

User Experiences on the Implementation of Exoskeletons in Care Work

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Abstract. This article describes the results of a field test of an exoskeleton in care work. Qualitative data about the implementation and use of exoskeletons, with the help of interviews and user diaries, were collected both from nurses who used the exoskeleton and managers at different levels of the care organization. On the basis of these data, there are relatively few obstacles in and many opportunities for the implementation of exoskeletons in care work, taken that the introduction, orientation and continuous support for technology use are given enough weight.

Keywords. Exoskeleton, care work, implementation, user experience

1. Introduction

There is a huge shortage of care workers, which is expected to get even worse during the next years [1,2]. Close to 40% of the work tasks of assistant nurses are physically strenuous, which is linked to sick leaves resulting from musculoskeletal disorders (6,5% of the working time) [3]. The two phenomena together lead to significant societal problems. One of the most strenuous work tasks is lifting patients with poor physical health, in round-the-clock housing services [4].

Exoskeletons are a form of wearable robotics that can reduce physical exertion and thus support the resilience of care workers. Exoskeletons have been defined as wearable devices that augment, enable, assist, and/or enhance physical activity through mechanical interaction with the body [5]. A review of the scientific literature reveals that there is a gap in research knowledge regarding implementation of exoskeletons in care work. This research thus aimed to examine the implementation and use of exoskeletons in care work, focusing on benefits and possible obstacles for use [6].

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2. Methods

A field study was organized as a part of the “Exoskeletons and caregivers’ changing daily work” (TUEKS) project [7]. In the field study, assistant nurses used an exoskeleton for three weeks during their working hours. The tested exoskeleton was Auxivo LiftSuit 2.0. It is a Swiss passive exoskeleton supporting the user’s back when working in a forward leaning position or lifting objects below waist level. There are textile springs on the back that store energy. The energy is released when activating the device to support the user’s movements. [8]

The research environment was a Finnish care home where older persons’ round-the-clock housing services are offered. The study participants were assistant nurses (N=8), who were recruited voluntarily. Their ages ranged from 19 to 61 years. They had varying care work experience (1.5– 40 years). The assistant nurses participated in two groups, four at any given time. Each nurse used an exoskeleton for three weeks.

Pre- and post-interviews and user diaries written during the trial were utilized to collect the data. The participants received a comprehensive orientation and introduction to the device’s use just before the pre-interview. The instructor was a researcher with a nursing background. During the interviews, the assistant nurses answered questions regarding what expectations they had beforehand and how they experienced the use of the device and its impacts on work, what orientation needs they had, and how other people reacted to the use of the device. With the user diary, information was collected on immediate experiences, purposes of use and times of use.

In addition, three managers (N=3) at different levels of the care organization were interviewed individually. They were asked questions about the managerial issues related to technology implementation.

Content analysis and data categorization were utilized to analyse the qualitative interview and user diary data. The analysis consisted of both data-driven and theory-driven phases. The data, after transcription and reduction, were inductively coded using an interpretive approach – searching for recurrent themes related to benefits of and obstacles for use.

3. Results

The exoskeleton was well suited to certain care tasks. Nursing is characterized by many different tasks, and in the tasks requiring leaning forward, the exoskeleton was felt to be beneficial. The participants expressed that they would like to reserve the device for showering days, for example, because a large part of the work on those days requires leaning forward. On the other hand, the exoskeleton was not comfortable when squatting. In those work positions, the device felt tight. Careful planning of the order in which work tasks are performed and increased practical knowledge about when, where and how the exoskeleton is useful are still needed.

The exoskeleton was felt to be easy to use after initial adjustments. It was also considered relatively unobtrusive and light. These were supportive factors, along with the view that the exoskeleton is a neutral tool that did not attract special attention and was generally socially accepted.

The participants highlighted that the benefits of the exoskeleton’s use are essential to bring up when the device is introduced to workers. It is critical to provide lucid guidelines regarding where and how the exoskeleton is useful – in what tasks. The

orientation should be sufficiently comprehensive and include a practical exercise related to daily work tasks. The instructor should provide a detailed explanation of when to activate and de-activate the support. Ensuring that the nurses remember to activate the suit before appropriate work tasks also requires reminders and time.

After the trial, all participants mentioned that they were ready to use an exoskeleton in their work if the use is beneficial for them. It was also felt that care work would perhaps become increasingly appreciated in the society through the development and use of such technologies. This could, again, lead to the nurses' voices gaining more prominence. The length of the three-week trial was, however, felt to be too short. The need for longer trial and implementation periods should be considered in future studies.

The managers at the different levels of the organization also highlighted the importance of being able to demonstrate the benefits of the device's use during the introduction. Responding to the question why it is important to use the exoskeleton is vital. Issues should be brought up from the perspective of both the care worker and the client. The managers also felt it is essential to secure resources for proper introduction and orientation, as well as to ensure that all care workers obtain introduction and orientation despite their changing work shifts. Communication and orientation should be provided in good time before the actual implementation, as early communication will help to avoid situations where the staff knows nothing about the technology when it is brought to the workplace. Such situations may lead to unnecessary resistance.

4. Discussion

The research indicates that there is potential in care work for the implementation of exoskeletons. Both the nurses and the managers emphasized the importance of understanding the goal and benefits of exoskeleton use. -Secondly, both the nurses and the managers felt that it is essential to invest in the introduction and orientation activities. If the introduction, orientation and implementation are well planned and attended to, the use of an exoskeleton can be a meaningful part of the daily care work. On the other hand, if these fail, and the goal of use is not clear, the exoskeletons may remain unused. It is worth mentioning that when they had the chance to experience the benefits, all the nurses were prepared to use exoskeletons in their work.

The nurses also emphasized the importance of designing new technology to directly support them and their work, as technology previously introduced to care work has mainly supported the client. The fact that new tools are introduced to support nursing work was therefore seen as a significant value per se.

5. Conclusions

The research showed that there are relatively few obstacles in and many opportunities for the implementation of exoskeletons in care work, taken that the introduction, orientation and continuous support for technology use are given enough weight in both care work and management. This calls for further research focusing on those topics.

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Ethical approval

Ethical approval for this research was obtained from the Regional Ethics Committee of the Expert Responsibility area of Tampere University Hospital (Finland) (approval number R22026/Chairperson Matti Korppi).

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