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Muri, Lucimar Andrade Cardoso; Primo, Cândida Caniçali; Pontes, Mônica Barros de; Silva, Danielle Aparecida da; Fioresi, Mirian; Lima, Eliane de Fátima Almeida

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Development and evaluation of an app to manage human milk home collection

Aplicativo móvel para gerenciamento do processo de captação domiciliar de leite humano

Aplicación móvil para la gestión del proceso de captación domiciliaria de leche humana

Lucimar Andrade Cardoso Muri[1] https://orcid.org/0000-0002-4862-0677
Cândida Caniçali Primo[1] https://orcid.org/0000-0001-5141-2898
Mônica Barros de Pontes[1] https://orcid.org/0000-0003-3629-236X
Danielle Aparecida da Silva[2] https://orcid.org/0000-0002-0061-4630
Mirian Fioresi[1] https://orcid.org/0000-0002-8560-4385
Eliane de Fátima Almeida Lima[1] https://orcid.org/0000-0001-5128-3715

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Corresponding author
Cândida Caniçali Primo
E-mail: candida.primo@ufes.br

Associate Editor (Peer review process):
Rosely Erlach Goldman
(https://orcid.org/0000-0003-4011-1875)
Escola Paulista de Enfermagem, Universidade Federal de São Paulo, São Paulo, SP, Brazil

Abstract

Objective: To develop and evaluate an app designed to manage human milk home collection.

Methods: This applied study was carried out in three steps: 1) definition of requirements and formulation of conceptual map; 2) proposition of alternatives of implementation and prototyping; and 3) execution of tests. The app, named CuidarTech Doe Leite, was evaluated by eight professionals who worked at a Human Milk Bank regarding objectives, structure, and relevance and by three milk donors regarding functionality, usability, and effectiveness.

Results: The app had five modules: Profile, My donations, Home collection, Information to donate human milk, and Contact the Human Milk Bank. The evaluation carried out by experts and donors considered the content adequate and easy to use.

Conclusion: The app CuidarTech Doe Leite contributes, in an innovative way, to the management of human milk collection by helping handling communication and interaction between the human milk bank team and donors.

Resumo

Objetivo: Desenvolver e avaliar aplicativo móvel para gerenciamento do processo de captação domiciliar de leite humano.

Métodos: Estudo de natureza aplicada realizado em três etapas: 1) definição de requisitos e elaboração do mapa conceitual; 2) geração das alternativas de implementação e prototipagem; 3) testes. O aplicativo foi avaliado por oito profissionais de Banco de Leite Humano quanto aos objetivos, estrutura e relevância, e três doadoras quanto à funcionalidade, usabilidade e eficiência.

Resultados: O aplicativo possui cinco módulos: Perfil, Minhas doações, Coleta domiciliar, Informações para doação de leite humano e Fale com o Banco de Leite Humano. A avaliação dos especialistas e doadoras considerou o conteúdo adequado e de fácil usabilidade.

Conclusão: O aplicativo *CuidarTech Doe Leite* colabora, de forma inovadora, com a gestão da captação do leite humano, por meio do gerenciamento da comunicação e interação entre a equipe do banco de leite e as doadoras.

Resumen

Objetivo: Desarrollar y evaluar una aplicación móvil para la gestión del proceso de captación domiciliaria de leche humana.

[1]Universidade Federal do Espírito Santo, Vitória, ES, Brazil.
[2]Fundação Oswaldo Cruz, Instituto Fernandes Figueira, Rio de Janeiro, RJ, Brazil.
Conflicts of interest: nothing to declare.

Métodos: Estudio de naturaleza aplicada realizado en tres etapas: 1) definición de requisitos y elaboración del mapa conceptual; 2) generación de alternativas de implementación y prototipo, 3) pruebas. La aplicación fue evaluada por ocho profesionales de un banco de leche humana con relación a los objetivos, estructura y relevancia, y por tres donantes en cuanto a la funcionalidad, usabilidad y eficiencia.

Resultados: La aplicación posee cinco módulos: Perfil, Mis donaciones, Recolección domiciliaria, Información para donación de leche humana y Contacto con el banco de leche humana. La evaluación de los especialistas y donantes consideró el contenido adecuado y de fácil usabilidad.

Conclusión: La aplicación *CuidarTech Done Leche* colabora, de forma innovadora, con la gestión de la captación de la leche humana, mediante el manejo de la comunicación e interacción entre el equipo del banco de leche y las donantes.

Introduction

Brazil houses the biggest and most complex Human Milk Bank Network (HMBn) in the world, with approximately 222 units distributed over all states, and has over 220 human milk collection stations. Therefore, it has become a model for international cooperation that includes more than 20 countries in the Americas, Europe, and Asia established by means of the Brazilian Cooperation Agency.[1,2]

The Human Milk Bank (HMB) is a specialized service, necessarily linked to a maternal and/or children's hospital, responsible for actions to promote, protect, and support breastfeeding. To reach these goals, the HMB carries out the activities of collecting the excess milk production of nursing women, selection, classification, processing, quality control, and distribution of pasteurized human milk.[3] Scientific evidence regarding biological and economic benefits of human milk are indisputable, especially for premature or underweight children. By means of HMBs, the superior quality and effectiveness of human milk confer benefits to children in the short and long run in all phases of their lives.[4,5]

Consequently, it is necessary to develop care and educational actions oriented toward promoting breastfeeding and human milk donation, mobilizing society, and guaranteeing support and comprehensive care to women's demands, especially in HMBs. Listening, embracement, and humanized care are essential skills in the process of raising awareness of the importance of breastfeeding and milk donation. Therefore, prenatal appointments, childbirth, and the postpartum period are privileged spaces to increase the breastfeeding rate and the number of donors in HMBs.[5-7]

Donating human milk involves social values, knowledge, and organization for both mothers who donate and health professionals. Altruism stands out among the reasons that make women donate human milk, resulting in a voluntary and conscious process that depends exclusively on human solidarity and cannot involve trading.[3-5] It ensures that donating human milk requires dissemination of information and establishment of a bond between health professionals and the mothers they provide care to, in addition to maternal will and availability.[8,9] Regarding communication, women have cited the following problems: lack of adequate information on how to donate milk and difficulties to take human milk to the closest HMB.[7,9]

Nursing teams make phone calls to each donor to confirm collection date and shift in order to organize human milk home collection. However, sometimes, several contact attempts are necessary and, despite these efforts, home visits without previous confirmation occur. Additionally, not finding the donor at home is common, which hinders guaranteeing milk collection. These issues originate attrition in the teams, milk waste, destocking of HMBs, and dissatisfaction of donors.

By understanding the importance of donating human milk for the health of hospitalized newborns and being aware of the difficulties to communicate with and secure the loyalty of nursing mothers so they become donors, the authors of the present study considered the possibility of using apps as facilitators of access to information and knowledge, without time and space restraints.[9,10] In addition, it is known that these tools allow to execute several activities in the health area to improve delivered care and are an effective means to make information or services available and reach the desired target audience.[11,12] After searching the literature and app stores, two apps related to the mentioned goals were found: "Amamenta Brasília" and "Amamente e Doe". These apps addressed subjects close to the present study but had different ob-

jectives, which reinforced the importance and innovative nature of the tool described in the following sections. The objectives of the present study were to develop and evaluate an app to manage human milk home collection.

Methods

This was an applied study that put into practice the user-centered design method and was developed in three steps: 1) definition of requirements and formulation of the content; 2) structuring and proposition of alternatives of implementation and prototyping; and 3) execution of tests. Active participation of users is a fundamental principle of user-centered design, a process that seeks to solve practical problems by designing products that are easy to handle and meet the needs and demands of users.[13]

The study was carried out at the HMB at the Cassiano Antônio Moraes Teaching Hospital, a reference hospital in the state of Espírito Santo, Brazil.

To survey the requirements, a search was carried out from October to November 2018 with the active donors of the mentioned HMB to identify whether they had access to cell phones and the internet compatible with the technology to be proposed and what contents should be included in the app. All 53 active donors received an envelope during human milk home collection containing an invitation letter, a free and informed consent form, and a form with the following questions: Do you have a cell phone with access to the internet? If the HMB had an app about human milk donation, would you use it? What contents would you like to see in this app? The two first questions had "yes" and "no" as answer options. After a period between 7 and 15 days, the envelopes were retrieved during another home collection section.

The answers were analyzed by calculating relative frequencies, and contents were grouped according to subject similarity. After examination of the answers written in the forms, the theoretical content of the app was designed from February to July 2019.

In the second step of the study, between May and September 2019, implementation and prototyping alternatives for the app features were proposed, and structured as interactive design cycles. Whenever possible, free and open technologies were considered.

The third step, executed from September to December 2019, focused on the app being tested by three groups: development team, HMB professionals, and donors. After each evaluation, the features and contents were changed or fixed, and the next test was carried out. The development team, made up of five members, evaluated the app regarding usability by applying the instrument proposed by Krone.[14]

There is no consensus in the literature regarding either the number of members that should make up the referee board or the method to run tests, but some variables must be considered by researchers, such as characteristics of users, of the tasks, the product, and its features.[15,16]

The HMB professionals evaluated the app regarding content taking into account objectives, structure, and relevance. The inclusion criterion was: being a health professional with at least one year of experience at the Espírito Santo HMB. Two strategies were applied to select participants: indication of professionals who belonged to the relational universe of the researchers and the snowball sampling technique.

Fifteen referees were selected and received the following materials: an invitation letter to introduce the study and its objectives; the free and informed consent form; a characterization form to gather information about the variables gender, age, area in which their degree was obtained, time since graduation, time of experience at the HMB, and the last obtained academic title; and a questionnaire adapted from the material proposed by Leite,[17] with 21 questions (six to evaluate the app goals, ten to evaluate its structure, and five to evaluate its relevance). A score was assigned to each question, whose answers were structured as a Likert-like scale with the options "adequate" (1), "needs adjustments" (2), and "inadequate" (3).

After the professionals assessed the material and adjustments were made, three donors carried out

their evaluations regarding functionality, usability, and effectiveness. They received an invitation letter and, after they accepted participating in the study, a home visit was scheduled. During the visit, clarifications were provided about the procedures, the participants were asked to sign free and informed consent forms, and a test version of the CuidarTech Doe Leite app was installed on the cell phone of the donors. The orientations given for the donors to test the app were: 1) in the function "Home collection", schedule a collection visit; 2) in the function "Information on human milk donation", access the tab "Step by step"; and 3) in the function "Log in as a visitor", register as a donor. After the donors used the app, an adapted version of an ABNT/ISO/IEC 9126:1[16] instrument was applied to evaluate characteristics related to functionality, usability, and effectiveness only. It had eight questions, and its answers were structured as a Likert scale with the options "adequate" (1), "needs adjustments" (2), and "inadequate" (3). The content validity index (CVI) was used to assess the level of agreement of professionals and donors, and an agreement equal to or higher than 80% was considered acceptable. The CVI of each item was calculated by using the formula CVI = ∑ answers "1" + "2" / ∑ answers "1" + "2" + "3".[15]

The study was approved by the research ethics committee as per Certificate of Presentation for Ethical Evaluation no. 57930016.0.0000.5060 and report no. 1,794,528. All the requirements to protect the participants involved in human research were met.

Results

Step 1: Definition of requirements and design of the app content

The survey with donors was answered by 28 women (52.83%) and showed that 96% had cell phones connected to the internet and compatible with the use of the technology proposed in the present study. Additionally, 100% of the women were willing to use the HMB app and suggested contents with illustrations and videos about human milk donation.

In a posterior step, the contents addressing guidance on collection, extraction, storage, and transportation were prepared based on Collegiate Board Resolution no. 171, of September 4, 2006, Human Milk Bank Manual: functioning, risk prevention, and risk control, which is part of the Technology in Health Services Series, Technical Norm 09.18: Donors: screening, selection, and follow-up. The app illustrations and videos were created by a design team.

Step 2: Structuring and proposal of alternatives of the app implementation and prototyping

The app, entitled CuidarTech Doe Leite, is a technology developed to manage human milk home collection and communication between professionals who work at the HMB and donors. It contained five modules, with screens that allowed free browsing. The app home screen showed its identification, its name (CuidarTech Doe Leite), and access features: access, login, and password, in case the nursing woman is already registered at the HMB. Women who are not registered can get to know the app by choosing the options "Tips about Donation" or "Register". Once one of these options is selected, the navigation menu screen will be shown (Figure 1).

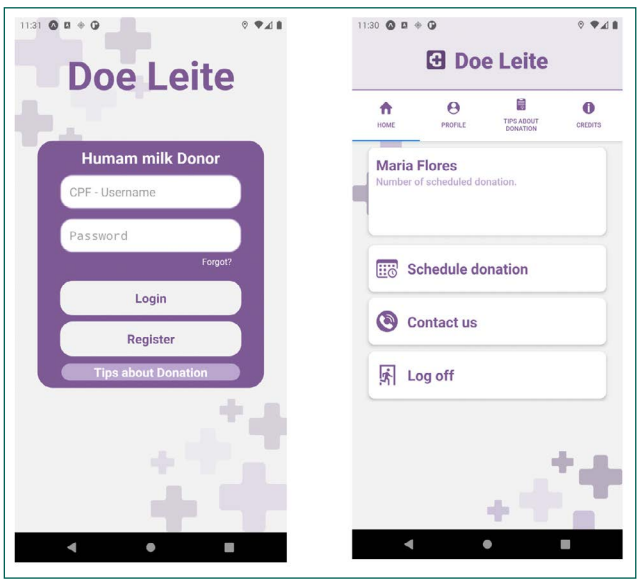

Figure 1. Home screen of the CuidarTech Doe Leite app.

The page options Profile and Schedule donation require password to be accessed, which is pro-

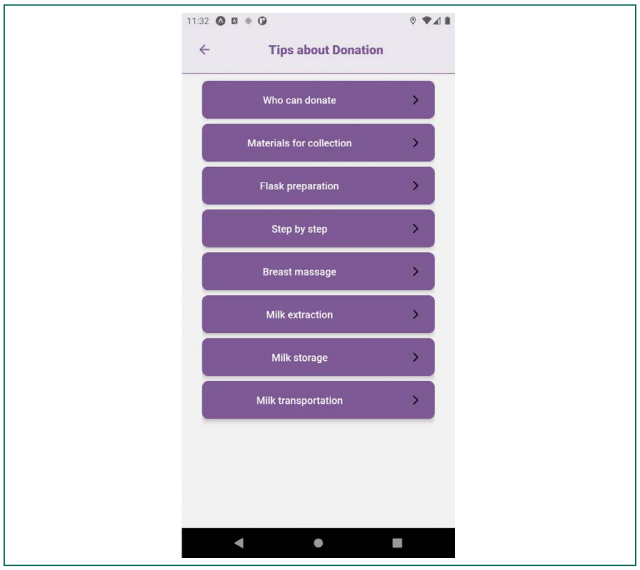

Figure 2. Screen of Donation Tips found in the CuidarTech Doe Leite app.

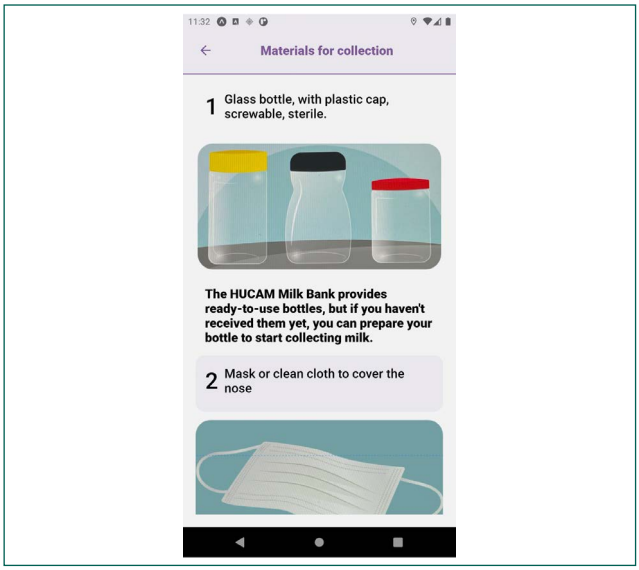

Figure 3. Screen of Donation Tips – Materials for collection

vided together with a login after the user becomes a donor. The item Profile allows access to register data, shows the donation history and messages sent by the HMB.

The option Schedule donation is the means to request a home visit to collect the extracted milk or cancel a visit or donor register, after informing the reason for cancellation. The item Tips is available to registered users and visitors. This section encompasses the subgroups Who can donate, Materials for collection, Flask preparation, Step by step, Milk extraction, and Milk transportation. These screens are shown in Figure 2.

All options indicated in Figure 2 contain illustrated information describing the execution of the processes step by step, and there are also three educational videos to guide on how to massage the breasts and extract human milk (Figure 3).

The app has an item called Contact the Human Milk Bank (Figure 1), which is an additional channel for communication between users and the bank. Messages are sent by Short Message Service, e-mail, or phone, if preferred.

Step 3: App tests

The app was tested by three groups: development team, HMB professionals, and donors. The designers detected some problems, which were fixed before the next evaluation steps occurred.

Eight health professionals participated in the content evaluation, representing four out of six milk banks in Espírito Santo. Regarding profile, 100% were women and 62.5% were between 50 and 60 years old. Regarding training area, 75% were nurses and 25% were physicians. Time since graduation was over 10 years for 87.5% of the professionals and the period of experience ranged from 1 to 30 years, with 75% of the participants stating that they had over 10 years of experience. Regarding academic titles, 50% had specialization, 25% had a master's degree, and 25% had a PhD degree.

According to the evaluation performed by health professionals, the overall CVI (valid for all the items of the instrument) was 0.96, which indicated that the app was adequate.

In the item Objectives, the subitems 1.5 and 1.6 obtained the lowest scores, which was an opportunity for the designers to think about how the app could be improved. For the former, "The app incites reflection on human milk donation", only one referee suggested to add information on the use of the HMB donated or pasteurized human milk, whereas no suggestions were given to improve subitem 1.6.

In block 2, the CVI ranged from 0.88 to 1.00. Item 2.8, The information on human milk donation is scientifically correct, obtained a CVI of 1.00, but alterations were proposed for the item that addressed the expiry date of donated human milk

Table 1. Evaluation of the proposed app by health professionals regarding objectives, structure/presentation, and relevance of the designed app according to CVI

Evaluated items	n	CVI
1. Objectives		
1.1. The app name (Doe Leite) is appropriate.	8	1.00
1.2. The app covers the proposed subject (human milk donation).	8	0.88
1.3. The app is suitable to the human milk donation teaching-learning process.	8	1.00
1.4. The app clarifies points about human milk donation.	8	1.00
1.5. The app incites reflection on human milk donation.	8	0.75
1.6. The app encourages behavior changes.	8	0.60
2. Structure/presentation		
2.1. The app has a logical sequence.	8	1.00
2.2. The size of the illustrations is adequate.	8	1.00
2.3. The size of the texts is adequate.	8	1.00
2.4. The addressed subject is a present-day one.	8	1.00
2.5. The language is suitable for the target audience.	8	1.00
2.6. Information is presented with clear and objective language.	8	1.00
2.7. The language is interactive and allows women to actively engage in the educational process about human milk donation.	8	0.88
2.8. The information on human milk donation is scientifically correct.	8	1.00
2.9. The provided information is really necessary for human milk donation.	8	1.00
2.10. The illustrations and videos are clear and easy to understand.	8	1.00
3. Relevance		
3.1. The app boosts learning.	8	1.00
3.2. The app is suitable for the target audience.	8	1.00
3.3. The app arouses interest in human milk donation.	8	1.00
3.4. The app figures/illustrations/videos help to understand the text.	8	1.00
3.5. The app screens are appealing and drew your attention.	8	1.00

because there were divergences between the data shown in the app and that reported in the literature.

In block 3, all subitems obtained a CVI equal to 1.00, and the participants suggested adding brief information on the destination of the donated milk as a way to increase the interest in the subject. The items that the experts considered inadequate were revised and adjustments were performed in the app.

After the corrections, the app was evaluated by three donors regarding functionality, usability, and effectiveness, and all items reached a CVI higher than 0.80 (Table 2).

The app is currently going through a correction phase and, once it is in its final version, it will be registered at the Technology Innovation Institute at the Federal University of Espírito Santo.

Discussion

Globalization and the advent of the internet have contributed for apps to get increasingly more important in people's lives. The versatility of this technology was one of the factors that made the World Health Organization[18] recognize, in 2011, the potential of mobile health as a strategy to promote health practices and favor the incorporation of this strategy more and more frequently.

Table 2. Evaluation of the proposed app by donors regarding functionality, usability, and effectiveness according to CVI

Evaluative items	n	CVI
1. Functionality		
1.1. The app is accurate when it comes to fulfilling its functions.	3	1.00
1.2. The app has the necessary features for women to request human milk home collection, obtain information on human milk donation, and register as a donor.	3	1.00
1.3. The app has safe access because of the existence of a password.	3	1.00
2. Usability		
2.1. It is easy to understand the orientations provided by the app.	3	1.00
2.2. It is easy to learn how to use the app.	3	1.00
2.3. It is easy to request a home collection visit by using the app.	3	1.00
3. Effectiveness		
3.1. The app answer time is adequate.	3	1.00
3.2. The resources made available in the app are adequate.	3	1.00

The app CuidarTech Doe Leite, with its interactive and informative screens as well as clear and objective language, will be a tool available to health professionals at the HMB, human milk donors, and nursing women. It is a management and educational technology innovation and the first app produced in Brazil with the aim of helping HMB health teams to manage the service of carrying out human milk collection. In addition, it supports donors in their learning process in the human milk donation sphere.

Nursing has caught up with the progress typical of the current innovation era by developing care, management, and educational tools. Most of what is produced in terms of software in the nursing area aims to support the development of the nursing process, but part of these products have management features.[12,19] Apps are new sources of information, broadly applied in the educational context, and can instill innovation in the teaching-learning process by allowing students to use interactive materials and virtual learning environments.[10,11,20]

Apps emerge as a new educational proposal with the potential of disseminating information in several contexts. However, caution and reflection are necessary before using them, because some are made available in virtual stores without monitoring

of any kind, and some probably are the result of private enterprises rather than research efforts, which hinders evaluating the quality of the information they present.[21]

The fact that the contents exhibited in CuidarTech Doe Leite were assessed by health professionals and donors allowed to make adjustments in the material and ensured that the provided information was based on scientific evidence, which increases the chances of the tool being accepted by its target audience.

The human milk home collection service carried out by HMB teams is a valuable strategy that facilitates the donation process. The main difficulties women have reported regarding becoming donors are: lack of adequate information, lack of time, resuming work activities, lack of guidance on how to donate milk, and lack of interest in carrying out all the necessary procedures to complete the donation and in taking human milk to the closest HMB.[7,9,22]

Orientations regarding human milk donation, especially milk collection and storage, must be provided together with guidance on breastfeeding and can contribute to increasing the number of donations.[22]

By resorting to the HMB service, nursing women receive support to solve the problems they posit and information on the importance of their milk and the benefits it provides, which makes them willing to continue donating for the sake of the health of other newborns.[23] Therefore, one of the roles played by HMBs is supporting women who want to breastfeed their children. Over this process, which allows to extend the breastfeeding period, many women learn to identify an eventual excess milk production and become donors.

A limitation of the present study that can be pointed out was the need to assess the app with a higher number of donors, taking into account that evaluation seeks to verify the users' opinion about the relevance and applicability of the tool. The contribution provided by the design, language, and systems analysis teams was noteworthy, since their technical knowledge was crucial to produce the app, illustrating the importance of interdisciplinarity in the development of these products. In contrast, it is possible to mention the difficulties related to organizing and keeping a technology production team involving different actors and knowledge areas.

Conclusion

The present study developed and evaluated the app CuidarTech Doe Leite, which contributes, in an innovative way, to the management of human milk collection by administering the communication and interaction between HMB teams and donors. It also plays an educational role, because it allows users to have immediate access to reliable information about human milk donation based on scientific evidence. The app offers the possibility of scheduling human milk home collection and has an interface that helps the HMB to manage this process, aiming to improve communication between the service and donors. The tool was evaluated by experts and donors and the results were satisfactory, indicating that the product has quality, which favors its acceptance by users.

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Contributions

Muri LAC, Caniçali Primo C, Pontes MB, Silva DA, Fioresi M, and Lima EFA contributed to the study design, data analysis and interpretation, manuscript writing, relevant critical review of the manuscript intellectual content, and final approval of the version to be published.

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