Safety and Health at Work 7 (2016) 32–37

Contents lists available at ScienceDirect

Safety and Health at Work

journal homepage: www.e-shaw.org

Original Article

Using Shoulder Straps Decreases Heart Rate Variability and Salivary Cortisol Concentration in Swedish Ambulance Personnel

Kåre J. Karlsson [1,2], Patrik H. Niemelä [1,2], Anders R. Jonsson [3,4], Carl-Johan A. Törnhage [5,*]

[1] Ambulance Service, Skaraborg Hospital, Skövde, Sweden
[2] Skaraborg Hospital, Skövde, Sweden
[3] School of Health Sciences, Borås University, Borås, Sweden
[4] Swedish Armed Forces, Centre for Defence Medicine, Västra Frölunda, Sweden
[5] Department of Paediatrics, Skaraborg Hospital, Skövde, Sweden

ARTICLE INFO

Article history:
Received 15 January 2015
Received in revised form
8 September 2015
Accepted 12 September 2015
Available online 28 October 2015

Keywords:
ambulance personnel
heart rate
saliva cortisol
shoulder straps
stretcher

ABSTRACT

Background: Previous research has shown that paramedics are exposed to risks in the form of injuries to the musculoskeletal system. In addition, there are studies showing that they are also at increased risk of cardiovascular disease, cancer, and psychiatric diseases, which can partly be explained by their constant exposure to stress. The aim of this study is to evaluate whether the use of shoulder straps decreases physical effort in the form of decreased heart rate and cortisol concentration.

Methods: A stretcher with a dummy was carried by 20 participants for 400 m on two occasions, one with and one without the shoulder straps. Heart rate was monitored continuously and cortisol samples were taken at intervals of 0 minutes, 15 minutes, 30 minutes, 45 minutes, and 60 minutes. Each participant was her or his own control.

Results: A significant decrease in heart rate and cortisol concentration was seen when shoulder straps were used. The median values for men (with shoulder straps) at 0 minutes was 78 bpm/21.1 nmol/L (heart rate/cortisol concentration), at 15 minutes was 85 bpm/16.9 nmol/L, and at 60 minutes was 76 bpm/15.7 nmol/L; for men without shoulder straps, these values were 78 bpm/21.9 nmol/L, 93 bpm/21.9 nmol/L, and 73 bpm/20.5 nmol/L. For women, the values were 85 bpm/23.3 nmol/L, 92 bpm/20.8 nmol/L, and 70 bpm/18.4 nmol/L and 84 bpm/32.4 nmol/L, 100 bpm/32.5 nmol/L, and 75 bpm/25.2 nmol/L, respectively.

Conclusion: The use of shoulder straps decreases measurable physical stress and should therefore be implemented when heavy equipment or a stretcher needs to be carried. An easy way to ensure that staff use these or similar lifting aids is to provide them with personalized, well-adapted shoulder straps. Another better option would be to routinely sewn these straps into the staff's personal alarm jackets so they are always in place and ready to be used.

1. Introduction

About half of all reported occupational injuries in Sweden are related to musculoskeletal strain injury [1]. It is well-known that emergency medical professionals suffer from various kinds of stress. According to a report published by The Swedish Social Insurance Agency [2], the length of sick leave taken by medical personnel in 2008 was more than 14 days. The report also indicated that nurses in general are eligible for sick leave of 10 days/year, whereas other health-care personnel are eligible for 13 days/year. These statistics also include musculoskeletal injuries. Internal figures for the ambulance district investigated show that between 2011 and 2013 there was an average of 9 days of sick leave for nurses and 23 days for paramedics. The Swedish Work Environment Authority's Statute Book AFS 2012:2 [3] states that is inappropriate for a personnel to lift objects weighing over 25 kg. It also

* Corresponding author. Department of Paediatrics, Skaraborg Hospital, SE-541 85 Skövde, Sweden.
E-mail address: carl-johan_tornhage@hotmail.com (C.-J.A. Törnhage).

http://dx.doi.org/10.1016/j.shaw.2015.09.005

describes that lifting aids should be used when lifts cannot be avoided and that the workplace should be designed in such a way that different kinds of harmful stress are avoided wherever possible. In the case of an emergency medical (ambulance) service, however, this can be hard to achieve when work has to be performed in different environments by two people. The profession requires that sick or injured persons should be cared for in all environments (indoors or outdoors), seasons (summer or winter), and at all hours; in some cases, these medical personnel also work under time pressure. Another aspect is that the team's composition varies in terms of physical conditions of work, age, height, sex, and education. Developments in the ambulance service have evolved from carrying patients on stretchers to having stretchers that in most cases are rolled (flexible); however, in some cases, manual lifting of individuals needs to be performed and heavier equipment has to be carried between the ambulance and place of care [4]. Examples of devices available in the ambulance service used for transferring patients are lifting belts, sliding boards, shoulder straps, stair climbers, mattresses for dragging, and stretchers. The Swedish ambulance service requires at least one of the team members to be a registered nurse for the administration of drugs. The nurse always has the medical responsibility for the patient. The team may consist of one nurse and one nursing assistant, called "paramedics," or two nurses.

There is strong evidence that professional life in general, regardless of profession, involves a high risk of injury to the lower back. Different prevalence rates have been reported, and the estimated annual and long-term risk rates of suffering from back pain during work varies between 27% and 62.5% [5–7]. The risk of suffering from back pain related to work at some point in one's career is 84–91% [8,9]. The major risks identified are heavy lifting [10–12], repetitive or sudden twisting movements [9,11], stress [10,12], and deficiencies in the psychosocial environment [13]. Lower back pains are a major occupational hazard, specifically for ambulance service personnel, with reports indicating a 32–67% frequency of lower back pain related to work in the past year [14–16]. As much as 10–13% of these medical personnel took a shorter or longer sick leave [17,18]. The reasons are similar to those reported in other professions with a predominance of lifting, twisting movements, and sudden unexpected movement from the patient. Injuries to the back and upper extremities are not just an emergency event for the individual. The median time per sick leave for lower back pain is 5 days [19] and it was the most important cause of early retirement. All these imply the individual's suffering and cost to the society [20,21].

Although ambulance service personnel perceive themselves as "healthy" [22], there are obvious indications that in addition to neck/back pain, a number of individuals also suffer from cardiovascular disease, cancer, and psychiatric disorders, conditions in which stress and strain are considered to be an underlying cause [20,23]. Studies show that proper use of assistive devices and lifting techniques can prevent overload and back problems [24,25].

Salivary cortisol measurement is a simple and established method and its result correlates well with the cortisol level in the blood [26]. The reason for taking cortisol samples in the morning is that cortisol follows a circadian rhythm with higher values generally being recorded after awakening followed by rapidly decreasing values [27,28]. Heart rate is a clinical indicator of stress, and thus, we measured this in our study population [29].

1.1. Study Objective

The aim of this study was to evaluate whether the use of shoulder straps reduces physical work. By applying psychosocial and psychological methods, heart rate and secretion of salivary cortisol before, during, and after carrying the stretcher were measured.

2. Materials and methods

2.1. Study design and methodology

This study was conducted in an ambulance organization in southern Sweden. When the study started, this organization consisted of 12 ambulances on duty for 24-hour shifts and eight ambulances on duty for daytime shifts only. The total number of employees was 164. All employees were requested to participate in this study by postal mail. The only exclusion criterion was treatment with any medication that interferes with heart rate and/or cortisol value.

The study was conducted in such a way that pairs of participants carried a standardized stretcher (alfabår) with a dummy. The total weight, including the stretcher (39 kg) and dummy [approximately 73 kg (160 pound)], lifted by the participants was 112 kg. The only previous occasion they used this equipment was in connection with an employment test. Therefore, their previous experience was only minimal. The dummy was carried over a flat terrain for 400 m for about 10 minutes, on two different days. The first time was without and the second time was with the shoulder straps (Easylift Shoulder, AB GERMA, Kristianstad, Sweden). The participants changed their position after covering 200 m: the first at the head end and the second at the foot end or vice versa. The same geographical path was used on both days. Heart rate was registered using the monitor brand Polar RS 400 (Polar Electro, Bromma, Sweden) that logged the heart rate every 15 seconds throughout the period of salivary cortisol sample collection. Salivary cortisol samples were collected in neutral cotton-based Salivette tubes (Sarstedt, reference 51.1534, Numbrecht, Germany) just before carrying the stretcher and 15, 30, 45, and 60 minutes after collecting the first sample. To prevent interference with the results, the participants were informed that they should avoid smoking, taking Swedish snuff, brushing their teeth, drinking coffee, and tea in the morning before the test.

2.2. Study period

All data collection took place between October 17, 2012, and March 25, 2013. However, one participant suffered a physical injury, and thus, the sample from this participant was collected on September 4, 2013. Samples were collected between 7:46 AM and 9:23 AM. The tests were cancelled in poor weather such as rain or snow to ensure the conditions for sample collection are as similar as possible. The temperature during tests ranged from +15°C to −5°C. Data collection took place on work-free days. At least one of the researchers participated as a supervisor on every occasion.

2.3. Participants

All 164 employees in the organization received oral and written information about the study during workplace meetings and all were invited to participate. This organization included 99 men and 65 women of whom 129 were nurses and 35 were paramedics. The age range was 31–62 years (mean = 43.4 years; median = 42 years) for men and 27–56 years (mean = 40.8 years; median = 41 years) for women. A total of 38 employees (25 men and 13 women) were interested in participating; of these 38, three were excluded because of medication use. Of the remaining 35 employees, 21 were randomly selected from a numbered code list by a nonparticipating individual. One woman had to drop out immediately before start because of her own injury. All remaining participants completed the study.