

Musculoskeletal Disorders Among Caregivers in Nursing Home

Hardianto Iridiastadi*, Bayuardi Anggawisnu
Faculty of Industrial Technology
Institut Teknologi Bandung
Bandung, Indonesia
*hiridias@vt.edu

Erry Rimawan
Graduate Program
Universitas Mercu Buana
Jakarta, Indonesia

Abstract— Manual handling of patients is a prevalent phenomenon in hospitals as well as nursing homes. The task of handling patients is ergonomically challenging, since it involves pushing, lifting, or lowering, which are often performed while adopting poor postures (e.g., excessive reaching, bending, or twisting). Epidemiology studies have demonstrated that these ergonomic risk factors are associated with musculoskeletal disorders (MSDs) among nurses and caregivers. The objective of this study was to describe MSDs among caregivers in several nursing homes and, furthermore, to conceptually design relevant patient handling assistive technology. Standardized Nordic questionnaires were given to 14 caregivers, which is useful in determining the prevalence of MSDs in different regions of the body. In addition, a video camera was employed with the purpose of capturing common body postures adopted during handling tasks. Results of this study demonstrated that 71% of the respondents reported shoulder pain, while 79% of them reported lower back pain (LBP). While the number of respondents was fairly small, this finding still showed that MSDs were a serious ergonomic issue. Based on the data obtained in this study, the use of a patient handling technology is highly recommended in homecare settings.

Keywords— *patient handling, nursing home, caregivers, MSDs, patient handling technology*

I. INTRODUCTION (HEADING 1)

Patient handling is usually manual activities, and due to its nature, poses ergonomic risks to those performing the job. Previous studies have reported different types of musculoskeletal disorders (MSDs) that are prevalent among health professionals, such as nurses in hospitals or caregivers in nursing homes [1], [2], [3]. The prevalence of lower back pain ranks first, followed by problems in the upper back, neck/shoulder area, and the extremities [4], [5], [6]

The implications of such ergonomic problems vary [5], but lower back pain can result in weeks or months of inactivity. The hospitals and nursing homes could have lower productivity or increased employee turnover due to MSDs in their workplaces. In addition, those with the problems typically may have to seek medical treatments, which can consequently result in financial and social burdens.

Solutions to these problems include ergonomic programs and interventions provided by the employer [7], [8], [9]. Other approaches include the provision of patient handling technology [10] that can be used to lift, lower, transfer, and position patients. The latter approach, however, has not been widely applied in Indonesia. The technology, while might be available, is relatively expensive and is not economically feasible to many hospitals and nursing homes. This investigation is part of a larger study sought to evaluate the magnitude of MSDs among health professionals. The study is an effort to provide design specifications [11] of a patient handling technology for healthcare settings. In this paper, musculoskeletal problems among nursing home caregivers are reported.

II. METHODS

As an initial effort, a survey was conducted to three different nursing homes in the capital of West Java Province. Three nursing homes (A,B, and C) were surveyed, and a total of 14 caregivers were asked to participate in this study. They were interviewed and asked to fill out Standardized Nordic Questionnaires [12]. The questionnaires dealt with types of body regions affected by MSDs, and how long the problems had occurred. A video camera was also utilized in order to capture working postures adopted by the caregivers. Furthermore, the caregiver's working posture is analyzed by using RULA [13] and REBA [14] to understand the risk level of patient handling activity, which is done by caregivers.

Table I and table II show the demographic and body posture data of the respondents. Mean age was 39.9 ± 12.5 years old, with five of the caregivers were males. Their duties were divided into two work shifts. Typical activities were lifting and moving patients (with limited mobility) onto the wheel chair from the bed, and vice versa. Morning activity also included helping patients taking a bath. The caregivers also helped the patients when going to the restroom. Whenever needed, the caregivers help the patients push the wheel chair to different areas of the nursing home. In bed, the caregivers were often responsible for changing the patient positions. In general, patients who are handled by caregiver weighed from 35 to 75 kg.

III. RESULTS

The following tables (Table III, IV, and V) show problems reported by the respondents in this study. It can be seen that 11 out of 14 (~ 78.6%) caregivers had ever had lower back pain. The majority of these caregivers experienced the problem for several weeks to a month. Half of them reported going to a physician or a therapist to treat their pain. The rest took pain medication or analgesic gel to relieve the pain.

The data also indicated that a large portion of the caregivers suffered problems in the shoulder area, with the majority affecting the right shoulder. Similar treatments to lower back pain were sought for this shoulder problem. Other problems observed included disorders of the elbow, wrist/hands, knees, and ankle/feet. Hips and thighs were body areas with the least problems. It should be noted that the caregivers were never hospitalized for the problem, and never changed or leave the jobs.

TABLE I. RESPONDENTS DEMOGRAPHICS

Participant ID	Sex	Age (y.o)	Time present of work	Average work hour (hours/day)
A1	Male	48	3 years	9
A2	Female	40	2 years	9
A3	Female	50	5 years	10
A4	Male	22	1 year	10
A5	Female	54	14 years	12
A6	Male	32	6 years	12
B1	Female	47	8 months	15
B2	Female	52	14 years	15
B3	Female	41	1 year	15
B4	Female	53	16 years	15
C1	Male	19	1 year	15
C2	Female	48	1 year	15
C3	Female	37	1 year	15
C4	Male	16	2 months	15

TABLE II. RESPONDENTS ANTHROPOMETRY

Participant ID	Height (cm)/ Weight (kg)	Body Mass Index
A1	165/52	19.1
A2	166/65	23.6
A3	147/55	25.5
A4	163/57	21.5
A5	152/63	27.3
A6	165/57	20.9
B1	150/50	22.2
B2	150/45	20.0
B3	150/49	21.8
B4	150/52	23.1
C1	155/40	16.6
C2	150/70	31.1
C3	155/60	25.0
C4	155/50	20.8

TABLE III. PREVALENCE OF PAIN AND BODY PARTS AFFECTED

Participant ID	Shoulders	Elbows	Wrists/Hands
A1	Yes, right side, during the last 12 month and the last 7 days	No	No
A2	Yes, right side, during the last 12 month and the last 7 days	Yes, right side, during the last 12 month and the last 7 days	Yes, right side, during the last 12 month and the last 7 days
A3	Yes, right side, during the last 12 month and the last 7 days	Yes, right side, during the last 12 month and the last 7 days	Yes, right side, during the last 12 month and the last 7 days
A4	Yes, right side, during the last 12 month and the last 7 days)	No	No
A5	Yes, right side, during the last 12 month and the last 7 days	Yes, right side, during the last 12 month and the last 7 days	Yes, right side, during the last 12 month and the last 7 days
A6	No	No	No
B1	Yes, right side, during the last 7 days	Yes, right side, during the last 7 days	No
B2	Yes, right side, during the last 12 month and the last 7 days	Yes, right side, during the last 12 month and the last 7 days	No
B3	Yes, right side, during the last 12 month and the last 7 days	Yes, right side, during the last 12 month and the last 7 days	No
B4	Yes, right side, during the last 12 month and the last 7 days	Yes, right side, during the last 12 month and the last 7 days	No
C1	No	No	No
C2	No	No	No
C3	No	No	No
C4	Yes, both sides, during the last 7 days	No	No

TABLE IV. PREVALENCE OF NECK AND BACK PAIN.

Participant ID	Neck	Upper Back	Lower Back
A1	No	No	Yes, during the last 12 month and the last 7 days
A2	No	No	Yes, during the last 12 month and the last 7 days
A3	No	Yes, during the last 12 month and the last 7 days	Yes, during the last 12 month and the last 7 days
A4	No	Yes, during the last 12 month and the last 7 days	Yes, during the last 12 month and the last 7 days
A5	Yes, during the last 12 month and the last 7 days	No	No
A6	No	Yes, during the last 12 month and the last 7 days	Yes, during the last 12 month and the last 7 days
B1	Yes, during the last 7 days	Yes, during the last 7 days	Yes, during the last 7 days
B2	Yes, during the last 12 months	No	Yes, during the last 12 month and the last 7 days
B3	Yes, during the last 12 months	No	Yes, during the last 12 month and the last 7 days
B4	Yes, during the last 12 months	No	Yes, during the last 12 month and the last 7 days
C1	No	No	Yes, during the last 12 month and the last 7 days
C2	No	No	No
C3	No	Yes, during the last 12 month and the last 7 days	No
C4	No	No	Yes, during the last 7 days

TABLE V. PREVALENCE OF PAIN AT LOWER LIMB.

Participant ID	Hips/ Tights	Knees	Ankle/ Feet
A1	No	No	No
A2	No	Yes, during the last 12 month and the last 7 days	No
A3	No	No	No
A4	No	No	No
A5	No	Yes, during the last 12 month and the last 7 days	Yes, during the last 12 month and the last 7 days
A6	No	Yes, during the last 12 month and the last 7 days	No
B1	No	No	No
B2	No	No	Yes, during the last 12 month and the last 7 days
B3	No	No	No

Participant ID	Hips/ Tights	Knees	Ankle/ Feet
B4	No	No	Yes, during the last 12 month and the last 7 days
C1	No	No	No
C2	No	No	Yes, during the last 12 month and the last 7 days
C3	No	No	No
C4	No	No	No

Occupational postures typically observed in the nursing homes can be seen in Fig. 1. It is shown in these figures that poor posture (excessive trunk bending) needs to be adopted in lifting or positioning the patients. Other ergonomic risks observed included twisting of the trunk and asymmetric movements. Based on the photo taken from caregiver’s patient handling activity, the caregiver’s working posture was analyzed to determine the level of ergonomic risks. Table VI shows RULA and REBA score result of 4 caregivers.



Fig. 1. Typical postures adopted by the caregiver A3 (left) and caregiver C1 (right)

TABLE VI. RULA AND REBA SCORE OF 4 CAREGIVERS

Participant ID	RULA Score	REBA Score
A1	7	9
A2	7	10
A3	7	8
A4	7	10

It can be seen from table 6, that all caregivers produce the highest RULA grand score. It means that the caregivers have a high level of risk. The RULA grand score indicates that investigation and changes are required immediately [13]. Refer to table 6, the REBA grand score of the caregivers is between 8 – 10. It means that the caregivers have a high level of risk, which need corrective action soon [14]. Based on the explanation above, it is necessary to conduct the changes immediately. The changes of the activity can be done by reduce manual handling activity. It is able to build and develop an assistive device to help caregivers lift and transfer the elder people.

IV. DISCUSSION

Findings in this study clearly indicated that MSDs were indeed prevalent among caregivers in nursing homes. Lower back pain and shoulder pain were the two problems ranked highest, followed by problems of the extremities, except the hip/thigh. Such phenomenon has also been reported in previous studies. The work which is done before, for instance, specifically noted lower back pain as a serious problem that needs urgent attention [4], [15].

Immediate ergonomic interventions and programs [16] need to be instituted in these nursing homes. The fact that the majority of the caregivers sought medical treatments should justify the interventions. However, the management seemed to

lack of ergonomic background, that they did not exactly know how to approach this problem. Also, they might not know what kinds of action need to be taken, and perceived that the risks were inherently part of the job.

Another ergonomic intervention that is worth discussing is the use of patient handling technology [17], [18]. Such technology will allow caregivers to manipulate and transfer patients in a much efficient method and, thus, potentially reduce the amount of risks. Three main activities observed in this study were lifting, transferring, and lowering the patients. Accordingly, the technology designed should be able to provide these three functions. It is also preferred that the technology can be operated by one individual, without the need for helps from other nursing home personnel.

At present, such technology has not been widely and economically available. They are available in limited numbers, and are only offered in large hospitals. They are available for rent, but may not be affordable to the general population in Indonesia.

V. CONCLUSION

MSD among caregivers are prevalent, and this seems to be strongly associated with patient handling tasks. It is likely that such problem also exists in any medical/hospital settings involving handling of patients with limited physical abilities. Therefore, the need for such technology should be clear, and any conceptual designs addressing lifting, lowering, transferring, or maneuvering patients will be invaluable. In addition to improving safety [19], such technology, whenever available, will also likely improve productivity and quality of care.

ACKNOWLEDGMENT

The authors would like to thank The Asahi Glass Foundation for fully supporting this research.

REFERENCES

- [1] S. Warming, D. H. Precht, P. Suadiciani, N. E. Ebbeheoj, "Musculoskeletal Complaints among Nurses Related to Patient Handling Tasks and Psychosocial Factors – Based on Logbook Registration," *Journal of Applied Ergonomics* 40, pp. 569 – 576, 2009
- [2] N. N. Menzel, S. M. Brooks, T. E. Bernard, A. Nelson, "The Physical Workload of Nursing Personnel: Associated with Musculoskeletal Discomfort," *International Journal of Nursing Studies* 41, pp. 859 – 867, 2004
- [3] J. D. Lin, L. P. Lin, S. F. Su, S. W. Hsu, C. H. Loh, J. L. Wu, C. M. Chu, "Personal and Workplace Factors for the Risk of Low Back Pain among Institutional Caregivers of People with Intellectual, Autistic, or Multiple Disabilities," *Research in Autism Spectrum Disorders* 8, pp. 509 – 517, 2014
- [4] A. N. Bardak, B. Erhan, B. Gunduz, "Low Back Pain among Caregivers of Spinal Cord Injured Patients," *J Rehabil Med*; 44: pp. 858 – 861, 2012
- [5] D. T. Cowan, J. M. Fitzpatrick, J. D. Roberts, A. E. While, J. Baldwin, "The Assessment and Management of Pain among Older People in Care Homes: Current Status and Future Directions," *International Journal of Nursing Studies*, pp. 291 – 298, 2003
- [6] N. M. Daaraiseh, S. N. Cronin, L. S. Davis, R.L. Shell, W. Karwowaki, "Low Back Symptoms among Hospital Nurses, Association to Individual Factors and Pain in Multiple Body Regions," *International Journal of Industrial Ergonomics* 40, pp. 19 – 24, 2010
- [7] D. R. Thomas, Y. L. N. Thomas, "Interventions to Reduce Injuries when Transferring Patients: A Critical Appraisal or Reviews and A Realist Synthesis," *International Journal of Nursing Studies* 51, pp. 1381 – 1394, 2014
- [8] B. D. Owen, K. Keene, S. Olson, "An Ergonomic Approach to Reducing Back/Shoulder Stress in Hospital Nursing Personnel: A Five Year Follow Up," *International Journal of Nursing Studies* 32, pp. 295 – 302, 2002
- [9] S. L. Kim, J. E. Lee, "Development of An Intervention to Prevent Work-Related Musculoskeletal Disorders among Hospital Nurses Based on the Participatory Approach," *Journal of Applied Ergonomics* 41, pp. 454 – 460, 2010
- [10] W. Elford, L. Straker, G. Strauss, "Patient Handling With and Without Slings: An Analysis of the Risk of Injury to the Lumbar Spine," *Journal of Applied Ergonomics* 31, pp. 185 – 200, 2000
- [11] Conrad, K. M., Reichelt, P. A., Lavender, S. A., Gacki-Smith, J., Hattle. S, "Designing Ergonomics Interventions for EMS Workers: Concept Generation of Patient-Handling Devices," *Journal of Applied Ergonomics* 39, pp. 792- 802, 2008
- [12] J. O. Crawford, "The Nordic Musculoskeletal Questionnaire," *Journal of Occupational Medicine* 57, pp. 300 – 301, 2007
- [13] L. McAtamney, E. T. Corlett, "RULA, A Survey Method for the investigation of Work-Related Upper Limb Disorders," *Journal of Applied Ergonomics* 24(2), pp. 91-99, 1993
- [14] S. Hignett, L. McAtamney, "Rapid Entire Body Assessment (REBA)," *Journal of Applied Ergonomics* 31, pp. 201 – 205, 2000
- [15] A. Karahan, S. Kav, A. Abassoglu, N. Dogan, "Low Back Pain: Prevalence and Associated Risk Factors among Hospital Staff," *Journal of Advanced Nursing*, 65(3), pp. 516 – 524, 2009
- [16] J. N. Hoddler, S. N. Mackinnon, A. M. Ralhan, P. J. Keir, "Effects of Training and Experience on Patient Transfer Biomechanics," *International Journal of Industrial Ergonomics* 40, pp. 282 – 288, 2010
- [17] S. J. Lee, J. Faucett, M. Gillen, N. Krause, "Musculoskeletal Pain among Critical-Care Nurses by Availability and Use of Patient Lifting Equipment: An Analysis of Cross-Sectional Survey Data," *International Journal of Nursing Studies* 50, pp. 1648 – 1657, 2013
- [18] C. A. Elnitsky, J. D. Lind, D. Rugs, G. Powell-Cope, "Implications for Patient Safety in the Use of Safe Patient Handling Equipment: A National Survey," *International Journal of Nursing Studies* 51, pp. 1624 – 1633, 2014
- [19] C. Cummins, "Barriatric Patient Journey: Obstacles and Risks in Patient Handling Safety in a Large Rural Australian Hospital," HETI Rural Research Capacity Program Report, NSW Government, Australia, 2012

BIOGRAPHY

Hardianto Irdiastadi is an Associate Professor and Head of the Laboratory for Work System Design & Ergonomics at Institut Teknologi Bandung, Indonesia. He earned Masters in Industrial Engineering from Louisiana State University, USA, and Ph.D. from Virginia Polytechnic Institute and Technology, USA. His research interests include occupational biomechanics, occupational physiology, and transportation safety. He is a member of IIE and IEA.

Bayuardi Anggawisnu is a masters student at the Faculty of Industrial Technology, Institut Teknologi Bandung, Indonesia. He obtained B.S. in material engineering, and is currently working on designing a cost-effective patient handling technology.

Erry Rimawan is an Associate Professor at Universitas Mercu Buana, Jakarta, Indonesia. He earned his Ph.D. from Universitas Airlangga, Indonesia. He has more than 20 years of industrial experience. His research interests include product design, quality in the service sectors, and industrial strategy.