

6th International Conference on Applied Human Factors and Ergonomics (AHFE 2015) and the
Affiliated Conferences, AHFE 2015

Identification of design requirements for ergonomic long spinal board using quality function deployment (QFD)

Hilma Raimona Zadry*, Dina Rahmayanti, Lusi Susanti, Dicky Fatrias

Department of Industrial Engineering, Faculty of Engineering, University of Andalas, Padang, West Sumatera, Indonesia

Abstract

Emergency Medical Services (EMS) is a basic medical acts carried to an accident victim with the purpose of sustaining life and preventing a decline in body condition before the victim finally getting further treatment from medical personnel. One evacuation tool of first aid commonly used is Long Spinal Board (LSB). This tool is set up as an emergency stretcher boards made from wood or polymer with a flat surface that is used to perform the evacuation of the injured spinal cord. The basic principle of the LSB use is to immobilize the position of the spine so that the secondary injury on the spine due to swing, clash, or shocks that occurred during the evacuation process can be minimized. However, the existing LSB has several disadvantages, both in terms of user comfort, and also the effectiveness and efficiency of the evacuation process when done. A recent study found the LSB use can cause pain, discomfort, and respiratory disorders to the patients. Furthermore, the LSB can blockage the flow of oxygen in the tissue capillaries at the placement of strap. Therefore, it is important to improve the design of the LSB with the aims to achieve mobility and better equipment compatibility when used, so that the evacuation process can be done more effectively, efficiently and safely. This study identifies the design requirements of ergonomic LSB using Quality Function Deployment (QFD). QFD is an effective design method to integrate ergonomics needs and comfort into LSB design because it explicitly addresses the translation of customer requirements into engineering characteristics. Preliminary survey was conducted through direct observation of the actual use of LSB that exists today and interviews with volunteers from the Indonesian Red Cross of West Sumatera. Data gathered was translated into questionnaire and answered by 47 participants from medics, Red Cross, Ambulance Unit Medical Officer and rescue team of Padang, West Sumatera. Then it was clarified and used in the House of Quality matrix. The QFD analysis of the LSB revealed that the selection of LSB main board materials, the application of LSB strap systems, as well as the addition of LSB features were receiving the highest overall weighting, which means that improving the design of those criteria would lead to higher customer satisfaction.

© 2015 Published by Elsevier B.V. This is an open access article under the CC BY-NC-ND license
(<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

Peer-review under responsibility of AHFE Conference

Keywords: Long spinal board; Ergonomics; Quality Function Deployment; Design requirement

* Corresponding author. Tel.: +62-821-744-20792; fax: +62-751-72566.
E-mail address: hilma@ft.unand.ac.id

1. Introduction

Emergency Medical Services (EMS) is a basic medical actions undertaken to accident victims quickly and precisely in order to maintain life and to prevent a decrease in body condition or disability before the victim finally getting further treatment from medical personnel. One method of first aid and evacuation of casualties commonly studied and practiced is the method of evacuation using a tool called Long Spinal Board (LSB). This tool is shaped like an emergency stretcher boards made from wood or polymer with a flat surface that is used to perform the evacuation of the injured spine. The basic principle use of LSB is immobilize (limiting the space) position of the spine so that the injury to the spine due to swing, clash, or shocks that occurred during the evacuation process can be minimized.

Integration between the cells of the central nervous and spinal cord contained within the structure of the spine and the brain makes these nerves sensitive if exposed to damage or injury. This means, damage to the central nervous system will lead to defects that will affect the structure of the body that are directly related to damage nerves. Injury or damage to the central nervous system on a larger scale can result in permanent paralysis and death. National Spinal Cord Injury Statistical Centre (NSCISC) collected epidemiological data in the United States from 2010-2012 on the cause of injury to the spinal nervous system. The data shows that the most common cause of traumatic injury to the spinal nervous system, among others, due to motor vehicle accidents by 36.5%, fell from a height by 28.5%, an intentional act of violence by 14.3%, sports by 9.2%, and other unknown causes by 11.4% [1]. Mortality (risk of death) in patients with traumatic spinal cord injury is estimated at 48% in the first 24 hours, and approximately 80% died at the case [2]. This shows that the effective and efficient handling should be done to reduce the risk of injury to the victim's death at times critical. One thing that should be kept in saving lives is the victim first aid and evacuation itself, by knowing the proper technique in moving the victims to a safer area to minimize secondary injury that occurs as a result of the evacuation process itself.

However, in practice, the existing LSB has several shortcomings, both in terms of user comfort and also effectiveness and efficiency of the evacuation process when done. In fact, a recent study found that the use of LSB can cause pain, discomfort in patients, and respiratory disorders. Furthermore, LSB can decrease tissue perfusion (blockage of the flow of oxygen in the tissue capillaries) at the points given pressure (in this case the placement of ropes or strap), which will lead to the occurrence of decubitus wound, the wound caused by blockage of blood flow on certain body parts [3].

By observing the facts, it can be concluded that it is necessary to redesign the existing LSB. It aims to achieve mobility and better equipment compatibility when in use so that the evacuation process can be performed more effectively, efficiently and safely. By doing this, it is expected that the risk of death of patients with traumatic injuries to the victim's spine can be minimized, and thus increase the comfort and safety of both victims and rescuers when evacuation is done.

Regarding the methods for designing the new product development, Quality Function Deployment (QFD) is a significant methodological approach to enhance customer satisfaction and reduce the product costs and development cycle time. It is also a crucial tool to increase time and resources saving throughout all stages – design to production planning [4]. QFD has been profitably applied by industries around the world [5-7]. Hence, this study used QFD method to investigate the customer and technical requirements for designing ergonomics LSB.

2. Research method

2.1. Preliminary study

Preliminary study was conducted by a direct observation to the actual use of the existing LSB. It was also carried out using interviews with volunteers from the Indonesian Red Cross of West Sumatera, assuming they have a good understanding of the accident evacuation process as well as having experience in the LSB use. The interviews were conducted to know in general how customers respond to the existing LSB on the market today as well as the characteristics of the customers towards the desired LSB in the future. The interview is a preliminary stage that serves as a reference in designing the research questionnaire. It is also a method to get an initial picture of consumer expectations for designing an ergonomic LSB.

متن کامل مقاله

دریافت فوری ←

ISIArticles

مرجع مقالات تخصصی ایران

- ✓ امکان دانلود نسخه تمام متن مقالات انگلیسی
- ✓ امکان دانلود نسخه ترجمه شده مقالات
- ✓ پذیرش سفارش ترجمه تخصصی
- ✓ امکان جستجو در آرشیو جامعی از صدها موضوع و هزاران مقاله
- ✓ امکان دانلود رایگان ۲ صفحه اول هر مقاله
- ✓ امکان پرداخت اینترنتی با کلیه کارت های عضو شتاب
- ✓ دانلود فوری مقاله پس از پرداخت آنلاین
- ✓ پشتیبانی کامل خرید با بهره مندی از سیستم هوشمند رهگیری سفارشات