

Evaluation of the ‘Gestação’ application from the perspective of semiotics: pregnant women’s views

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Abstract *Evaluating health-related applications is necessary for their adequacy and dissemination in society. The GestAção application was evaluated based on the opinion of 13 pregnant women followed up in prenatal care consultations at three public health services and at a private institution in Fortaleza, Ceará, Brazil. Data emerged from an evaluation carried out from June to December 2017, including semi-structured interviews. Data were analyzed from content analysis in thematic and semiotic modality. Thus, the theme “meanings attributed to the application by pregnant women” emerged, which is associated with the following cores of meaning: provision of safe and diverse information; possibility of changing behavior and motivations for using the application. It is considered that semiotics allowed to understand the meanings attributed to the application from the interaction of pregnant women with the tool. The GestAção application was considered satisfactory, motivating to use, informative, safe and promoter of changes in the context of gestational health. Participants’ views allow the evaluated technology to compose strategies aimed at promoting health care for pregnant women.*

Key words *Pregnancy, Biomedical technology, Mobile applications, Prenatal care, Woman’s health*

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Introduction

Pregnancy is a period of significant importance for women, permeated by doubts, fears and curiosities in the face of the bodily and psychic changes associated with this phase¹. Motivated by the need to obtain knowledge, either by inexperience or by the desire to share their experiences with others, women seek clear and safe information on current or future pregnancies on websites, applications (app) and social networks²⁻⁴.

Using mobile technology provides health-related information due to instant accessibility, availability and connectivity^{5,6}. Internet's ascending expansion has opened space for several fields, such as electronic health (eHealth), which promotes accessible and safe use of information and communication technologies to support health and related fields, including care, surveillance, health education, teaching, and research⁷. When the virtual health environment is supported by mobile devices, such as cell phones, patient monitoring devices, among other wireless tools, it is called mobile health (mHealth)⁷.

Such tools have strengthened services and the dissemination of health knowledge by allowing the incorporation of professional advice and the sharing of secure information. In this domain, smartphones have revolutionized the way people communicate, share and consume content⁸.

Thus, several applications are being used for clinical assistance, improvement of continuing education and patient care, contributing to the promotion of health communication⁹. Studies report the benefits of using applications in health interventions, with regard to improving clinical decision-making, patient education and health professionals^{9,10}. Thus, developing solutions in the form of applications represents an effective means of reaching the target audience. However, other research shows that the biggest concern for using these tools in health is the general lack of regulation and evidence^{11,12}.

In this context, the *GestAção* application was designed and developed by an interdisciplinary team at *Universidade de Fortaleza*, in 2014. It is a technological tool aimed at empowering the pregnant woman, containing multimedia information and easy to understand about the gestational period phases. Contents are individualized, culturally contextualized and accessible to the target audience. Moreover, it has a health survey aimed at recording data on prenatal care, through a specialist system capable of identifying pregnant women at risk, supporting the direction of prenatal actions¹³.

In fact, *GestAção* is an informative support, through which women can answer questions and monitor the gestational process interactively. The application can contribute to the scheduling of prenatal consultations and serve as a guide for the recommended actions in the pregnancy-puerperal period, since it signals the need for tests (laboratory and imaging), consultations, vaccines, the likely date of delivery, among other relevant information¹³.

For this technology to be widely transferred to health services and disseminated for use of pregnant women and professionals, it needs to be evaluated and validated for the safety and clarity of information, handling, appearance, functionality, among other characteristics. Evaluating this type of technology is necessary. These tools have implications for people's lives, lead users to changes in attitudes and behaviors, and enhanced care in favor of quality of life and health.

The study aimed to evaluate *GestAção*, from the perspective of pregnant women and in the light of semiotics.

Method

The study is part of a project entitled "mHealth para promoção de saúde da mulher: inovação tecnológica para melhoria da qualidade da assistência pré-natal", funded by Ceará Foundation for Support to Scientific and Technological Development (FUNCAP - *Fundação Cearense de Apoio ao Desenvolvimento Científico e Tecnológico*). The results of this project have been deployed in several scientific productions, such as articles, books and chapters^{13,14}.

The investigation is of an applied, methodological nature, with a qualitative approach, aimed at the broad validation of a technological resource, *GestAção*, through pregnant women's regarding prenatal care.

For technology evaluation, among other techniques, it is suggested validation by experts and the target audience¹⁵. Indeed, technology validation implies the most direct forms of Human-Computer Interaction (HCI) and the ability of an artifact to cause attitudinal and/or behavioral changes in its users¹⁶. This phase of the study included validation of *GestAção* by using semiotics as a science that associates the meaning given to user-technology interaction.

Semiology, in the language field, is related to science that studies the phenomena of social production of meanings. In a culture, all objects are

covered with meaning, whose significant objects interact culturally with people, forming a chain of interpretants through an infinite cycle of production of meanings and effects¹⁷.

Therefore, semiotic theories study the signs, units of meaning and meaning that a person attributes to something, someone or some situation. Semiotics seeks to understand how people interpret things and facts in the context surrounding them, considering that subjects attribute meaning to everything around them¹⁸. Semiotics offers as one of the possibilities to understand how people interact with objects, how they think and get emotional.

Although still little explored by scientific methodology in the health field, semiotics favors the study of understandings and changes in attitude resulting from Human-Computer Interaction, being supported by several theories of communication^{16,18,19}. In this context, this theory was considered to support validation of *GestAção* by pregnant women concerning prenatal care¹⁸.

Evaluation took place from June to December 2017, including three moments. At first, there was a selection of 13 pregnant women who were undergoing prenatal consultations, which were approached in the waiting rooms of two Primary Health Care Units (PHCU), at a Maternity Care Program of *Universidade de Fortaleza* (UNIFOR) and at *Maternidade Escola Assis Chateaubriand* (MEAC), in the city of Fortaleza, state of Ceará, Brazil.

Pregnant women available to participate in meetings for training on using the application, women with a pregnancy period up to the second trimester of pregnancy, undergoing prenatal care, who had smartphones with Android technology and with easy access to internet (via Wi-Fi, 3G, 4G) have been included. Women with high-risk pregnancies, in addition to some other reasons related to their smartphones, reduced data package, slow connection speed, limited Wi-Fi access and phone number change have been excluded.

Concerning the study participants, it was found that pregnant women's ages ranged from 13 to 35 years. Six of them were adolescents (under the age of 18); all had a low level of education (only two completed high school); five of them lived with a partner in a common-law marriage; eight were single; nine participants had no income; ten pregnant women were primiparous; 11 reported not having chronic diseases. All pregnant women used applications on their cell phones, as well as surfed social networks. However, it is noteworthy, in this study, the fact that nine

participants do not know any application about pregnancy.

In the second moment, there was an individual training with pregnant women guided by the research team about the application's tutorial, providing explanations about its use. Then, *GestAção* was installed on their smartphones, being available for use for a period that varied from one to three months. It is noteworthy that, during this time, these pregnant women were monitored fortnightly by the research team.

The last part of the field investigation took place from November to December 2017, when the period of use of the application by pregnant women ended. On that occasion, a semi-structured interview was conducted with each participant, using a script based on the premises of semiotics, to identify their experiences using *GestAção*. The trigger questions were: what did you like most about the *GestAção* app? What contributions did the application bring to your pregnancy process? Would you have suggestions for improving *GestAção*? If so, which ones?

Based on the interviews' recordings and the researchers' notes, data were transcribed and organized based on thematic content analysis²⁰, showing cores of meaning and their associated ideas. From this analysis, the meanings and senses attributed by pregnant women to *GestAção* have emerged. It is noteworthy that data interpretation was supported by semiotics²¹, seeking to understand how pregnant women appropriate and signify their interaction with the highlighted technology, making it possible to verify how ideas, representations and *GestAção*-related motivations come up.

To protect participants' identity, letters and numbers were adopted. Thus, PG1 refers to "Pregnant Woman 1", and so on.

The ethical-legal precepts of the research followed the recommendations of Resolution 466 of December 12, 2012 of the Brazilian National Health Council (*Conselho Nacional de Saúde*), which points out the Regulatory Guidelines and Norms for Research Involving Human Beings²². The Ethics Committee of *Universidade de Fortaleza* approved this project.

Results

Considering a data analysis based on semiotics, the theme "meanings attributed to the application by pregnant women" emerged from all interviews, considered as the most comprehensive

and significant subject to verify the perceptions of pregnant women about the application and its effects on the gestational process. In order to systematize and organize the analytical results, it was decided to present three cores of meaning (CM), which converge opinions and align ideas, which support their significance.

The first CM refers to the “safe and diverse information” offered by the application, which highlights aspects related to women’s understanding of their informational role, and addresses elements that deal with the tool’s influence for knowledge search and acquisition. The second CM corresponds to the “possibility of behavior change”, which focuses on making women aware of the need for care and valuing the application as an interactive and supportive tool for pregnancy. Finally, “motivations for using the application” show signs that lead to an understanding of the pregnant women’s adherence for using the tool.

Safe and diverse information

When referring to the information that *GestAção* brings, the tool’s credibility stands out, according to participants’ opinions. It is observed that the application became, during the period of use, an informational support about pregnancy, establishing a relationship of trust in HCI, as expressed in the reports:

[...] being a mother for the first time was good, but having the GestAção app was better, because it is something that informs us [...], if there was something I had doubts about, I had my doubts clarified by it (the app). (G6)

[...] the application, because it has all the themes, it explains very well and is safe, so it was great for me. (G12)

[...] I liked it because it helped me learn more about my pregnancy. I liked it because it gives more access to reliable information that not everyone has. (G4)

For pregnant women, safe information from trusted sources inspires credibility, which denotes the importance of these aspects for choosing the information path that is of interest and that will be used by the target audience. The statements reveal that the application provided an experience that evokes confidence in relation to the information presented. Nevertheless, PG4 is hesitant about relying on content accessed from other sources.

Possibility of behavior change

Pregnant women revealed update of knowledge after using *GestAção*. They highlighted points that they consider important, which result in healthy attitudes during pregnancy, meaning that the new knowledge led to positive attitudes and changes in their daily lives. In this context, applications have great potential in promoting health, making users more aware and interested in their living conditions. It is also noteworthy that most of these technological tools play an important role for people to adopt healthier lifestyles, as demonstrated in the following reports:

[...] my diet changed a lot, I didn’t have a healthy diet and I changed a lot after I went to find out what could happen and what I would need to change. The application shows all of this and in a very easy way! (G6)

I have a friend who is in early pregnancy. I told her about the application I’m using [...]. As it won’t be all the time that she will be able to talk to me to answer her questions, I will always have an answer for her, but with the GestAção app to access, it will be easier for her to learn to take better care of herself. (G5)

Based on reports, it is clear that the application is capable of disseminating a variety of impactful information about pregnancy care, promoting the co-responsibility of pregnant women about the gestational process.

Motivations for using the application

GestAção reveals a motivational and organizational potential, as it is a tool that aggregates informative and interactive aspects. The application provides pregnant women with tools to carry out their daily and individual planning, organize and schedule appointments and appointments, in addition to being inclusive, allowing access to information for people who cannot read.

[...] sometimes, I forgot to take my vitamins [...], then I looked at the application, remembered and took it. It (the app) also helped me a lot because I’m very young and the app helped me to see what I didn’t know. (G4)

[...] I liked the app because, if I feel anything, I can write it down so I don’t forget it and when I go to an appointment to talk to the doctor. (G5)

I liked the radio in the app because it shows exactly how it has to be when the baby is born. I found this radio even more interesting because there are many mothers who cannot read and write, understand? The radio helps these people and there is also

a lot on the radio that is explained in a more summarized way. (G10)

It is evident that the application has aspects that cause motivation to use and behavior changes in users, especially because it is easy to handle and self-explanatory.

The ease of use and what it (the application) explains, the ease of searching (finding the information), of handling, because what was in that application, how to handle it, was not available in the other one I used to use. (G6)

I had experience with an application that I don't remember the name. I used this application through a colleague of mine. It didn't have the content that this application has (referring to GestAção) nor the explanations about food. What was in the other application were explanations about the gestation period; but there was no information on food and medication. I didn't even use that app, so I took it out of my smartphone, because it didn't motivate me. GestAção is different, I really like what it offers and this is motivating, right? (G12)

The statements reveal some reasons that stimulated using the application by participants, bringing indications of a positive evaluation about ease of access, handling and locating information, in addition to the diversity of information contained.

Discussion

Health technologies are effective in meeting the needs of users and generate positive impacts^{2,11,23-27}. Applications have emerged as a means of mediation and provision of information, as they have great potential for communication and health education, as well as helping to promote health and well-being²⁸.

GestAção is one examples, since it favors learning about care for a healthy pregnancy. However, one cannot forget the importance of evaluation approaches; this process is capable of evaluating the potential of a technological tool and the importance of the attributes it brings, presenting itself as an indispensable step in the process of wide use of applications²⁹. In fact, there is a need to evaluate technologies developed for the health field, which includes validating the effectiveness and reliability of these resources before using the tool with a larger population^{12,23}. Knowledge of the target audience's experiences and the effects of using an application is one of the most important aspects for validating this type of tool¹⁴.

The participants in this study used several applications on their smartphones; however, some of them reported not knowing any apps about pregnancy. This fact differs from the study conducted by McKay et al.²⁶, which showed that most pregnant women download, in an average of three applications containing information about pregnancy, during the gestational period.

Regarding the application's diversity of content and safety, *GestAção* has become for pregnant women as a reliable tool for information support. Barbosa and Silva³⁰ recognize that these aspects establish a relationship of trust in HCI. In this scenario, women are increasingly interested in new knowledge that brings them supportive strategies based on scientific evidence¹⁴.

According to semiotics¹⁸, the meanings attributed to the application by the study participants refer to an experience of trust and credibility, making the tool's potential evident. Pregnant women expressed feelings of satisfaction using the application and the possibility of changing their behavior, revealing the potential promoter of attitudinal transformations through content and quality of information offered by the application.

Moreover, studies^{8,11,16,23} refer that a tool's dialogue with users should promote behavioral change in favor of health and that health informatics applications can make a difference in people's lives, as they serve as allies to a series of content and services, encouraging the promotion of healthier behaviors. Indeed, a well-directed and clear language favors users to understand and formulate or re-signify meanings, which allows adopting behaviors that improve their health conditions²³.

A study²⁷ that investigated interventions supported by using applications demonstrated the capacity of these devices to encourage changes in behaviors related to physical and dietary activities. Delgado et al.²³ claim that using some mobile strategies and tools leads to changes or behavioral adaptations that facilitate health promotion.

As for motivations for using the application, pregnant women pointed out aspects that encourage using *GestAção*, revealing their perceptions about its positive impacts, incorporating knowledge about the theme. They also confirmed that the recommendations proposed for improving lifestyle, offered by the app, bring motivational stimuli and positive effects.

Studies confirm^{12,24} the effectiveness of using applications for self-management of health prac-

tices and draws attention to the need for motivating elements that generate greater participation by participants. In this regard, this investigation emphasizes aspects that cause motivation regarding *GestAção* use by pregnant women who positively evaluated ease of access, handling and locating information, in addition to the diversity of information offered to pregnant women. Therefore, it appears that this application provides important contributions to improve interventions and strategies aimed at maternal and child health.

The signs revealed by the experiences of pregnant women regarding *GestAção* use expand its usefulness for health services and professionals who can use this technological tool as an enhancer of prenatal care. Indeed, the evaluated application proved to be functional, suitable for use, with motivating and effective characteristics for the purpose for which it is proposed.

This study reveals an important contribution in the health field, as it certifies, through the target audience's evaluation, a safe and effective use of a technological tool aimed at prenatal care. Furthermore, it can serve as an example for other evaluation studies, from a qualitative perspective, as it refers to using an analytical method based on semiotic theories, which is still little used in the health field, but which is suitable for evaluation studies of m-health technologies and their interaction with humans.

The limitations of the investigation stem from difficulties in gathering participants due to lack of internet access for some pregnant women intercepted in the institutions that hosted the study and lack of contact with participants due to reasons for changing the phone number, cell phone theft, among other reasons.

Final considerations

Evaluating *GestAção*, according to pregnant women's views, revealed that this application is a facilitating and supporting technology for maternal and child care in the gestational period because it enables an interactive, educational, continuous, accessible and safe process of pregnant women to health information and actions required at this stage.

Participants attributed to the application under evaluation, meanings that refer to the motivation for use, capacity for attitudinal changes and support for pregnancy. This encourages the co-responsibility of women in health care, in improving their attitudes and in strengthening pregnant women's autonomy and self-care.

GestAção evaluation was positive, according to users' opinion, indicating that this technology can be disseminated to society as a technological tool that helps health care during prenatal care.

Collaborations

FFSN Queiroz, CCP Brasil, RM Silva, IC Bezerra, PMC Collares and JE Vasconcelos Filho participated in all stages of the study, going through planning, literature review, data collection and analysis, article writing and critical review of the material.

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