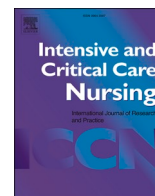




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Research Article

Experiences of nurses with an innovative digital diary intervention in the intensive care unit: A qualitative exploration

Tineke Haakma^a, Rob Tieben^b, Brenda Sleven^c, Marc Buise^c, Margo van Mol^{a,*}^a Erasmus MC, University Medical Center Rotterdam, Department of Intensive Care Adults, The Netherlands^b Games for Health (Game Solutions Lab), Eindhoven, The Netherlands^c Catharina Hospital Eindhoven, Department of Anesthesia and Intensive Care, The Netherlands

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ABSTRACT

Introduction: Diaries have been used regularly in various intensive care units (ICUs) in international settings. Hard copy diaries written by relatives became impractical during the COVID-19 pandemic due to ICU visiting restrictions and infection control considerations. The implementation of a web based application, named the "Post-ICU" diary, offered relatives the ability to collaboratively write in a digital diary, to easily upload photos, video and audio clips and to feel engaged with the patient at a safe distance. In addition it allowed nurses to easily provide up-to-date information. The aim of this pilot study was to explore the experiences of ICU nurses with the implementation process and application of the Post-ICU diary.

Methods: A multicentre qualitative design with focus group interviews was used with ICU nurses in November 2020. Interview data were audiotaped and transcribed verbatim, and then a thematic analysis was performed to categorize the data.

Results: Participants from three hospitals (n = 14), 57% of whom were women, with a mean age of 40.6 years, described their experiences with the Post-ICU diary. The following themes emerged: implementation process, COVID-19, integration, and motivation. The results showed that ICU nurses perceived the Post-ICU diary to be applicable in daily care and endorsed the added value of the digital Post-ICU diary as a new opportunity to improve interhuman connectedness. However, the nurses also experienced barriers such as non-user-friendly access, lack of time and hesitance to write short messages.

Conclusion: ICU nurses reported that the Post-ICU diary had added value for patients and their relatives. However, in the beginning they also experienced barriers such as lack of time, insufficient integration with their own work processes, and challenges regarding writing short messages themselves. For structural embedding of the intervention, tailored strategies are needed to support ICU nurses in using this innovative Post-ICU diary.

Implications for clinical practice

- The Post-ICU diary is a supportive digital tool for clinical bedside nurses providing short personal messages to ICU patients' family members, thus, meeting the goals of person centred ICU practice.
- ICU nurses can change their daily care for the patient and family members through interaction and reading in the Post-ICU diary.
- This study revealed that ICU nurses perceived the Post-ICU diary as applicable in daily care and endorsed the added value of the digital innovation as an opportunity to improve interhuman connectedness.
- ICU nurses also experienced barriers such as non-user-friendly access, lack of time and hesitance to write short messages. Therefore, tailored implementation strategies in nursing work processes should be considered before introduction of the innovative intervention.

* Correspondence author at: Erasmus MC University Medical Center, Department of Intensive Care, P.O. Box 2040, 3000 CA, Rotterdam, Room Ne409, The Netherlands.

E-mail addresses: t.haakma@erasmusmc.nl (T. Haakma), rob@gamesolutionslab.com (R. Tieben), brendasleven@gmail.com (B. Sleven), marc.buise@catharinaziekenhuis.nl (M. Buise), m.vanmol@erasmusmc.nl (M. van Mol).

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Introduction

The application of diaries in the clinical practice of intensive care units (ICUs) is a valuable intervention for the prevention of long-term mental health-related problems in patients and their relatives (Ullman et al., 2015; Nielsen and Angel, 2016). As a consequence of ICU admission, symptoms of post-intensive care syndrome (PICS), including physical, cognitive, psychological and social problems, may occur in up to 50% of ICU survivors (Needham et al., 2012; Harvey and Davidson, 2016; Geense et al., 2021(ja)). In addition, relatives (partners, family, friends) can suffer from PICS-family (PICS-F), which includes symptoms of posttraumatic stress (experienced by 30–42% of respondents), anxiety (21–56%) and depression (20–34%) (van Beusekom et al., 2015; Inoue et al., 2019). These symptoms and percentages were expected to increase due to undesirable physical distance due to isolation and adjusted ICU policies in family-centred care necessitated by the COVID-19 pandemic (Murthy et al., 2020; Robert et al., 2020; Hart et al., 2020; Hwang et al., 2021). These restrictions have affected COVID-19 positive patients as well as regular ICU patients from March 2020 till the present, resulting in a lack of face-to-face meetings and normal human contact (Wakam et al., 2020). A mobile app, the digital “Post-ICU” diary, was developed and implemented through a fast-tracked process as paper diaries were no longer accessible due to visitation restrictions during COVID-19. It was expected that the digital diary would have the potential to ameliorate the increasing frequency and intensity of PICS and PICS-F.

Diaries have been used regularly in various hospitals in international settings. In the Netherlands, it was found that 87% of ICUs provided diaries, which were mostly written by the patients’ relatives (Hendriks et al., 2019). These were usually a paper versions, sometimes accompanied by (outdated) brochures and other informational materials (Aitken et al., 2016; Garrouste-Orgeas et al., 2014). Reading a diary can have positive effects for ICU patients coping with a traumatic aftermath of the ICU period (Barreto et al., 2019; Nydahl et al., 2020). Additionally, keeping a diary might effectively support the mental health status of relatives by helping them to feel useful, as the process provides emotional support during the recovery of their loved one (McIlroy et al., 2019; Geense et al., 2019). Visiting limitations and worries about infection control during COVID-19 limited the use of diaries written by relatives (Jones, 2021). The implementation of a digital ICU diary, offers relatives the ability to stay engaged with the patient at a safe distance, to easily upload photos, videos and audio clips; and to write collaboratively with other relatives in the digital diary. In addition, it allows nurses to easily add up-to-date information.

In this study, the patient’s primary contact person was invited to start the Post-ICU diary and he or she provided authorization of responsibility

in line with the privacy regulations according to Dutch law. The Post-ICU diary was made available on any connected device with a display (e.g., smartphone, tablet). Relatives could contribute short messages similar to WhatsApp functionality or write longer stories about what happened in the personal situation of the patient. Fig. 1 provides an overview of the screen layouts of the Post-ICU diary. Upon an invitation from the patient’s primary contact, ICU nurses could also write short messages in the patient’s Post-ICU diary. These voluntary messages, which most nurses wrote in addition to their regular daily activities, could, be a valuable contribution to the relatives’ description of the situation and medical circumstances each day for the ICU patient. Through this messaging and interaction, nurses could become more aware of the importance of preventing PICS and PICS-F (Holme et al., 2020). Furthermore, they could experience the use of a diary as a holistic intervention, leading to more personalized care (Johansson et al., 2019) as they could become aware of the importance of giving words and meaning to the period when the patient was critically ill.

For this study, applicability was defined as a combination of the usability, integration and appreciation of the Post-ICU diary. Usability could be described as the accessibility of the web based application and the ease of use, including the extent to which the Post-ICU diary was used and the extent to which the ICU nurses were prepared to maintain it as part of their work processes. Integration referred to the incorporation of the new intervention in ICU nursing care, while appreciation reflected the positive or negative judgements encountered in regard to the Post-ICU diary.

Several strategies were used to implement the diary. First, informational strategies were used such as a weekly team newsletter to announce and encourage the use of the Post-ICU diary; posters in the nurse station and in the waiting room for relatives; handouts and users guidelines; and an online kick-off with the developers of the Post-ICU diary to provide the instructions for logging in. Second, educational strategies were used, such as clinical lessons to learn how to use the Post-ICU diary; video material to enhance the involvement of the nurses, and onsite explanations during working time to support the introduction of the Post-ICU diary. Third, motivational strategies, such as family support staff and champions, were used to inspire the ICU team to use the Post-ICU diary. Because the intervention was developed and implemented in a short time period, a pilot study was conducted to evaluate the experiences of the nurses. In addition, persuasive prompts in the electronic patient dossier were used to persuade and inspire relatives and nurses to write regularly.

Although the needs and preferences of ICU survivors, relatives and ICU professionals were considered in the development of the Post-ICU diary, the applicability of this intervention from their perspectives was unknown. Therefore, the aim of this pilot study was to explore the experiences of ICU nurses with the implementation process and applicability of the Post-ICU diary.

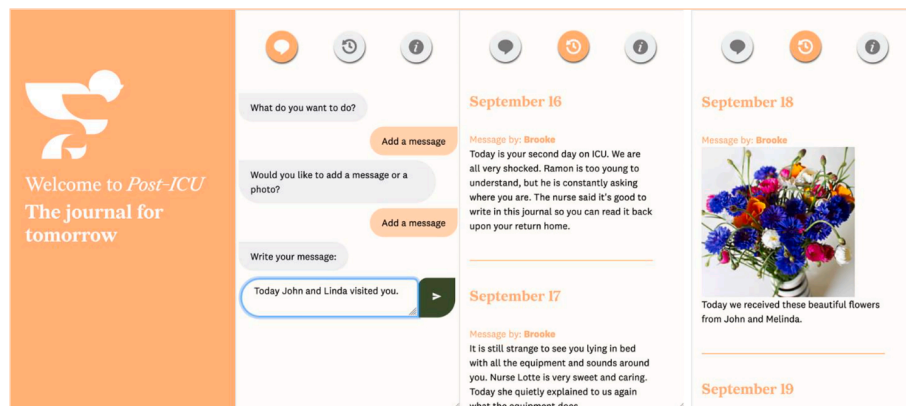


Fig. 1. Overview of screen layout Post-ICU diary (in Dutch language).

Methods

This study was conducted as an explorative pilot study prior to national scale-up of the Post-ICU diary. It was intended to pre-test the study materials and procedures for broader inquiry in the near future. The study question was: ‘What is the applicability of the Post-ICU diary in daily practice for ICU nurses?’ The consolidated criteria for reporting qualitative studies (COREQ), a 32-item checklist (Tong et al., 2007), was used to finalize reporting of the study methods in detail (Supplemental file 1).

Study design

A qualitative multicentre design, including focus group and individual interviews with ICU nurses was applied from November 2020 to January 2021, when the second wave of the COVID-19 pandemic was occurring. Focus groups were the preferred method of data collection for this study, for reason that a moderated interaction will help the participants to articulate their personal experiences, beliefs, perceptions and attitudes around this subject, which may be especially beneficial for those who have little experience with the Post-ICU diary (Nyumba et al., 2018). One advantage of using focus group data collection method is that the interaction between the participants can enrich discussions on the topic, which cannot be achieved with individual interviews. The study design ensured that all viewpoints of participants were included, with equal importance assigned to multiple perspectives (Hall, 2004).

Study setting

Three ICUs in the Netherlands, including an academic hospital and two tertiary teaching hospitals, actively participated in the study; thus, the study covered a variety of patients and medical treatments. Experiences with the Post-ICU diary differed across the three study settings, with the length of the use of the diary varying from three to eight months at study onset.

Study population

The population consisted of a nonrandom sample of nurses working in the included ICUs. They were invited in collaboration with the nurses’ managers who had no role in the study preparation, aims and methods, nor in the analysis of the results. One nurse manager participated in a focus group interview and one project leader had an individual interview with the researcher. The meetings were announced among the team members and the managers allowed their staff to join during work time. Participants were informed of the study objectives, the duration of the interviews, expectations for their contribution, and the background of the researchers. At the start of the interview, informed consent was given in written or oral form. All participants were offered a transcription of the interview to review so that they could provide their comments and member check the implications for practice.

Ethical considerations

The study is approved by the Daily Board of the Medical Ethics Committee Erasmus MC of Rotterdam, The Netherlands as coordinating centre institutional review board (MEC- 2020–0640). The committee has reviewed the research proposal and decided that the rules laid down in the Medical Research Involving Human Subjects Act (also known by its Dutch abbreviation WMO), do not apply to this research proposal. The study was conducted according to the principles of the Declaration of Helsinki (64th WMA General Assembly, Fortaleza, Brazil, October 2013) and in accordance with the Medical Research Involving Human Subjects Act. Participants could leave the study at any time for any reason if they wished to do so without any consequences.

Study procedures

Qualitative data were collected through two focus group interviews in two study settings and three individual interviews with ICU nurses from a third setting. There was no mix of participants across the ICUs. These meetings would have ideally been held in person (to observe nonverbal attitudes and facial expressions); however, due to the COVID-19 measures and social distancing, it was not possible for all participants to be physically present or to organize themselves for a group interview. In those cases, the interviews were carried out via individual appointments using video calling technology. The inclusion criterion was to be an ICU nurse at one of the participating hospitals. The exclusion criterion was complete unfamiliarity with the Post-ICU diary. Two researchers with expertise in qualitative research and ICU care led the two focus group interviews in the workplace with five (by TH and BS) and six (by TH and MvM) participants. Three individual interviews were conducted by (TH) online, with the participants choosing to participate either from home or from the workplace. No one refused to participate. Prior to the interviews, the research group created a topic list and interview guide based on the literature and their own experiences to structure the meetings (Supplemental file 2). All interviews took approximately 45 minutes. Fieldnotes were used for analysis and reflection and to add more specific interview questions, in order to gain an in-depth understanding of the phenomenon in different contexts.

Demographic data were collected with a two-minute survey at the beginning of the interview. In addition, all participants were asked to give a score from 1 (not at all) to 10 (excellent) on how relevant and how useful they assessed the Post-ICU diary to be in daily practice. This was a self-composed, non-validated numerical rating score. None of the participants was interested in receiving a transcript or summary of the interviews

Data management and analyses

Thematic analysis was used as a foundational method that provided clear steps to categorize and report the data that were found (Braun and Clarke, 2006). This method describes the data set in rich detail and investigates patterns of response or meaning within the data set. To explore predominant themes, an accurate reflection of the content of the entire data set was needed. As a consequence, some depth and complexity were necessarily lost (Braun and Clarke, 2006). An inductive analysis was applied to find emergent themes outside the pre-existing theory or the researchers’ preconceptions. Finally, a semantic approach was used to identify themes within the explicit meanings of the data and without assigning implied meanings beyond the actual words used by the participants.

Interview data were audiotaped and transcribed verbatim. Two researchers (TH and MvM) read the transcripts (Step 1; Familiarise with the data). Each developed a structured analysis framework that consisted of preliminary codes (Step 2; Generate initial codes). After that, they compared their frameworks to reach consensus on codes and themes. Next, one researcher (TH) coded the transcripts line by line according to this framework in the software programme NVivo12© (Step 3; Search for themes). When coding was finished and the code ‘Other’ was used, the two researchers discussed the coded texts and categorized them into a new or existing code best reflecting the contents of the otherwise uncategorized text fragment (Step 4; Review themes). After coding was finished, the cohesion and interrelations between codes were analysed by the two researchers through mind mapping (Step 5; Define and relate themes). The principal investigators had access to these data, and data will be stored for fifteen years.

Results

Fourteen respondents, of whom 57% were women and with a mean age of 40.6 years (Table 1), participated in the interviews across three

Table 1
Demographic characteristics of participants.

ID	Sex	Age	Level of education	Work experience
1	F	55	Vocational nurse training	>10 years
2	F	44	Vocational nurse training	>10 years
3	F	42	Bachelor of nursing	<1 year or student
4	F	30	Bachelor of nursing	<1 year or student
5	M	59	Vocational nurse training	>10 years
6	M	40	Vocational training and bachelor of healthcare management	<1 year or student
7	M	29	Bachelor of nursing	1–4 years
8	M	51	Bachelor of nursing	>10 years
9	M	30	Vocational nurse training	1–4 years
10	F	40	Vocational nurse training	>10 years
11	F	29	Bachelor of nursing and academic training	1 to 4 years
12	F	38	Bachelor of nursing and academic training	>10 years
13	F	49	Vocational nurse training	>10 years
14	M	32	Vocational nurse training	5–10 years

different study settings. All were familiar with the Post-ICU diary. Four participants had no experience with the Post-ICU diary. However, they have been exposed to the implementation strategies that were applied in the ICU. Six participants had used the Post-ICU diary 1 to 5 times, two had used it 10 to 15 times and the last two had used it >16 times. The diary was used in all shifts (day, evening and night). The mean scores for applicability and relevance of the Post-ICU diary were 7.3 and 8.4, respectively. The following four themes were found with thematic analyses: implementation process, COVID-19, integration, and motivation (Fig. 2).

Implementation process

The first theme encompassed the respondents’ experiences with the implementation process; they reported how they became familiar with the Post-ICU diary and how it may have contributed to their professional work processes. Divergent opinions were reported, both between settings and among individual ICU nurses from the same setting. Although a clear introduction and educational materials were provided by project leaders and team managers, the initial use of the diary was experienced as difficult by the respondents. One respondent felt insufficiently supported during the implementation process, even though the supporting implementation strategies were applied.

‘How nice that a written guideline was made, as it wasn’t clear in the beginning [what to write in the diary].’ (Respondent 9)

The fast-tracked development and introduction of the digital Post-ICU diary resulted in misunderstandings that generated resistance to use of the diary. Consequently, some nurses felt apathetic to new information, leading to differences in the level of familiarity among the ICU nurses.

‘I think I will speak for myself, [...] I really am information tired’ (Respondent 9).

cCOVID-19

This second theme described the contextual particularities of implementing the POST-ICU diary during the COVID-19 pandemic. The pandemic profoundly affected the ICU work environment and daily routine of the ICU nurses. It had a dual effect on the implementation process of the Post-ICU diary. On the one hand, the pandemic led to a high workload in the ICU, which reduced the available time for adequate introduction and support. On the other hand, the diary offered added value when relatives were worried, waiting at home due to visiting restrictions and suffering from feelings of physical distance.

‘And yes, we had the feeling that “the family cannot visit the patient at all, so we have to do something to capture what is going on.”’ (Respondent 13)

Integration

The integration of the Post-ICU diary referred to the extent to which, and how, the diary was used by all participants in all settings. This theme also included the facilitating and hindering factors concerning the provision of the diary and writing of short messages by nurses for integration into daily practice. Integration included three subthemes: user friendliness, work process in offering the diary, and work process in writing in the diary.

User friendliness

Respondents indicated that logging in was not as easy and fast as they would have liked. This was mainly the result of privacy and legal data protections; however, it created a barrier in the ease of use of the Post-ICU diary.

‘If it is just one click, that would be super motivating for me, because then I could just write [in the diary]. However, now it is not so I believe it is too difficult.’ (Respondent 1)

The user friendliness of the POST-IC diary was a ‘work in progress’ and the respondents suggested the need for technical adjustments to logging in procedures. Creating an account, logging in to a separate programme and following several subsequent steps were barriers in the beginning. More specifically, if the Post-ICU web application had been connected to their hospital account, the extra step of logging in would have been redundant.

Work process in offering the diary

The ICU nurses’ role in initiating and encouraging diary use is necessary to ensure that relatives understood and used the Post-ICU diary. The final choice regarding whether to use the diary was up to the relatives; however, ICU nurses played an important role in encouraging them to use the diary.

‘They sometimes get a lot of information that also needs to be processed [...] then you actually have to inquire the very next day [if there is interest].’ (Respondent 5)

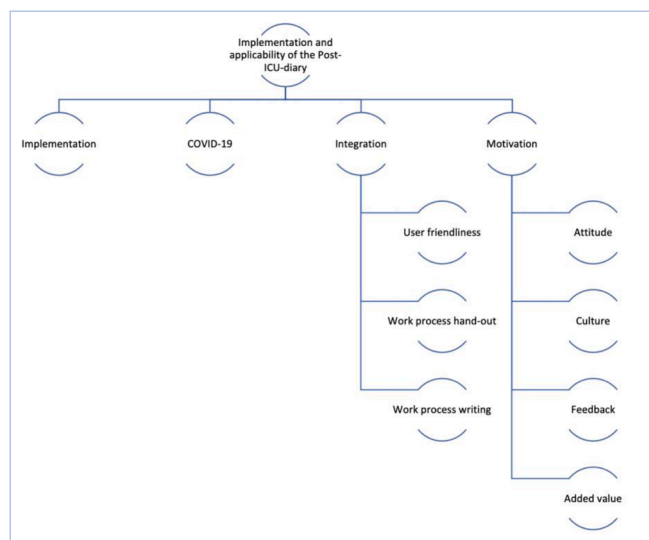


Fig. 2. Themes and sub-themes of study results.

All respondents agreed that the Post-ICU diary should be offered and started immediately upon admission because the first days in the ICU are crucial and impactful for the patient and his or her relatives. Some ICU nurses were reluctant to offer the Post-ICU diary due to the time it might take to provide the corresponding explanation, and the possible questions they could get in return. Others reported that the time investment was minimal and that it had become a routine practice in their ICU.

The completion of consent forms delayed the diary initiating process somewhat, partly due to visitation restrictions. One of the respondents found an alternative way.

'Recently, I had a family from a transferred patient who lived far away, and then we had an oral agreement on the juridical responsibility via telephone. Thereafter we sent the form via post to get it signed, but the diary had already started by then. This was in collaboration with the team management, because officially we should have waited until we had the signature.' (Respondent 11)

Work process in writing in the diary

Respondents acknowledged that writing in the Post-ICU diary should be part of their own daily work, becoming care as usual. Thinking about the content of what they could write was a learning process including consideration of relevant events, sensitive privacy aspects, and use of understandable language for the relatives. Appreciation and gratitude from relatives contributed positively to the nurses' willingness to write short messages.

'If I post a picture of a patient sitting in the chair for the first time and a few hours later I have the daughter on the phone saying: "How nice that he is sitting in a chair!", then you see an immediate effect.' (Respondent 12)

At the beginning of the Post-ICU diary, many ICU nurses lacked confidence in their own writing skills; they did not always know what to write or how to write the messages, and they worried about others misunderstanding their messages. The respondents with little experience in writing mentioned that they would write about 'special events' such as 'you opened your eyes today after 14 days in the ICU', and they had difficulty finding something to write when 'nothing special' happened.

'Writing for the sake of writing has no added value. But when you give a short recap of the past four nightshifts for example, then you can leave a mark in my opinion.' (Respondent 9)

Respondents with more experience also wrote about daily events such as 'I washed your hair today' and 'I sat at your bedside for a while'. Some also wrote more personal messages.

'We have a "get-to-know-me" poster with personal information about the patient that the relatives provides. This way, we can write more personal messages like: "We know you liked this type of music and today I played you a song by your favourite artist".' (Respondent 13)

Motivation

The fourth theme concerned nurses' personal motivation, which was partly shaped by the environment and organization. It included four subthemes: attitude, culture, feedback, and added value.

Attitude of the individual ICU nurse

All respondents believed that the diary should be distributed to the relatives immediately upon admission of the patient to the ICU. The respondents with little experience with the diary were positive about starting to use it. They felt that clear coordination and expectation

management about writing in the Post-ICU diary, among themselves and with relatives, was important.

'And also not to make the expectation with the family too high that we are going to write in it daily.' (Respondent 1)

Respondents also compared themselves to colleagues in that respect and felt pressure to write similar-length messages.

'[...] But in general you do see very short to medium-length stories, but I mean the longer the story gets, the more that they start to expect from me.' (Respondent 8)

Culture in the work environment

The respondents were not asked to be accountable for distributing or writing in the Post-ICU diary, which was partly because this was not directly linked to their predominant nursing tasks. The ICU nurses mainly focused on the treatment and care of the patient during admission and less on emotional recovery afterwards.

'[...] for me it is important in the moment, how is it going at the bedside? And not, how will it go later? [...] That mindset has to change.' (Respondent 5)

Feedback from relatives

Sometimes, the respondents received direct feedback from relatives when they had written a message in the Post-ICU diary. Some respondents mentioned that they found it motivating when they experienced interaction through the diary with relatives of the patient.

'With some patients you also have the children actively responding [...] about what you wrote and then kind of interacting. I do like that.' (Respondent 11)

Added value

All respondents were convinced of the potential added value of a diary for the patient and relatives. However, not all were positive about their own contribution into the diary.

'It's actually a bit difficult now with the time you have, but family can do that, they [the relatives] just have all the time now.' (Respondent 2)

The respondents were convinced that the digital Post-ICU diary offered enough added value that the organization could not return to the paper version when COVID-19 no longer played a role.

'Basically it does work so well and the responses are also so positive that we are actually not going to use the paper diary anymore.' (Respondent 14)

All respondents recognized the added value in the short term for relatives and in the long term for preventing health-related impairments in ICU survivors. They felt that human interaction with relatives was stimulated by the use of the Post-ICU diary, specifically in situations of complete visitor restrictions. This situation inspired them to take leadership in advocating the introduction and use of the Post-ICU diary.

Discussion

This qualitative multicentre study to explore the ICU nurses' experiences with the Post-ICU diary and its applicability in their daily practice highlighted their opinions on the added value for the patients and relatives. Most nurses quickly embraced the intervention as a positive innovation. However, they also experienced barriers such as lack of

time, insufficient integration with their own work processes, and challenges regarding writing short messages themselves. These hindering factors are similar to those observed in previous studies (Kiwunuka et al., 2019; van Mol et al., 2017). Offering the diary was considered more important than writing messages for the patients. An interesting feedback loop was identified, where nurses reviewed the entries of relatives to check if messages from doctors and nurses were correctly understood and to ensure that relatives were coping sufficiently. Other researchers have reported that the ICU diary could stimulate contemplation and professional development, as nurses reflected on their thoughts, feelings, and actions while writing in the diary (Johansson et al., 2019). This kind of statement was not found in the current study. Collegial support and interaction with relatives were facilitating factors for use of the post-ICU diary.

The results of this pilot study provided an evaluation of the current implementation process and direction for the scalability of the Post-ICU diary. Clear differences in implementation phases among the centres emerged; at one ICU, the implementation of the diary was in its infancy, while in the other, it was already standard to offer the diary. The ICUs also differed in culture and motivation to put efforts into a policy of family-centred care. One of the centres assigned handling the Post-ICU diary to relatives, and a special family guidance team motivated ICU nurses to write on a daily basis. This team regularly supported relatives with information about the facilities of the hospitals, organized appointments with the medical staff, and provided psychosocial guidance. Champions such as these family guidance team members were a valuable strategy for implementing the Post-ICU diary (Curtis et al., 2016). For structural embedding of the intervention, tailored implementation strategies are needed to support ICU nurses in using the innovative Post-ICU diary (Wensing et al., 2011).

Focus groups and individual interviews involve different interactions. It would have been ideal to conduct a third focus group. This was unfortunately prevented by a high workload due to an upcoming new COVID-19 surge. However, in the focus group interviews that were held, the participants were prompted through questioning. The participants reacted to each other, in agreement or disagreement, but mostly the participants answered the interviewer regarding their opinion on the proposed item. The same technique, questions and sequence were followed in the individual interviews. Following this method and using thematic analyses supported the reporting of the results. Because of the explorative character of this study, we aimed to learn whether the participants were aware of the Post-ICU diary. Even if they had little experience themselves in using the diary, it was important to determine why they did not make use of it. Since the aim was to evaluate the implementation process and usability of the Post-ICU diary, unexperienced participants made valuable contributions.

In general, the psychological impact of quarantine measures might include posttraumatic stress symptoms, confusion, and anger (Brooks et al., 2020). The presence of relatives could be supported by nonphysical methods to reduce the negative impact of the pandemic for ICU patients. In previous studies, video calling was introduced to facilitate contact between relatives and patients as well as communication with professionals (Hart et al., 2020; Negro et al., 2020). Although appreciated by all stakeholders, it seemed insufficient or difficult to carry out because patients were often physically and cognitively incapable of participation. Privacy and functionality considerations were reported to limit the utility of commercially available video communication tools (Montauk and Kuhl, 2020). In addition, health care professionals lacked materials and time to support online connections. The development of the Post-ICU diary addressed such problems in collaboration with privacy officers and legal support from all participating hospitals. The overall process is provided robust and safe.

Traditionally, healthcare entities have been reluctant to embrace innovation, probably due to the need for safety and excellent quality. Digital developments with the patient and their self-care in mind are accelerating in the 21st century. This necessitates a cultural

transformation to a technological/scientific approach. Therefore, considering the needs and perceptions of the professionals involved and supporting their adaptation to new methods, interventions or features is essential to progress in quality ICU care.

Strengths and limitations

The strength of the study was the qualitative design implemented in several hospitals with broad exploration of opinions and experiences until data saturation was reached. Thematic analysis provided in-depth insights into ICU nurses' perspectives on the applicability and implementation process of a digital diary intervention in the ICU, which was a timely innovation in response to the challenges of the COVID-19 pandemic. There were several limitations to this study. First, there was likely a response bias in the overall evaluation, due to a high proportion of early adopters of the Post-ICU diary who participated. Second, related to the difficulty of doing research during the COVID-19 pandemic, a convenience sample of participants was included instead of the planned sampling of early and late adopters of the innovation. Third, no triangulation of data was performed, and conclusions were drawn based on the literature and qualitative results. However, data saturation was reached, and the results resonated with those of similar studies, suggesting the accuracy of the results reported. On the topics of technique and writing in the diary, the last two interviews did not reveal new information. Fourth, using focus groups and individual interviews could have influenced the findings. Finally, patients and their relatives were not included in this study. Thus, this study was not an overall holistic evaluation of the Post-ICU diary; further research addressing these perspectives is ongoing.

Conclusion

ICU nurses endorsed the added value of the digital Post-ICU diary for patient and their relatives. However, they also experienced barriers to diary use, such as a lack of time, insufficient integration with their own work processes, and challenges regarding writing short messages themselves. Although most of the experienced barriers were resolved during the first half year after introduction, tailored strategies are needed to support ICU nurses in using the innovative Post-ICU diary.

Consent for publication

Not applicable.

Availability of data and materials

Anonymized data gathered and analysed during the current study are not publicly available due to legal and ethical restriction. These can be requested from the corresponding author as well as text and photo material of the developed intervention. Materials described in the manuscript, including all relevant raw data, will be freely available at a reasonable request to any scientist wishing to use them for non-commercial purposes.

Competing interests

The authors declare no conflicts of interest.

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Authors contributions

MvM and MB jointly designed the study, raised funding and established the development of the study protocol. MvM, TH, BS and RT prepared the study materials and gathered the data of both sub-studies. TH and MvM produced the first draft of the article. All authors (TH, BS, RT, MB and MvM) critically revised the content of the manuscript, have read and approved the final version

Declarations of interest

The authors declare no conflict of interest.

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