Analysis of the return on preventive measures in musculoskeletal disorders through the benefit–cost ratio: A case study in a hospital

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ARTICLE INFO

Article history:
Received 18 August 2014
Received in revised form 30 October 2015
Accepted 10 November 2015
Available online xxx

Keywords:
Occupational safety and health (OSH)
Work related musculoskeletal disorders (WMSDs)
Preventive measures
Cost–benefit analysis
Benefit–cost ratio
Externalities
Hospital

ABSTRACT

Work-related musculoskeletal disorders (WMSDs) are among the most costly health problems that society is facing today. Prevention involves investments and it is important for organizations to make a cost–benefit analysis of ergonomic projects. Return on prevention is a recent concern in the domain of occupational safety and health (OSH). There are many studies concerning the return on the prevention of WMSDs, in terms of the benefits for the organization in which the preventive measures are implemented. However, it is also important to perform an analysis of the impact of each measure on society (externalities). A model to perform a financial and economic cost–benefit analysis related to OSH projects was developed and it was applied in the case of the prevention of WMSDs in a Portuguese hospital. An analysis of the accidents and corresponding costs has been made in six of the services of the hospital. Financial and an economic cost–benefit analysis have been made and the benefit–cost ratio (B/C) has been calculated. While the B/C financial ratio, considering only the benefits to the hospital, is around 2, the economic B/C ratio, taking into account all the external benefits that have been quantified, is higher than 14.

Relevance to industry: Both the economic and the financial B/C ratio are important support tools for decision makers in public and private organizations, helping them to define which preventive measures should be implemented, taking into account the costs involved and the resulting quantified benefits, for the organization, for the workers and for the society.

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1. Introduction

The economics of occupational safety and health (OSH) has been viewed for many little more than “how can better working conditions be made profitable for business?” (Dorman, 2000). Certainly, the financial costs and benefits involved in OSH are an important aspect of economic analysis, but above all, economics is a social science; its perspective is that of society as a whole, which includes workers, their families and their communities as well as enterprises, and it recognizes that not all the effects of ill-health show up in monetary transactions. The purpose of this paper is to contribute for the economic analysis that should be made in order to increase our understanding and management of OSH particularly, in the context of work-related musculoskeletal disorders (WMSDs).

According to Moar et al. (2015) the real cost of WMSDs is difficult to calculate, mainly because of the lack of their standardization. Some reports from the European Agency for Health and Safety at Work, have published the rating 0.5–2% of GNP. Therefore, in any case, it is a priority health problem in the Euro Zone.

The World Health Organization has defined a work-related disorder as one that results from a number of factors, and where the work environment and the performance of the work contribute significantly, but in varying magnitude, to the causation of the disease. The term musculoskeletal disorder covers a broad range of health problems: problems with the locomotor apparatus, i.e. muscles, tendons, the skeleton, cartilage, the vascular system, ligaments and nerves. The main groups are back pain/injuries and work-related upper limb disorders, commonly known as “repetitive strain injuries”. Lower limbs can also be affected. Lifting, poor posture and repetitive movements are among the causes and some types of disorders are associated with particular tasks or occupations (EU-OSHA, 2010).

According to Pouliakas and Theodossiou (2013) the most
prevalent health problems caused by work in the modern job market include musculoskeletal disorders, respiratory and skin diseases and psychosocial health problems. These authors report that, according to data from NIOSH (1997) and EU-OSHA (2000), musculoskeletal disorders are among the most common work-related health problems in the USA and the EU-27, predominantly affecting blue-collar workers. Around 25–30% of European employees are affected by them, while they are estimated to account on average for 20.5% of the total compensation costs of European countries. It has been estimated that 25% of European workers complain of back pain and 23% of muscle aches. WMSDs are the main cause of sickness absence in western European countries (Bernal et al., 2015; Murray et al., 2012).

Today, it is widely recognized that there is a need for a multidimensional approach in order to understand WMSDs as well as establishing guidelines to reduce them. At the same time, the establishment of corresponding prevention strategies remains a difficult task (Major and Vezina, 2015).

In the industrial environment, it is essential to reduce the occurrence of muscle fatigue because it has a great impact on task performance. Thus, the major challenge for ergonomics is to design the work in order to prevent WMSDs and with no negative impact on production quality and productivity (Santos et al., 2015).

Corrective measures are often made too late, only when employees complain and WMSDs have already occurred. Besides, several studies have shown that poor ergonomics result in deteriorated assembly quality and reduced productivity and that late measures are often costly (Falk and Rosenqvist, 2012).

Although ergonomics is integrated in the production system of many industries to improve human wellbeing and to prevent WMSDs, these disorders are still the main problem of occupational disease in many countries. In addition to the effects of WMSDs on business performance, they have considerable impact on human quality of life as they are the main causes of discomfort and pain in the workplace (Zare et al., 2015).

These disorders are a significant problem for industrialized countries, representing one-third of work injuries, resulting in serious social and economic impacts on individuals and communities. Costly for employers due to reduced quality and productivity, they also overburden the health system (Chiasson et al., 2012; Escorpizo, 2008; Widanarko et al., 2011). Thus, WMSDs are a cause of concern not only because of the health effects on individual workers, but also because of the economic impact on businesses and the social costs of treatment and recovery which are often unsatisfactory especially for more chronic causes. The end result can even be permanent disability, with the loss of employment (EU-OSHA, 2010). Furthermore, according to Escorpizo (2008), work productivity is the key to understanding health burden and cost associated with WMSDs. Productivity is an important indicator of economic growth and social health and it is frequently discussed from an economic perspective.

Indeed, the National Occupational Research Agenda (NORA) of the National Institute for Occupational Safety and Health (NIOSH) in the USA concluded that WMSDs are among the most costly health problems that the society is facing today (Marras et al., 2009). According to the European Agency for Safety and Health at Work (EU-OSHA, 2013), priorities for research related to the occupational safety and health (OSH) in Europe during the period 2013–2020 include WMSDs. Among these priorities for research, the following can be highlighted: to clarify the interaction of combined physical and psychological factors in the development of WMSDs, to develop and conduct high-quality multidimensional intervention studies combining technical, organizational and person-oriented measures, to use a participatory approach to prevent WMSDs, and (justifying the research perspective followed in this research project) to evaluate the efficacy and cost-effectiveness of such interventions.

The scientific literature shows that preventive interventions to reduce exposure to WMSDs risk factors remain the best strategy. Also experts generally agree that effective ergonomics programs must have a core set of elements to ensure that ergonomic hazards are identified and controlled to protect workers (Hedge et al., 2011).

Furthermore, prevention measures should be viewed as investments and a proper cost–benefit analysis (CBA) of such projects must be undertaken. In this context, a benefit–cost (B/C) ratio can be used for the analysis of the Return on Prevention (ROP) which is a recent request in the OSH literature. Nevertheless, we should go beyond the traditional costs vs benefits analysis performed in OSH studies which have been essentially focused on the company. Indeed, in the OSH literature, the return on prevention tends to just consider the benefits for the organization. However, it is also important to take into account the impact of each measure to the worker and to the society, i.e. to consider the externalities associated.

This paper presents a model to perform a financial and also an economic cost–benefit analysis in the context of OSH projects. WMSDs are one of the main causes of sickness absence among hospital nurses and nursing aids, although underreporting is common (Bernal et al., 2015; Menzel, 2008). Thus, this model was applied in the case of the prevention of WMSDs in a Portuguese hospital. The analysis of the accidents and corresponding costs has been made, followed by a risk assessment exercise. Subsequently, a set of preventive measures have been designed and the costs of these measures and the expected benefits have been estimated.

Finally, a financial and an economic cost–benefit analysis have been made and the benefit–cost ratio has been calculated. A sensitivity analysis of the B/C ratio is presented and discussed. Additional analytical tools based on the B/C ratio are also proposed.

### 2. Economic costs in OSH

The cost and benefits of ergonomics measures are rarely shown in companies. This may be a contributing factor to why ergonomics is not sufficiently considered (Falk and Rosenqvist, 2012).

Occupational injuries entail significant economic and human costs for all society. The estimation of these costs is important in order to optimize decision-making in the areas of prevention and research (IRSSST, 2013). In fact, several studies show that society bears the largest part of the costs created by accidents at work and ill-health, followed by individuals, while the employers bear the smallest part of these costs (European Commission, 2011). Accordingly, a full understanding of such costs must take into consideration these externalities.

For Varian (1992), the definition of externality is that the action of an agent directly affects the living conditions of another agent. Externalities can also be defined as: “the uncompensated impact of a person’s actions on the well-being of a bystander” (Mann and Wustemann, 2008). According to Cullis and Jones (2009), externalities may be positive (external benefits) or negative (external costs) and occur both at production or consumption. The concept of externality can and should be applied to the area of OSH, namely through the implementation of a cost–benefit analysis. The benefits and costs can be external, private or social. External benefits and costs are related to agents who benefit without paying (positive externalities) or suffer and are not compensated (negative externalities). Private benefits and costs are related to agents that have a direct involvement in the project. Social benefits and costs are the sum of external and private benefits or costs (ILO, 2012).

Xie et al. (2008) report that the intangible costs can be monetized according to the willingness-to-pay method, which was first
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