างมีนัยสำคัญ ($p < .05$) สำหรับผู้ปฏิบัติงาน เช่น การซักผ้า การปั่น การรีดผ้า การบรรจุ และการขนส่ง เพื่อแก้ไขปัญหาอาชีวอนามัยและความปลอดภัย ผลการวิจัยนี้เน้นย้ำถึงความสำคัญของแนวทางปฏิบัติในการทำงานและการปรับปรุงสถานี

คำสำคัญ: การลดความเสี่ยงด้านการยศาสตร์; การปรับปรุงสถานีงาน; ILO Checkpoint; คนงานซักรีด

1. INTRODUCTION

Laundry operations in small-scale enterprises include sorting, washing, spinning, drying, ironing, folding clothing into plastic bags, and shipping. According to each stage, the majority of workers were standing and working eight hours a day, additional two to three hours paid overtime. The issue regarding posture at work, which includes reaching out, bending back, twisting the body, and lifting excessively

The International Labor Organization (ILO) checkpoint[1] which is a checklist for identifying fundamental ergonomic issues and practical, inexpensive remedies in the wash factory, was used for the preliminary survey. The findings showed that there was no adequate handle for the handling and storage of products, such as trolleys used for transferring clothing. The employees' bodies twisted and bent while they pushed and lifted heavy garments. Furthermore, issues with height of the desk along with other work station design issues are below elbow level. The majority of those times, the workers stood watching while they worked. Well-being may be impacted by these, particularly in the musculoskeletal system.

Laundry staff members reported the greatest Rapid entire body assessment (REBA) risk score level relative to the rest of the service department, according to research on hazardous working positions and the incidence of musculoskeletal diseases (MSDs) among non-healthcare workers at Naradhiwasrajanakarindra Hospital[2]. According to a study examining how work posture affects MSDs among laundry workers in Indonesia's Tembang region. The findings indicated that the neck, shoulders, arms, fingers, back, waist, and lower back muscles are all susceptible to MSDs. The most common musculoskeletal problem was lower back discomfort. An employee's opportunity to experience musculoskeletal problems increases with the duration of their employment. Furthermore, poor posture, repeated motions, an unpleasant work attitude, and excessive stretching while working are all factors that contribute to MSDs[3].

Based on the results of the preliminary investigation and the literature analysis, the health effects of ergonomic issues in the washing industry workers' workspace have been identified. Therefore, the researcher aimed to reduce the ergonomic risk MSDs of a laundry factory employee in Rayong Province by improving the working area in accordance with the ILO guidelines, improving workstation ergonomics focuses on material handling, storage, and workstation design to mitigate ergonomic risk factors that may contribute to musculoskeletal disorders. These risk factors are assessed using ergonomic tools such as the revised NIOSH lifting equation, Rapid Upper Limb Assessment (RULA), and REBA. Additionally, the researcher aimed to provide as a guideline for health surveillance for employees in this industry.

2. METHODS

2.1 Study design

This research used a quasi-experimental one-group pre-post-test design, carried out for three months.

2.2 Sample size and sampling

The subjects were selected from within those who were employed for a laundry service and were willing to participate. After achieving the requirements for inclusion, twenty samples were assessed for their capability to understand and communicate in Thai. Using a variety of observational techniques, including REBA, RULA, and the NIOSH lifting equation, the posture evaluations were carried out by taking frames from video recordings. The RULA analysis were carried out based on the three sorting workers' observed postures. Washing (3 workers), spinning (2 workers), drying (2 workers), ironing (3 workers), and packaging (3 workers) were among the tasks where the REBA approach was used to identify posture-related concerns in a standing position. For the transportation of four workers, the NIOSH lifting equation was also assessed.

2.3 Data collection

2.3.1 Posture analysis

The NIOSH lifting equation for transportation workers, the Rapid Upper Limb Assessment (RULA) for sorting workers, and the Rapid Entire Body Assessment (REBA) for workers who wash, spin, dry, iron, and fold goods into plastic bags were used to collect data before and after an improved work station. Table 1 displays the risk categories and preventative measures based on the derived RULA, REBA, lifting index from NIOSH lifting equation ratings. The body position angles in the REBA and RULA procedures were estimated using the angle meter program.

2.3.2 Implementation of ILO checkpoint

Without focusing on expensive and extremely complex technologies, this research applied ergonomic intervention based on ILO checkpoints in seven processes: sorting, washing, spinning, drying, ironing, packing, and shipping. Additionally, the personnel received training on safe lifting techniques and posture.

The section operationalized the ILO Ergonomic Checkpoints into two thematic dimensions appropriately. The designated 10 items were adapted from the original set of 132 checkpoint recommendations and structured as follows:

1. Material storage and handling (4 items)
2. Workstation design (6 items)

Each item was scored using a binary scale: "Yes" (compliance with the recommended checkpoint), and “No" (non-compliance or absence of measures.

Table 1 REBA and RULA scoring results

RULA score	REBA score	Lifting index
1-2 = acceptable posture	1 = negligible Risk	≤ 1 = without significantly increase the risk of work-related injury
3-4 = further investigation, change may be needed	2-3 = low Risk. change may be needed.	> 1-3 = increase risk of lifting related low back pain for some fraction of the workforce
5-6 = further investigation, change soon	4-7= medium Risk. further Investigate. Change Soon.	> 3 = increase risk of work-related injury when performing highly stressful lifting task
7 = investigate and implement change	8-10 = High Risk. Investigate and Implement Change 11+ = Very High Risk. Implement Change	

2.4 Data Analysis

Utilizing non-parametric methods, such as the Wilcoxon signed-rank test for paired data, the locations of the RULA, REBA, and NIOSH lifting index scores were compared before and after the improved based on ILO checkpoints. Considering that the data utilized in this investigation originated from tiny, non-normal distributions[7].

This study was approved by the Human Research Committee of Burapha University, Thailand (Reference No. IRB008/2561).

3. RESULTS

Used the ergonomic checklists from ILO checkpoints for taking a fresh look at workplace conditions in seven processes: sorting, washing, spinning, drying, ironing, packing, and transporting (Fig. 1). The workplace conditions propose actions indicated 12 from 30 items (related to the materials storage and handling, and workstation design) at locally practicable improvements (Table 2). After discussing in a group for selecting the better solutions found by multiple ideas coming from workers and manager. The prioritized actions derived from many ideas and reached a consensus that is beneficial to the people concerned 11 items except providing sitting workers with adjustable chairs with a backrest.

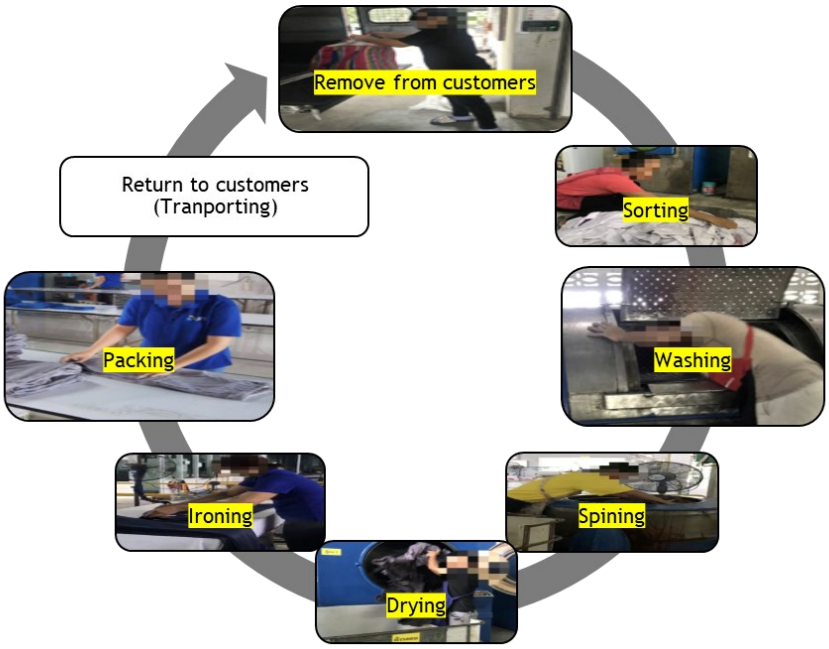


Fig. 1 Laundry processes are areas of study.

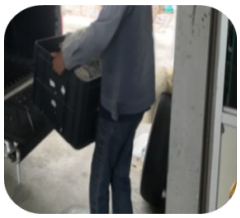
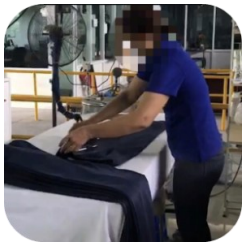
Table 2 Workplace conditions propose action from related ergonomic checklist

Ergonomic checklist	Workplace conditions propose action
1. Materials storage and handling	Instead of carrying heavy weights, divide them into smaller light weight packages, containers or rays. Provide hand holds, grips, or good holding points for all packages and containers. Move materials horizontally at the same working height. Eliminate tasks that require bending or twisting while handling materials. Keep objects close to the body when manually handling materials.
2. Workstation design	Adjust the working height for each worker at elbow level or slightly below it. Make sure that the workplace accommodates the needs of smaller workers. Make sure that the workplace accommodates the needs of taller workers. Makesure that workers can stand naturally,with weight on both feet,and perform work close to and in front of the body. Allow workers to alternate standing and sitting at work as much as possible. Provide standing workers with chairs or stools for occasional sitting. Provide sitting workers with good adjustable chairs with a backrest.

It was suggested to make improvements gradually. This requires prioritizing the 11 components in the ergonomic checkpoints. Consequently, it makes sense to enhance. The findings indicated that just five processes had a significant reduction in the ergonomic risks that all process workers experience (Table 3).

Table 3 The advance improved base on ILO checkpoint

Process	Improvement	Picture	ILO checkpoint
1. Transporting	- Luggage changing	 (pre-intervention)  (post-intervention)	CHECKPOINT 11 Instead of carrying heavy weights, divide them into smaller lightweight packages, containers, or trays. CHECKPOINT15 Keep objects close to the body when manually handling materials.
2.Transporting, washing, spinning, & drying	- Handhold providing	 (pre-intervention)  (post-intervention)	CHECKPOINT12 Provide handholds, grips or good holding points for all packages and containers
	- Luggage changing for grip and good holding	 (pre-intervention)	

Process	Improvement	Picture	ILO checkpoint
		 (post-intervention)	
3. Ironing	- Table height increasing	 (pre-intervention)  (post-intervention)	CHECKPOINT 14 Eliminate tasks that require bending or twisting while handling materials. CHECKPOINT51 Adjust the working height for each worker at elbow level or slightly below it. CHECKPOINT53 Make sure that the workplace accommodates the needs of taller workers.
4. Drying	- Use ladle	 (pre-intervention)  (post-intervention)	CHECKPOINT 52 Make sure that the workplace accommodates the needs of smaller workers. CHECKPOINT62 Provide a sound and stable footing and sufficient guarding arrangements for work in high places.
5. Ironing & Packing	- Chair preparing for selection	 (pre-intervention)	CHECKPOINT56 Make sure that workers can stand naturally, with weight on both feet and perform work close to and in front of the body.

Process	Improvement	Picture	ILO checkpoint
		 (post-intervention)	
6. Packing	- Chair preparing	 (pre-intervention  (post-intervention	CHECKPOINT 57 Allow workers to alternate standing and sitting at work as much as possible.

After implementing ILO-recommended ergonomic principles to improve the workspace in seven processes, the majority of employees had ergonomic risks in lifting tasks and working postures were found to be decreased following the implementation of work area enhancement. (Table 4).

Table 4 Ergonomic risk analysis

Task	Tool assessment	N=20	Aversage score		Z	p-value
			Before improvement	After improvement		
1.Sorting	RULA	3	7.00	7.00	0.00	0.50
2.Washing	REBA	3	11.50	10.50	-1.73	0.04*
3.Spinning	REBA	2	11.00	9.50	-1.73	0.04*
4.Drying	REBA	2	12.00	11.50	-1.00	0.15
5.Ironing	REBA	3	10.00	6.00	-1.73	0.04*
6.Packing	REBA	3	10.00	6.00	-1.73	0.04*
7.Transporting	NIOSH lifting	4				
- lowering	equation		6.14	1.24	-1.86	0.03*
- lifting			7.02	1.28	-1.86	0.03*

N = number of workers; * = p-value<0.05.

4. DISCUSSION

Prior to implementing ILO-recommended ergonomic principles to improve the workspace, the majority of employees had extremely high average scores for the potential hazards of their working postures. Workers frequently bend their necks and backs, among other improper working positions, when sorting clothing, for instance. putting clothes in and taking them out of water extractors, dryers, and washing machines. Reaching out, the clothes were removed from the machine. Because there are no grip points on the clothing transfer trolley, people are assuming positions that break their wrists. Similarly, Taweepiriyajinda et al. reported the incidence of hazardous working posture and work-related musculoskeletal illnesses (WMSDs) among non-healthcare workers at Naradhiwasrajanakarindra Hospital. They found that the laundry service staff had the highest REBA risk score level when compared to the other service departments[2].

Following the renovation of the workspace, which included instruction on proper lifting techniques and ergonomic work postures, as well as an explanation of the potential health risks and examples to aid all staff members in understanding. Enhancing the workspace in a practical, uncomplicated manner that takes into account the suitability of each workstation and doesn't have to be expensive. In order to upgrade the laundry factory's workspace, it costs about 10,000 baht to build a cart handle and buy bases, seats, silicone, compressed mattresses, and clothing bins.

Employee ergonomic risks in lifting tasks and working postures were found to be decreased following the implementation of work area enhancement based on ILO ergonomic principles. This aligns with the research conducted by Suhardi et al. who used ergonomic checkpoints to enhance the production process in the batik fabric stamping station to comply with ILO ergonomic guidelines[8]. The goal was achieved by making the work table and batik fabric mold handles more suitable, which can help lower employee ergonomic risks. Following the findings of Dastranj & Helali studied sample of 60 pharmaceutical business employees were given ergonomic checkpoints together with participatory ergonomics (PE) concepts. The findings demonstrated its applicability for enhancing work schedules and creating work systems in accordance with ILO norms, which reduced ergonomic risks and employee health issues[9].

Furthermore, the limitation of the study used the Wilcoxon signed rank test might be the most appropriate to use in this research. It was discovered that the best test for non-normal distributions, especially for small sample sizes (Imam et.al, 2014). It can be difficult to find the optimum summary measure because nonparametric approaches are, at best, indirect functions of conventional location measurements[10]. To enable more accurate statistical analysis, such as the paired t-test, future research ought to consider considering increasing the sample size.

5. CONCLUSION

The assessment and mitigation of ergonomic risk factors in the study is based on the International Labour Organization's (ILO) checkpoints guideline. so many practical, inexpensive ergonomic enhancements serve as the foundation for those recommendations. Examples include materials-handling techniques, ergonomically designed handholds, and office layouts. The knowledge gained from these locally achieved innovations is extremely beneficial to ergonomic applications. It is becoming increasingly evident that local shop floor improvements should be shared with other businesses where similar improvements could be achieved.

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References

1. International Labour Organization. Ergonomic Checkpoints: Practical and Easy-to-implement Solutions for Improving Safety, Health and Working Conditions. International Labour Office Publisher; 1996.
2. Taweepiriyajinda S, Jamulitrat S, Sungkhapong A. Hazardous working posture and prevalence of musculoskeletal disorders among non-healthcare workers of Naradhiwasrajanakarindra hospital. KKU Research Journal (Graduate Studies) 2015;15(2): 80-8.
3. Ekawati, Wahyuni, I. The influence of work posture to the musculoskeletal disorder on laundry workers in Tembalang region. In Nurjanah, SKM, M.Kes (Ed.), International seminar and workshop on public health action “Building health community”; 2015. p. 120-26.
4. Waters TR, Putz–Anderson V, Garg A. Applications manual for the revised NIOSH lifting equation. Cincinnati, OH: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health, DHHS (NIOSH) Publication No. 94-110 (Revised); 2021.
5. McAtamney L, Corlett EN. RULA: a survey method for the Investigation of work-related upper limb disorders. Appl Ergon. 1993;24(2):91-9.
6. Hignett S, McAtamney L. Rapid entire body assessment (REBA). Appl Ergon 2000;31(2): 201-5.
7. Rosner B, Robert J, Glynn RJ, Lee MLT. The Wilcoxon signed rank test for paired comparisons of clustered data. Biometrics 2006;62(1):185–92.

8. Suhardi B, Zoratoshi N, Laksono PW, Custodio BP. Ergonomic checkpoints as the base of stamping station work facilities Improvement, Institute of Electrical and Electronics Engineers (IEEE) (Eds.), 2nd International Conference of Industrial, Mechanical, Electrical, and Chemical Engineering (ICIMECE); 2016. p. 136-41.
9. Dastranj F, Helali F. Implementation “job enrichment” with using ergonomic checkpoints i an “appreciative way” at a manufacturing company in an industrially developing and its meta-reflection. J Ergonomics. 2016;6(4):1-14.
10. George D, James NH, Ronald H, Jacqueline D. A review of analysis and sample size calculation considerations for Wilcoxon tests. Anesth Analg. 2013;117(3):699-710.