

Development and evaluation of the GISSA Mother-Baby ChatBot application in promoting child health

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Abstract *This study aimed to develop a prototype of the GISSA Mother-Baby ChatBot Application (GCBMB), a conversational agent to promote child health and evaluate the experience of use and satisfaction with this technological solution. This is a two-stage cross-sectional research with a mixed methodology. The first stage develops the settings of dialogue and the GCBMB prototype. The second stage evaluates the experience of using the ChatBot through a structured questionnaire where statements are used to assess the respondent's level of agreement using the Likert Scale and analyzes the application's use path through its database. The sample consisted of 142 puerperae, with a mean age of 25.4 years, where 38.1% were primiparous. The level of agreement of women with simplicity, good quality of information, clarity of content, usefulness, and satisfaction with the application was above 90%. Women between 26 and 30 years of age had a higher mean number of hits (5.21), settings accessed (9.26), and usage time (272 seconds) comparing younger and older women. The use of ChatBots on smartphones is encouraging to promote the health of children in Brazil. However, more investments are required to improve technological solutions and research with robust methodologies to evaluate their effectiveness.*

Key words *Health Strategies, Maternal and Child Health, Digital Health, Public Health, Mobile Applications*

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Introduction

In 1997, the World Health Organization (WHO) gathered the Member States to discuss the global health community's challenges. At that time, advances in Information and Communication Technology (ICT) were considered, and Health Telematics was defined as a compound term for health-related activities, services, and systems carried out through ICT to promote global health, disease control, health care, health education, management, and research¹.

The cost-effective and safe use of ICT in support of health and health-related areas, including services, surveillance, literature, education, knowledge, and research, was defined as eHealth by the World Health Organization in 2005².

In 2011, Eric Topol stated that digital technologies, social networks, mobile connectivity, and broadband would increase computing power, and the universe of data would converge with wireless sensors, genomics, image, and health information systems to creatively deconstruct the hitherto known medicine. He referred to this as digital health³.

In 2020, the WHO started to define Digital Health as the field of knowledge and practice associated with the development and use of digital technologies to improve health. Digital health expands the concept of eHealth to include digital consumers, with a broader range of smart devices and connected equipment. It also covers other uses of digital technologies for health, such as the internet of things, artificial intelligence, big data, and robotics⁴.

Thus, mHealth emerges as a subdivision of digital health from the widespread use of the internet via mobile devices. The advancement of ICT has led to the increasing emergence of mobile applications to assist and continuously assess healthy habits, self-management of chronic conditions, and other aspects⁵.

Brazil is a signatory to the 2030 Agenda of the United Nations (UN)⁶ in which there is a consensus among member states that internet access is a prerequisite for human development in current society, and ICTs are a tool with crucial social implications in reducing inequalities and expanding dialogue, learning, and participation.

According to the 2019 ICT Household Survey, 99% of Brazilians have cell phones as the most used device to access the internet, only one in four individuals do not use the internet, the Northeast is the region with the lowest percentage of households with internet access (65%),

and 47% searched for health information on the internet, a percentage that has been growing every year of the survey⁷.

The internet can democratize knowledge, freedom through networking, and freedom of expression. Thus, the advances in ICT for health promotion bring ideas for preventive actions to prevent the emergence of specific diseases, curbing their incidence and prevalence through epidemiological knowledge, supporting a process of educating people on health. In this sense, children have been highlighted in many studies and public policies due to their vulnerability and considering that, when meeting their health needs, they will be more likely to reach adulthood with a better quality of life, which has positive repercussions over the whole society⁸.

Thus, the implementation of actions aimed at the well-being of children is a challenge for the health system and is a process under construction since it involves several collective and intersectoral actions based on health promotion with new practices and technologies, establishing a more integrated and humanized care⁸.

The more specific the information, the better the decision that the user can make. Thus, it is essential to develop technological tools that make health care more efficient in general, and in the focus of this paper, on child health.

Speech is the most natural form of communication and exchange of information between human beings⁹. Solutions that use conversational agents (CA) in healthcare are contemporary technologies on the rise¹⁰. CA for health communication could systematically carry out tasks of dialogue while reducing the communication burden of health services and complementing the delivery of health information, specifically related to child health promotion¹¹.

Instituto Atlântico, a private non-profit technology company, in partnership with the Federal Institute of Ceará (IFCE), the Federal University of Ceará (UFC), the Oswaldo Cruz Foundation on Ceará (Fiocruz/Ceará), and startup AVICENA, developed the GISSA Mother-Baby ChatBot Application Prototype in the context of the GISSA technological platform^{12,13}, a CA that uses computational techniques with decision rules to define the flow of interaction of textual dialogues with mothers of children aged 0-2 years about care in feeding, immunization, growth promotion, and development.

Thus, this study aimed to develop a prototype of the GISSA Mother-Baby ChatBot Application (GCBMB) to promote child health and evaluate

the experience of use and satisfaction with this application by mothers of newborn children.

Methods

This is a cross-sectional research using a two-stage mixed method¹⁴: the first developed the GCBMB application, including dialog settings and the computational code. The second evaluated the experience of using the GISSA Mother-Baby ChatBot Conversational Agent prototype (Figure 1).

First stage

This stage was structured from January to September 2019 and was performed by an interdisciplinary team involving health (doctors, nurses, psychologists, and social workers) and technology professionals (computer engineering and Natural-Language Programming - PLN specialists).

Developing settings

An interdisciplinary team of health professionals and information technology professionals built settings of possible dialogues about care

in feeding, immunization, promoting growth and development of the baby aged 0-2 years, totaling 15 settings. The information for creating the settings was extracted from the Primary Health Care Notebooks of the Ministry of Health regarding the Health Care of the Newborn^{15,16}, Child Health: breastfeeding and complementary feeding¹⁷, Low-Risk Prenatal Care¹⁸, the Immunization Standards, and Procedures Manual, including the Updated Vaccine Calendar¹⁹.

Figure 2 in the Results section presents Setting 1, which guides breastfeeding for babies up to six months, later added to a database and used by the GISSA Mother-Baby ChatBot for a conversation with users.

Developing the GISSA Mother-Baby ChatBot-application

It is important to note that, besides the module aimed at mothers or caregivers of children under two years of age evaluated in this study, the GISSA ChatBot has two other modules: one aimed at pregnant women, with guidance on pregnancy complications, and a third module for evaluating the satisfaction of health service users.

The GISSA Chatbot frontend was developed using the React Native framework, a JavaScript tool that develops native mobile applications for

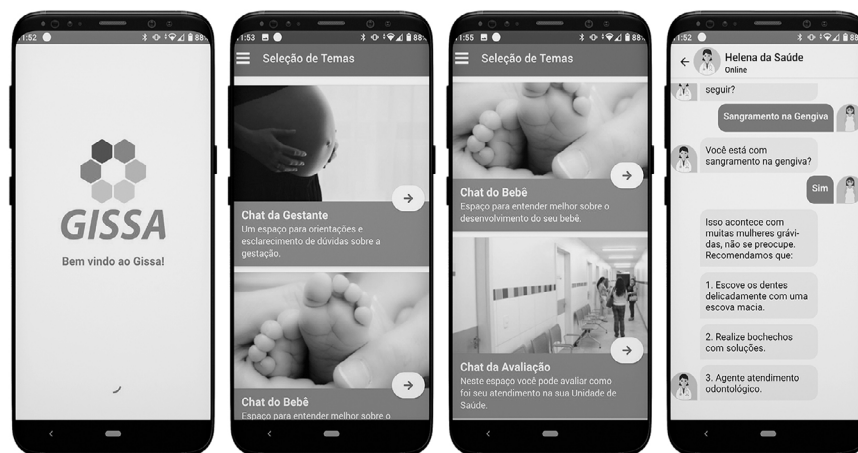


Figure 1. Demonstration Gissa Mother-Baby ChatBot - initial screens.

Captions: 1) Welcome to GISSA; 2) Pregnant Woman's Chat: A space of guidance and clarifications on pregnancy; Baby's chat: A space to better understand the development of your baby; Evaluation chat: In this space, you can evaluate your attendance at your Health Unit; 4) Helena da Saúde: Hello! I'm Helena da Saúde. Would you like to talk about your baby today? Yes. Great! What's your baby's age? 12 months. For the 12 months, we have 3 vaccines and an important development point of your baby! Can you have a look at your vaccination card? (Yes) (No). Type here...Send.

Source: Elaborated by the authors.

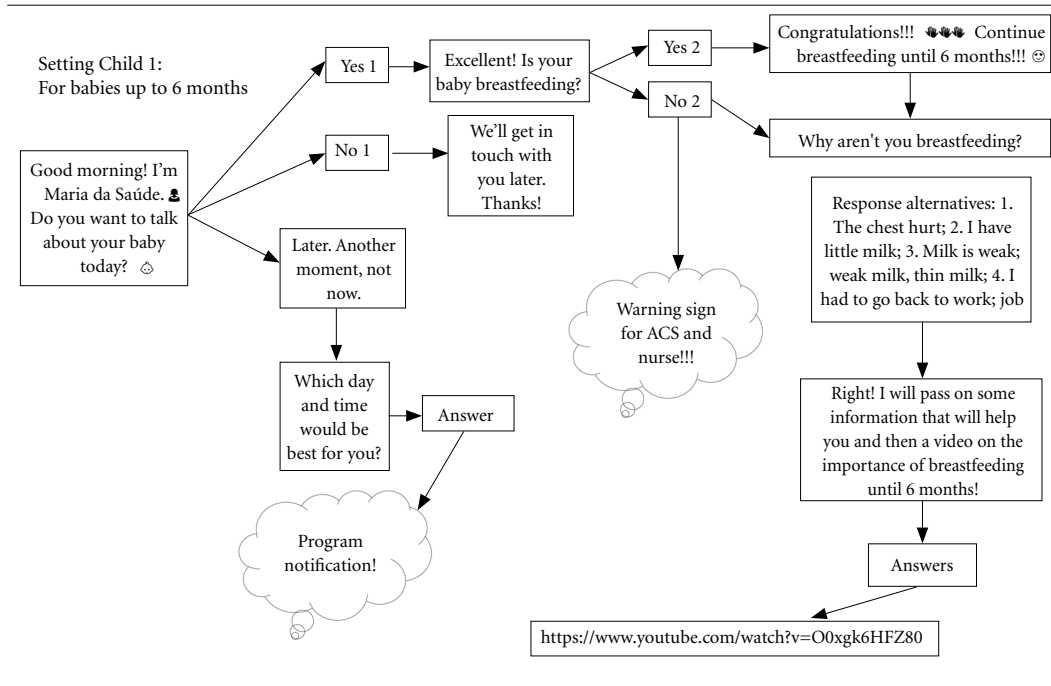


Figure 2. Demonstration of a scenario built for guidance on breastfeeding children up to six months.

Source: Elaborated by the authors.

ANSWER 1: If the nipple hurt, it can be a huge challenge in breastfeeding. The pain can discourage you. But if your desire is to return to breastfeeding due to its great relevance for your baby, don't give up. Ask your health worker and nurse in your area for help. Thanks for listening!

ANSWER 2: I will give you some tips to increase the production of your milk: Make sure your baby's grip is correct (if necessary, ask a professional for help); Let the baby breastfeed freely; Always have longer skin-to-skin contact with the baby; Wait for the baby to release the breast naturally; Drink plenty of water, as hydration is important for milk production! I hope I contributed! Thanks for listening!

ANSWER 3: There is no such thing as weak breast milk! The quality of your milk is ideal for the baby, its production is sufficient and suitable for your child up to 6 months, ok? Your milk is faster to digest, so your baby wants your breast more often! Also, your milk contains protective substances that are essential for your baby! I hope this helps! Thanks for listening!

ANSWER 4: Did you know that your milk can be stored both in the refrigerator and in the freezer of your home in a glass container? The shelf life of raw milk is 12 hours if stored in the refrigerator and 15 days if stored in the freezer. If you have any questions, contact your local health worker or nurse! I hope it helped you! Thanks for listening!

Possibilities for synonyms of the words Yes and No

| | |
|-------|---|
| YES 1 | Sure thing; All right; I Can; Certainly; Of course; I want; Hum hum. |
| NO 1 | I don't want to; I can't; I really don't want to; No; I really can't. |
| YES 2 | Since the baby was born; The baby never stopped; Of course; Certainly; Hum hum. |
| NO 2 | The baby never breastfed; No. |

OBS OF THE VIDEO:

| Video link | Video start (min) | Video end (min) |
|---|-------------------|-----------------|
| https://www.youtube.com/watch?v=O0xgk6HFZ80 | 0:09 s | 02:45 s |

iOS and Android²⁰. The bot interface consists of some features such as login to access the system through the Facebook profile, facilitating access to users, and the firebase tool was used; the interaction between user profiles with the system

through screens and customized buttons with a friendly interface, and the virtual character “*Helena da Saúde*”, according to usability standards; implementation of service consumption of an API (Application Programming Interface) made

available by the backend to communicate with the server.

The backend was developed using the Python programming language with Flask²¹ technology. A flow scheme model was implemented and enabled the inclusion of the settings developed by the health team. This scheme generated a table with questions and answers. Each response can lead to a new flow of conversation until the dialogue ends. The NLTK library was adopted, with basic natural language processing, which allows interpreting basic texts typed by the user, such as “y” for “yes” and “n” for “no”. An HTTP API was also implemented to allow communication with the frontend, allowing the consumption of these services by the Chatbot²² user.

Second stage

This stage evaluated the experience of using the GISSA Mother-Baby ChatBot application. The population consisted of mothers of newborns with at least 24 hours of life allocated in the rooming format¹⁵ of the Nossa Senhora da Conceição Hospital (HNSC) in Fortaleza-CE. Mothers of newborns who had not completed 24 hours of life and those under 18 years of age were excluded. The collection took place on alternate days, from October 22 to November 29, 2019.

A total of 210 women were approached, of which 7.6% (n=16) were excluded because they were under 18 years of age, and 24.7% (n=52) refused to participate in the research. The final sample consisted of 142 mothers of newborns, representing the population of 240 who gave birth during the study period at HNSC, with a 90% confidence level and a 5.3% error margin.

Evaluative study on experience of use and satisfaction with the prototype

The GISSA Mother-Baby ChatBot prototype application, installed on a research cell phone, was presented to the mothers, who freely handled the prototype according to their interest in the subjects made available by the baby’s age, such as breastfeeding, feeding introduction, immunization, and growth and development milestones.

The structured evaluation questionnaire was completed by the researcher after handling the GISSA Mother-Baby ChatBot, with questions about the identification of the mother, schooling, gestational history, and information about the baby’s birth. The question “Regarding your experience with the Mother-Baby Application, how much do you agree with the statements below?”

was asked to evaluate the prototype, followed by the following statements: The GCBMB is simple to use; The GCBMB has the information I need; I understood the GCBMB commands well; The GCBMB uses simple words; The GCBMB helped me to take better care of my baby; I enjoyed using the GCBMB; I liked GCBMB’s look; I plan to use the GCBMB in my daily life.

The responses were psychometric, based on the Likert Scale comprising the following response alternatives: strongly agree, partially agree, neither agree nor disagree, partially disagree, strongly disagree.

Analysis of the prototype handling path

By mining the GISSA Mother-Baby ChatBot database data, this underlying stage analyzed the application use handling path by participants, such as the number of hits, which settings and subjects were most accessed, and mean usage time in each setting.

After completing the statistical analysis of the data collected in the quantitative questionnaire, in which the level of agreement of the participants with the ChatBot assessment questions above 95% was observed, the authors decided to conduct some open-ended interviews to understand this high agreement level better and rule out possible biases, such as the participant’s desire to please the interviewer or end the interview quickly.

The open-ended interviews were held at HNSC’s rooming sector with an initial methodological flow, applying the structured questionnaire for use evaluation. Then, the participant was informed of the need for audio-recording to continue the collection, reinforcing at this point whether women wished to continue with their participation, after which open-ended questions about the use of Chatbot were applied.

Direct observation of the application by researchers

This underlying stage was set to assess the researchers’ perception, make a critical reflection on the application and its use, whether the participant did not report any difficulties, and evaluate the overall handling of smartphones, considering the social and educational diversity of the population assisted at the HNSC.

Data analysis

The quantitative study data were organized and analyzed in the Stata Package Statistics ver-

sion 13 for Desktop. Descriptive and bivariate analyses were applied using the Student's T-test.

The open-ended interviews were transcribed and analyzed by the researchers to understand the reasons for the good evaluation of the GISSA Mother-Baby Chatbot by the women participating in the study.

Ethical aspects

The research was submitted, through Plataforma Brasil, to the Research Ethics Committee of the School of Public Health of Ceará (ESP/CE) and was approved. All respondents were informed about the purpose and importance of the research and signed the Informed Consent Form (ICF).

Results

Characterization of the GCBMB

GCBMB is a mobile application prototype that uses Python and JavaScript programming languages and React Native, Flask, and Firebase technologies. It consists of three modules found on the application's home screen, namely Pregnant Chat, Baby Chat, and Health Service Assessment Chat, and Baby Chat was the target of this study.

After selecting the Baby Chat, users have access to a screen where the virtual character "Helena da Saúde" greets them and asks whether they want to talk about their baby's health. If users' answer is "Yes", an age list in months is provided from a list of 1 to 24 months of life. When selecting the desired age, users have access to a set of questions and, according to their answers, proper guidelines for the specific situation addressed, such as care and guidance on breastfeeding problems, introduction to supplementary feeding, checking the vaccination calendar, developmental marks for the selected age and risk signs. The initial screens of the application are shown in Figure 1. In Figure 2, the design of one of the settings of textual dialogues of the GCBMB is presented, in this case, for guidance on breastfeeding children up to 6 months.

Evaluative study on experience of use and satisfaction with the prototype

The participants' mean was 25.4 years, with a minimum of 18 and a maximum of 40 years.

Ninety-seven (68.3%) of the 142 participants had incomplete secondary education or some level of higher education. Only seven (4.9%) did not have their cell phone, and 12 (8.5%) did not have access to the internet via cell phone. Table 1 shows more data on the sociodemographic profile of the puerperae.

As for obstetric history, 33.8% (n=48) of women were primigravidas (first pregnancy) and 38.1% (n=54) primiparous (first delivery). Also, 26.1% (n=37) of the participants had a history of abortion, and 4.2% (n=6) of them had two or more abortions. Concerning current pregnancy, 64.8% (n=81) of the women had seven or more prenatal care visits, and 57.9% (n=81) had a cesarean delivery.

The most prevalent complications during pregnancy were urinary infection with 46.5% (n=66), followed by anemia with 13.4% (n=19). Only 15.5% (n=22) of the complications reported by the puerperae were pre-existing to pregnancy. Other diseases mentioned were hypertension (7.7%/n=11), diabetes mellitus (6.3%/n=9), vaginal bleeding (6.5%/n=9) and the threat of premature delivery (3.5 % / n=5).

Most newborns were born with adequate weight (83.9%/n=109) and encouraged to breastfeed (75.4%/n=107), and 36.6% (n=52) of them had some complications after birth.

Table 1. Maternal sociodemographic profile. Fortaleza. 2019 (n=142).

| Characteristics | N | % |
|--------------------------------------|-----|------|
| Age group (years) | | |
| 18-29 | 101 | 71.1 |
| 30-40 | 41 | 28.9 |
| Schooling | | |
| Up to Elementary School | 45 | 31.7 |
| Incomplete Secondary School and over | 97 | 68.3 |
| Owens a cellphone | | |
| No | 7 | 4.9 |
| Yes | 135 | 95.1 |
| Has internet on the cellphone | | |
| No | 12 | 8.5 |
| Yes | 130 | 91.5 |

Source: Elaborated by the authors.

Table 2 shows the results of the evaluation questions of the experience of use and satisfaction with the GCBMB. The level of agreement of women with simplicity, good quality information, content clarity, usefulness, and overall satisfaction with the application, was above 90%.

The evaluation responses of the application were crossed with the age range, education, and parity of the participants, with no statistically significant differences concerning satisfaction and ease of use (Table 3).

Table 2. Evaluation of use of the GISSA Mother-Baby ChatBot. Fortaleza, 2019 (n=142).

| Characteristics | N | % |
|--|-----|------|
| The GCBMB is simple to use | | |
| Totally agree | 134 | 94.4 |
| Other answers | 8 | 5.6 |
| The GCBMB has all the information I need | | |
| Totally agree | 129 | 90.8 |
| Other answers | 13 | 9.2 |
| The GCBMB commands are fast | | |
| Totally agree | 139 | 98.6 |
| Other answers | 2 | 1.4 |
| I understood the GCBMB commands well | | |
| Totally agree | 128 | 90.8 |
| Other answers | 13 | 9.2 |
| The GCBMB uses simple words | | |
| Totally agree | 134 | 95.0 |
| Other answers | 7 | 5.0 |
| The GCBMB has helped me care for the baby better | | |
| Totally agree | 132 | 93.6 |
| Other answers | 9 | 6.4 |
| I liked using the GCBMB | | |
| Totally agree | 137 | 96.4 |
| Other answers | 5 | 3.6 |
| I liked the way the GCBMB looked like | | |
| Totally agree | 136 | 97.1 |
| Other answers | 4 | 2.9 |
| I intend to use the GCBMB in my daily life | | |
| Totally agree | 131 | 92.9 |
| Other answers | 10 | 7.1 |
| Some error occurred while using the GCBMB | | |
| No | 125 | 91.9 |
| Yes | 11 | 8.1 |

Source: Elaborated by the authors.

Some suggestions from the puerperae were recorded in the evaluative study: they include more guidance on newborn care, such as cleaning the umbilical stump and bathing; breastfeeding details, such as expressing breast milk, and explanations about the types of nipple. Another suggestion was that the application should allow the user to “scroll” the screen alone or decrease the size of the texts, which is an important feature when ChatBot displays many answers, such as tips on supplementary feeding.

Analysis of the handling of the GISSA Mother-Baby ChatBot

When starting the conversation with the ChatBot, the user is initially directed to an introductory setting. At each access, the user can start and end in the introductory setting and be directed to other settings according to the dialogs' responses. The user can also interrupt a setting conversation with ChatBot at any time. Of the 466 access events analyzed, 129 conversations were abruptly interrupted by users in the introductory setting; 76 conversations were interrupted by users after having completed at least one setting; and users ended 261 conversations at the end of all the dialogues. Thus, in 337 access events, the ChatBot was terminated by users after completing the conversation of at least one dia-

Table 3. Relationship between the intention to use the GISSA Mother-Baby ChatBot by puerperae versus age, schooling, and parity. The Nossa Sra. da Conceição Hospital, Fortaleza, 2019.

| I intend to use the app | Totally agreed | | p-value |
|--------------------------------------|----------------|------|---------|
| | N=131 | % | |
| Age group (years) | | | |
| Up to 29 | 90 | 68.7 | 0.7009 |
| 30 and over | 41 | 31.3 | |
| Schooling | | | |
| Up to Elementary School | 42 | 32.1 | 0.7275 |
| Incomplete Secondary School and over | 89 | 67.9 | |
| Number of pregnancies | | | |
| Primiparous | 52 | 39.7 | 0.9391 |
| Multiparous | 79 | 60.3 | |

Source: Elaborated by the authors.

logue setting. Of these, 312 addressed the conversation about children, allowing the visualization of child health promotion settings 682 times.

Considering that each user can access more than one setting at each access, of the 337 ChatBot access events, the conversations covered a total of 796 settings, including those related to children, pregnant women, and the evaluation of services, with a mean of approximately two settings per access. The three most accessed settings were Setting 1 (babies up to 6 months old) with 115 hits; Setting 2 (2-month-old baby) with 74 hits; and Setting 7 (6-month-old babies emphasizing complementary feeding) with 21 hits.

Regarding usage time, considering the 312 access events addressing conversation about children and the settings whose conversation was concluded without interruption, the mean conversation time was approximately 27 seconds in each setting and approximately 48 seconds in each access (including the conversation of all settings dialogued by the user during access). Concerning access, the longest conversation lasted 20 minutes and 52 seconds and the shortest 1 second.

The information about the settings of children whose conversations were more frequent, Setting Child 1 and Setting Child 2 are shown next.

The conversation about health promotion for babies up to 6 months (Setting Child 1) starts by asking the user whether her baby is breastfeeding. In the 115 conversations in this setting, 91 users replied that the baby is breastfeeding (“Yes”), 15 users replied that the baby is not breastfeeding (“No”), and nine users interrupted the conversation on this question. Of the 15 users who replied that the baby is not breastfeeding, four responded that this is because the breast hurt, four because there is little milk, one because the milk is weak/thin, and six interrupted the conversation without mentioning the reason for the lack of breastfeeding.

The conversation about 2-month-old children (Setting Child 2) starts with the vaccination, asking whether users can look at the vaccination card. Of the 74 conversations about this setting, 11 interrupted the conversation on that question, three said it was not possible to look at the vaccination card, ending the conversation at this setting, and 60 users reported that it is possible to look at the vaccine card. According to these, the conversation continues to ask whether the baby has already had the four vaccines scheduled for the two months: five interrupted the conversa-

tion on this question, 14 answered “No”, and 41 responded “Yes”. For those who answered “Yes”, the ChatBot asks if the baby is already looking at people and is watching and following objects: 11 interrupted the conversation on this question, 13 answered “No”, and 17 replied “Yes”. For those who answered that the baby did not have the vaccines, the ChatBot asks the user wants to see a video about the importance of vaccination, to which two users interrupted the conversation on this question. Nine answered “Yes”, and three answered “No”.

The conversation about a setting goes through a flow of questions and answers between users and the ChatBot. As previously mentioned, of the 682 child settings covered in the conversations, users interrupted the conversation right in the introductory setting 67 times, and users interrupted the conversation after having finished at least one setting, that is, the interruption did not happen in the introductory setting, 120 times.

From the analysis of ChatBot’s handling data from the prototype database added to that of the evaluative study on usability and user satisfaction, no consistent differences were observed in the mean number of access events, settings accessed, and usage time by schooling level. On the other hand, we observed that women between 26 and 30 years of age had a higher mean number of access events (5.21), number of settings accessed (9.26), and usage time (272 seconds) comparing the younger and older.

On average, access lasted 48 seconds, which can be considered short. The possible causes for this short duration are the limited quality of the ChatBot and the fact that research was carried out with puerperae women in the rooming context under puerperal stress, which may have discouraged the exploration of the application.

Open-ended interviews were carried out with six women after handling the ChatBot and applying the questionnaire about the experience of use and satisfaction. In general, women’s responses at this stage showed that they had an easy time using and understanding ChatBot.

Two participants reported having already used applications to help with child care. When asked to compare the applications, one of them commented that the GISSA Mother-Baby ChatBot was more practical because “the other one did not provide us with exactly what we wanted: we just saw it, right? Here the app explains, shows videos, and we can look into things properly. In the other, we had to look for things and read everything”. Another participant also reported that

she liked the application because it used photos and videos to complement the written part.

Conversely, during one of the interviews in which the puerperae gave a maximum score to all the usability issues of ChatBot, a particular urgency was perceived by the participant to answer the questionnaire quickly. When asked about the reason for this, we found out that she had been discharged from the hospital and was extremely looking forward to going home. She had given top marks in all the evaluation aspects of the application and, therefore, one can notice the weight of the “rush” factor for participant N° 1, “I just kept on answering” were her words.

The suggestions presented by them in this stage were the design of a new icon, something that reminded more of the care for the child; that the app addressed the development of children over the age of two; that the app works so that, periodically, it brings something new about baby care or an alert.

Discussion

This study demonstrated the feasibility of developing technological solutions applied to health in an innovation ecosystem composed of interdisciplinary and interinstitutional teams.

The study results pointed out that most of the participating women had easy handling, good understanding, and satisfaction in using the GCBMB. Considering that half of these women had only elementary education, this contradicts an initial expectation of the team that there would be difficulties in using the application, showing a significant familiarity in handling applications on smartphones by the studied population.

The high prevalence of smartphone use is already known, given technological changes. The presence of mobile devices is massive, even in areas where the population has a lower socioeconomic level, such as the population served at the Hospital where this study was conducted.

In the Brazilian context, Spizzirri et al.²³ researched the use of technology in adolescence, in the so-called “Digital Generation” and, regarding the intensity of the dissemination of technologies in this age group, they claim that Brazil is one of the record-breaking countries in the number of residential users and the mean number of monthly internet use hours²³.

Silva et al.²⁴ conducted a study on gender differences in the use of ICTs and suggest that, while research shows that there is specific gender equity

in internet access, women relate differently than men to ICTs and, thus, in the medium to long term, this should impact women’s perspectives in the information and knowledge society²⁴.

Besides the gender roles still rooted in society, this perspective suggests that women use health-related ICTs for their self-care and that of their family²⁵.

Chatbot’s adaptation to the realities of its target audience is also a great advantage. The possibility of having a resolute, low-cost technological innovation that works with primary health care problems is encouraging, especially when it comes to disseminating health care information through a device that most people have: the smartphone.

The suitability of language and the use of explanatory videos as a visual tool are examples of this novelty to facilitate the transmission of knowledge and an innovative way of promoting health, which can and should cooperate with primary care through the Brazilian Family Health Strategy (ESF).

The applicability of the ChatBot tool in health care is reaffirmed from this focus, and this tool currently exists for the most diverse topics. Some examples are: Kumar and Keerthana²⁶, propose a virtual health agent with whom users can solve their health concerns; Ili and Markovi²⁷ reviewed the use of Artificial Intelligence (AI) in health, pointing to lower service costs; Cameron et al.²⁸ proposes creating a ChatBot for virtual mental health counseling.

Although this type of program allows its adoption in several health themes, it is essential to emphasize that, currently, the use of ChatBot is still limited when used within public health, requiring more investments to improve the design and safety, for example¹¹.

The use of the tool in maternal and child care is more frequent during pregnancy. Yadav et al.²⁹ brought a study on the opportunity of using ChatBots in breastfeeding education in India, providing the example of some of the applications that address post-pregnancy on this subject.

In this setting, according to the results of good usability and satisfaction with the GISSA Mother-Baby ChatBot, we can conclude that the use of the application can positively affect the care of children in early childhood, drawing mothers’ attention to the milestones of growth and development, adequate nutrition, and the necessary immunizations.

Among the limitations of the study, we can mention that it would have been interesting to

have approached mothers of children between one and twenty-four months, which should be done in future studies. Another aspect to be commented on is that evaluating the use of the application through (mainly) longitudinal studies may bring more knowledge about its usability and the users' adherence. We should justify that the app is still in the prototyping phase and should be better developed and evaluated to increase its effectiveness.

Based on the experience of the researchers in observing the use of the application by the puerperae, we suggest the following betterments: showing in the initial part what the application is about, and we suggest choosing a logo with something that refers to the pregnancy and the newborn; returning the user to the menu of available settings when she activates the "return" option; redirecting the user to resume use when the suggested videos end; adding artificial intelli-

gence technology to enable new answers to questions asked by women through the application.

It is essential to highlight the originality of this study in Brazil since publications reporting evaluations of experiences of using conversational agents in health services have not been identified in the national and Latin American literature¹¹.

These results show that using the ChatBot tool on the smartphone platform is encouraging to promote children's health. However, significant investments are required to develop quality tools, assess effectiveness, and monitor their use results.

The field of technology, specifically Digital Health, is constantly and rapidly evolving, and Chatbot technology and its use within healthcare organizations are also expected to advance. Thus, further longitudinal studies are required to more accurately analyze and report the use of ChatBot within Public Health.

Collaborations

ICHC Barreto worked on the design, research, and methodology, the writing of the text and the final review. NBS Barros worked on research and writing of the text. RL Theophilo worked on research and writing of the text. VF Viana worked on research and writing of the text. FRV Silveira worked on the research, writing of the text, and the final review. O Souza worked on the research. FJG Sousa worked on research and writing of the text; AMB Oliveira worked on the research. LOM Andrade worked on the research, the writing of the text, and final review of the paper.

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