

An Ergonomics Risk Assessment for Hospital Workers

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Abstract –

Hospital workers are under increasing pressure to work more efficiently with fewer resources and management skills. This stressful situation can be made worse by physical discomforts in the workplace. In part for this reason, the healthcare workers are at high potential risk of physical strain that can lead to musculoskeletal disorders (MSD). Our objective is to assess the physical risk factors for musculoskeletal injury among eighty five hospital workers at ten large hospitals using Psycho-physiological study. Participants were categorized into two groups: Government hospital (GH) workers and Private hospital (PH) workers. Result showed that GH workers were exposed significantly ($p < 0.05$) to high physical risk as compared to PH workers due to the interaction of personal factors and poor circumstantial factors, which combine to affect the quality of care and working life.

I. INTRODUCTION

Today's greatest challenges in Asian countries are to deliver the basic health care needs to improve the quality of life of people. Why because the most nearer reason is largest population and the economical variation. So far, medical field is concerned as the demanded one, where always shortage of man power as required till date. For example, medical supplies, physicians as well as hospital staffs are inadequate in India of total population of about 1.21 billion [9]. This scenario pressurizes the healthcare workers to work more efficiently with fewer resources and management skills. Moreover, many jobs in healthcare involve a very wide range of physical action from positions and postures that may not be ideal and could place workers at risk for accidents and injuries. The common jobs in it comprises of pushing, pulling, reaching, bending, stretching, lifting, lowering, sitting, standing, walking and carrying. This stressful situation can be made worse by physical discomforts in the workplace. In part for this reason, the healthcare workers are at high potential risk of physical strain that can lead to musculoskeletal disorders (MSD) [1].

Healthcare worker's MSD is generally caused by patient-related activities such as lifting associated with patient transport. The National Institute of Occupational Safety & Health (NIOSH) reported the average MSD claim is over \$18,000 [2]. Moreover, hospital sector is the second highest

number of illness (MSD) with an incident rate of 8.8 per 100 workers compared to 5.7 in all other industries (US Department of Labour Bureau of Labour Statistics, 2002). Extensive research on studies of hospital ergonomics have been conducted to identify the extent to which hospital administrators provide opportunity for healthcare workers in developing approaches to resolve an acceptable workload with good quality of care. The ergonomics of hospitalization involves the interaction of personal factors such as fatigue, fitness, age and experience and circumstantial factors such as work organization, schedule, work load, hospital layout, furniture, equipment and psychological support within the work team, which combine to affect the quality of care and working life. Analysis of the interaction of these factors influencing care-physical strain and cognitive strain is essential to improve the working condition of the hospital workers [4].

The most common shared workplace in hospitals is nurse's station. These workplaces should accommodate a wide range of different people for any given twenty-four hour period. Most of the hospitals have more than 60% of the work goes to nursing staffs who handles the patients and the equipments mostly [3]. This exposure involves high physical workload which is assessed through the analysis of posture, movement, and cumulative load over time or through indirect approach of questionnaires, checklists, or diaries.

This paper focuses on assessment of physical risk factors among Government hospital (GH) workers and Private hospital (PH) workers through discomfort/pain that are experienced during job hours using interviewer-administered structured questionnaire.

II. METHODS AND MATERIALS

A. Participants

Eighty five participants (35 male, 50 female, mean age (years) = 28.13; SD = 3.2, mean experience (years) = 5.91; SD = 2.34) involved in this study. Of which, twenty four were physicians; eighteen were OT staffs and forty three were nursing staffs. Participants were categorized into two groups: GH workers (45) and PH workers (40). Table I shows the name of the hospitals where the study had been conducted and the details of the participants.

B. Experimental design and protocols

Following the evaluation of initial mini-mental state examination, the study had been clearly explained to the participants. A self-administered questionnaire was given to the participants to quantify the overall perceived discomfort/pain score at different body locations such as neck, shoulder, back, elbow, wrist/hand, thigh, knee, leg and ankle/foot (Fig. 1). It was taken care that survey was conducted on participants who experiencing MSD that are caused due to their on-duty jobs itself. Pain-scale criteria and their corresponding grades are depicted in Table II.

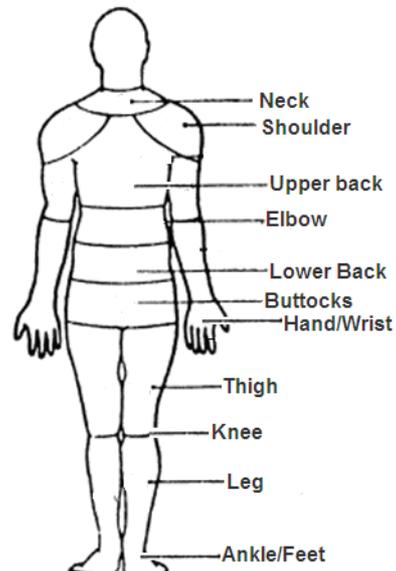


Fig. 1. Work related discomfort/pain perceived in different parts of the body.

TABLE I
NAME OF THE HOSPITALS WHERE THE STUDY HAD BEEN CONDUCTED AND DETAILS OF THE PARTICIPANTS

Category	Hospitals	Physicians	OT Staffs	Nursing Staffs
GH	Government General Hospital, Chennai	1	2	5
	Government Vellore Medical College & Hospital, Vellore	2	0	4
	Government Hospital, Vellore Arakkonam	5	4	4
	Government Hospital, Coimbatore Suler	4	1	6
	Rajaji Government Hospital, Madurai	0	2	5
PH	Sri Ramachandra Medical Centre, Chennai	3	3	2
	Vijaya Health Center, Chennai	2	0	5
	Meenakchi Mission Hospital & Research Centre, Madurai	1	2	5
	Kovai Medical Center and Hospital, Coimbatore	4	3	4
	Ganga Medical Centre & Hospitals Pvt. Ltd., Coimbatore	2	1	3

TABLE II
CRITERIA FOR PAIN-SCORE AND THEIR CORRESPONDING GRADES

Criteria for Pain-score	Grade
No pain, feeling perfectly normal	0
Mild pain, very barely noticeable	1
Minor pain, discomforting	2
Very noticeable pain, tolerable	3
Strong pain, distressing	4
Piercing pain, very distressing	5
Intense pain	6
Very intense pain	7
Utterly horrible	8
Excruciating unbearable	9
Unimaginable unspeakable	10

III. RESULTS AND DISCUSSION

Perception of pain/discomfort is a qualitative measure and is entirely subjective. Psycho-physical tests involving questionnaire studies are well-known methodologies for screening musculoskeletal disorders. Outcome of the study (Fig. 2) shows workers in GH perceived pain in the upper extremities of the body (shoulder, upper back, elbow and wrist/hand) was significantly ($p < 0.05$) high as compared to PH workers. Perceived pain in the lower extremities of the body (thigh, knee and ankle/feet) regions was also ($p < 0.05$) significantly high for GH workers as compared to PH workers. In this study, we have attempted to understand the physical demands of wide range of tasks performed in hospitals. Some studies of health care professionals and hospital workers have been carried out using electro-goniometers and electromyography. Particularly relevant to the hospital setting,

the application of such methods is difficult because of the disruption of the work associated with attaching and calibrating such devices [6]. Hence we applied the psycho-physiological questionnaire study in a potential analysis of work related MSD in the hospital setting. Lifting, forceful action and load on the back are the cause of pain in the neck, shoulders and shoulder joints [10]. This study shows that these risk factors are found high in GH workers compared to PH workers as a consequence of dynamic work situations where higher percentage of patients who seek medical treatment from GH free of charge.

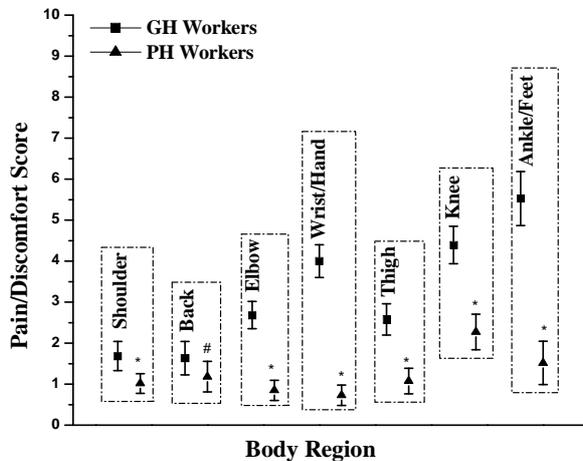


Fig. 2. Perceived discomfort/pain based on pain-score criteria between Government and Private hospital workers. (*p<0.05 and #p<0.01)

Shannon et al. (2001) examined changes in general health and time with back pain and neck pain and identified predictors of any such changes. The study showed that there was a significant decline in general health and significant increases in time with neck pain and back pain. They concluded the predictors of changes in these outcomes were mainly work-related variables such as job interference with family, work psychological demands, job influence and hours worked [5]. Most of the recent researches have concentrated on problems of the elbow, hands and wrists. High risk jobs require repeated, forceful movements of body parts held at the extremes of their ranges of movements, such as with the wrist flexed, extended and promoted.

Microscope work is a visually demanding task that requires OT staffs even sometimes physicians to bend over the eyepiece. These postures can irritate soft tissues such as muscles, ligaments and spinal discs. They sit on laboratory stools typically dangle their feet or place them on a ring-style footrest. If the footrest is not adjusted properly, this posture can lead to contact stress on the popliteal fold (back of the knees) and pooling of blood in the feet. These awkward postures can cause fatigue and discomfort and place the worker at risk of developing a work related MSD [8]. Our survey showed workers in hematology complained of back, leg, ankle, heel and foot pain from the long hours of standing. Results also showed the knee problems exposed to the hospital workers as a result of extreme postures lifting loads and long hours of work [7].

The above-said problems can be prevented by properly designing the job or work station and selecting the appropriate tools or equipment for that job. NIOSH recommends using the following guidelines in jobs requiring manual handling:

- Minimize the distance between the load and the body
- Lift loads from knuckle height
- Keep the travel distance for the lift to less than 10 feet
- Minimize twisting
- Appropriate engineering controls, such as work station, tool, and equipment design or redesign
- Work practices, such as proper lifting techniques and keeping work areas clean
- Administrative controls, such as worker rotation, more task variety, and increased rest breaks

IV. CONCLUSIONS

Hospital workers suffer from multiple musculoskeletal problems that significantly impair their activities of daily living. As our understanding from the study, the GH Workers were exposed to more discomfort/pain as compared to the PH Workers. Reasons could be hospital layout and poor infrastructure, due to improper work plan, the number of inpatient and outpatient admissions are considerably high, duty timings and the wrong placement of the equipments. In practice, the adoption of appropriate postures and handling practices depends on the amount of functional space, presence of appropriate furniture and equipment and quality of care. Each hospital needs a comprehensive ergonomic plan and the necessary resources to support the same. The net effect of these factors can improve the prevention of healthcare risks among hospital workers.

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REFERENCES

- [1] Brown, N.D., Thomas, N.I., "Exploring variables among medical center employees with injuries: developing interventions and strategies," *AAOHN J* 51 (11), 2003, 470-481.
- [2] Collins, J.W., Owen, B.D., "NIOSH research initiatives to prevent back injuries to nursing assistants, aides, and orderlies in nursing homes," *Am. J. Ind. Med.* 29 (4), 1996, 421-424.
- [3] Engkvist, I.L., Hjelm, E.W., Hagberg, M., Menckel, E., Ekenvall, L., "Risk indicators for reported over-exertion back injuries among female nursing personnel," *Epidemiology* 11 (5), 2000, 519-522.
- [4] Forde, M.S., Punnett, L., Wegman, D.H., "Pathomechanisms of work-related musculoskeletal disorders: conceptual issues," *Ergonomics* 45 (9), 2002, 619-630.

- [5] <http://censusindia.gov.in/>
- [6] Marras, W.S., Davis, K.G., Kirking, B.C., Bertsche, P.K., "A comprehensive analysis of low-back disorder risk and spinal loading during the transferring and repositioning of patients using different techniques," *Ergonomics* 42 (7), 1999, 904–926.
- [7] NIAMS (2001). Internet link knee problems from <http://www.niams.nih.gov/Health_Info/Knee_Problems/default.asp> Retrieved on 5.11.2009.
- [8] Ostry, A.S., Yassi, A., Ratner, P.A., Park, I., Tate, R., Kidd, C., "Work organization and patient care staff injuries: the impact of different care models for "alternate level of care" patients," *Am. J. Ind. Med.* 44 (4), 2003, 392–399.
- [9] Shannon, H.S., Woodward, C.A., Cunningham, C.E., McIntosh, J., Lendrum, B., Brown, J., Rosenbloom, D., "Changes in general health and musculoskeletal outcomes in the workforce of a hospital undergoing rapid change: A longitudinal study," *Journal of Occupational Health Psychology* 6 (1), 2001, 3–14.
- [10] Wells, R., Norman, R., Neumann, P., Andrews, D., Frank, J., Shannon, H., Kerr, M., "Assessment of physical work load in epidemiologic studies: common measurement metrics for exposure assessment," *Ergonomics* 40 (1), 1997, 51–61.