

Cuid@r: development and validation of gerontechnology for self-care among older adults undergoing outpatient surgery

Cuid@r: desarrollo y validación de gerontecnología para el autocuidado de personas mayores en el período perioperatorio de cirugías ambulatorias

Cuid@r: desenvolvimento e validação de gerontotecnologia para autocuidado da pessoa idosa no perioperatório de cirurgias ambulatoriais

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Abstract

The aim was to develop and perform content validation of a prototype of a gerontechnology for mobile devices aimed at the self-care of older adults in the preoperative and postoperative periods of elective surgeries performed on an outpatient basis. A qualitative, applied health technology production research, conducted in Florianópolis, between February 2022 and June 2023. The methodological pathway comprised: the development of the prototype, grounded in Dorothea Orem's Self-Care Theory and user-centered design tools; and content validation, performed by a committee of experts and analysis of the Content Validity Index greater than or equal to 70%. The prototype of the mobile gerontechnology Cuid@r was developed, structured into six self-care domains, and developed with a focus on accessibility, usability, and support for older adults in the perioperative period. After expert validation, the content was expanded from 18 to 25 care/interventions, incorporating the judges' suggestions. The overall Content Validity Index (CVI) reached 88.25%, evidencing adequate content validity. The developed gerontechnology demonstrated satisfactory content validity, indicating potential to support perioperative self-care for older adults undergoing elective outpatient surgeries.

Descriptors: Self-Care; Geriatric Nursing; Educational Technology; Elective Surgical Procedures; Patient Safety.

Resumen

El objetivo fue desarrollar y validar el contenido de un prototipo de gerontecnología para dispositivos móviles, orientado al autocuidado de adultos mayores en los periodos preoperatorio y posoperatorio de cirugías electivas ambulatorias. Se trató de una investigación cualitativa y aplicada de producción de tecnología en salud, realizada en Florianópolis, entre febrero de 2022 y junio de 2023. El itinerario metodológico comprendió: el desarrollo del prototipo, fundamentado en la Teoría del Autocuidado de Dorothea Orem y en herramientas de diseño centrado en el usuario; y la validación de contenido, realizada por un comité de expertos y mediante el análisis de un Índice de Validez de Contenido igual o superior al 70 %. Se desarrolló el prototipo de la gerontecnología móvil Cuid@r, estructurado en seis dominios de autocuidado y diseñado con un enfoque en la accesibilidad, la usabilidad y el apoyo a los adultos mayores durante el periodo perioperatorio. Tras la validación de los expertos, el contenido se amplió de 18 a 25 cuidados/intervenciones, incorporando las sugerencias de los evaluadores. El Índice de Validez de Contenido (IVC) global alcanzó el 88,25 %, lo que evidencia una validez de contenido adecuada. La tecnología gerontológica desarrollada demostró una validez de contenido satisfactoria, lo que indica su potencial para apoyar el autocuidado perioperatorio de las personas mayores sometidas a cirugías ambulatorias electivas.

Descriptores: Autocuidado; Enfermería Geriátrica; Tecnología Educativa; Procedimientos Quirúrgicos Electivos; Seguridad del Paciente.

Resumo

Objetivou-se desenvolver e realizar a validação de conteúdo de um protótipo de gerontotecnologia para dispositivo móvel direcionado ao autocuidado da pessoa idosa no pré- e pós-operatório de cirurgias eletivas realizadas em nível ambulatorial. Pesquisa de produção tecnológica, qualitativa, aplicada à saúde, realizada em Florianópolis, entre fevereiro de 2022 e junho de 2023. O percurso metodológico compreendeu: o desenvolvimento do protótipo, fundamentado na Teoria do Autocuidado de Dorothea Orem e em ferramentas de design centrado no usuário; e a validação de conteúdo, realizada por um comitê de especialistas e análise do Índice de Validade de Conteúdo maior ou igual a 70%. Foi desenvolvido o protótipo da gerontotecnologia móvel Cuid@r, estruturado em seis domínios de autocuidado e desenvolvido com foco em acessibilidade, usabilidade e apoio à pessoa idosa no período perioperatório. Após a validação por especialistas, o conteúdo foi ampliado de 18 para 25 cuidados/intervenções, incorporando as sugestões dos juízes. A gerontotecnologia desenvolvida demonstrou validade de conteúdo satisfatória, indicando potencial para apoiar o autocuidado perioperatório da pessoa idosa em cirurgias eletivas ambulatoriais.

Descritores: Autocuidado; Enfermagem Geriátrica; Tecnologia Educacional; Procedimentos Cirúrgicos Eletivos; Segurança do Paciente.



Introduction

Population aging is a global and prominent phenomenon in Brazil. Data from the 2022 Demographic Census¹ evidence a significant increase in the population aged 60 years or older, reaching levels that demand more robust public health strategies for the monitoring of chronic conditions and surgical procedures in this age group.

Concurrently, although generational barriers persist, a significant advance in digital inclusion among older adults is observed. According to the research on the use of information and communication technologies in Brazilian households², there has been an expansion of internet access and the use of mobile devices by individuals over 60 years of age, consolidating health applications as relevant tools for supporting self-care.

Promoting self-management and self-care is essential for quality of life and patient safety. However, older adults, especially those with multiple comorbidities, still face significant challenges related to self-care, including difficulties in accessing health services, financial limitations, fragility of social support networks, and divergences in professional guidance³. These factors may compromise adherence to and management of therapeutic recommendations for self-care.

Considering Dorothea Orem's Self-Care Theory^{4,5}, self-care comprises the practice of activities that individuals initiate and perform on their own behalf to maintain life, health, and well-being. Such practices involve needs common to all human beings, termed universal, developmental, and health-deviation requisites, related, respectively, to food, hydration, rest; to the stages of human life; and to needs generated by genetic conditions, illnesses, injuries, or medical treatments.

In the geriatric perioperative context, these needs involve understanding preoperative instructions, adherence to surgical preparation, appropriate management of the surgical wound, early recognition of warning signs, and follow-up of recommendations after hospital discharge. When these needs are not adequately met, self-care deficits may emerge that can compromise clinical outcomes and the safety of older adults undergoing surgical procedures⁶.

In this context, Educational Technologies emerge as promising tools to expand the dissemination and access to health information and care. Among them, gerontechnologies stand out, consisting of products, environments, and services whose intentionality is to support daily care, promoting the protagonism of older adults and self-care in a playful and participatory manner, providing better quality of life, whether through support for the older adult, caregiver, and/or family members⁷. In this logic, the use of mobile devices has transformed interaction with health services, facilitating contact with professionals and access to reliable guidance for self-care practices⁸.

However, although a progressive increase in internet use among older adults is evident², this process occurs heterogeneously and is marked by significant social, economic, and regional inequalities. Furthermore, factors such as low digital and health literacy, visual impairments, cognitive decline, multimorbidities, and dependence on

caregivers may limit the effective use of these technologies⁸, evidencing the need for accessible, intuitive solutions compatible with the specificities of this population⁹.

Gerontechnologies emerge as potentially effective strategies to support self-care and promote greater safety care. Structurally developed mobile applications can empower older adults by providing accessible and reliable information, supporting decision-making, and expanding autonomy in situations related to health^{8,10}.

In the context of outpatient surgery, older adults face specific challenges, such as fear, anxiety, and insecurity due to lack of knowledge about the procedure's stages and the necessary care in the pre- and postoperative periods. Added to this is the fact that early discharge, characteristic of this surgical modality, reduces the time of continuous professional supervision and increases the importance of self-care at home, making the provision of clear, accessible, and adapted guidance for this population essential⁶.

Furthermore, the absence of adequate information may compromise adherence to surgical preparation, hinder the early recognition of complications, and increase the risk of preventable adverse events⁶.

However, the literature shows substantial difficulties in accessing high-quality information about the surgical process, as well as a scarcity of accessible, functional, and specific technological solutions for the perioperative context of older adults¹¹.

Although this study does not aim to evaluate clinical outcomes related to surgical safety, it is considered that educational technologies supporting perioperative self-care of older adults undergoing outpatient elective surgeries may indirectly contribute to patient safety. This occurs by favoring the understanding of guidelines, adherence to surgical preparation, and early recognition of signs and symptoms in the postoperative period^{6,10}.

Also highlighted is the relevance of developing user-centered educational technologies, structured based on the real demands of the older adult population and grounded in consistent theoretical frameworks, incorporating principles of accessibility, usability, and appropriate language⁸⁻¹⁰. Furthermore, the delimitation of the gerontechnology's scope to the pre- and postoperative periods of outpatient elective surgeries is justified by the need for active participation of the older adult and their caregivers in the management of self-care at home, since the intraoperative period corresponds to a stage predominantly assisted by the healthcare team in the hospital environment.

Given this context, the theoretical framework of Dorothea Orem's Self-Care Theory^{4,5} guides the organization of the content and functionalities of the gerontechnology prototype, directing them to the real needs of older adults in the perioperative period of outpatient elective surgeries. Thus, the objective was to develop and perform content validation of a prototype of a gerontechnology for mobile devices aimed at the self-care of older adults in the pre- and postoperative periods of elective surgeries performed on an outpatient basis.



Methodology

Study Design and Context

This is methodological research on technological production, with a mixed-methods approach (qualitative and quantitative), applied to the health field. The study was grounded in the theoretical framework of the Self-Care Theory^{4,5} proposed by Dorothea Orem, and adopted the assumptions of user-centered design methodologies, such as the ADDIE (Analyze, Design, Develop, Implement, Evaluate) methodology¹² and Garrett's Framework¹³. For the methodological design, the SQUIRE 2.0¹⁴, instrument, from the EQUATOR Network, was used as a guide for quality improvement studies in health.

The research was conducted in Florianópolis, in the state of Santa Catarina, Brazil, from February 2022 to June 2023. The development of the prototype followed the Double Diamond model proposed by the Design Council¹⁵, which comprises interactive processes of divergent and convergent thinking, organized into four main stages: discover, define, develop, and deliver. The content validation by experts does not constitute an autonomous stage of the methodological pathway, but is inserted in the 'define' stage, as detailed below.

Description of the Prototype Development Stages

Stage Discover: technological prospecting and scoping review

In the 'Discover' stage, an analysis of scientific literature and technical documents related to pre- and postoperative care applicable to older adults undergoing outpatient elective surgery was conducted, based on a scoping review¹⁶ and technological prospecting¹¹. The technological prospecting, of a documentary nature and qualitative approach, aimed to identify applications and digital technologies focused on the safety and self-care of older adults in the surgical context, through searches in the Apple Store® and Google Play® platforms, conducted from July 2022, using descriptors such as “autocuidado idoso”, “pré-operatório”, “pós-operatório” and “segurança do paciente idoso”, in Portuguese, English, and Spanish. No applications with the proposed theme were identified, which reinforced the relevance and originality of the Cuid@r prototype development. The scoping review, conducted according to the Joanna Briggs Institute recommendations, raised the requirements and relevant guidelines for the product to assist older adults in preventing risks and incidents and to provide pre- and postoperative guidance for outpatient surgeries.

Stage Define: content construction

In the 'Define' stage, data related to the theme, recommendations, clinical rationale, accessibility requirements, and the link to the theoretical framework were extracted from the selected documents. These data were organized in an electronic spreadsheet and analyzed by the researchers considering Orem's Self-Care Theory^{4,5}, supporting the construction of the content to be inserted into the gerontechnology.

From this analysis, the gerontechnology content was organized into six domains: preoperative care; postoperative care; patient rights; patient agenda; important tips; and “contact us”. The pre- and postoperative care domains are articulated mainly with health-deviation requisites, by guiding specific actions arising from the surgical condition, such as fasting, medication suspension, wound care, and warning signs. The patient rights and important tips domains relate to universal self-care requisites, by supporting basic information for maintaining safety and well-being. The “patient agenda” and “contact us” domains are linked to developmental requisites, by supporting continuity of care, organization of the therapeutic routine, and strengthening the autonomy of the older adult throughout the recovery process. For each domain, learning objectives and key messages were established, articulated with universal, developmental, and health-deviation requisites, according to the Self-Care Theory^{4,5} and the ADDIE Instructional Design methodology¹², with the purpose of ensuring effective, coherent educational interventions aligned with the needs of the target audience.

Content Validation by Experts

After the gerontechnology content was structured, content validation was performed. As noted, this process did not constitute an autonomous phase of the methodological pathway, but occurred within the 'define' stage, being conducted only on the textual content produced, without the judges having access to the navigable prototype or application screens, since prototyping was performed subsequently, in the 'develop' stage. The number of experts followed the recommendations of Pasquali¹⁷, who recommends between six and twenty judges for instrument validation processes, a recommendation also adopted by Coluci, Alexandre, and Milani and by Polit and Beck, this being the methodological framework widely used in content validation studies in the health field¹⁷. Thus, to select the judges, inclusion criteria were defined as: undergraduate degree in nursing; minimum professional experience of five years in the field of surgery or geriatrics, or postgraduate degree; and technical-scientific production related to the theme. No specific exclusion criteria were defined, since only experts who met the inclusion criteria and voluntarily agreed to participate in the research, by signing the Free and Informed Consent Form (TCLE), were included in the study. The option for a committee composed exclusively of nurses stemmed from the study's focus on content validation of nursing interventions aimed at perioperative self-care, grounded in Orem's Self-Care Theory; future stages of usability and appearance evaluation may incorporate the perspective of other professional categories involved in multidisciplinary perioperative care.

The judges, experts in the field for content validation, were recruited among faculty members of the Department of Nursing at the Federal University of Santa Catarina and nurses working in surgical and hospital units in the Florianópolis region, with their electronic contacts obtained through a search in the Lattes Platform. Thirty professionals were invited, through invitations to participate



in the content validation of the prototype sent by electronic correspondence, containing information about the study objectives, confidentiality, and voluntary participation. The data collection instrument was structured in two parts: the first aimed at sociodemographic and professional characterization of the judges, including age, sex, professional training, and years of experience; and the second focused on the evaluation of the gerontechnology content, also containing an open field for qualitative comments and suggestions from the experts. After acceptance, the electronic TCLE was made available. Up to three biweekly reminders were sent, with a final deadline for response on March 31, 2023. Of the 30 invited professionals, only 13 returned the complete instrument, resulting in a response rate of 43.3%.

For content validation, a Google Forms® form was organized, containing the contents distributed across three domains: strongly recommended guidelines/interventions; preoperative guidelines; and postoperative guidelines. Each item was evaluated according to ten criteria proposed by Pasquali¹⁸: comprehensiveness, clarity, coherence, criticality, objectivity, scientific writing, relevance, sequence, uniqueness, and timeliness; using a four-point Likert scale (1 = strongly disagree; 2 = disagree; 3 = agree; 4 = strongly agree).

Data were tabulated in Microsoft Excel® 2013 and analyzed using descriptive statistics. The Content Validity Index (CVI) was calculated by summing the responses considered adequate, divided by the total sum of responses, and multiplied by 100. This calculation measures the proportion of participants who agree on a given aspect or item of the instrument, being considered a validity parameter when the index is greater than or equal to 0.70 (70%) among the experts¹⁸. Items with CVI $\geq$ 75% were accepted and refined according to the judges' suggestions, with no need for a new validation round. There were no items below the cutoff point. It is worth noting that all pertinent suggestions were incorporated into the prototype content.

Instructional Design and Prototyping

Concurrently with content validation, in the 'define' stage, qualitative analysis of the collected data was performed, applying the Fixed Instructional Design through the ADDIE model¹². In the analysis phase, the instructional problem was clarified; in the design phase, learning objectives and content were systematized; in the development phase, the planned material was produced to generate and validate the learning materials; in the implementation phase, final revisions and adjustments were made; and in the evaluation phase, data were collected for reanalysis and revision of the constructed material.

Furthermore, the concept of user-centered graphic interfaces was applied, aligning gerontechnology with the needs of older adults and their caregivers. For this purpose, Garrett's Framework¹³, was employed, structuring the design into five interdependent levels: Strategy: needs of the older adult or caregiver; Scope: functional requirements such as font adjustment and reminders; Structure: flows and

navigation; Skeleton: layout and visual hierarchy; Surface: graphic elements and microtexts.

Stage Develop

Subsequently, the 'Develop' stage occurred, in which the defined scope was applied to the solution prototyping. The prototype was developed on the Adobe Experience Design (Adobe XD) platform, prioritizing accessibility features, such as font enlargement, adequate contrast, enlarged buttons, linear navigation with visible return, and simple language, considering visual and motor limitations common in older adults. Meetings were held between the research team and design professionals, aiming to prioritize functionalities and refine the screens until the version candidate for validation was obtained. All design and content decisions were recorded in minutes and in a systematic version control system.

Stage Deliver

Stage Deliver: delivery of the prototype, which had its patent registered with the National Institute of Industrial Property (INPI), under process number 512023002786-3.

Ethical Aspects

The study is part of a doctoral research approved by the Research Ethics Committee Involving Human Beings of the Federal University of Santa Catarina, under CAAE No. 53338921.6.0000.0121 and opinion No. 5,183,889. The ethical precepts of Resolution No. 466/2012 were respected. In accordance with the principles of Open Science, research data were deposited in a repository, ensuring the anonymization of participants and the integrity of the information.

Results

The developed gerontechnology was named 'Cuid@r', reflecting the proposal to support the self-care of older adults in the perioperative period of outpatient elective surgeries, grounded in Dorothea Orem's Self-Care Theory^{4,5}. The prototype was structured for mobile devices and developed with a focus on accessibility, usability, and intuitive organization of information, considering the specific needs of the older adult population.

The structuring of content into six domains aimed to address the three types of self-care requisites advocated by Orem's Theory^{4,5}. The 'preoperative guidelines' and 'postoperative guidelines' domains correspond mainly to health-deviation requisites, as they guide actions directly arising from the surgical condition, such as fasting, medication suspension, wound care, and identification of warning signs. The 'patient rights' and 'important tips' domains relate to universal self-care requisites, by providing basic information for maintaining safety and well-being, applicable to any person in a perioperative condition. The 'patient agenda' and 'contact us' domains are articulated with developmental requisites, by supporting the organization of the therapeutic routine, continuity of care, and the progressive strengthening of the older adult's autonomy throughout recovery.



The interface was developed predominantly in shades of blue, prioritizing adequate contrast, legibility, and visual comfort, characteristics frequently recommended for interfaces intended for the older adult population and compatible with accessibility and usability principles.

Furthermore, its organization in a simple layout, linear navigation, enlarged buttons, and objective language sought to favor a more intuitive and safer user experience for this audience.

Figure 1. Application home screen, login access, definition and care domains inserted in the Cuid@r prototype. Florianópolis, SC, Brazil, 2023

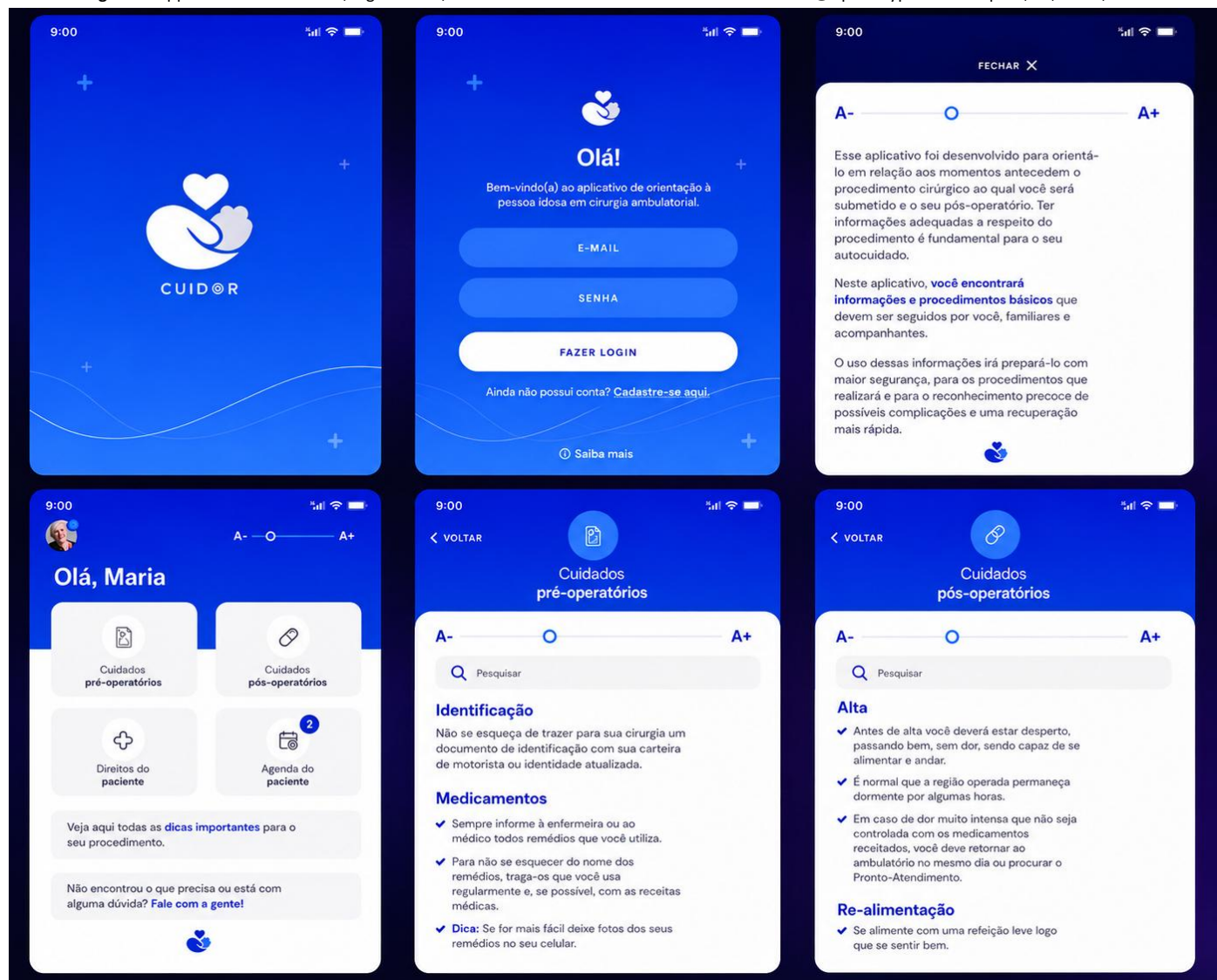


Figure 1 illustrates the application's initial screens, comprising: (I) the opening screen, titled "Cuid@r - guidance for older adults undergoing outpatient elective surgery"; (II) the login screen; and (III) the welcome screen, in which the purpose and mode of use of the application are presented. Additionally, the main menu screen is presented, composed of six icons corresponding to the content domains. These icons enable direct navigation, allowing the user to intuitively access the specific guidelines of each domain.

The pre- and postoperative care incorporated into the prototype were based on the findings of the scoping review conducted in the 'discover' stage¹⁶, which mapped scientific evidence, guidelines, and care protocols focused on the safety of older adults in the perioperative period of elective surgeries, encompassing recommendations related

to perioperative fasting, suspension of anticoagulant and antiplatelet medications, hand hygiene, patient identification, and surgical wound care, among other practices widely recommended by the surgical patient safety literature. These recommendations were subsequently submitted to content validation by the experts, who suggested additions and editorial adjustments, as detailed in Chart 1.

In the 'Preoperative guidelines' domain, the final version of the prototype presents thirteen care items organized in a continuous scrolling format, while in the 'Postoperative guidelines' domain, ten care items structured by topics are made available. Below, synthetic examples of the content effectively displayed in the final version of the prototype are presented.

Chart 1. Examples of the contents made available in the final version of the Cuid@r gerontechnology, according to the self-care domains.
Florianópolis, SC, Brazil, 2023

Domain	
Preoperative instructions	Identification: "Bring an official photo ID; check your wristband/label before any procedure."
	Medications: "Report all medications you are currently taking; do not stop taking them on your own; follow instructions regarding the suspension of anticoagulants or antiplatelet drugs."
	Always inform the nurse and doctor: "Report allergies, previous surgeries, and hospitalizations; disclose any self-medication."
	Diet: "Follow fasting instructions; do not consume liquids or medications during the fasting period without authorization."
	Personal hygiene: "Bathe—preferably using antiseptic soap—at the hospital when instructed; keep your skin clean and dry."
	Hand hygiene: "Clean your hands with soap and water or 70% alcohol, and remind your companion to do the same when entering the room."
	Hair removal: "Do not shave the surgical area at home; this carries a risk of micro-injuries and infection."
	Companion: "Arrange for a responsible companion to assist with your discharge and return home."
	Smoking and alcohol: "Adhere to the recommended period of abstinence; use increases the risk of complications."
	Consent form: "Read the form and clarify any questions before signing; bring your glasses if needed."
	Tests: "Bring all requested test results; do not undergo tests without guidance from the healthcare team."
	Jewelry and dentures: "Remove jewelry, accessories, and dentures before the procedure; leave them with your companion for safekeeping."
	Previous infections: "Inform the team of any recent infections; certain conditions may prevent or delay the surgical procedure."
Post-operative instructions	Discharge: "Leave with written instructions; confirm details regarding medications, dressings, and warning signs."
	Resuming diet: "Reintroduce food gradually; opt for clear liquids and light foods as tolerated."
	Dressing: "Keep clean and dry; do not remove without instruction; watch for soiling or odor."
	Surgical wound and warning signs: "Do not scratch or manipulate; intense redness, heat, purulent discharge, fever, or disproportionate pain require evaluation."
	When to seek emergency care: "Active bleeding, persistent fever, uncontrollable vomiting, shortness of breath, or severe pain."
	Scar: "Protect from the sun; avoid direct exposure; follow instructions for topical care."
	Rest: "Adhere to the recommended rest period; avoid physical exertion and heavy lifting until cleared by the medical team."
	Post-operative medications: "Use only prescribed medications; do not stop or substitute them without medical advice."
	Follow-up appointment: "Attend scheduled appointments; bring discharge instructions and current medications."
	Additional information: "If you have questions, contact the team via the 'Contact Us' channel; warning signs require immediate emergency care."

Figure 2 gathers the screens corresponding to the other application domains: (I) 'Patient Rights', with clear information about rights during outpatient hospitalization; (II) 'Patient Agenda', presenting organization in a calendar format for medications and appointments, with notification sending; (III) 'Important Tips', containing practical guidance for the day of the procedure; and (IV) 'Contact Us', a communication channel with the team. The prototype makes it explicit that messages sent through this channel, in an assisted implementation model, are triaged by nursing professionals during business hours, with a target response time of up to 48 hours, in addition to explicit guidance for immediate seeking of emergency care upon identification of warning signs.

All thirteen judges participating in the content validation were nurses, recruited among faculty members of the Department of Nursing at UFSC and nurses working in surgical and hospital units in the Florianópolis region.

Regarding the area of practice, participants were distributed among the fields of surgical nursing, older adult health/gerontology, perioperative care, teaching, and research, reflecting the multidisciplinary interface required by the study's theme. Of these, 69.2% held an academic master's degree. Professional experience ranged from 11 to 42 years. Regarding sex, twelve participants were female, and one was male, aged between 33 and 63 years. It should be noted that the validation process focused exclusively on the textual content of the gerontechnology, organized in an electronic form; the judges did not have access to the navigable prototype, screens, or interaction flows, a validation stage of appearance and usability not yet performed. The overall Content Validity Index (CVI) reached 88.25%. Validation was performed on 18 initial items, distributed across three domains: strongly recommended guidelines/interventions (1 item), preoperative guidelines (11 care items), and postoperative guidelines (6 care items).



After incorporating the judges' suggestions, the content was expanded to 25 items/care items in the final version, distributed as follows: 2 items of strongly recommended guidelines/interventions, 13 preoperative care items, and 10 postoperative care items. No item fell below the 70% cutoff. The items with the highest agreement among experts were body hygiene, consent form, refeeding, and surgical scar care, all with a CVI of 100%. The items with the lowest

agreement, although still above the cutoff, were discharge guidelines and wound care, both with a CVI of 75%, and smoking and alcohol intake, with 76.9%, signaling the need for greater editorial and clinical attention to these contents. Table 1 presents the detailed analysis of the gerontechnology content validation. Chart 2 systematizes the suggestions and considerations of the content judges that supported the improvement of the Cuid@r prototype.

Figure 2. Screens of the patient rights, patient agenda, important tips, and 'contact us' domains of the Cuid@r prototype. Florianópolis, SC, Brazil, 2023

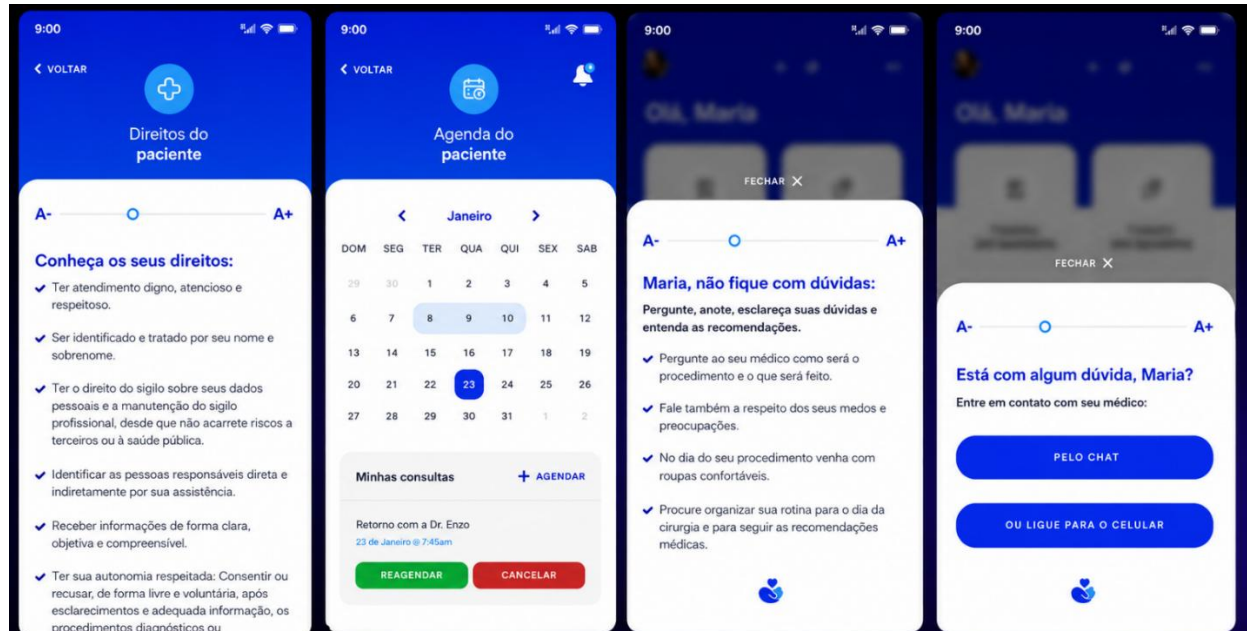


Table 1. Percentage of agreement among experts in the content validation of the Cuid@r gerontechnology. Florianópolis, SC, Brazil, 2023

Validation items and percentage of agreement CVI	Strongly disagree (%)	Disagree (%)	Agree (%)	Strongly agree (%)	CVI (%)
Strongly recommended guidelines/interventions	-	15.3	38.5	46.2	84.7
Preoperative guidelines					
Patient identification	-	7.7	38.5	53.8	92.3
Medications	-	15.4	23.1	61.5	84.6
Diet	-	23.0	38.5	38.5	77.0
Personal hygiene	-	-	38.5	61.5	100.0
Hair removal	-	7.6	23.1	69.3	92.4
Presence of a companion	-	7.7	30.8	61.5	92.3
Smoking (cessation period) and alcohol consumption	-	23.1	15.4	61.5	76.9
Informed consent form	-	-	38.5	61.5	100.0
Tests/Examinations	-	15.4	23.1	61.5	84.6
General care regarding jewelry and dental prostheses	-	15.4	23.1	61.5	84.6
Postoperative guidelines					
Discharge instructions	-	25.0	33.3	41.7	75.0
Resumption of oral intake	-	-	58.3	41.7	100.0
Dressing care	8.3	16.7	33.3	41.7	75.0
Surgical wound care and warning signs	-	7.7	38.5	53.8	92.3
Surgical scar care	-	-	30.8	69.2	100.0
Additional information	-	7.7	23.1	69.2	92.3

Note: CVI: Content Validity Index.

Chart 2. Suggestions and considerations from content judges for the improvement of the Cuid@r prototype. Florianópolis, SC, Brazil, 2023

Domains	Suggestions/Considerations	Decision
Strongly recommended guidelines/ interventions	Could include guidance on psychological support from nursing through active and attentive listening; explanations about the procedures; clarifying doubts to reduce surgical stress.	Content of additional information to the patient and the contact channel with the nurse was inserted.

Preoperative guidelines	1. Recommendation to bring any official photo ID. 2. Guidance to inform about self-medication and suspension of anticoagulants. 3. Include a time frame for fasting duration and include not taking medications during fasting. 4. Include the need for an aseptic bath at the hospital. 5. Instruct the patient to remind their companion to wash hands whenever entering the room. 6. Guidance on the risk of complications during and after surgeries with smoking and alcohol use. 7. Add the importance of reporting allergies to the healthcare team. 8. Guidance to report previous infections that may prevent the surgical procedure.	1. Included in patient identification care. 2. Included in medication care. 3. Included in nutritional care. 4. Included in personal hygiene care. 5. Included in hand hygiene care. 6. Included in care regarding smoking (cessation period) and alcohol intake. 7. New item added: always report the presence of allergies and previous procedures. 8. New item added: previous infections.
Postoperative guidelines	1. Advise against scratching the surgical wound and instruct to report any changes. 2. Advise that sunlight can cause surgical dehiscence and provide instructions regarding insect exposure at the surgical site.	1. Included information on surgical wound care and warning signs. 2. Included warning signs and indications of when the patient should seek emergency care. 3. Included care instructions for the surgical scar.

Discussion

The study evidences the development and content validation of the Cuid@r gerontechnology, intended to support self-care of older adults in the pre- and postoperative periods of outpatient elective surgeries. Grounded in Dorothea Orem's Self-Care Theory^{4,5}, this technology configures itself as an educational support tool, in which the nursing professional guides and empowers the older adult to manage their own care. The implementation of gerontechnologies in the outpatient surgical flow, mediated by clear and accessible guidance via mobile device, presents itself as a potentiality for the understanding of perioperative guidelines, active engagement, and support for the self-care of older adults at home, both for preoperative preparation and for postoperative follow-up^{20,21}.

The use of information and communication technologies to qualify clinical processes and care management should consider the specificities of the older adult population, incorporating accessibility features such as font enlargement, larger buttons, clear language, and intuitive interfaces to favor inclusion and usability for this population^{22,23}. Mobile applications have demonstrated a positive impact on therapeutic adherence, care self-management, and access to health information, provided they are associated with digital literacy strategies and sociocultural adaptation to the target audience²²⁻²⁴. This scenario demands from health professionals the development of solutions compatible with the cognitive, functional, and contextual needs of the elderly population.

By specifically addressing perioperative self-care of older adults based on a theoretical nursing framework, the Cuid@r prototype differentiates itself from applications described in the literature that are predominantly focused on clinical monitoring or medication adherence in chronic diseases^{11,20,23}. In addition to educational guidelines, the gerontechnology incorporated features aimed at accessibility, usability, and decision-making support,

considering limitations frequently present in older adults, such as visual impairments, functional decline, and the need for family support²⁵. Such characteristics reinforce the importance of developing user-centered educational technologies aligned with the real demands of the older adult population.

In the context of nursing practice, mobile educational technologies can expand the reach of perioperative guidelines and favor the continuity of care after outpatient discharge, especially in scenarios characterized by reduced hospital stay. However, the incorporation of these technologies into care practice requires digital inclusion strategies, professional support, and adaptation to the sociocultural conditions of the older adult population, preventing access inequalities from limiting the potential benefits of digital health^{10,22-24}. In this sense, the use of gerontechnologies should be understood as a complementary tool to in-person care, and not as a substitute for clinical evaluation and professional follow-up.

The content validation of the gerontechnology showed an overall CVI of 88.25%, indicating high agreement among experts. The items body hygiene, consent form, refeeding, and surgical scar care achieved maximum agreement, reflecting consensus among experts regarding the clarity, relevance, and applicability of these contents.

The validated contents addressed the self-care requisites, universal, developmental, and health-deviation, described by Orem^{4,5}, evidencing coherence between the adopted theoretical framework and the conceptual structure of gerontechnology. The highest agreement rates concentrated on contents related to basic physiological needs and to care directly resulting from the surgical procedure.

Considering Orem's Self-Care Deficit Theory^{4,5}, these items relate to therapeutic self-care requisites as they guide actions necessary for maintaining health, preventing complications, and ensuring continuity of care in the perioperative period. The literature corroborates this finding

by demonstrating that educational interventions in the surgical context contribute to patient understanding, prevention of surgical site infection, wound care, and postoperative recovery, including refeeding when clinically indicated^{26,27}.

On the other hand, guidelines related to hospital discharge, wound care, smoking, and alcohol intake, although above the cutoff point, presented lower agreement and evidenced content requiring greater editorial and clinical attention, as they involve symptom interpretation, adherence to recommendations, and behavioral changes. These contents involve greater interpretive capacity, behavioral changes, and active participation of the older adult in self-care management. From Orem's perspective^{4,5}, such aspects are fundamental to strengthening self-care and reducing possible deficits arising from unclear or insufficient information.

This interpretation finds support in the literature, which demonstrates that structured educational interventions favor the understanding of perioperative guidelines, prevention of surgical site infection, appropriate management of the surgical wound, refeeding when clinically indicated, and safe continuity of care at home²⁶⁻²⁸. Thus, the lower agreement observed in these contents does not reduce their clinical relevance, but reinforces the need for clearer, individualized educational approaches centered on the needs of the older adult.

Available evidence also points to promising results for the use of digital technologies in perioperative care. A systematic review with meta-analysis²⁹ identified an association with reduced readmissions and emergency department visits after abdominal surgeries but recognized that the mechanisms of action and applicability in different surgical contexts still need further investigation. Similarly, a narrative review³⁰ on mHealth technologies in perioperative surgical care pointed to potential for improving communication, monitoring, and continuity of care. However, heterogeneity in intervention designs, types of surgery evaluated, outcomes measured, and methodological quality of studies stands out, which limits definitive conclusions about clinical effectiveness^{29,30}.

In this scenario, Cuid@r represents an innovation in the promotion of safe self-care in the perioperative period in outpatient surgical contexts, by bringing together educational content validated by experts, accessibility features, and functionalities specifically aimed at perioperative self-care of older adults, grounded in Orem's Self-Care Theory^{4,5}. Although the present study did not evaluate clinical outcomes, the technology presents potential to favor the understanding of guidelines, strengthen adherence to perioperative home care, adding value to Nursing, patient safety, and active aging policies.

It should be noted that the present study was limited to the development and content validation of the prototype, carried out through expert evaluation, lacking application in a representative sample of the target population for appearance validation. Furthermore, the use of the application presupposes the availability of a smartphone with Android version 8 or higher, or iOS version

13 or higher, minimum functional literacy, or caregiver support, and intermittent internet access for reminder synchronization. Finally, it is highlighted that the application is strictly educational in nature, does not replace clinical evaluation, and configures itself as a support technology for self-care.

In clinical practice, the operationalization of technology may be conducted primarily by the Nursing team, as it is an educational tool for care self-management. The incorporation of Cuid@r may occur at different moments of the outpatient perioperative flow. During the preoperative consultation, the nurse may present the application, guide its use, and clarify doubts. At the time of hospital discharge, the technology may reinforce verbal and written guidance, favoring greater information retention. At home, features such as agenda, reminders, and communication with the team may support adherence to recommendations, remote monitoring, and early recognition of complications.

Conclusion

The present study enabled the development and content validation of the Cuid@r gerontechnology, aimed at supporting self-care of older adults in the pre- and postoperative outpatient periods. The methodological process adopted, grounded in Design Thinking, the ADDIE model, and Dorothea Orem's Self-Care Theory, favored the construction of a technology based on scientific evidence and the needs of the target audience, culminating in an overall Content Validity Index (CVI) of 88.25%, demonstrating adequate content validity. Aligned with the assumptions of Orem's Self-Care Theory, the Cuid@r gerontechnology presents potential to favor access to qualified information, support the development of self-care in older adults, and contribute to the continuity of care in the pre- and postoperative outpatient periods, especially in contexts in which the patient's active participation is fundamental for surgical preparation and home recovery. Furthermore, it constitutes a strategy to support clinical practice, potentially subsidizing health professionals in offering standardized, accessible, evidence-based guidance for perioperative care of older adults. As a subsequent step, it is recommended to carry out appearance and usability validation with the target audience, as well as studies that evaluate the effectiveness, implementation, and impact of the gerontechnology in care practice. These investigations will contribute to expanding evidence regarding its applicability in different care contexts and strengthening its potential as a support tool for self-care and safety of older adults in the perioperative period. In this context, the Cuid@r gerontechnology represents a promising tool to qualify health education and strengthen person-centered care for older adults, contributing to safer, systematized care practices guided by the promotion of self-care.

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