Designing for relaxation in the ER: a contribution to delirium prevention in older patients

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Older patients in the emergency department have a high risk of delirium, a condition that is described as an acute deterioration of attention and awareness, not explained by preexisting conditions. Prevention of delirium is important, as it has negative consequences, among which negative experiences of care and an increased 6-month mortality rate. However, the staff's lack of knowledge, recognition and awareness of delirium and the nurses' rigid routines complicate the acceptance of new technologies. A contextual inquiry and co-design sessions were executed to gain an understanding of the patient's experience, to map the patient's and nurse's needs, and to map the design opportunities for delirium prevention through patient relaxation. The latter is used for the design of Birdhome, which consists out of a soothing nature video with sound projected on the ceiling and interactive birdhouse, which was evaluated at the emergency department of Vestfold Hospital Trust, Norway.

Relaxation; delirium prevention; emergency department

1. Introduction

Delirium is a condition that is described as an acute deterioration of attention and awareness that cannot be explained by pre-existing conditions such as dementia [1]. There are three forms of delirium: hyperactive (i.e., increased psychomotor activity), hypoactive (i.e., decreased psychomotor activity) and mixed [2]. Everybody could get delirium but especially older patients are at risk [3], which can be seen in the emergency department, where the prevalence of delirium in older patients is 8-17% [4]. Another study on incidence delirium [5] found that the overall incidence of delirium in the emergency department is 12.1%. Of the older patients with delirium, around 96% have either the hypoactive or mixed forms [6]. Inouye et al. [7] have found that delirium was only recognized in 31% of the patients and especially hypoactive delirium often goes undetected. Symptoms of hypoactive delirium may be ascribed to other causes, such as depression [8]. The consequences of delirium can be severe: older ED patients with delirium have an increased 6-month mortality as compared to non-delirious patients [9]. This is even worse for patients with unidentified delirium, as they have a 6-month mortality rate nearly three times higher than patient with identified delirium [10]. Additionally, patients with delirium often have negative experiences of care [11]. It is therefore important to prevent delirium in older ED patients. Because the cause of delirium is multifactorial, solutions that tackle multiple causes are more likely to be successful than solutions that only tackle one cause [4]. It is therefore advised to make use of multicomponent interventions, rather than single interventions [12]. Kim et al. [13] have comprised an overview of pathways for nonpharmacological delirium prevention. The pathway used for this study is 'induce relaxation. To map the needs of the users, the typology of 13 Fundamental needs human centred design of Desmet and Fokkinga [14] was applied.

The goal of this work is therefore twofold: 1) to answer the research question '**How can we design a product that creates a relaxing environment to prevent delirium in older emergency room patients?**', and 2) to design a concept for Vestfold Hospital Trust that fulfils the same goal.

2. Approach and set-up

This study was performed in the emergency department of Vestfold Hospital Trust, Tønsberg, Norway, between November 2022 and June 2023. This study consisted out of a contextual inquiry, co-design sessions, and a concept evaluation. For the contextual inquiry, Three observations sessions of stimuli in the emergency rooms and, the mood of three patients and the behaviour of staff, several informal interviews with nurses, and an expert interview with a geriatrician were performed, to obtain an understanding of patient experience and the barriers for change.

Three co-design sessions were completed to gain insights into the needs of the user and to map the design opportunities. The 6 participants of the first session were staff without patient contact (e.g. head department, leaders), the 5 participants of the second session were patient representatives (e.g. relatives, nurses, physicians), and the 3 participants of the third session were staff with patient contact (e.g. nurse, physician, ambulance worker),

Two types of evaluation sessions took place: one with patients and one with patient representatives. All evaluations took place in a multi-bed room. The evaluation with patient representatives consisted out of a simulation of an ED visit, in which a nurse played the role of the nurse and a nurse or ED aid played the role of the patient. During the simulation, the researcher did observations of the participants' moods and the patient representatives interaction with the designed concept. After the simulation, a short interview took place.

For the evaluation with patients, the prototype of the concept was set up in the room and the patient was asked to participate. The researcher observed the patient's mood and the interaction with the birdhouse during the first 1.5 hours of the ER visit. Afterwards, a short interview with the nurse took place.
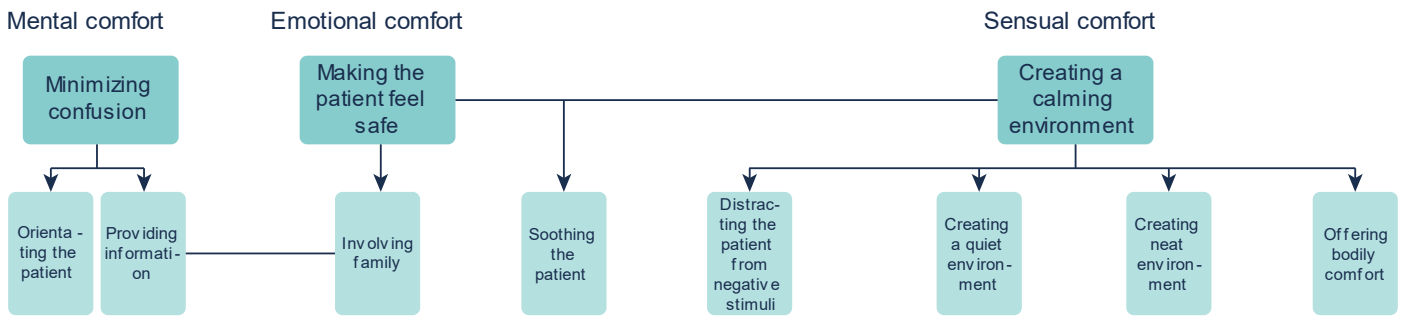
Figure 1: Design opportunities

3. Contextual inquiry

3.1. Patient experience

Through the observations, it was identified hat patients were exposed to a large amount of negative stimuli, e.g. audio-visual stimuli and bodily discomfort, which may contribute to the development of delirium. While an effort is made to place older patients in single-bed rooms to provide them with a low stimulus environment, this is not always feasible during peak hours (e.g. Monday – Friday, 12AM – 3PM). Patients in the multi-bed rooms are not only exposed to negative audio-visual stimuli related to their own care, but also related to other patients' care (e.g., nurses talking to other patients, multiple beeping heart monitors, etc.), meaning that afternoon patients have a worse experience than morning patients. Additionally, all patients are exposed to unnecessary negative stimuli unrelated to patient care (e.g. blinking motion sensors, noises from the breakroom, etc.).

3.2. Barriers for change

The expert interview revealed information about why changes for delirium prevention have not been implemented yet. A reason for this is that delirium is often not recognized. Therefore, decisionmakers for approving changes to the ED are not aware of the problem. Additionally, the interviewee stated that "We are not used to have to think these things, that's the problem.", meaning that not all care staff (e.g. nurses, physicians, ED aids) have sufficient knowledge of delirium and the care for frail, older patients.

Another barrier is the acceptance of technology, as this not only depends on the patient. As mentioned above, decisionmakers need to accept new technologies in order for them to be implemented in the ED. In addition, the crowded ED during peak hours puts high pressure on nurses, resulting in rigid routines to use the time efficiently. It can be challenging to fit new technologies within these rigid routines.

4. Co-design

4.1. Needs-profiles

During the co-design sessions, a list of product requirements was made. It was found that these requirements not only related to the patient's experience, but also to the nurse's workflow. It was therefore found that the nurse's acceptance should not simply be considered a barrier for change, but that nurses should be considered end-users of the design intervention. Information derived form the co-design sessions resulted in the needs-profiles for both the patient and the nurse. The needs-profile of nurses can be found in Table 1 and the needs-profile of patients can be found in Table 2.

Needs	Sub-needs
Autonomy	Freedom of decision
Comfort	Peace of mind Simplicity Overview and structure
Competence	Knowledge and understanding
Security	Physical safety

Table 1. Patient needs

Needs	Sub-needs
Comfort	Peace of mind Convenience Overview and structure
Competence	Knowledge and understanding

Table 1. Nurse needs

4.2. Design opportunities

The goal of the brainstorming exercises was to come up with as many product ideas as possible, that would induce relaxation in older ER patients. Surprisingly, the ideas not only related to 'creating a calming environment', but also to 'making the patient feel safe' and 'minimizing confusion'. When asked whether these ideas related to inducing relaxation, the participants answered that they did. The ideas of the three co-design sessions were grouped, which resulted in a practical overview of design opportunities for designing for relaxation in the ER (see Figure 1).

5. Birdhome

Birdhome was designed to induce relaxation in older patients placed in multi-bed rooms during peak hours. The goal was to design a product that creates an environment that makes older patients feel safe and calm, as if they are in a quiet and familiar nature environment.

The concept consists out of a video projected on the ceiling and an interactive birdhouse (see Figure 2). The video shows a birch tree (a local tree of the Vestfold area) under the blue sky with slow-moving white clouds. Every now and then, a bird flies by. The related sounds consist out of wind rustling through the leaves and distant birdsong. Every two months, the video is replaced by one related to the season.

The design of the interactive birdhouse was inspired by traditional Norwegian south coast houses, which is recognizable for most patients and may remind them of home. Inside the birdhouse is a tablet, which shows a video of local birds flying in

and out. The birdhouse also contains fake leaves, which gives the inside the appearance of a real birdhouse, and a soft green light, which contributes to creating a complete experience. When the noise in the emergency room gets above a certain threshold, the sound of the birdhouse will turn on, which is the song of the birds in the video. This prompts the patient to look at the birdhouse and become distracted from negative stimuli. The hole of the birdhouse is big enough to take a peak inside, but small enough to provoke curiosity.

Figure 2: Prototype of Birdhome set up at Vestfold Hospital Trust

6. Evaluation

A prototype of Birdhome was made and the concept was evaluated at the ED of Vestfold Hospital Trust.

6.1. Interaction

Both patients that were part of the evaluation with real patients looked at the projection and birdhouse. For one of the patients, the birdhouse acted as a conversation starter, as he started telling about the birds he had in his garden at home. The patient paid attention to the birdhouse during waiting periods, but was not distracted when staff was caring for him. The second patient paid relatively little attention to the birdhouse. This may be due to the chosen prompt, e.g. sound, as the patient had a hearing impairment. When the nurse pointed out the birdhouse, she picked it up to take a look inside. The nurse that participated in these two sessions had a slightly negative interaction with the birdhouse, as it occasionally formed a hindrance.

Patient representatives looked at the projection often, but had a passive attitude towards the birdhouse. All patient representatives reacted to the prompt the first time, but some paid no attention to it for the remainder of the simulation. Interestingly, one patient representative interacted with the birdhouse before and after the simulation, but hardly during it.

It is difficult to draw conclusions about the effect Birdhome has on the mood of the participants, as the set up of the simulation influenced this. Birdhome appeared to only have a little hindrance on nurses, as they paid hardly any attention to it after the explanation of the products.

6.2. Need fulfilment

Some patient representatives felt that they had little freedom of decision over their use of Birdhome. However, this was not always viewed negatively, as some stated that many options could become confusing. All patient representatives felt that Birdhome had a positive influence on their peace of mind, as it made them feel calm. Most participants felt positively about the simplicity of the concept. All patient representatives felt safe during the simulation. Interestingly, the main cause for their sense of safety was the nurse.

Most nurses felt that Birdhome had no influence on their peace of mind. One nurse felt a positive influence, as the concept reminded her to stay calm. The opinions of the convenience of Birdhome were divided: some felt that it had no influence on their care activities, while others indicated that the birdhouse caused a hindrance.

7. Conclusion

One of the goals of this work was to answer the research question '**How can we design a product that creates a relaxing environment to prevent delirium in older ER patients?**'. This can be done by designing for the needs of the patient (i.e. autonomy, comfort, competence, and security) and the nurse (i.e. comfort and competence). Additionally, it can be done by designing for the design opportunities 'creating a calming environment', 'minimizing confusion' and 'making the patient feel safe'. Tables 1 and 2, and Figure 1 may be used for this purpose.

The second goal was to design an intervention for Vestfold Hospital Trust that induces relaxation in older patients. Birdhome offers a starting point for this purpose.

8. Discussion

8.1. Discussion of the findings

This study was focussed on finding ways to design a product that creates a relaxing environment to prevent delirium for older emergency room patients. The findings show that the patient's experience is negatively influenced by stimuli from the environment, and therefore 'creating a calming environment' would improve this experience. Dahlke and Phinney [15] have found that sensory overload has a direct relation to delirium. Therefore, it can be said that 'creating a calming environment' contributes to delirium prevention.

Secondly, it was found that the design opportunity 'making the patient feel safe' contributes to their level of relaxation, which can be done by involving family. This is confirmed by Bridges et al. [11] have found that former patients (especially those with delirium) and their relatives often note that their relationship with each other and care staff was important in making them feel safe.

In addition to the design opportunities, it was found that patients have a need for autonomy, comfort, competence, and safety. The need for competence and security are confirmed by Nydén et al. [16], who found that ED patients have a high need for safety and understanding what is happening around them. Interestingly, they also found that ED patients have a passive attitude towards the decision-making in their care process which is in contrast with the need for autonomy found in this study.

8.2. Discussion of the concept

Difficulties were found with some of the properties of Birdhome. Firstly, the audio prompt was not always effective, as one of the patients did not react to it due to hearing impairment. Birdhome therefore lacks an inclusive prompt for users to interact. Additionally, it was found during the evaluation with real patients, that patients did not focus on the birdhouse when there was a lot of noise around them, since they were focussed on the care staff. The prompt should therefore depend on an alternative factor than the noise in the room.

While some participants showed an interest in the birdhouse, it did not keep their attention. Therefore, changes need to be made to the interaction between the patient and the birdhouse.

Most participants had an passive attitude towards the birdhouse. Often patients are not aware of the influence they are allowed to have on their care process, and therefore may have been afraid to touch the birdhouse. Some participants found that the birdhouse did not appear sturdy enough to be handled. Therefore, the appearance of the birdhouse needs to be improved so it afford the user to handle it.

Some comments were made on the portability of the projector. In the case that it is unfeasible to place a projector and speaker for every bed in the multi-bed rooms, improvements need to be made to the portability of Birdhome.

9. Recommendations

9.1. Recommendations for Birdhome

It is recommended that future designers make improvements to Birdhome's prompt, interaction, appearance and portability, as described in the discussion of the concept.

During the course of this study, it was not possible to evaluate whether Birdhome fulfils all of the users' needs. It is therefore recommended to evaluate Birdhome on the patient's need for overview and structure.

Additionally, it is recommended to involve other EDs in the continuation of this work, as they have shown an interest, and the exchange of information and ideas could result in fruitful outcomes.

9.2. Recommendations for future work

It is recommended that researchers and designers who contribute to the challenge of designing for the ER are mindful of the needs of nurses, as they greatly influence the acceptance of new technologies.

Secondly, it is recommended that (former) patients are involved in the research and design process, as they are the expert of their own experience [17]. Other important stakeholders, e.g. relatives, other departments, other EDs, may be involved as well.

For this study, a choice had to be made on which design opportunities to explore. It is therefore recommended that future designers explore the other design opportunities identified, as shown in Figure 1.

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