Exploring the user-friendliness of a contactless monitoring system used for sleep monitoring: A usability study

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Abstract

A usability study exploring the usability of a contactless monitoring system used during sleep. Overall, the participants found the contactless monitor easy and satisfying, but further improvements to the user manual and design might optimize the usability of the monitor.

Keywords

Type 1 diabetes - Nocturnal Hypoglycemia - Contactless Monitor - User-friendliness - Usability Study

1 INTRODUCTION

Diabetes is an increasing global health challenge [1]. The most common complication among people with type 1 diabetes (T1D) is hypoglycemia [2]. Strong counterregulatory responses exist if hypoglycemia occurs [3]. Activation generates hormone creation, which causes physiological changes in e.g., heart rate (HR) and respiration rate (RR) [4–6]. More than 50% of critical cases of hypoglycemia occur at night [7], leading to fear and reduced quality of life for people with diabetes and their relatives [7,8]. As a result, people with T1D frequently measure glucose at night to prevent hypoglycemia, which causes a major negative load [2]. Continuous glucose monitoring (CGM) or self-monitoring of blood glucose (SMBG) remains the decisive marker in the detection of hypoglycemia [9]. CGM is found to estimate inaccurate glucose values during hypoglycemia [10]. In comparison, SMBG depends on frequent monitoring, which can cause massive pain, scarring, and loss of sensibility [11]. Due to disadvantages and lack of access to CGMs, there is an increasing interest in methods that can predict hypoglycemia based on physiological changes [9]. The contactless monitor (Sleepiz One, Sleepiz AG, Switzerland) may be used as an alternative prediction method as it can monitor vital parameters affected by hypoglycemia. However, the contactless monitor is a newly developed technology, and the usability of the monitor is uncertain. Therefore, it is highly relevant to explore the usability of the monitor as this is an important parameter for a successful implementation of new technology [12]. Thus, the aim of the present study was to explore the usability of a contactless monitor used for sleep monitoring.

2 METHODS

The present study was a usability test, which was performed at Aalborg University, Denmark. Five healthy individuals aged ≥ 18 years were included. They were recruited through social media. Exclusion criteria were pregnancy, diagnosed cognitive challenges, vulnerability, and implemented electronic devices. The usability test was divided into two parts (Figure 1). Part one was a "thinking aloud test" followed by follow-up questions. The participants were instructed to use a user manual to set up the contactless monitor in a laboratory setting while thinking aloud. In part two, the participants slept with the monitor at home for one night, after which a semi-structured interview was conducted. The interview guide was based on the four components: learnability, memorability, errors and satisfaction, which according to Nielsen defines usability [13]. The components were furthermore used as a starting point for an overall assessment of the user-friendliness of the contactless monitor. Data were analyzed using Kvale and Brinkman's thematic approach [14].

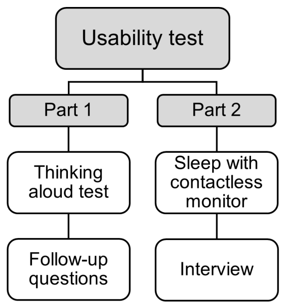

Figure 1. Overview of the two parts of the usability test.

3 RESULTS

Five participants aged 26-73 years were included in the study (two females). Four participants completed the study, one participant was excluded from part two due to illness. A total of 10 themes, related to the four components defining usability, were identified (Figure 2). Overall, the participants found that the contactless monitor was easy to use. The participants found that the monitor was comfortable to use, as it did not require any physical contact and thus was not perceived as physically uncomfortable. When the participants used the user manual they were in doubt regarding the location and position of the monitor. Furthermore, the participants found it essential to follow the user manual step-by-step to prevent errors in the setup. Overall, the participants found it easier to set up and use the contactless monitor for the second time at home. The majority of the participants stated that they did not have a feeling of surveillance when using the monitor. The

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participants quickly grew accustomed to the monitor, and the monitor did therefore not affect their sleep. To increase the usability some of the participants suggested improvements related to the design and the user manual. Some participants expressed concerns about using the monitor due to the risk of radiation. All the participants were interested in using the monitor in case of a relevant disease.

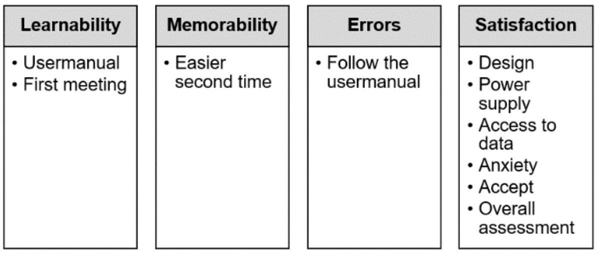

Figure 2. Overview of the identified themes related to main keywords.

4 DISCUSSION

The present study aimed to explore the usability of a contactless monitor used for sleep monitoring. Overall, the participants found that the contactless monitor was easy to use. The participants found that the contactless monitor was not physically uncomfortable. Previous studies found that people preferred contactless monitoring over contact-based monitoring and that contact-based monitoring could be related to skin irritation, discomfort, and constraining movement [15,16]. All the participants agreed that the step-by-step guide in the user manual helped them set up the monitor. A previous study found that a step-by-step structure of the user manual was considered satisfying among users [17]. However, the participants had suggestions for improvements that could increase the usability of the user manual and the contactless monitor.

5 CONCLUSION

In conclusion, the contactless monitor was user-friendly, as it was easy and satisfying to use. However, the usability of the contactless monitor may be optimized by further improving the user manual and design of the monitor.

6 LIMITATIONS

A limitation of this study is the relatively small sample size of five participants, as new knowledge was still generated during the last interview, which might indicate that the number of participants were not sufficient to achieve data saturation. Therefore, increased sample size is recommended for future studies.

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