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CODESIGN OF A CARE-EDUCATIONAL APP FOR PEOPLE WITH HEART FAILURE: DESIGN, PROTOTYPING AND CO-IMPLEMENTATION

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ABSTRACT

Objective: to describe the process corresponding to the design, prototyping and co-implementation of a care-educational app prototype for vulnerable people with heart failure, their family members/caregivers and the health team.
Method: a methodological study with five phases: Construct, Design, Prototyping, Co-implementation and Adaptation, all performed from September 2020 to July 2021. The Codesign team involved 72 actors (15 patients with HF, 19 family members/caregivers, 35 health professionals, two researchers and a designer and developer), who contributed with linguistic and visual data.
Results: the *InCare*® prototype was produced, represented by the flowchart corresponding to the user's interaction and structural sketches. Colors were defined to compose the screens and the prototype resources were chosen, outlining the description, proposal and functional requirements. The app involved relevant themes (definition of the disease and vulnerability, etiology, classification, signs and symptoms, daily care measures and palliative approaches, treatments, diet, physical activity and support networks, benefits) and gathered functionalities according to the team's needs and preferences, being considered innovative and encouraging for self-care.
Conclusion: codesign allowed designing resources, contents, screen sketches, user flow, prototyping and prototype name, in a creative and participatory process to promote the health of people with heart failure in vulnerable health situations.

DESCRIPTORS: Heart failure. Mobile apps. Educational technology. Vulnerability in health. Diffusion of innovations.

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CODESING DE APLICATIVO CUIDATIVO-EDUCACIONAL PARA PESSOAS COM INSUFICIÊNCIA CARDÍACA: IDEAÇÃO, PROTOTIPAGEM E CO-IMPLANTAÇÃO

RESUMO

Objetivo: descrever o processo de ideação, prototipagem e co-implantação do protótipo de aplicativo cuidativo-educacional à pessoa com insuficiência cardíaca em vulnerabilidade, seus familiares/cuidadores e equipe de saúde.
Método: estudo metodológico, com cinco fases: Constructo; Ideação; Prototipagem; Co-implantação e Adequação, realizadas de setembro de 2020 a julho de 2021. A equipe do *Codesign* envolveu 72 atores (15 pacientes com IC, 19 familiares/cuidadores, 35 profissionais da saúde, dois pesquisadores e um *designer* e desenvolvedor), que contribuíram com dados linguísticos e visuais.
Resultados: foi produzido o protótipo InCare®, representado pelo fluxograma de interação do usuário e esboços estruturais. Foram definidas cores para composição das telas e escolhidos recursos do protótipo, com delineamento da descrição, proposta e requisitos funcionais. O aplicativo envolveu temáticas relevantes (definição da doença e vulnerabilidade, etiologia, classificação, sinais e sintomas, cuidados diários e abordagens paliativistas, tratamentos, alimentação, atividade física e redes de suporte, benefícios) e aglutinou funcionalidades conforme necessidades e preferências da equipe, sendo considerado inovador e um incentivo ao autocuidado.
Conclusão: O *Codesign* permitiu a ideação de recursos, conteúdos, esboços das telas, fluxo do usuário, prototipagem e nome do protótipo, em processo criativo e participativo, para promoção da saúde da pessoa com insuficiência cardíaca em situação de vulnerabilidade em saúde.

DESCRITORES: Insuficiência cardíaca. Aplicativos móveis. Tecnologia educacional. Vulnerabilidade em saúde. Difusão de inovações.

CODESIGN DE UNA *APP* DE CUIDADOS E INSTRUCTIVA PARA PERSONAS CON INSUFICIENCIA CARDÍACA: DISEÑO, PROTOTIPACIÓN Y CO-IMPLEMENTACIÓN

RESUMEN

Objetivo: describir el proceso de diseño, prototipación y co-implementación del prototipo de una app de cuidados e instructiva para personas con insuficiencia cardíaca en situación de vulnerabilidad, sus familiares/ cuidadores y el equipo de salud.
Método: estudio metodológico con cinco fases: Constructo; Diseño; Prototipación; Co-implementación y Adaptación, realizadas entre septiembre de 2020 y julio de 2021. El equipo Codesign estuvo compuesto por 72 actores (15 pacientes con IC, 19 familiares/cuidadores, 35 profesionales de la salud, dos investigadores y un diseñador y desarrollador), que contribuyeron con datos lingüísticos y visuales.
Resultados: se produjo el prototipo *InCare*®, representado por el diagrama de flujo de interacción del usuario y bosquejos estructurales. Se definieron colores para componer las pantallas y se eligieron recursos para el prototipo, incluyendo el diseño de la descripción, propuesta y requisitos funcionales. La *app* abarcó temáticas relevantes (definición de la enfermedad y vulnerabilidad, etiología, clasificación, señales y síntomas, cuidados diarios y enfoque paliativos, tratamientos, alimentación, actividad física y redes de apoyo, beneficios), además de agrupar funcionalidades conforme a las necesidades y preferencias del equipo, y fue considerada innovadora y como un incentivo para el autocuidado.
Conclusión: Codesign permitió diseñar los recursos, contenidos, bosquejos de pantallas, el flujo del usuario, la prototipación y el nombre del prototipo, por medio de un proceso creativo y participativo, para promover la salud de personas con insuficiencia cardíaca en situación de vulnerabilidad relacionada con la salud.

DESCRIPTORES: Insuficiencia cardíaca. *Apps* móviles. Tecnología educativa. Vulnerabilidad en salud. Difusión de innovaciones.

INTRODUCTION

Codesign is a product development model in which users and designers establish links for mutual learning and work, together and creatively, generating useful and high-impact products, from planning to delivery of the final product[1]. In health, it represents the partnership between patients, caregivers, family members, professionals, managers and researchers to improve the service[2], aiming to develop technological innovations without losing the human touch.

By challenging the traditional approach, Codesign stands out in the elaboration of care-educational technologies, such as mobile apps, as they require choosing a method that recognizes each individual as an essential component for improving health care quality. Based on theoretical-methodological references, apps allow patients to self-evaluate and manage their health condition; involve family members and caregivers in care and enable follow-up care by the multidisciplinary health team[3–4].

When designed for people with chronic and complex conditions such as heart failure (HF), apps must meet specific contexts and demands[5]. For this, it is indispensable to permeate technical care and adopt strategies in favor of creating technological innovation based on exchange, interprofessionality, intelligence and collective learning[6], identifying the future users' preferences. Thus, it is possible to capture life experiences and gather data to choose contents and resources that will be later interactively refined and included in the app.

Despite the benefits of Codesign, its use in the creation of an app on HF is restricted to international studies[7–11], as few are produced in connection with scientific studies and there are no Brazilian apps based on a theoretical-methodological framework for this population group. Therefore, in order to develop technology that is suitable for users, Codesign was applied in creating the app on HF.

This study is justified by its technological contribution to the leading role of people with HF, their family members/caregivers and the health team in the development of a tool that enables comprehensive care. Thus, the objective of this study was to describe the process corresponding to the design, prototyping and co-implementation of the care-educational app prototype for vulnerable people with HF, their family members/caregivers and the health team.

METHOD

A methodological study based on the Codesign model[12], for creating innovative mobile learning (*m-Learning*) systems. The study was conducted from September 2020 to July 2021, being developed in five phases: 1) Construct; 2) Design; 3) Prototyping; 4) Co-implementation; and 5) Adaptation (Figure 1).

In Phase 1 (Construct), the researchers defined the app construct. In order to transpose biomedical care, a technology was planned based on theoretical frameworks that added comprehensiveness and health promoting aspects, such as vulnerability in health[13–14]. Once the construct was defined, the objectives of the prototype proposed were established.

In Phase 2 (Design), actors were selected to comprise the Codesign team and, in this way, guarantee technological innovation consistent with the needs of the interested parties, divided into four categories with a minimum of 8 participants:[12] a) primary (people with HF): people who use the system directly; b) secondary (family members/caregivers and health team professionals): people who do not use the system directly but receive results from it or provide information to them (indirect users); c) tertiary (researchers): people who do not interact with the system, either directly or indirectly, but are affected by its success (or failure); and d) facilitators (designer and developer): people involved with design, development and maintenance of the system.

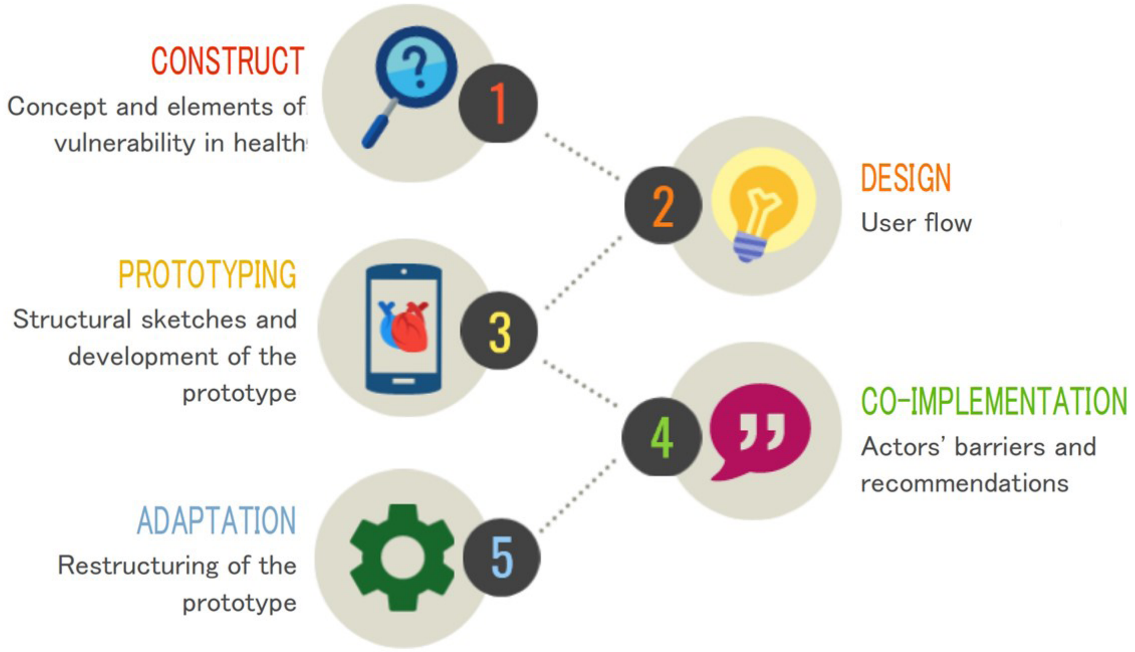

Figure 1 – Phases to develop the prototype following the Codesign method.

In Phase 3 (Prototyping), the ideas captured and visualized were refined, which, linked to the user flow, allowed initiating the app prototyping step. Low-fidelity prototyping is a quick and low-cost way to validate a product's interface, decide whether or not an idea has functional value, and solve menu hierarchy issues[15]. The structural sketches (wireframes) were hosted on the Marvel platform, with a schematic and/or diagrammatic representation of the structures and divisions of a digital technological product, design specifications and workflow enhancement, based on the users' experience.

Based on the sketches, the prototype was created in JavaScript with React Native (https://reactnative.dev/), a framework for developing cross-platform mobile apps (Android and iOS) and Visual Studio Code, a free, repurposed and optimized source code editor for creating and debugging modern web and cloud apps. For the back-end, the Java language with Spring framework (https://spring.io/) was used to guarantee data integration and security, as well as IntelliJ IDEA, an integrated environment for editing codes.

Phase 4 (Co-implementation) consists in the actors' involvement in the gradual implementation, evaluation and review of the app. The goals are to engage with existing groups, develop skills and allow for a conversation between the creative team members to obtain a consistent product for the users[12]. At this stage, part of the Codesign team came together to share an understanding of the benefits of innovation and identify barriers, with a commitment to a successful the final implementation. Once the discourses arising from Co-implementation were analyzed, Phase 5 (Adaptation) was initiated. Any pertinent change was made, rendering the prototype ready for the validation process and later final application.

A total of 72 actors participated in the Codesign team, namely: 15 patients with HF (primary), 18 family members/caregivers and 35 health professionals (secondary), two researchers (tertiary), and a designer and developer (facilitator).

The health professionals (twelve nurses, three nursing technicians, five physiotherapists, four physicians, three nutritionists, three dentists, two psychologists, two social workers and one occupational therapist) and the patients and family members came from a tertiary-level health institution in the Brazilian Northeast region which is a reference in the diagnosis and treatment of heart and lung diseases. Choice of the institution is justified because it has a care complex for people with HF, consisting of an outpatient Unit for Transplantation and Heart Failure (UTHF), an Inpatient Unit and a Cardiac Rehabilitation Unit.

Professionals belonging to the active staff were selected, who carry out daily consultations and/or guidance to people with HF and with experience in the care of these patients equal to or greater than one year. Regarding the patients, those with a medical diagnosis of HF and undergoing outpatient monitoring were included; whereas those that presented any complication during data collection were excluded. Family members/Caregiver aged >18 years old and who directly participated in the care provided to the HF patient were included. Sampling was for convenience and the representativeness criterion to end data collection was discourse saturation. There were no refusals or withdrawals.

Both researchers were nurses, one a PhD student and the other a post-PhD student in Nursing at a graduate program of a state university in the Brazilian Northeast region, expertise in HF, vulnerability and development of health technologies. The designer and developer was hired by the researchers due to his experience in developing educational systems and apps in the health area, in addition to working as a software engineer in a company specialized in education.

It is noted that not all the actors had active participation in all the stages. Both researchers participated in the first phase, choice of the construct, with definition of the concept and elements of vulnerability in health. In the second phase, design, all 72 actors were involved. Here, it is recommended to include up to eight actors per category[12]; however, it is understood that HF requires specialized care from a multiprofessional team and the active participation of patients and family members/caregivers, with varied sociodemographic, cultural and clinical profiles. Therefore, it was necessary to include more subjects to ensure diversity of information.

The third and fifth phases, prototyping and adaptation of the prototype, respectively, involved both researchers and the designer/developer. For the fourth phase, co-implementation, recognizing that three to five subjects can identify 85% of the prototype's problems[16], 15 team actors were recruited among the participants from the primary and secondary categories, comprised by five health professionals, five individuals with HF and five family members/caregivers.

Sensitization and the invitation to the actors were via telephone contacts. For data production, visual and linguistic (interviews) data collection methods were combined to ensure a rich variety of information and explain experiences. Initially, all the actors were asked regarding gender, age and use of general apps, either for health support and/or specific for HF.

This was followed by conducting semi-structured, individual and group interviews between September and December 2020 and in a private space, reserved for the activity, in the health institution itself. The interviews were coordinated by the main researcher and assisted by two nurses, MSc and PhD students and duly trained, who sought to understand the users' needs in order to collect relevant information and observations regarding the design for developing the prototype.

The guiding question was the following: "how should an app for HF (self-)care be used?" Based on the main question, other secondary questions were asked in order to deepen the conversations. Support materials such as pencils and sheets of paper were provided to those who were willing to freely record their content ideas and sketches for possible screens. The visual data were chosen and a smartphone with a voice recorder was used to record the conversations.

During the interviews, the actors were encouraged to exchange ideas with the researcher and with other actors, when in groups. At the end, a synthesis of the findings was performed, as well as a previous analysis to express knowledge. The interviews lasted from 12 to 43 minutes and the content obtained guided the elaboration of the user flow, a technique that allows mapping the flow of screens, aligning paths and actions that the user will follow. The flow was prepared in *Draw.io*, an online graphic editor that allows developing drawings and graphs, devoted to information architecture.

For the Co-implementation phase, the authors were provided the link to download the prototype, which was handled for one week. After this period, all 15 actors selected were contacted via telephone calls and invited to answer three questions: “what did you think about the prototype?”, “What worked well and what might be improved?” and “Would use or recommend the prototype?”

The interviews took place in July 2021 and via telephone calls due to the epidemiological scenario imposed by the COVID-19 pandemic and the change in routine at the health institution, and the conversations were recorded using a smartphone app. Based on the actors’ considerations, the researchers and the developer adapted the prototype.

The conversations obtained by means of shared understanding in Phases 2 and 4 were transcribed and subsequently verified by each actor to determine consistency. Each statement was read and re-read separately and later organized in units of meaning. Successive reductions undertaken considered convergent and divergent points. Senses and meanings attributed by the actors to the prototype emerged based on the analysis of the discourses.

Some of Hannah Arendt’s ideas[17–18] supported the interpretive process and articulated to other authors, favored understanding of intentionality in the discourses. The choice for Arendt’s ideas is based on understanding that education emerges as a political and awareness-raising tool, which enables subjects to overcome situations of vulnerability, develop singularities, overcome alienation and implement lessons learned with respect to freedom and the encouragement of actions that allow their evolution.

The study was approved by the health institution’s Research Ethics Committee, together with signing of the Free and Informed Consent Form by the participants, who were guaranteed anonymity by indicating the professional category among health professionals, patients and family members, followed by the numbers 1-15.

RESULTS

The prototype was developed according to the vulnerability in health elements of people with HF. As it is a multidimensional phenomenon, it involves essential elements in contexts of socioeconomic and demographic situations, clinical profile, learning, health behaviors, mental health, social support, family ties and technologies, costs and health services[13–14]. Based on its elements and on Arendt’s educational and freedom ideas[17–18], it was established that the prototype should have the following objectives: having educational content to support people with HF in vulnerable situations and their family members/caregivers; assisting people in identifying their contexts of vulnerability; allowing follow-up by the multiprofessional health team, necessary for the decision-making process; and serving, for all users, as a care support tool, with immediate availability of information.

Once the construct and objectives were established, actors aged between 20 and 71 years old were selected for the Codesign team, with majority of the female gender (52; 72.2%). Among the professionals, only three used an app for HF; all patients and family members/caregivers reported owning and using smartphones every day for research and access to social networks and handling apps for delivery and urban mobility services, but none of them used apps to help with disease care.

The actors stated that living with HF is complex and multifaceted. Therefore, they suggested development of an app that included educational information about the disease (definition, etiology, classification, signs and symptoms, daily care, treatments and support networks – benefits) and which allowed recording daily data through interactive resources and easy handling.

The functionalities designed by the team were identified and grouped into eight resources, characterized in Chart 1: 1) Management panel, so that the multiprofessional team has access to all the information filled in daily by the patients; 2) Patient profile, with social, demographic and clinical data; 3) Education, space devoted to relevant topics for patients and family members/caregivers about the disease and its interface with vulnerability in health; 4) Monitoring, a section for the patient to enter health data; 5) Alarms, to help patients with self-care; 6) Contacts, with the possibility of introducing numbers of health professionals and services; 7) My tests, a section for storing diagnostic reports; and 8) General information, where the users will have access to objectives, bibliography materials used in development of the prototype, responsible researcher and user manuals and educational content, available for download.

Chart 1 – Resources designed for the prototype, Fortaleza, CE, Brazil, 2021.

Resource	**Characterization**
Management panel	Description: a website where the health professionals can see the everyday data filled out by the patient. Proposal: promote awareness of the situation around the patient and the need for care measures. Functional requirements: Visualization of the care routines.
Profile of the patient	Description: screens with diverse information about the patient. Proposal: provide essential information to understand and support the patient. Functional requirements: record of the patient's social, demographic and clinical information.
Education	Description: screens with multiple themes that encompass all the aspects of the disease experienced by patients and family members/caregivers. Proposal: solve doubts about issues pertinent to the universe of heart failure that emerge from the process of living with the disease. Functional requirements: increased knowledge about the disease by means of texts, figures and educational videos.
Monitoring (routine)	Description: screens that the patient and/or family member/caregiver fills out every day. Proposal: ease care continuity and accuracy. Functional requirements: monitoring of weight, blood pressure, heart rate, oxygen saturation, urinary volume, diet, fluids, physical activity, cardiac rehabilitation, consumption of cigarettes, alcoholic beverages and other substances, oral hygiene, symptoms, medications, well-being and sleep quality.
Alarms	Description: screens to create alarms and reminders. Proposal: assist the patient and family member/caregiver in the everyday monitoring actions. Functional requirements: definition of important reminders or alarms to manage the disease: life habits, medications and tests.
Contacts	Description: screens to include contacts of health professionals and institutions. Proposal: help the patient maintain the contacts of the professionals monitoring them and the health institutions they attend in a single place. Functional requirements: a record corresponding to the health professionals' and institutions telephone numbers.
Tests	Description: screens to record the test reports by type and by data. Proposal: provide a safe place to store the tests. Functional requirements: record corresponding to the laboratory, biochemical, imaging, tracing and other tests.

Chart 1 – Cont.

Resource	**Characterization**
General information (settings)	Description: screens to access tutorials about handling and diverse information about the app. Proposal: provide all the users with basic and support information to use the app. Functional requirements: understanding how the app works by means of a tutorial.

The design process also enabled general planning of the prototype conception, incorporating contents and resources by means of the screen sketches. A ten-step user flow was developed, including the functionalities defined for the prototype (Figure 2).

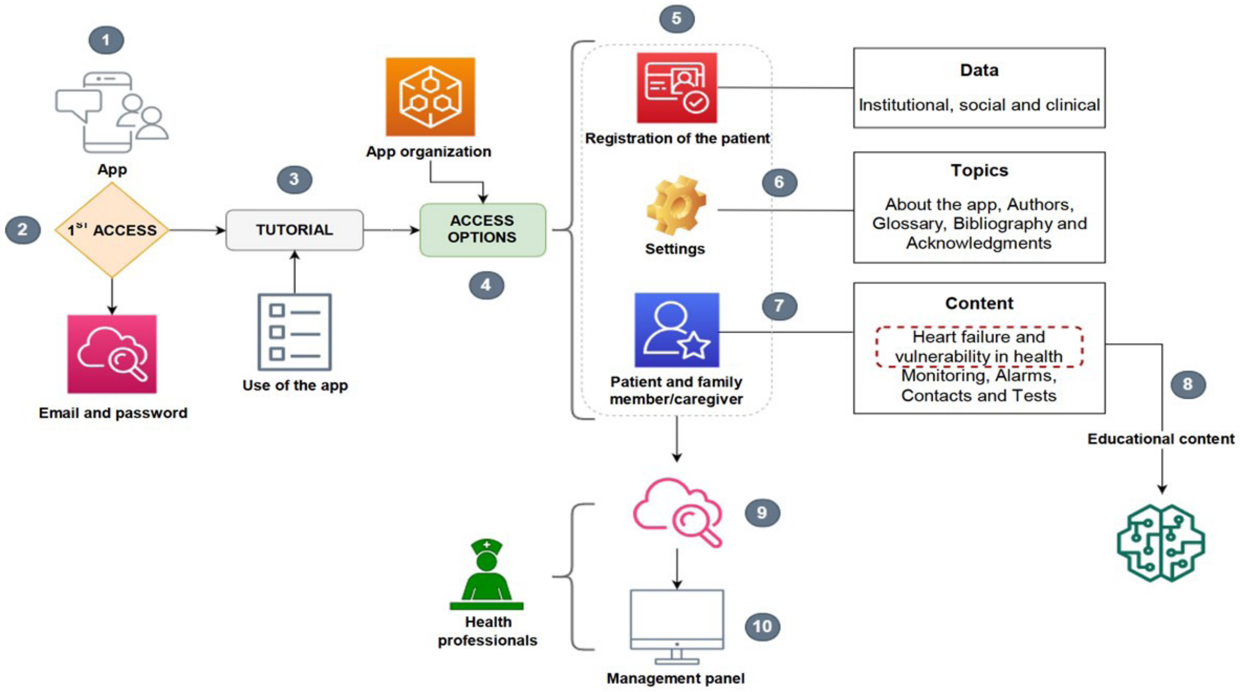

Figure 2 – Prototype user flow**.**

Initially, the professional will guide the users to download the app (Step 1); at the first access, they will enter their email address and password (Step 2) and then they will learn to use the app through a tutorial (Step 3). The app will be organized in three parts: registration of the patient, settings, and content for patients and family members/caregivers (Step 4). In the registration phase, institutional, social and clinical data will be filled out (Step 5) and in the settings there will be general information of the app (Step 6). In the space devoted to the patient and family members/caregivers there will be a screen with options (Step 7): Educational content, addressing the interface between HF and vulnerability in health (Step 8), Monitoring, Alarms, Contacts and Tests. All information filled in the app by the users will be saved in the cloud (Step 9) and can be accessed by the multiprofessional team that monitors them through the management panel (Step 10).

Once the flow has been determined, the visual data collected were evaluated and, together with the designer and developer, the prototype structural sketches were created. It is pointed out that, to ease organization of content and elaboration of low-fidelity prototyping, the following division was observed: settings, educational content, monitoring, alarms, contacts and tests (Figure 3).

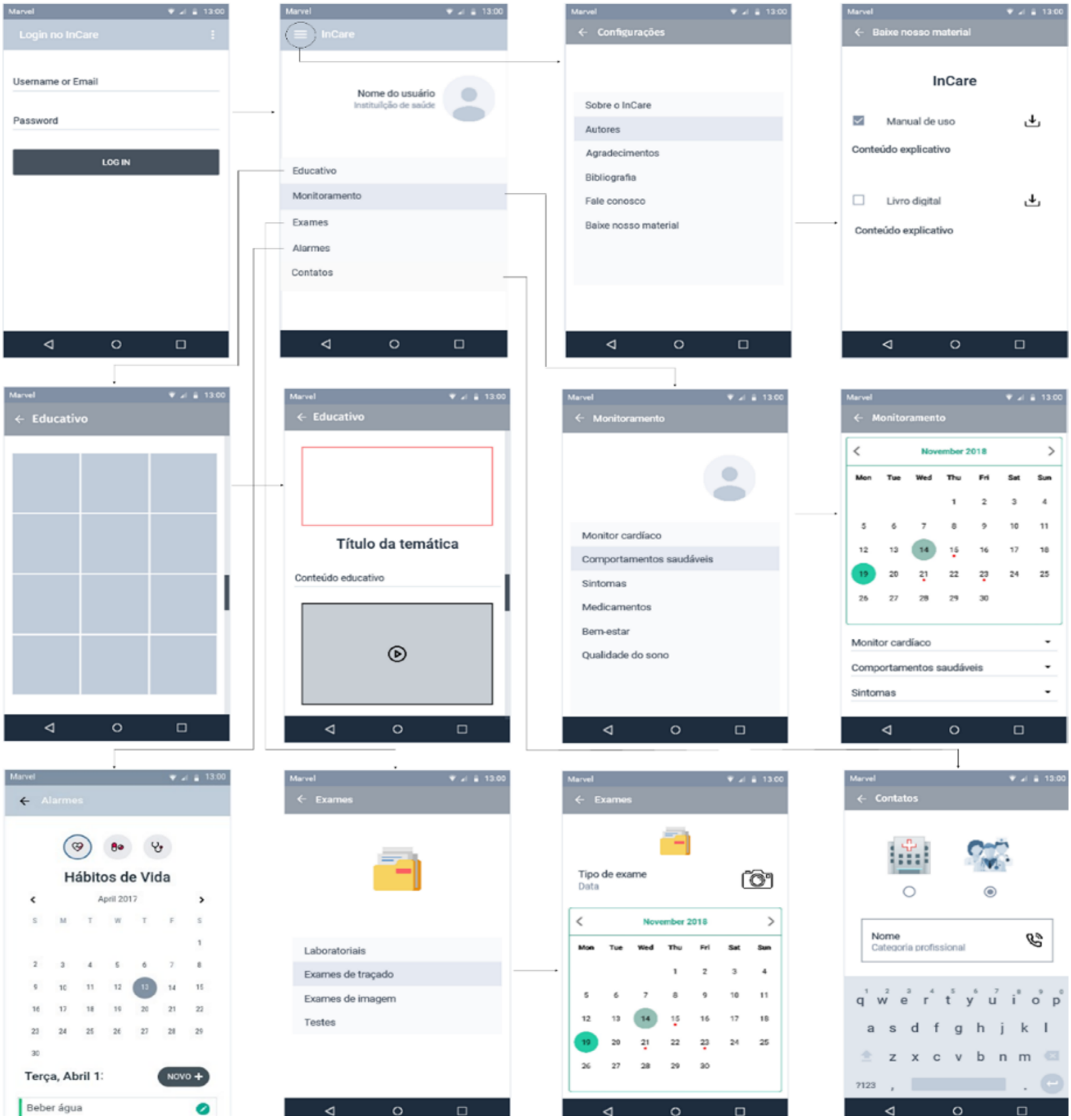

Figure 3 – Wireframes of the *InCare*® app prototype.

Colors (red, green, blue and white) were defined to compose the screens. The prototype was named *InCare*®, where *InC* is the abbreviation for "*Insuficiência Cardíaca*" ("Heart Failure") and *Care* is read with one "C" suppressed in the union. It is a digital care-educational technology for communication, information and follow-up, which brings together multiple functionalities, aligned with the precisions and expectations of users committed to HF (self-)care. The entire app will have language that is easy for users to understand, written with short, simple and familiar words and phrases (without jargon, acronyms or abbreviations), avoiding the use of medical and technical terms that, when unavoidable, will be explained.

Preliminary, the structural sketches infer that the user will have to be linked to a health institution to use the app. It was planned that all the sections be used without any need for an Internet connection.

However, for the professionals to have access to the health data to be filled in daily, the user must connect to the Internet, so that they are saved in the cloud and viewed in the management panel. The data filled out will generate performance graphs, available for all the users.

Once the functioning and screens of the prototype were defined, the app was developed and made available to the actors, who considered the prototype as an encouraging tool for self-care, as it has relevant content, allows daily self-monitoring and has visually pleasing screens, as can be verified in the following statements: […] *you have to accept that something is wrong and that you can't do that (take care of yourself) alone. You delve so deep in that (complexity of the disease) that you sometimes don't know how to ask for help. That's why I'm extremely satisfied with the app. It'll be a way of knowing more about my disease and share that with my family members and friends. I believe that it'll be an incentive for me take better care of myself, as I know that the professionals will be monitoring me closely* (Patient 1, 24 years old); […] *I loved it. It's nice, it's not heavy on the eyes and I was able to understand all the information. In addition to all that, it also helps me remember the medications and appointments and I can keep the phone number of the professionals who monitor my mother and the tests performed. It's very good* (Family member 3, 56 years old).

Health professionals praised choice of the method for developing the prototype, which resulted in an innovative product with relevant themes for the patient, accessible language and an appealing design. Despite showing concern with the amount of information to be included in the monitoring section, the system was considered intuitive. They also congratulated the inclusion of audio resources and videos in the educational section, as shown in the statements: […] *the app is nice and practical; it's complete, the font and images are excellent, the content is broad, and the resources are cool. I realized that some screens condense more information, but having included the content audios, videos and images softens everything and are much more functional for the patients* (Nurse 2); […] *it really is an innovation; it's the offer of an opportunity for coordinated care, allowing sharing information among all: patients, family members or caregivers and health team professionals. There many data to filled out, but I found it intuitive, then I don't think that it's a problem* (Physician 1); […] *this way that was chosen to create the app was fantastic (...) My concern is that the patient considers the app as a requirement, as another care action to be performed. But I believe that if explained correctly, they'll understand and value the technology that was developed with the help of so many people* (Psychologist 4).

After analyzing the actors' considerations, the prototype was restructured and finalized in terms of the design and programming process, funded by the authors themselves, being ready to be validated by specialists in the area regarding content, face and usability, to be subsequently validated clinically and, therefore, made available free of charge on digital platforms (Android and iOS) for unrestricted use. It is noted that the prototype logo was registered at the National Institute of Industrial Priority (*Instituto Nacional da Prioridade Industrial*, INPI), under processes No. 921458622 and No. 921466404).

DISCUSSION

Heart disease manifests itself in different dimensions and is rooted in the subjects' interpretations of reality. Discovering oneself with HF raises changes and appropriation of knowledge that enable subjects to assume responsibility for their condition. It is in education that subjects are faced with new paths and become responsible for and aware of their actions[18]. From this perspective, thinking about using an educational and follow-up app based on a theoretical and methodological framework is an opportunity to promote comprehensive care by reconciling scientific and empirical foundations, which goes beyond the hospital walls.

Mobilizing theory and improving practice requires consistency in the relationships established between researchers and users, communicating through a shared language and uniting practical approaches for effective implementation[19,] Technological innovations, such as apps, can be implemented more appropriately by means of collaboration and choosing methods that support the creative and development process, which will increase the capacity for collaboration and promote respectful interdisciplinary relationships.

Codesign stood out as a robust method that allowed combining resources in the *InCare®* prototype by enabling involvement of the interested parties and, thus, guaranteeing shared care practices. The phases covered represented an advantage in relation to the other frameworks used in app development, which lies mainly in the participation of the interested parties, for awareness and empowerment. The transforming power of the method placed health professionals, patients and their families/caregivers and researchers at the core of the process of building and sharing their interlocutions with the collective.

Unlike other methods, Codesign allows users to help identify the process or project that needs to be designed (or redesigned), based on their personal experience and coordinate efforts in partnership with developers[20]. In other words, all stakeholders are fully and equally involved in development of the technology.

The team was instrumental in building the prototype. The number of actors in the team is not well established in the literature; however, a recent review study revealed that, among 20 selected articles that used Codesign as tool for the development of health technologies, the number ranged from 6 to 159 actors, with a median of 16, involving health professionals, managers, patients and family members[21].

In this research, diversity, inclusion and interdisciplinary collaboration boosted development of the prototype. The relationships established between the actors were consistent and based on a specific practical reality, which enabled collective learning and reinforced mutual trust. Two researchers were included in the team with the intention of expanding responsibility for care. After all, researchers must focus on human plurality and be open to experiences, as well as take the initiative and critically evaluate the interventions they produce[18]. This action is a form of unlimited action on the world, with a tendency to break limits and cross borders[17].

All the information shared in the design phase was powerful in determining the most important content and resources to be incorporated into the prototype. Creating and sharing digital data can reveal important information about the health of people with HF and, as such, the management panel emerged as a resource for remote patient follow-up, as well as for tracking measurements of vital signs, symptoms, physical activity, weight, habits of life, well-being and medication use. Despite the management panel resulting in an increase in the workload of the professionals from the multidisciplinary team[22–23], the actors included in this study considered the resource valuable for care, as it eases the interaction between professionals and patients.

The educational, monitoring, alarms and contacts sections are relevant to HF management. Self-care management proves to be one of the support pillars in the holistic therapy of individuals with HF. Therefore, information related to the health-disease process, such as symptoms, vital signs, health and well-being behaviors, show a positive impact on knowledge, reduction in hospital readmissions, mortality rate and decrease in disease-related courses, both for patients and for the health system[7–11].

It is noted that, unlike other studies, the actors did not seek to replicate existing products. Contents and resources were designed to encourage reflection, extrapolate technical care and enhance changes, respecting their own identity processes, seeking to raise awareness to guarantee equality and equity for those who are in vulnerable situations[17]. The idea with the prototype is to transform realities: free the patient from careless attitudes regarding self-care, ease the burden on family members and support health professionals. In Arendt's perspective, it is to train and encourage subjects to produce something meaningful for themselves[18].

The user flow diagram showed the prototype sections. The decision to use login and password represents an attempt to interrupt the user information trail. Currently, health data goes beyond the professional's office. Due to the ever-increasing amount of data derived from digital technologies, there is a need for greater transparency in collection and use of this information and broader health privacy safeguards[24]. Therefore, choosing to use safer frameworks, such as linking users to an institution and requiring registration, is a security measure.

After entering the login and password, tutorial images are made available to use the prototype so that the user has a better idea of how it works. In the settings section, a navigation manual is offered for download. These measures were adopted so that the subjects maintain a purposeful relationship with the product created and represent an attempt to teach them how to make the best possible use of the technology and ensure good usability and adherence.

The focus on flow and prototyping visually represented the ideal technology. Contemplating the sketches eased the choice of appealing colors and made them contribute to greater involvement and effectiveness of the care-educational action. The colors help to break monotony; reading, readability and textual interpretation; memorization and differentiation of all the information; and provide feelings of satisfaction[25]. For *InCare®*, the predominant colors are associated with life, warmth and dynamism (red) and birth, purity and peace (white); while the secondary ones represent truth, faith and trust (blue) and well-being, health and balance (green).

Based on the actors' statements in the Co-implementation phase, the *InCare®* prototype proved to be a competent tool to support users. As stated by the actors, the prototype represented safety, where the patients felt more cared for monitoring their daily data and sharing them with professionals. In many parts of the world, where there is intense inequality in social and access to health terms, and in the face of the COVID-19 pandemic, remote patient management stands out as a significant alternative for care[23]. In fact, the moment experienced is opportune to expand app development on platforms that promote greater involvement among users.

The prototype's dialogue with the user should collaborate to changing behaviors in favor of health and making a difference in people's lives, as they serves as allies with a series of contents and services, stimulating the promotion of healthier habits. Indeed, well-directed and clear language favors the user's understanding and formulation or re-signification of meanings, which enables the adoption of behaviors that improve their health conditions[26].

HF demands are diverse and particular to each subject. Every day, people with HF and their family members/caregivers and health professionals are faced with the need to (re)construct and incorporate knowledge, behaviors and attitudes to reduce situations of vulnerability and, thus, improve (self-)care and quality of life. In this sense, it is imperative that the app promotes the subjects' awareness, making them part of their own existence process.

The study limitations were non-inclusion of managers, in order to obtain other perspectives on the prototype and, in the Co-implementation stage, conducting interviews via telephone calls. The interviews of this stage were not in-person so as not to endanger the health of people with HF, due to the pandemic period, which may have influenced depth of the statements.

CONCLUSION

Codesign enabled the involvement of subjects with HF, their family members/caregivers, the health team, researchers and a developer in the creation of a care-educational app prototype, which resulted in its conception, with design of resources, contents, screen sketches, user flow, prototyping and app name. After development, it was also possible to make the prototype available to the actors, who considered it innovative, relevant for allowing self-monitoring, including information with accessible language and a pleasant design, in order to help promote the health of people with HF in a situation of vulnerability in health.

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NOTES

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Discussion of the results: Cestari VRF, Florêncio RS, Negreiros FDS and Garces TS.
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APPROVAL OF ETHICS COMMITTEE IN RESEARCH

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CONFLICT OF INTEREST

There is no conflict of interest.

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