WearRAcon Europe 2023
European Exoskeleton Conference
October 25-26, 2023

TOWARDS SMOOTHER IMPLEMENTATION OF EXOSKELETONS IN CARE WORK

Saurio R[1&2], Pekkarinen S[1], Melkas H[1&3]

[1]Lappeenranta-Lahti University of Technology LUT, School of Engineering Science, Lahti, Finland,
[2]Ostrobothnia Wellbeing Services County, Finnish Centre for Client and Patient Safety, Vaasa, Finland,
[3]University of Agder, Centre for E-health, Kristiansand, Norway

ABSTRACT

The use of exoskeletons is gradually increasing in care work. This paper presents research results about user experiences and implementation of an exoskeleton in a Finnish care organization. Qualitative data about the implementation and use of the exoskeleton were collected, with the help of interviews and user diaries, both from nurses who used the exoskeleton and managers at different organizational levels. Based on these data, there are relatively few obstacles and many opportunities for the implementation of exoskeletons in care work. The exoskeleton was felt to be particularly suitable for bedside care, while when squatting, it was felt to be uncomfortable to use. The need to know about the aim and the benefits of using the exoskeleton was emphasized by both nurses and managers. A proper introduction to the use and practical examples of where the exoskeleton is useful in care work were identified as particularly important. An implementation guide was created on the basis of the research results. The aim of the guide is to support the work of managers, in particular, in implementation of exoskeletons in care organizations.

Keywords: exoskeleton, user experience, implementation, care work

1. INTRODUCTION

Almost 40% of work tasks of assistant nurses are physically strenuous, and this is linked to sick leaves resulting from musculoskeletal disorders (6,5% of the working time) [1]. Exoskeletons might be of help, but a review of scientific literature reveals a gap in research knowledge regarding implementation of exoskeletons in care work. This paper presents research about implementation and use of exoskeletons in care work, focusing on benefits and possible obstacles to use. The research was part of the "Exoskeletons and caregivers' changing daily work" (TUEKS) research project that explored impacts of exoskeletons on the physical load of care work and identified prerequisites and readiness for their implementation. The project's findings provide information about the potential of exoskeletons in facilitating care work, based on physiological measurements, user experiences and social perspectives. Additionally, the project developed a guide for exoskeleton implementation in care work. The user experiences and implementation-related findings as well as the guide are briefly presented in this paper.

2. MATERIALS AND METHODS

The field study was carried out in two phases. Two three-week exoskeleton trials were implemented in 2022 and 2023 in two Finnish care homes offering older persons' round-the-clock housing services. A total of 12 nurses (N=12) and five (N=5) managers at different levels of the care organization participated in the study. Each participating nurse received an exoskeleton for their personal use for three weeks after introduction to the use. 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 energy-storing textile springs on the back. The energy is released when activating the device to support the user's movements. The suit can be washed in a washing machine at 60°C and wiped with disinfectants. [2]

Qualitative data collected from the nurses consist of pre- and post-interviews and user diaries written during the trial. User experiences and implementation-related matters were examined. In addition, individual interviews were arranged for the managers. Their interviews concerned technology implementation process and managerial practices. Content analysis and data categorization were utilized to analyse the qualitative interview and user diary data. Quantitative data were also collected in the project in 2022 from seven voluntary nurses (N=7) via physiological measurements. These measurements were carried out by the Finnish Institute of Occupational Health [3]. Their results provide background information for this paper.

3. RESULTS AND DISCUSSION

The participating nurses provided a wealth of information on diverse impacts of exoskeleton use through physiological measurements, interviews and user diaries, also related to the implementation. In addition, many implementation-related matters arose in the interviews with the managers.

The nurses brought up many benefits and relatively few challenges. The suit was felt to be appropriate especially for tasks that require leaning forward, such as bedside care. Squatting positions caused the suit to feel tight and uncomfortable. Factors supporting the suit's use included ease of use after initial adjustments and the fact that it was relatively unobtrusive and light. Physiological measurements supported the findings of the qualitative study [3]. All nurses mentioned that they would use some type of an exoskeleton in their work if they knew the aim and the benefits of using it. As to the implementation, it was particularly important to receive a proper introduction to the use and practical examples of where in nursing an exoskeleton is useful.

Managers highlighted the importance of being able to provide reasons for why exoskeleton use is beneficial. Therefore, there must be a clear aim and reasons for the use from the perspectives of both the staff and the clients. The managers pointed out that resources must be provided in the implementation phase for nurses to participate in the introduction and to properly learn the suit's use. Timely communication was also raised as essential.

The findings regarding implementation provided the basis for creating the implementation guide [4]. It is intended to support, in particular, managers in the implementation of exoskeletons in care work. The guide starts from a situation where an exoskeleton has already been acquired for the workplace. The guide is divided into three stages: planning, starting the use, and embedding the use. The planning stage concerns selection of responsible persons, goal for use, communication, and introduction. Starting and embedding of the use are also further detailed. All these stages emphasize the importance of communication. The guide also contains a one-page checklist. The first version of the guide was tested by the managers. It was further developed with the help of their feedback and development ideas.

4. CONCLUSION

All participating nurses were willing to use some type of an exoskeleton in their work, insofar as they know the benefits of using it. The practical aspects related to exoskeleton implementation, identified in this study, were compiled into an implementation guide. Its purpose is to facilitate the role of managers in the implementation of exoskeletons in care work.

ACKNOWLEDGEMENTS

This research was supported by the Finnish Work Environment Fund ("Exoskeletons and caregivers' changing daily work" – TUEKS project).

REFERENCES

[1] Finnish Institute of Occupational Health. Työelämätieto: Sairauspoissaolot ja työn raskaus. [Database with worklife data; in Finnish]. https://www.tyoelamatieto.fi (2020).
[2] Auxivo AG. LiftSuit 2. https://www.auxivo.com/liftsuit (2022).
[3] Finnish Institute of Occupational Health. Eksoskeleton hoitotyössä [Exoskeleton in care work; in Finnish]. Unpublished report. (2022).
[4] Saurio, R., Pekkarinen, S., Laakso, H. & Melkas, H. Eksoskeletonit hoito- ja hoivatyöhön – Opas käyttöönottoon [Exoskeletons for health and care work – An implementation guide; in Finnish]. LUT University. https://urn.fi/URN:ISBN:978-952-335-948-2 (2023).