



# Reducing ergonomic injuries for librarians using a participatory approach



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## ABSTRACT

This study utilized a participatory ergonomics approach to examine the ergonomic hazards and reduce musculoskeletal symptoms for librarians in the East Baton Rouge Parish Main Library. A variety of research activities were conducted, including: ergonomics training and tests, observations, work environment and health questionnaires, and focus group discussions. A total of 39 employees from 9 different divisions in the Library participated in the study. The results of pre- and post-training ergonomics knowledge tests indicate significant improvement of librarians' understanding of ergonomics principles. The questionnaire responses for both 2-month-post- and 8-month-post- ergonomics training compared against those before the training have shown positive improvements in ratings of the presence and severity of a majority of the musculoskeletal symptoms, the design of computer workstations and manual material handling tasks, as well as perceived control over the work environment. With the identification of ergonomic hazards through RULA (Rapid Upper Limb Assessment) and REBA (Rapid Entire Body Assessment) observations as well as focus group discussions, the study findings accomplished the project's overall objective of assisting librarians with improvement of ergonomics in the workplace. The results of this study provide a necessary foundation for future long-term study of participatory ergonomics to reduce musculoskeletal injuries and disorders for librarians.

*Relevance to industry:* Library work entails prolonged use of computers and other electronic tools, as well as repetitive handling of books, boxes, and other materials, which has exposed librarians to a significant risk of developing musculoskeletal injuries and disorders. A participatory ergonomics approach might be effective in improving librarians' understanding and application of ergonomics principles, and subsequently reducing musculoskeletal symptoms.

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## 1. Introduction

Technological advancement has shaped the work environment in libraries dramatically since the 1990s (Chao, 2001). Intensive or long-term use of computers and other electronic tools has become more and more popular in all public service areas and technical operations, particularly cataloging. This has caused librarians to use awkward postures of the head, neck, and upper extremities and to endure increased pressures on the soft tissues against external workstation surfaces. On the other hand, librarians are still involved in extensive and repetitive handling of books, boxes, and other materials, where they usually have to exert excessive strength

during different activities and maintain sustained static posture during prolonged holding (Thibodeau and Melamut, 1995).

Both of these typical aspects of library work expose librarians to a relatively wider range and higher level of ergonomic hazards than "standard" office-type work does, as they have produced enormous risk and stress on librarians (Chao, 2001). Bryant (1993) estimated that eight out of every 100 Library of Congress employees suffer work-related injuries caused by repeated physical stress, outdated workstation design, poor materials-handling techniques, along with the lack of employee training programs. Mansfield and Armstrong (1997) reported that among a yearly average of 4917 staff at the Library of Congress during 1991–1995, the average yearly numbers of injuries and traumatic musculoskeletal disorders (MSDs) are 229 and 47, respectively. These injuries and disorders have caused an average annual workers' compensation cost of \$946,284 during that five-year span. Laberge (2000) found a high incidence of symptoms of MSDs in a sample of 406 respondents

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from Québec public libraries in Canada, 90% of whom had experienced symptoms in the course of the previous year.

It seems there is a great need to address ergonomic issues within the library environment. Although there is a growing body of literature discussing ergonomics and libraries found in books, journals, and internet sources (Bellemare et al., 2006; Osquei-Zadeh et al., 2012; Summer, 1996; Wick and Woodford, 2006), there is currently no systematic process to determine needs and evaluate interventions (Tepper, 1996). Rather, the majority of relevant ergonomic research either centers on the evaluation of ergonomic risks for library users or only investigates the setup of computer workstation for the librarians. Libraries spend a great amount of time planning the hardware and software implementations of electronic information services, but human factors and ergonomics are often overlooked (Thibodeau and Melamut, 1995). Thus, it is imperative to explore effective and efficient research methodologies to identify, analyze, and control ergonomic hazards during library work.

One method for introducing and implementing ergonomics is to use the concept of participatory ergonomics, which originated from discussions between Drs. Kageyu Noro and Kazutaka Kogi in Singapore in 1983 (Imada, 1991). As the word “participatory” indicates, this specific concept constitutes the use of participative techniques and various forms of participation in the workplace (Vink and Wilson, 2003). Wilson (1995) defined participatory ergonomics 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.” Such an approach maximizes the active involvement of workers in implementing ergonomic knowledge, procedures and changes with the intention of improving working conditions, safety, productivity, quality, morale and/or comfort.

The participatory ergonomics approach has been applied in a wide range of industries, including: construction, health care, manufacturing, military, production and processing plants, and transportation (de Jong and Vink, 2002; de Looze et al., 2001; Evanoff et al., 1999; Hallbeck et al., 2010; Halpern and Dawson, 1997; Laitinen et al., 1998; Moore and Garg, 1998; Rice et al., 2002). The reported benefits include: enhanced performance and reductions in work-related health problems, an improvement of work organizational climate and industrial relations, increased job satisfaction and decreased work-related stress, etc. (Brown, 1993; Haims and Carayon, 1998; Imada, 2000; Lanoie and Tavenas, 1996; Maciel, 1998; Vink et al., 2008).

Several research studies have been conducted to examine and explain the etiology and principles of participatory ergonomics. The framework of and typical methods used in such a technique have been explored by many researchers (Haines and Wilson, 1998; Haines et al., 2002; Hignett et al., 2005; Jatczak, 2008; Kuorinka, 1997; McNeese et al., 1995; Wilson, 1995). Haines et al. (2002) presented and validated a framework for participatory ergonomics by introducing the nine dimensions in participatory ergonomics. Hignett et al. (2005) later ranked those dimensions highlighting the importance of workers, with the top two relating to consultation in decision-making and involvement of workers at all levels in an organization. They also placed the permanence of the ergonomics input as the lowest order, suggesting that ergonomic input is project-specific rather than a permanent organizational role. Common tools that have been used in participatory work groups include: round-robin questionnaires, cause-and-effect diagrams, brainstorming, mock-ups, observations, and checklists.

The objective of the present study was to utilize a participatory ergonomics approach to reduce musculoskeletal symptoms for librarians in the East Baton Rouge Parish Main Library. Specifically,

the study was designed to: provide training on the basic concepts and principles of ergonomics to librarians; identify the ergonomic hazards associated with typical library work; and introduce and then apply the participatory ergonomics approach to mitigate the ergonomic hazards within the library environment. The following hypotheses were proposed:

- Hypothesis 1 Librarians' knowledge of ergonomics will increase after ergonomics training which is indicated by the comparison of post- vs. pre-test scores.
- Hypothesis 2 Librarians' utilization of ergonomics principles will improve after completion of this participatory ergonomics project.
- Hypothesis 3 There will be a reduction of musculoskeletal symptoms after the project is complete.

## 2. Methods

Fig. 1 illustrates a simplified diagram outlining the participatory ergonomics process used in this study. It should be noted that *evaluation* is one of the most crucial elements involved in the entire research process.

### 2.1. Preparation/start up

#### 2.1.1. Establishing management support and employee buy-in

Employees of the East Baton Rouge Parish Main Library work for the City-Parish Department of Public Works of Baton Rouge. The City of Baton Rouge Risk Management Division approached the researcher with a plan to provide ergonomics training to all Public Works employees working for the East Baton Rouge Parish Library (EBRPL), which is comprised of a Main Library and 13 community or regional branch libraries, and several bookmobiles (EBRPL, 2015). A walk-through in the East Baton Rouge Parish Main Library was made in the summer of 2009. The management personnel exhibited strong interest in and support for both the ergonomics training and this expanded ergonomics research study. There were approximately 100 employees in the Main Library when the study was conducted and all of them were invited to participate in this project. The targeted number of participants was 50.

The recruitment of study participants started with an initial meeting where the research procedures were explained. Employees that were interested in participating in the study would take the ergonomics training at a scheduled time inside the Library and complete both pre- and post-training ergonomics knowledge tests. Also, they would complete the work environment and health questionnaire before the ergonomics training, 2 months after the training, and 8 months after. They would be observed in the workplace when performing their normal work duties, so that ergonomic hazards could be noted. Finally, they might be invited to participate in the focus group discussion as employee representatives. Participants signed the informed consent form if they agreed to participate. The researcher performed all of the research activities, with help from a research assistant on recording the ergonomics training and focus group discussion notes and entering the questionnaire responses into a computer. The research procedures were approved by the Southeastern Louisiana University Institutional Review Board.

#### 2.1.2. Ergonomics training

The training program was developed by the researcher, a senior ergonomist who has more than ten-year experiences in the ergonomics field, based on references from a variety of sources, including: OSHA (Occupational Safety and Health Administration)

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