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Original Article

Use of Ergonomic Measures Related to Musculoskeletal Complaints among Construction Workers: A 2-year Follow-up Study

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ABSTRACT

Background: The physical work demands of construction work can be reduced using ergonomic measures. The aim of this study was to evaluate the use of ergonomic measures related to musculoskeletal disorders (MSDs) among construction workers.
Methods: A questionnaire was sent at baseline and 2 years later to 1,130 construction workers. We established (1) the proportion of workers reporting an increase in their use of ergonomic measures, (2) the proportion of workers reporting a decrease in MSDs, (3) the relative risk for an increase in the use of ergonomic measures and a decrease in MSDs, and (4) workers' knowledge and opinions about the use of ergonomic measures.
Results: At follow-up, response rate was 63% (713/1,130). The proportion of workers using ergonomic measures for vertical transport increased (34%, 144/419, $p < 0.01$); for measures regarding horizontal transport and the positioning of materials, no change was reported. The proportion of workers reporting shoulder complaints decreased (28%, 176/638, $p = 0.02$). A relationship between the use of ergonomic measures and MSDs was not found; 83% (581/704) of the workers indicated having sufficient knowledge about ergonomic measures. Lightening the physical load was reported to be the main reason for using them.
Conclusion: Only the use of ergonomic measures for vertical transport increased over a 2-year period. No relationship between the use of ergonomic measures and MSDs was found. Strategies aimed at improving the availability of ergonomic equipment complemented with individualized advice and training in using them might be the required next steps to increase the use of ergonomic measures.

1. Introduction

Work-related musculoskeletal disorders (MSDs) are one of the most prevalent occupational health problems [1], affecting millions of workers every year. Specifically, construction workers face higher rates of work-related MSDs [2]: approximately 16% higher than workers in other industries [3]. Major causes of MSDs among construction workers are high physical demands [4], such as heavy lifting, repetitive motions, and awkward working postures (e.g., bending and twisting, kneeling, working with the arms above shoulder height) [3,5]. Ergonomic solutions may therefore help to reduce the risk of MSDs among construction workers [3,6].

In general, ergonomists agree that the use of ergonomic measures to reduce the physical work load of construction workers should be facilitated [7,8]. However, ergonomic measures do not find their way automatically to the workers. Therefore, the Dutch sectors' Health and Safety Institute (Arbouw, Dutch Health and Safety Institute in the Construction Industry, Harderwijk, The Netherlands) implemented the national campaign "Lighter Work(s)," whose goal was to inform both workers and employers about ergonomic

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measures that are aimed at decreasing adverse physical exposures. The goal of the campaign was to increase awareness and induce a change regarding ergonomic working methods and the use of mechanical ergonomic measures. The campaign was an opportunity for evaluating the use of ergonomic measures related to musculoskeletal complaints among construction workers over a 2-year period. We assumed that the physical work demands related to physically demanding construction trades would be reduced by ergonomic measures and consequently MSDs would be reduced. Therefore, we hypothesized that when the use of ergonomic measures would increase by means of a national campaign, eventually MSDs would decrease (Fig. 1). Furthermore, we wanted to gain more knowledge on barriers and facilitators for using ergonomic measures.

Physical demands vary widely across different construction occupations. Bricklayers and drywall installers, for example, spent most of their working time in a bent and twisted position while performing repetitive hand-arm movements, whereas tile workers spent most of their working time in a kneeled, crouched, or stooped position [3]. Nowadays, a wide variety of ergonomic solutions for a range of occupations can reduce the time spent by the workers in these adverse activities and improve working postures, thus potentially reducing MSDs.

The following types of ergonomic measures were highlighted in the campaign: measures for horizontal/vertical transport and for the positioning or installing of materials. Measures for horizontal transport aimed at decreasing pushing, pulling, and carrying. Measures for vertical transport aimed at decreasing heavy lifting, and measures for the positioning or installing of materials were aimed at optimizing the working height and thereby decreasing kneeling, working with a bent back, or with the arms above shoulder height.

Evidence on the impact of the use of ergonomic measures by means of a large-scale campaign like “Lighter Work(s)” is conflicting. A longitudinal study among carpenters and pavers indicated that the use of some specific ergonomic measures was associated with a lower likelihood of lower back or shoulder complaints [9], but most ergonomic measures for these occupations were not associated with such a reduction in complaints [9,10].

This paper describes a 2-year follow-up study about the use of ergonomic measures related to musculoskeletal complaints among nine construction occupations. The research questions were as follows: (1) What is the use of ergonomic measures over a 2-year period and what are the facilitating factors and barriers for using ergonomic measures?; (2) What is the change in MSDs over the 2-year period?; (3) Is there a relationship between an increase in the use of ergonomic measures and a decrease in MSDs (in the most affected body regions, i.e., the shoulders, lower back, and knees)?; and (4) To what extent do the workers have sufficient knowledge about the use of ergonomic measures and what activities are, according to the workers, needed to facilitate the use?

2. Materials and methods

2.1. Study design and participants

A 2-year follow-up study was conducted among construction workers in nine different occupations (reinforcing iron and rebar workers, glaziers, bricklayers, natural stone masons, drywall and ceiling tile installers, scaffolders, pavers, plasterers, and carpenters). We randomly selected 4,500 Dutch construction workers, 500 in each occupation. The random selection was performed by the independent data manager of the Registry of Arbouw who frequently assisted in selecting samples for research purposes.

The survey consisted of a baseline questionnaire (October 2010) and a follow-up questionnaire (March 2013). At baseline, all participants received a sealed envelope at their home address containing an invitation to participate, a questionnaire survey, and an incentive (lottery ticket, with an iPod as the first prize). At follow-up, only those who had responded at baseline were sent a second postcard, a follow-up questionnaire, and an incentive (lottery ticket). Completing the questionnaires took approximately 15 minutes. The participants were asked to fully complete and return the questionnaire within 2 weeks. One reminder letter was sent to all participants after 1 week.

2.2. The campaign “Lighter work(s)”

The campaign “Lighter Work(s)” focused on each of the ergonomic measures (when applicable) for nine construction occupations (reinforcing iron and rebar workers, glaziers, bricklayers, natural stone masons, drywall and ceiling tile installers, scaffolders, pavers, plasterers, and carpenters). The assumed efficacy of the

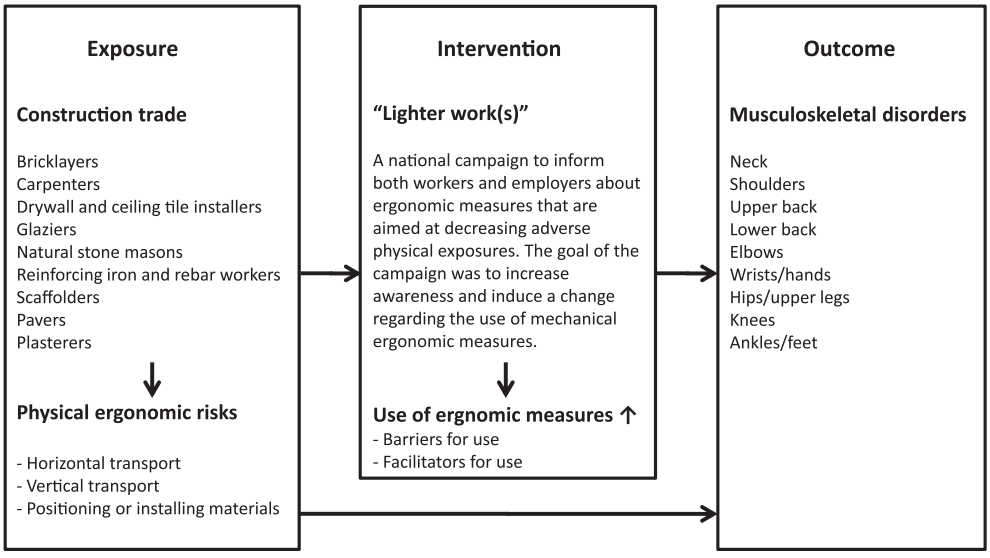

Fig. 1. Hypothesis on the relation between exposure, ergonomic measures, and MSDs. MSDs, musculoskeletal disorders.