Original article

Multimedia application for home care of post-surgery patients: care-educational technology prototype*

Aplicativo multimídia para cuidados domiciliares de pacientes pós-cirúrgicos: protótipo de tecnologia cuidativo-educacional*

Aplicación multimedia para el cuidado domiciliario de pacientes posquirúrgicos: prototipo de tecnología asistencial-educativa

Joseph Wrague da Conceição[I] , Elisabeta Albertina Nietsche[II] , Cléton Salbego[III] , Silvana Bastos Cogo[IV] , Nara Marinele Oliveira Girardon-Perlini[V] , Andrei Pompeu Antunes[VI]

[I] Universidade Federal de Santa Maria, Santa Maria, Rio Grande do Sul, Brazil

Abstract

Objective: to develop a care-educational technology prototype, in the form of a multimedia application, aimed at home care of post-surgical patients with invasive devices. **Method:** this is methodological research, developed between March 2021 and April 2022, guided by the ADDIE model (Analyze, Design, Develop, Implement and Evaluate). Prototyping was carried out with the help of Adobe Experience Design software, applying plugins for icon animation and inclusion of educational videos. **Results:** the "Home Self-Care" prototype contains a logo, main menu with description of invasive devices, information about the procedure, care and frequently asked questions by patients as well as images and educational videos to guide the construction of knowledge. It should be noted that in the future the application will be hosted in a virtual store. **Conclusion:** using this tool aims at continuity of care, encouraging users' autonomy and empowerment at home. It is believed that the technology will facilitate patient recovery and reduce (re)admissions.
Descriptors: Patient Discharge; Nursing; Home Nursing; Multimedia; Mobile Applications

Resumo

Objetivo: desenvolver um protótipo de Tecnologia Cuidativo-Educacional em forma de aplicativo multimídia, voltado aos cuidados domiciliares de pacientes pós-cirúrgicos com dispositivos invasivos. **Método:** pesquisa metodológica, desenvolvida entre março de 2021 e abril de 2022, norteada pelo modelo ADDIE (*Analize*, *Design*, *Develop*, *Implement* e *Evaluate*). Realizou-se a prototipagem com auxílio do

software Adobe Experience Design, sendo aplicados *plugins* para a animação dos ícones e a inclusão dos vídeos educacionais. **Resultados:** o protótipo "*Home Self-Care*" contém logomarca, menu principal com descrição dos dispositivos invasivos, informações sobre o procedimento, cuidados e dúvidas frequentes dos pacientes, bem como imagens e vídeos educacionais para conduzir a construção do conhecimento. Ressalta-se que futuramente o aplicativo será hospedado em loja virtual. **Conclusão:** o uso desta ferramenta visa a continuidade do cuidado, estimulando a autonomia e empoderamento dos usuários em domicílio. Acredita-se que a tecnologia facilitará a recuperação do paciente e reduzirá as (re)internações. **Descritores:** Alta do Paciente; Enfermagem; Assistência Domiciliar; Multimídia; Aplicativos Móveis

Resumen

Objetivo: desarrollar un prototipo de tecnología asistencial-educativa en forma de aplicación multimedia, dirigida a la atención domiciliaria de pacientes posquirúrgicos con dispositivos invasivos. **Método:** investigación metodológica, desarrollada entre marzo de 2021 y abril de 2022, guiada por el modelo ADDIE (Analyze, Design, Develop, Implement y Evaluate). El prototipado se realizó con la ayuda del software Adobe Experience Design, aplicando plugins para la animación de íconos y la inclusión de videos educativos. **Resultados:** el prototipo "Home Self-Care" contiene un logo, un menú principal con descripción de los dispositivos invasivos, información sobre el procedimiento, cuidados y preguntas frecuentes de los pacientes, además de imágenes y videos educativos para orientar la construcción del conocimiento. Cabe señalar que en el futuro la aplicación estará alojada en una tienda virtual. **Conclusión:** el uso de esta herramienta tiene como objetivo la continuidad de la atención, estimulando la autonomía y el empoderamiento de los usuarios en el hogar. Se cree que la tecnología facilitará la recuperación del paciente y reducirá las (re)hospitalizaciones. **Descriptores:** Alta del Paciente; Enfermería; Atención Domiciliaria de Salud; Multimedia; Aplicaciones Móviles

Introduction

Hospital discharge represents an important moment experienced by patients and their companions, characterized as a transition from the hospital environment to home management. Preparing this public for discharge represents, among many factors, equipping them with the necessary tools for self-care.[1] Thus, among the multidisciplinary health team, nursing professionals stand out as agents that promote care. It is up to nurses to guide and map doubts, seeking to minimize them and also organize a personalized therapeutic plan to patients' needs.

However, in practice, the care-educational approach of professionals may prove to be minimal or non-existent. This fragility is reflected in the high rate of hospital (re)admissions, which reach approximately 39.1%, with the main cause being the failure in monitoring and communication between staff and patient.[2]

Nurses, as part of the multidisciplinary team, are one of the professionals responsible for preparing patients and their families for hospital discharge, instructing them and making sure that the pre-hospital discharge education process was effective enough, thus facilitating continuity of care at home.[3] At this stage, it is common for patients and their companions to

have doubts regarding the procedures to be performed at home, mainly in the case of surgical patients, who generally make use of invasive devices (tracheostomy, feeding tubes, elimination ostomies, urinary catheters).

There are several complications in the home environment resulting from a weakened hospital discharge process. Urinary tract infections are the most frequent in this context of care, and may result from erroneous handling of urinary catheters. Furthermore, complications in the airways are also associated with careless handling of patients' tracheostomy.[4] From these events, one can see discontinuity of care, enhanced by lack of communication between professional and patient in the post-discharge period.

To improve the logistics of communication between professional and patient, offering information related to recovery, technologies are being developed and used, promoting the process of caring and educating in health. These have been developed in the form of applications for smartphones, given the dissemination of these devices and their easy handling.[5]

A study that developed an educational application aimed at patients undergoing orthognathic surgery named OrtogApp describes the absence of educational apps for surgical patients with the aim of complementing verbal guidance and helping home self-care.[5] Therefore, the need for this type of technology becomes noticeable in a context in which part of the population has access to mobile devices and makes use of applications offered on them. Still, research sought to analyze the technologies developed for health education about airway obstruction, concluding that there are several gaps regarding educational technologies.[6]

In this way, care-educational technologies (CET) emerge as possible allies in the care-education process in the post-hospital discharge period, because they represent a type of strategy resulting from scientific knowledge, derived from nurses' practice, providing opportunities for the exchange of information between patient, family/caregiver and professional. They are characterized by the development of new theories, research and concepts that allow the evolution of knowledge, improving the practice of care-education and health care actions.[7] Thus, in this study, CET proposes to promote the necessary means to help patients and family members/caregivers to develop their autonomy, allowing (self)care at home more easily through a multimedia application. When developing it, different formats of information representation are addressed, such as sound and videos.[8] From this perspective, it constitutes a possibility of meeting patients' needs during the care-educational process.

Considering the prototyping of this application, the term prototype can have two meanings. The first refers to the physical representation of the product to be produced industrially. The second refers to any means of physical representation whose purpose is to perform functional tests. It is a way to present a new product to consumers and people of a company.[9] Thus, we opted for its second representation, which seeks to carry out tests for greater scientific significance. This developed prototype aims to help the process of (self)care in the late postoperative period, which includes the period in which patients or companions are at home, where they are sometimes without the help of a health professional. Given this scenario, this study aimed to develop a prototype of CET in the form of a multimedia application, aimed at home care of post-surgical patients with invasive devices.

Method

Study design

This is methodological research applied to the production of multimedia applications, developed between March 2021 and April 2022, having as a reference the ADDIE model (Analysis, Design, Development, Implementation and Evaluation) for application development.[10] In it, the first four stages of the model were used, therefore, the assessment stage of the application with patients will be left for later research. As part of the work, information contained in the database of matrix research entitled "*Desenvolvimento de proposição Tecnológica Cuidativo-Educacional com a equipe multiprofissional de uma unidade cirúrgica*". This is linked to the Group of Studies and Research in Nursing and Health (GEPES) of the *Universidade Federal de Santa Maria* (UFSM).

Study setting

The study was carried out in a clinical-surgical unit of a University Hospital in southern Brazil, comprising 52 adult beds, distributed among pre- and post-surgical patients.

Study participants

Three nurses participated in the research, a nursing student and a web design

professional, this being the development team. Together, 23 professionals were included in the matrix research database: eight nurses, eight nursing technicians, three physiotherapists, two nutritionists, a speech therapist and a social worker.

Selection criteria

The participants included in the database were selected based on inclusion criteria: having a work schedule in the morning and afternoon shifts, working at the unit for at least six months. Exclusion criteria were: being on vacation, medical report, maternity leave or any other type of absence from activities during the period of data collection.

Data collection

Data collection took place through the ADDIE Model (Analyze, Design, Develop, Implement, Evaluate), applied by separating the design stages (Analyze, Design, Develop) from the execution stages (Implement, Evaluate) during the process of creating the didactic situation.[10]

Analyze: comprised two moments, the first referring to the previous research, with a qualitative character and immersion in a surgical clinic in order to identify, from the multidisciplinary team' perspective, the care-educational health needs of surgical patients dependent on invasive devices for hospital discharge.[11] Data from the first part were generated from 170 hours of non-participant observation and six focus groups with an average duration of between 50 and 90 minutes. In the second moment, during the development of this study, a search was carried out for applications involving care with invasive devices and home care available on PlayStore (Android, Google) using the words "Nursing", "Home care" and "Postoperative", which obtained minimal results.

Design: the second phase competed in content selection, layout elaboration and technology structure based on the previously analyzed applications and according to the target audience's needs. We opted for information arranged in textual, visual and interactive format with video content for user understanding. This step was carried out by four nurses, one a PhD, two masters and a nursing student as well as a web design professional to digitize the material. Furthermore, it should be noted that part of the content included comes from material resulting from the previous work. Both videos were produced by research carried out at UFSM, with the one

related to nutrition available on YouTube and the one referring to ostomies available on DVD in possession of the Nucleus of Studies in Care and Family at UFSM.

Develop: the third stage comprised the interface design and its interactions in Adobe XD, allowing the construction of a prototype for a smartphone with a high level of detail and allowing the anticipated visualization of the final product in operation. As for language used in the interface, the prerogatives of simplicity, clarity and objectivity were followed, in order to make contents accessible to users. The application was named "Home Self-Care", as its content contributes to the care-education process of its target audience. Adobe Photoshop C6 was used to process the material and insert it into the body text.

Implement: at this stage, the developer has shared the application prototype from the link, https://xd.adobe.com/view/534aa763-9dac-4782-9838-5050064e0e37-0619/?fullscreen, to the idea team. Thus, it was possible to see its operation and discuss possible improvements.

Data analysis and treatment

The data obtained from non-participant observation and focus group were treated using the thematic content analysis technique[12], being operationalized from three stages: pre-analysis; material exploration; readings and organization of findings identified as units of meaning that respond to the object under study, meeting the completeness, representativeness, homogeneity, pertinence and exclusivity criteria. Finally, data treatment and interpretation were carried out based on convergent references to the studied object. The results were presented in a descriptive and visual way with a view to clarity in the technological product representation regarding its content and functionalities.

Ethical aspects

The research development stages were carried out respecting ethical aspects. Data veracity, reliability, security and quality generated were guaranteed. The study is linked to a matrix research project entitled "*Desenvolvimento de proposição tecnológica cuidativo-educacional com a equipe multiprofissional de uma unidade cirúrgica*", approved by the Research Ethics Committee, under Opinion 2,453,836, on November 26, 2019. Resolution 466/12 recommendations were complied with, in addition to the application of an Informed Consent Form for participants' consent. Participants were identified by the letter

P (corresponding to "professional"), followed by the ordinal number referring to the order in which they accepted to participate in the study.

Results

The multimedia application prototype called "Home Self-Care" presents content with characteristics to equip post-surgical patients and their companions with the necessary tools for care regarding invasive device maintenance. The proposition of technology is to promote the autonomy of those involved in the care-educational process. In the analysis stage, through access to the database, care-educational needs emerged for hospital discharge related to care with feeding tubes, urinary tubes and elimination ostomies.

> [...] *the physiotherapist asks if the companion knows how to handle the tracheostomy tube. This one says yes, but without security. Thus, the physiotherapist and nurse demonstrate how to remove, clean and replace the device.* (Excerpt from the field diary, P03, 12/10/2019, from 1:40 pm to 6:10 pm)

There were several reports referring to needs regarding guidance in the Nelaton probe technique execution.

> [...] *it is important to equip with the necessary tools about Nelaton probe. "We explain, but there is always a doubt.* (Excerpt from the focus group, P18, 12/21/2019, from 2:17 pm to 2:58 pm)
> [...] *skin care in a patient who is bedridden or semi-bedridden.* (Excerpt from the focus group, P06, 12/21/2019, from 2:17 pm to 2:58 pm)

Through these findings, it was decided to add two educational videos to facilitate application user understanding, not limiting them to only one form of learning. These videos were included based on some reports regarding ostomy care and the offer of oral and tube diets.

> [...] *ostomy care* [...] *patients and those responsible have many questions.* (Excerpt from the focus group, P19, 12/21/2019, from 2:17 pm to 2:58 pm)
> [...] [patient] *positioning to offer oral diet at home. Tube diet too.* (Excerpt from the focus group, P02, 01/08/2020, from 9:25 am to 10:03 am)

The "Home Self-Care" prototype was designed to assist its target audience (post-discharge surgical patients and their companions, at home) through a simple and functional interface, analyzing the possible hardware and software difficulties of smartphones. The development process started with paper sketches containing a series of possible logos for the splash screen as well as the application name. The current version was chosen after associating the "self-care and home" elements.

In this way, prototyping in the software began, opting to organize the technology

with an intuitive layout, favoring user quick adaptation. When clicking on the icon to start using it (tab 1), a presentation screen (tab 2) will appear, welcoming users, taking them to the main menu. This includes seven choices (tab 3), six of which are composed of invasive devices (tracheostomy, nasoenteric and nasogastric tube, gastrostomy and jejunostomy, Nelaton probe, indwelling urinary catheter, elimination ostomies), and the last option is a specific menu for educational videos. Therefore, when choosing one of the devices, a submenu will appear, standardized among the devices, with three options to choose from (Figure 1).

"What are they?": when selecting this option, the user will be directed to the definition of the invasive device as well as which target audiences it is recommended, in order to provide context.

"Procedures and care": after choosing, a screen opens with guidelines regarding specific procedures for this device. Guidance will also be available regarding care for safe handling/maintenance.

"Doubts": this option contains information about frequently asked questions regarding care about the invasive device. It should be noted that these are doubts raised by the research participants, and not by the target audience. The screens have, in the lower region, the "Next" and "Return" buttons for better navigation in the application, with the restriction of only one button on some occasions so as not to confuse users during use. Some screens have a scroll bar for having a greater amount of information as well as other menu possibilities.
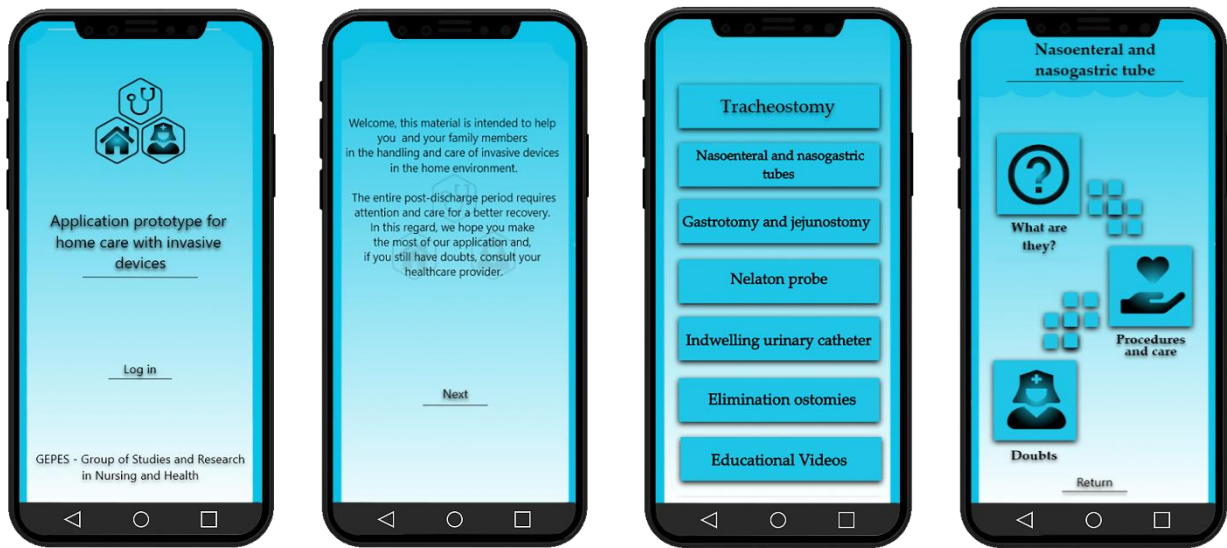
Figure 1 - Illustrative image of nasoenteral and nasogastric tube opening screens, main menu and menu

By browsing this submenu, users will have information that will help them as well as their companions/caregivers, in the performance of care with the specific invasive device. In this way, the guidelines regarding nasoenteral and nasogastric tubes are organized in textual and visual format, and there are also specific menus: "Hygiene in diet preparation", "Diet preparation and conservation" and "Procedures" (Figure 2).
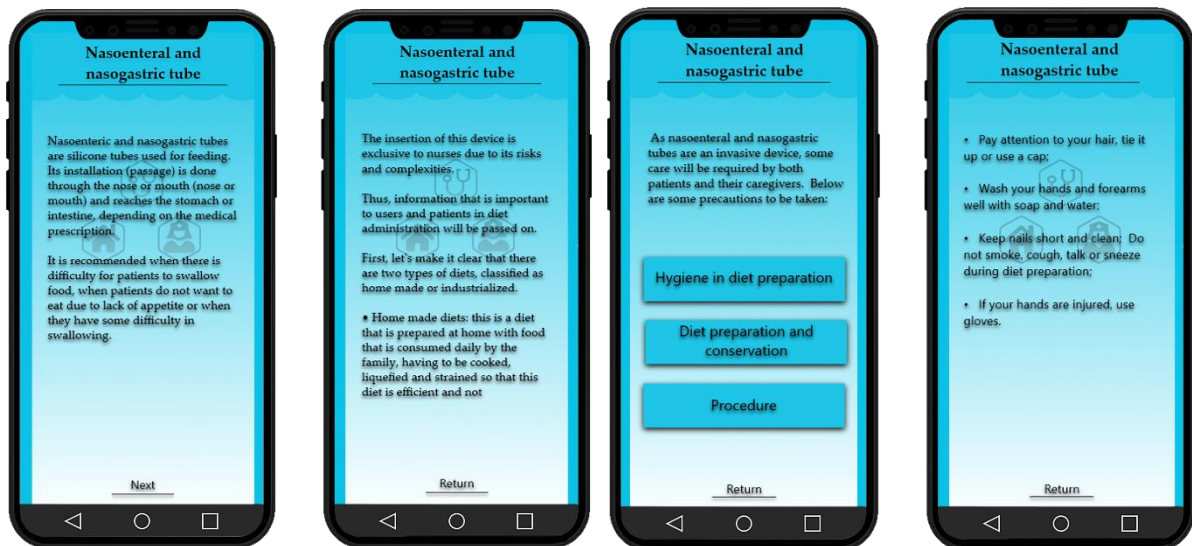

Figure 2 - Illustrative image of nasoenteral and nasogastric tube submenus

The content of the other invasive devices has specific menus containing information in textual and visual formats and two videos on tube feeding and elimination ostomy care (Figure 3).
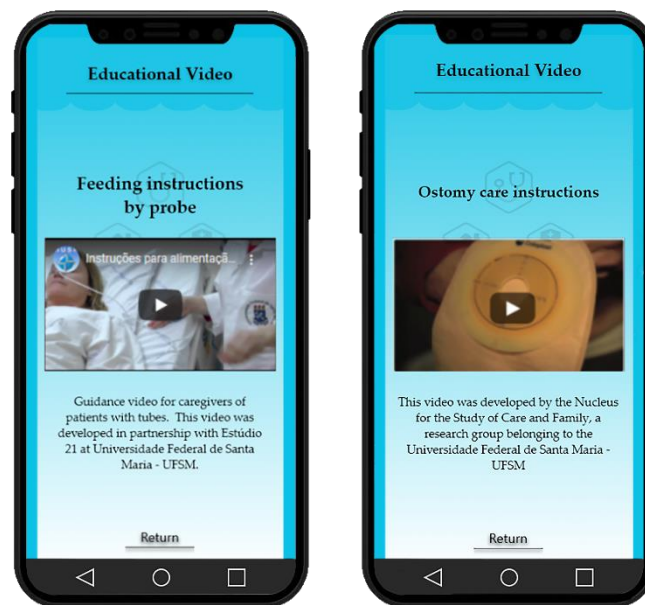
Figure 3 - Illustrative image for educational videos on ostomy care and tube feeding

Discussion

The "Home Self-Care" application has the potential to assist the care-educational needs of patients/family members using invasive devices at home, since this technology was built based on field research with professionals from a surgical clinic in a hospital in the southern region. With regard to the approach to application-type technology, studies have shown ease of access due to the high use of smartphones as well as the constant possibility of updating the information contained.[13] Still, mobile devices progressively reach a larger portion of the population, which allows for better communication in the health area, bringing patients and professionals closer together.[14]

Therefore, several studies reveal that most patients discharged from hospital do not receive sufficient guidance regarding the care required in their post-hospital discharge period, often due to the absence of health education strategies for patient empowerment.[15-16] Furthermore, the findings point to hospital discharge as a transition from hospital care to patients at home, comprising a period of adaptations in their daily activities.[16-17]

In this perspective, nurses have the task of coordinating and executing the care of this transition, seeking to investigate the individual and collective needs of the public assisted to proceed with pre-hospital discharge guidelines. Moreover, in the case of

surgical patients, it is emphasized that, among all possible complications, those of an infectious nature stand out in their occurrence rate.[18]

Hospital readmission is also observed as a result of this weakened care-educational process, as a large part is the result of postoperative infections. Data referring to the low percentage of records in medical records about preoperative and pre-discharge guidance reveal that patients are going home with a lack of guidance, making continuity of care difficult.[1] Therefore, it is evident the need for these guidelines to allow the development of patients' autonomy and safety, culminating in continuity of home care.

In order to improve care transition between the hospital and home environments, using technologies that help patients to continue their care with quality becomes fundamental. When analyzing studies proposing application development as well as those available for download, it is noticed that their use focused on the care of surgical patients shows a low quantitative.[5] Still, it can be said that they do not have the content presentation to develop patients' knowledge and enable the performance of self-care with propriety. The applications have a generalist focus, addressing a variety of superficial guidelines or have specific content for certain chronic diseases (hypertension, diabetes).[5,19]

Consequently, there are also few studies addressing the issue of invasive devices and proposing some form of auxiliary intervention in the hospital discharge process. There are even fewer publications about apps on care for post-surgical patients while handling their devices at home. Also, it should be noted that digital technologies have informative characteristics enabling the enrichment of their users' knowledge and, thus, greater agility of information.[19]

In this way, the lack of instructional tools in the form of applications that provide patients' and family members' autonomy makes the recovery process worrying, since care with invasive devices requires specific knowledge to be followed to avoid possible intercurrences. As for the technology of this study, it is noticed that from the analysis of the emerging problem in the practical context of the multidisciplinary team of a public hospital, it became possible to create a potentially resolving tool for the care-education needs of patients and their families.

In this way, the "Home Self-Care", through a simplified language, with visual and video content, demonstrates the ability to help this patient at home, minimizing remaining

doubts about the hospital discharge process, reducing the chances of a possible hospital readmission.

It is understood that there is the possibility of filling the scientific gap present in searches for research and applications. This is because the main invasive devices used in the recovery of surgical patients after hospital discharge are included in the "Home Self-Care" in a didactic way, with a sequence of information arranged in a logical way for understanding the content.

The research presented, as limitations, having its initial development only as a prototype, without the operability and interfaces for Android or iOS devices. It is believed that the absence of physicians among participants was a limiting factor for structuring the proposal content, since they did not express interest in collaborating with the construction. Another highlight is the lack of validity of application content and appearance by the target audience and by expert judges. Furthermore, application studies are suggested to assess potentialities and/or weaknesses in using technology in the context of the target audience. These restrictions will be minimized in further studies.

The "Home Self-Care" prototype can be an innovative technological tool and contribute to professional nursing practice as it is used for health education of post-surgical patients for home care. Also, this research may encourage the construction, validity and evaluation of new technologies aimed at computerizing home (self)care of post-surgical patients.

Conclusion

The educational technology prototype developed proves to be a dynamic, practical and easy-to-operate tool for its users, seeking to promote (self)care of surgical patients using an invasive device at home. It is believed that the proposed application has in its content informative possibilities to reduce postoperative complications and hospital (re)admission rates.

It should be noted that using this prototype aims at continuity of care, equipping patients and their families in the management of long-term invasive devices. Promoting studies with the scope of technological development contributes to professional health practice in the context of surgical patients, as it offers a multimedia application that brings

professionals and users closer together through sharing of knowledge for individual and collective health promotion.

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Authors' contributions

1 – Joseph Wrague da Conceição
Nurse - josephwrague@gmail.com
Research conception, development and manuscript writing, review and approval of the final version.

2 – Elisabeta Albertina Nietsche
Nurse, PhD - eanietsche@gmail.com
Autor Correspondente
Research conception, development and manuscript writing, review and approval of the final version.

3 – Cléton Salbego
Nurse, PhD - cletonsalbego@hotmail.com
Research conception, development and manuscript writing, review and approval of the final version.

4 – Silvana Bastos Cogo
Nurse, PhD - silvanabastoscogo@gmail.com
Review and approval of the final version.

5 – Nara Marinele Oliveira Girardon-Perlini
Nurse, PhD - nara.girardon@gmail.com
Review and approval of the final version.

6 – Andrei Pompeu Antunes
Nurse - andrei.pompeuantunes@outlook.com
Review and approval of the final version.

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