EHealth Technologies

in the context of health promotion

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ed UECE

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Summary

INITIAL REFLEXIONS

Working with technology in interdisciplinary settings is a trend that meets the demands of the contemporary world, in which science and innovation come together to seek feasible, affordable and sustainable solutions in the globalized world. In this context, health occupies a prominent place, as technology and digital transformation are consolidated through strategies and tools that favor actions at all levels of health care (protection, promotion, prevention, and care), as well as the management of services, processes, and people.

In experiencing this reality and understanding the dynamism of humanity, the University of Fortaleza (UNIFOR - *Universidade de Fortaleza*) strives to develop electronic health (ehealth) projects in an integrated and interdisciplinary manner. These actions are performed from the Training and Integration area of the Information Technology Application Center (NATI - *Núcleo de Aplicação em Tecnologia da Informação*). This sector is responsible for conducting interdisciplinary projects that promote the integration of applied computing research in the most diverse areas.

In this context, there is a special look at health that, since 2014, has had the intensive participation of undergraduate, master and doctorate students, as well as Computer Science, Computer Engineering, Marketing and Communication, Administration and Health (courses in Psychology, Nursing, Medicine, Physiotherapy, Collective Health, Nutrition and Speech Therapy) professors and researchers, in joint projects.

It is believed, in the academic context, that one of the ways to boost and enable interdisciplinary projects is the creation of spaces

and programs based on the use of methods and tools that allow and systematize this integration. To this end, UNIFOR's ehealth team has jointly organized a working method in which collaboration and co-participation are the cornerstones of the entire process.

It is noteworthy that this ehealth research group, along this trajectory, has already established national and international partnerships, seeking to learn and collaborate continuously with other institutions and researchers of excellence. With experience in this area of knowledge, technology and health, they are associated in search of faster, more comprehensive and sustainable solutions to the problems experienced in reality.

In this book, we present some experiences that go through a scientific, theoretical and technical foundation, and of practical application. The book begins with a theoretical approach in which the focus is on the introduction to ehealth and the strategies for evaluating and validating these technologies. In the second part of the book, we demonstrate the application of ehealth in designing tools for improving health care in 14 chapters that bring successful experiences that can inspire readers.

In the spectrum of ehealth technologies, the experiences presented involve mobile health (mHealth). This is from application design, development, and validation (chapters 1, 2, 3, 5, 7, 8, 9, 11, 12, 13, and 14); health information systems - HIS (chapter 4); eLearning (distance learning) associated with mHealth (chapter 6). In addition to these, chapter 10 presents a netnographic approach, showing how a social network provides discussions about the professionalism of the obstetrician.

We also emphasize that we chose as a method called User Centered Design (UCD) for the conception, development and validation of technologies, in projects carried out at UNIFOR. This method is in line with similar methods used in the projects of the

national and international partners participating in this work. The term UCD was coined by Donald Norman in his research lab at the University of California. It is a broad denomination that describes a philosophy and framework of processes and design methods (not restricted to interfaces or technologies), in which potential end users of the product, process or service influence the project model. This makes the technology conceived and developed in a contextual way, under the eyes of those who will actually use it.

UCD is a multi-stage problem-solving process where the usability goals, user characteristics, environment, tasks, and workflow of a product, service, or process receive wide attention at every stage of the process. It is precisely with the concern of making technologies more accessible and decisive in the health setting that we share this work with the scientific community, hoping that many new works, ideas and solutions may spring from this reading.

Raimunda Magalhães da Silva, Christina César Praça Brasil e José Eurico de Vasconcelos Filho

SECTION 1

THEORETICAL-METHODOLOGICAL FRAMEWORK

INTRODUCTION ON eHEALTH TECHNOLOGIES

Cátia Pereira, Duarte Ferreira, Priscila Maranhão, Liliana Correia, Jorge Félix, Ricardo Cruz-Correia

EHEALTH EVOLUTION AND DEFINITION

EHealth definition has evolved much since its initial use in 1999. At first, the concept meant "Internet medicine", i.e., anything related with health that used the Internet. More recently, Eysenbach defined "ehealth is an emerging field in the intersection of medical informatics, public health and business, referring to health services and information delivered or enhanced through the Internet and related technologies[1]. In a broader sense, the term characterizes not only a technical development, but also a state-of-mind, a way of thinking, an attitude, and a commitment for networked, global thinking, to improve health care locally, regionally, and worldwide by using information and communication technology". Due to the limitations of these definitions, it is suggested that it can be better defined using a conceptual model including 3 prominent but overlapping domains: (1) health in our hands (using eHealth technologies to monitor, track, and inform health), (2) interacting for health (using digital technologies to enable health communication among practitioners and between health professionals and clients or patients), and (3) data enabling health (collecting, managing, and using health data)"[2]. In the same study, it is suggested that eHealth initiatives that are most impactful include elements from all three domains.

The scope of eHealth is broad and focuses in health-related technology, its usage and impact on health. In this chapter, we make a general approach on EHealth technologies, we report on their impact on healthcare, research and health policies, we present a summary of the World Health Organization (WHO) view on EHealth, and finalize with some open questions that are current hot topics.

EHEALTH TECHNOLOGIES

Healthcare organizations and governments have been investing resources in health information (HI) technology to optimize patient care, improve clinical practice, prevent medical errors, and reduce costs, among other concerns [3-5]. With the widespread introduction of computers and HI systems (HIS) to support the provision of healthcare, the availability of easily accessible electronic health data has increased dramatically. A new paradigm emerged in the practice of medicine and health research thanks to the quantity and quality of available information. Electronic Health Records (EHR) have been developed to integrate patient data and help healthcare professionals to make the best decisions[6]. Although there are many different technologies associated with eHealth, we feel that the most used and described in literature are: (1) electronic health records, (2) artificial intelligence and decision-support systems and (3) mhealth and telemedicine.

ELETRONIC HEALTH RECORDS

A patient record is a set of documents containing clinical and administrative information regarding that specific patient, supporting communication and decision-making in daily practice while en-

abling different users and purposes. Computer-based patient records have been considered essential tools for the provision of healthcare in the past 35 years even though their true cost-effectiveness still needs more research. Currently, health care activities strongly rely on electronically collected patient data; these data, additionally, can be used to feed big data-driven health care projects that, among other objectives, seek reliable predictors of health outcomes. This highlights the importance of storing high quality and complete data, not only to support clinical practice but also to facilitate effective clinical research. In fact, health care professionals need to deal with a great volume of EHR data in activities that are heavily dependent on information access, as well as the way it is processed, managed, and made available.

The data recorded on EHRs results from the processes of healthcare provision and, to be fully understood, it is essential for the person performing data analysis and interpretation to know such processes. In the current healthcare scenario, patients usually go to various places that provide care, such as public and private hospitals, clinics, laboratories and others. At each institution, at each patient visit, a new record is created and stored, resulting on a huge amount of data being stored and spread across several sources, frequently using systems that were designed without fully accounting for these sharing needs.

With the patient records distributed in many heterogeneous and non-interoperable repositories, it is hard to consolidate and extract data. Nevertheless, the information available in healthcare institutions has the potential to be very valuable, including economically, due to the existing amount of data and the decisions they describe. Thus, many efforts have been made to empower researchers into an effective use of EHR, promoting a better understanding of the variables that are collected and stored, including their valuable opinion on

the design of more user-friendly and clinical and research optimized EHR. One example of such an effort is the open EHR standard that will be briefly described in a subsequent section of this chapter.

ARTIFICIAL INTELLIGENCE AND DECISION-SUPPORT SYSTEMS

Artificial Intelligence (AI) is defined as a field of science and engineering concerned with the computational understanding of what is commonly called intelligent behavior, and with the creation of artifacts that exhibit such behavior[7]. AI techniques deeply depend on labeled big data and computing power. In some health care scenarios these requirements are now fulfilled. The use of AI in medicine can have a major impact at three levels:

- for clinicians, e.g. via rapid and accurate image interpretation;
- for health systems, e.g. improving workflow and having the potential to reduce medical errors;
- for patients, e.g., enabling them to process their own data to promote health.

The implementation of AI-based clinical decision support systems (CDSS) is one of the most promising applications of AI, taking advantage of the use of machine learning techniques to improve prediction beyond those provided by more traditional rules-based systems[8].

Current limitations and concerns to the use of AI in medicine include bias, privacy and security, lack of transparency, accuracy, productivity, and patient–doctor relationship[9]. The dependence of AI on data quality also stresses the importance of proper design and use of EHR systems. Therefore, it is expected that, in the future,

the systems will be increasingly more autonomous, going beyond making recommendations and suggestions about a clinical issue to autonomously performing certain tasks such as patient screening[10].

MHEALTH AND TELEMEDICINE

Another area that emerged from the use of technology in health care is an abundance of mobile health (mHealth) applications that intend to improve the delivery of care[11]. Mobile phone usage has been rapidly increasing worldwide, both in high-income countries, where mobile phone subscriptions may already exceed the population, and in many low- and middle-income countries, where the number is expanding very fast. mHealth is being used for:

- patient communication, monitoring, and education;
- to reduce the burden of diseases linked with poverty;
- to improve access to health services, clinical diagnosis, and treatment adherence;
- for chronic disease management.

Nevertheless, and although mHealth is growing in popularity, evidence supporting its efficacy is still limited[12].

E-HEALTH IMPACT

Health Care

EHealth applies communication and electronic technologies to manage health. An example is the possibility to have remote consultations that allow, at least in some specific situations, to provide patient counseling, fast access to remotely collected patient data, promoting monitoring/support, and consequently facilitating diagnosis and treatment, while avoiding a face-to-face appointment[13].

EHealth technologies can improve healthcare efficiency by reducing its cost, allowing high mobility, and wide information access and distribution. However, some authors state that the most relevant consequence of EHealth is to provide an improvement in healthcare service quality[14]. Nevertheless, the cost-effectiveness of eHealth technologies remains controversial. Cord et al. found that the use of EHR, one of the most widely implemented eHealth technology, can reduce overall healthcare costs once the data infrastructure is established[15]. In contrast, another study has shown that evidence of costs and benefits for decision making is still limited and that it is difficult to confirm whether the implementation of eHealth interventions has a measurable impact on the cost-effectiveness of healthcare[16]. A systematic review performed in 2018 showed that the current evidence is limited and that further research is warranted to demonstrate the long-term cost-effectiveness of using eHealth[17].

However, it is indisputable that eHealth improves remote patient monitoring and quality of care, by allowing continuous assessment and physician access to data on symptoms and signs of disease[18,19]. Telemedicine is now established as a relevant tool for monitoring patient safety[18]. Moreover, through video calls, the physician can promote fast and timely access to patient information and diagnosis[20,21]. Physicians have reported a positive perception on the use of telemedicine[22]. In addition, other monitoring tools, especially mobile ones (e.g.: smartphone apps, smartwatches, among others), support the collection of a wider range of data, in a more accessible and prompter way[23, 24].

Furthermore, some studies have shown that eHealth improves the quality of data collection, reducing paper use and, consequently, decreasing medical errors[14]. A study by Waithera et al demonstrated that the implementation of an EHR in a hospital had a significant impact on the healthcare delivery system, increasing the collaboration between health professionals, the productivity of

healthcare providers, and, finally, improving satisfaction[25]. Besides that, another study has demonstrated that patients of primary care providers who used EHRs were less likely to have specialist visits and radiology tests than patients of primary care providers who did not use EHRs[26]. Finally, a narrative review suggested that the effects of using clinical decision support systems (CDSS), computerized provider order entry (CPOE), ePrescribing and EHR systems are largely mixed, although there are positive findings which encourage the ongoing digital transformation of hospital practice[27].

Recent years have shown tremendous growth in eHealth that has the power to improve healthcare. Nevertheless, there are many challenges to eHealth implementation and use, and, for better results, the technology should be adapted and understood in the context where it is applied.

RESEARCH

In the last years, the widespread implementation of eHealth tools in clinical practice, with easily accessible data, has been used to accelerate and facilitate clinical research. However, there are only a few studies assessing the impact of using eHealth in clinical research and the results are discrepant. An exploratory study has shown that hospitals that used a specific gynecology/obstetrics EHR - ObsCare, that allows the collection of structured patient data during daily clinical practice, published studies with significantly higher sample size and longer study length (compared with hospitals without a specific EHR)[28]. Otherwise, Cazorla et al. demonstrated that the computerization of medical records in a maternity ward had no immediate results in the production and publication of scientific articles. The authors suggest that this may be related to the lack of government investment in research and the need for a learning period to use these technologies, which delays scientific publication[29].

Due to these benefits, eHealth has been adopted for the vast majority of clinical trials[35, 36] , and it demonstrated a positive impact in terms of improved patient recruitment[37]; ensuring participant compliance[38] and study cost[38, 39]. This last item was verified by a study that found the wider use of mobile technologies as one of the most effective means of reducing trial costs across therapeutic areas and clinical trial phases[40].

Besides the enormous potential in the collection of a structured traditional patient or physician reported data, eHealth technologies, especially in its mHealth subsegment, might also be used to collect other types of data, that traditionally would need additional devices. An example is described in two feasibility studies of the use of a smartphone application to capture spirometry directly through the smartphone microphone[30,31]. These studies showed that collecting acceptable expiratory maneuvers using only the smartphone microphone is possible, even in children[31], and that the collected sounds can be used to classify the lung function as normal or abnormal[30]. Although this technology is not yet in use in daily practice, it has the potential to improve the care of respiratory patients and give access to easily collected data that can be used to improve clinical research.

All these points highlight the importance of eHealth in clinical research, and it is undeniable that health informatics journals have been increasing their impact around the world. As an example, in 2017, the most significant health informatics journals presented an impact factor ranging from 1.5 (Applied Clinical Informatics) to 5.2 (Journal of Medical Internet Research), which supports the increased importance of eHealth issues, with a higher number of publications increasing the overall number of citations.

Moreover, literature shows that traditional methods of surveillance and data collection using a paper-based methodology pose many challenges such as data loss and duplication, difficulty in man-

aging the database, and lack of timely access to the data[32]. eHealth technology brings many benefits that can help to overcome these barriers. Zeleke et al. compared data quality parameters in the data collected using mobile electronic data capture tools and standard paper-based ones in one of the health demographic surveillance sites in northwest Ethiopia. The authors found that the use of mobile electronic data capture was associated with significantly better data quality and efficiency compared with paper-based data capture; it had fewer errors and it allowed instant data submission and easier handling[33]. In addition, another study developed a mobile application that is intended to enable rapid mobile data collection using both online and offline modes, supporting various stages of surveillance and response through the extension of data collection and analysis of the mobile environment[32]. Besides, another study has compared collecting data from patients with urinary tract infection (UTI) using text messaging and a mobile phone app and an online survey. The authors observed that the use of mobile data collection methods to capture patient data improved the efficiency of data collection and that this novel approach also has the advantage of collecting data in real time across multiple points in time. There was little variation in the number of patients responding between text message survey, UTI diary, and online survey, but more patients participated in the text message survey than in the UTI diary app[34].

In the eHealth context, openEHR should be mentioned; it is a technology for eHealth that consists of open specifications, clinical models and software that can be used to create standards, and build information and interoperability solutions for healthcare. Some researchers have shown the relevance of openEHR to improve interoperability, data quality, and also clinical care provision[41,42], with the potential for a long-term impact on clinical research.

HEALTH POLICIES

eHealth and health policies go hand-in-hand, mutually benefiting from each other's progress. EHealth has allowed policy-makers the use of extra tools and more accurate descriptions of almost every aspect of health systems, from drug prescription to epidemiological data. Before the digitization of health records, for instance, it would be much harder for policymakers to quickly understand the context of a certain policy intervention, as well as to measure its impact. A very recent example of the importance of eHealth in the implementation of health policies is the WHO European Region "Action Plan to Strengthen the Use of Evidence, Information and Research for Policy-Making" [43].

EHealth has also contributed to the empowerment of patients. Aspects such as health literacy and closer monitoring of health outcomes can be better integrated into health systems, allowing a true shift from hospital-based medicine to community-based health strategies. The impact of eHealth in public health policies is well documented[44].

On the other hand, the best way to ensure efficient eHealth interventions is through quality policy-making directed at health systems. Since eHealth significantly benefits from large volumes of data, health policies that are needed to ensure standards, interoperability rules and infrastructure, among other aspects, were put into practice in several countries. As an example, we can look at a Swiss law that requires hospitals to adopt interoperable EHRs. The ultimate goal of this policy is two-fold: patients have improved access to their health information, but also policy-makers have better data about the health system[45]. What can also be seen in this example is how good policy-making is needed to overcome implementation barriers, in what are frequently game-theory dilemmas that will require that everyone cooperates at the same time with the same degree of effort. Without health policies that help to coordinate all agents,

no one has the incentive to act first, leading to delays in the implementation of eHealth tools. This is one of the conclusions of a paper comparing US and UK policies regarding the implementation of national EHRs[46].

WORLD HEALTH ORGANIZATION´S VIEW

The World Health Organization - WHO, as a global leader in health policy coordination and standard setting, has been paying attention to eHealth for some years. Due to its own institutional framework, it has historically not focused on leading the development and implementation of these technologies.

In 1997, Member States gathered at the 50th World Health Assembly, "Recognizing that in some situations provision of medical products by an authorized health professional on the basis of an electronically communicated request may contribute to more rational and better health care, and to the easier availability of necessary medical products and information about them", asking the Director General to collect information on uses of the Internet in drug advertisement, promotion and sales[47].

Since that first step, WHO has been increasingly involved in regulating eHealth, mostly in areas such as mHealth and EHR. In 2013, for instance, WHO started a partnership with the International Telecommunication Union (ITU) called "Be He@lthy, Be Mobile" that aims to give governments worldwide access to best practice policies on mHealth.

More recently, WHO has tried to bring a more innovative and multisectoral approach to the field. A clear example of an innovative approach is the announced partnership with Google Fit, that will allow WHO to start offering health advice through the Google Fit

app[48]. WHO has been trying to increase its involvement with the private sector, but some of its member states are reticent about this move. In 2019, WHO has completed a major reform of its internal structure, creating a Department for Digital Health, a move that signals the increasing importance of digital tools. It is still too soon to predict the impact of such move.

OPEN QUESTIONS

Patient empowerment is one of the key elements of patient-centered healthcare. It can be seen as both a prerequisite and an outcome of patient-centered healthcare – a goal as well as a process. Empowerment can be conceived as a personal disposition, referring to the patient's control and power in the medical context or as a relational concept, emphasizing the existing balance in the physician-patient relationship [49,50].

Patient empowerment is gaining greater international importance in healthcare. Reflecting the shift in the Western culture towards increasing consumerism and individualism, institutional culture in healthcare is slowly moving away from an ethic of paternalism towards an ethic of empowering patients to make informed decisions [51]. A collaborative doctor-patient relationship can improve patient empowerment, i.e. the lack of agreement between doctors and patients can lead to paternalism, and negotiated care can bring power balance into the medical relationship[52]. As a matter of fact, physicians, by facilitating patient engagement in the communication process, can foster patient empowerment and better outcomes for both[53].

Discussion on the use of technology to advance patient empowerment [54,56] has taken into consideration how the concept may need to be reimagined within the eHealth context [57]. In addition, particular technologies such as patient portals have become a focal

point in this research, with relations made between the use of patient portals, patient empowerment, engagement, and/or activation and ultimately, improved personal health outcomes [58, 59] . The move from a decidedly more paternalist system, dominated by the views and preferences of health care practitioners, to one in which patient voice has arisen as a priority, has resulted in an increased exploration of patient empowerment [60, 61].

The aforementioned challenges in evaluating patient empowerment have influenced the effectiveness of research on the relation of this concept with specific and measurable changes in health outcomes [62]. Even so, recent reviews on patient empowerment reveal global interest in the advancement of research on this concept [60,63]. The WHO European Regional Office included empowerment and patient-centered practice as key elements in its Health 2020 report [64], a follow-up on a previous WHO study on the effectiveness of empowerment to improve health [65].

Specifically, chronic diseases are seen as a sustainability challenge for European health systems. This is usually presented in terms of funding; health systems cannot cope financially with chronic conditions and the ageing population. Patient-centered care models have demonstrated better quality of care as well as potential long-term cost-efficiencies. Still, too many patients are struggling to get the support they need to become equal partners in care [18]. Chronic diseases require a fundamental shift from disease-centered to patient- and family-centered approach, combining self-management in the community with well-integrated professional support through the course of life. Patients are experts by lived experience, whose perspective on disease and care is unique. This implies the empowerment of patients and their involvement at every level in the health system, ensuring active patient involvement in policy-making and in co-designing care services to meet their needs more effectively.

Some of the reasons why patient participation is still absent in some key health areas, and not strong enough in others, include a lack of awareness and acknowledgement of patient empowerment; slow pace in sharing and adopting good practices; a lack of resources in the health system but also of patient organizations; poor know-how on how to meaningfully involve patients and patient organizations; and a patient community with very different levels of capacity and different priorities across the EU [66].

To overcome these constraints, organizations may implement a structured patient empowerment strategy. An European patient forum [66] suggests an implementation roadmap for organizations focused in main areas and highly complementary actions, and points towards multiple paths towards the goal of achieving health systems in Europe that are high-quality, patient centered, participatory and sustainable. The eight priority areas for action are:

1. Health literacy & information
2. Professional training & skills
3. Self-management support
4. Patient-driven technology solutions
5. Patient involvement in patient safety
6. Patient centeredness in healthcare
7. Patient involvement across the R&D lifecycle
8. Patient involvement in health policies

DATA QUALITY

Forty years ago, Komaroff warned that medical data collected on paper records were defined and collected with a significant degree of variability and inaccuracy[67]. Twenty years ago, Hogan and Wagner argued that EHRs were not properly evaluated regarding

data accuracy[68]. Unfortunately, many studies have been published meanwhile showing that many of the problems found by Komaroff can still be found today. EHRs are used for healthcare provision, research, education, management and legal purposes. This fact has an important impact on the way data are uploaded by healthcare professionals, on how data are structured on databases, and also on the heterogeneity found when trying to integrate data from different HIS. Issues regarding data quality have become more relevant than ever as the utilization of databases is increasing both in magnitude and importance.

Data quality is relative to each objective and can be defined as "fitness for use", i.e., data can be considered of appropriate quality for one purpose but they may not hold sufficient quality for another situation. This is especially true in medical databases; a medical database can be of quality for economic analysis but it may be of insufficient quality for a clinical study [69]. To fulfill the full potential today and in the future, it is critical that data scientists fully understand how these data were collected. Storing context information, protocols used and precision/accuracy information in clinical databases helps to ensure future understanding of such data[70].

Integrations

Currently people have more mobility, live longer and health care is more shared than ever before. It is clear that HIS are evolving to meet people's needs by implementing regional networks, allowing patient access and integration of even more items of patient data. Patient information is becoming more accessible as there are more integrated HIS, which are more likely to involve primary care and a wider range of patient data from different medical specialties, and which are essential to support shared and consistent care to individuals – patient-centered care. However, to integrate HIS in a way that

will improve communication and data use for healthcare delivery, research and management, many different issues must be addressed. Consistently combining data from heterogeneous sources takes a great deal of effort because individual input systems usually differ in several aspects, such as functionality, presentation, terminology, data representation and semantics.

Security

Despite the benefits achieved with all this data collection, there are several challenges that are faced, namely, ensuring data integrity and confidentiality, and patient privacy[71]. In the particular case of health data, security issues are very complex. Consider that if someone unduly accesses another subject's personal data, it can cause serious damage to him, putting his future at risk. But the access to a patient's health data can bring harmful consequences not only to the individual himself, but also to the generations to come [72].

Undue accesses to EHR happen frequently. Reports by professionals from healthcare institutions show that there are professionals who share credentials to get help from other professionals or to help other professionals on their tasks; some professionals that no longer work at the hospital might have their credentials still in use by other users; professionals might use the information available in health systems to confront other professionals about their personal life; or patients have been blackmailed because someone had undue access to his or her EHR data.

Although the concern for personal data protection exists since long ago, the Health Insurance Portability and Accountability Act (HIPAA)[73] is only from 1996 and the European Data Protection Directive is from 1995; it has recently been enforced in Europe by the new General Data Protection Regulation (GDPR), in May

2018[74]. This regulation brings serious issues to Healthcare institutions to demonstrate compliance due to the great amounts of sensitive data they possess diffused by a large number of HISs[75].

Regarding technology, audit trails have been very useful on this matter. They comply important GDPR requirements, such as audit and traceability of actions on patients' data[76]. However, these repositories are used in most cases as a forensic investigation tool once a complaint occurs [77], and they do not prevent or alert for possible undue access. Such occurrences may be data breaches, and in that case, they should be communicated to authorities and even to the affected person within 72 hours since the breach is known[78]. Moreover, if the healthcare institutions have this knowledge, they can preventively act to avoid such incidents.

Although Data Privacy has been on the recent news in Europe due to the GDPR, security problems on Healthcare are not only related with data breaches or unauthorized access to patients' data. In the recent years there have been reports of global attacks on information systems that, even though they were not focused on HISs, greatly affected some healthcare institutions, disabling HISs and creating chaos on some hospitals worldwide[79]. Attacks like the WannaCry ransomware attack of 2017, which included encrypting sensitive data from systems and demanding a ransom for the decryption key, had a great impact on the NHS, shutting down departments on some hospitals [80].New threats include also hacktivism and organized crime, specialized in cybercrime, targeting individual identified data stored in hospitals and offices. New technologies and policies are needed to address these risks [81,83].

REFERENCES

1. Eysenbach G. What is e-health? J Med Internet Res. 2001; 3(2):E20.
2. Shaw T, McGregor D, Brunner M, Keep M, Janssen A, Barnet S. What is eHealth (6)? development of a conceptual model for eHealth: qualitative study with key informants. J Med Internet Res. 2017; 19(10):e324.
3. Bell B, Thornton K. From promise to reality: achieving the value of an EHR. Healthc Financ Manage. 2011; 65(2):50-6.
4. Buntin MB, Burke MF, Hoaglin MC, Blumenthal D. The benefits of health information technology: a review of the recent literature shows predominantly positive results. Health Aff (Milwood). 2011 Mar; 30(3):464-71.
5. Protti D. Comparison of information technology in general practice in 10 countries. Healthc Q. 2007; 10(2):107-16.
6. Shortliffe EH, Cimino JJ, editores. Biomedical informatics: computer applications in health care and biomedicine. Berlin: Springer-Verlag; 2006.
7. Shapiro SC. Encyclopedia of Artificial Intelligence. 2n ed. New York: Wiley; 1992. 1 vol. 1. Artificial intelligence; p. 54-7.
8. Challen R, Denny J, Pitt M, Gompels L, Edwards T, Tsaneva-Atanasova K. Artificial intelligence, bias and clinical safety. BMJ Qual Saf. 2019 Mar; 28(3):231-37.
9. Topol EJ. High-performance medicine: the convergence of human and artificial intelligence. Nat Med. 2019 Jan; 25(1):44-56.
10. Yu K-H, Beam AL, Kohane IS. Artificial intelligence in healthcare. Nat Biomed Eng. 2018 Oct; 2(10):719-31.
11. Radbron E, Wilson V, McCance T, Middleton R. The use of data collected from mhealth apps to inform evidence-based quality improvement: an integrative review. Worldviews Evid Based Nurs. 2019 Feb; 16(1):70-7.
12. Marcolino MS, Oliveira JAQ, D'Agostino M, Ribeiro AL, Alkmim MBM, Novillo-Ortiz D. The impact of mhealth interventions: systematic review of systematic reviews. JMIR Mhealth Uhealth. 2018 Jan; 6(1):e23.

13. Alvarez RC. The promise of e-Health - a Canadian perspective. Ehealth Int. 2002 Sep; 1(1):4.

14. Naseem A, Rashid A, Kureshi NI. E-health: effect on health system efficiency of Pakistan. Ann Saudi Med. 2014; 34(1):59-64.

15. Mc Cord KA, Ewald H, Ladanie A, Briel M, Speich B, Bucher HC, Hemkens LG: Current use and costs of electronic health records for clinical trial research: a descriptive study. CMAJ Open. 2019 Feb; 7(1):E23-E32.

16. Reis ZSN, Maia TA, Marcolino MS, Becerra-Posada F, Novillo-Ortiz D, Ribeiro ALP. Is There Evidence of Cost Benefits of Electronic Medical Records, Standards, or Interoperability in Hospital Information Systems? Overview of Systematic Reviews. JMIR Med Inform. 2017 Aug; 5(3):e26.

17. Sanyal C, Stolee P, Juzwishin D, Husereau D. Economic evaluations of eHealth technologies: a systematic review. PLoS One. 2018 Jun; 13(6):e0198112.

18. Paré G, Moqadem K, Pineau G, St-Hilaire C. Clinical effects of home telemonitoring in the context of diabetes, asthma, heart failure and hypertension: a systematic review. J Med Internet Res. 2010 Jun; 12(2):e21.

19. Steinman M, Morbeck RA, Pires PV, Abreu Filho CA, Andrade AH, Terra JC, Teixeira Junior JC, Kanamura AH. Impact of telemedicine in hospital culture and its consequences on quality of care and safety. Einstein (Sao Paulo). 2015; 13(4):580-86.

20. Barjis J, Kolfschoten G, Maritz J. A sustainable and affordable support system for rural healthcare delivery. Decis Support Syst. 2013; 56:223-33.

21. Van Velsen L, Wildevuur S, Flierman I, Van Schooten B, Tabak M, Hermens H. Trust in telemedicine portals for rehabilitation care: an exploratory focus group study with patients and healthcare professionals. BMC Med Inform Decis Mak. 2016 Jan; 16:11.

22. Ly BA, Bourgeault IL, Labonte R, Niang MN. Physicians' perceptions on the impact of telemedicine on recruitment and retention in underserved areas: a descriptive study in Senegal. Hum Resour Health. 2017; 15:67.

23. Su CJ. Mobile multi-agent based, distributed information platform (MADIP) for wide-area e-health monitoring. Comput Ind. 2008 Jan; 59(1):55-68.

24. Lu C, Hu Y, Xie J, Fu Q, Leigh I, Governor S, Wang G. The use of mobile health applications to improve patient experience: cross-sectional study in chinese public hospitals. JMIR Mhealth Uhealth. 2018 May; 6(5):e126.

25. Waithera L, Muhia J, Songole R. Impact of Electronic Medical Records on Healthcare Delivery in Kisii Teaching and Referral Hospital. Medical & Clinical Reviews. 2017; 3(4):1-7.

26. Kaushal R, Edwards A, Kern LM. Association between electronic health records and health care utilization. Appl Clin Inform. 2015; 6(1):42-55.

27. Charles K, Cannon M, Hall R, Coustasse A. Can utilizing a computerized provider order entry (CPOE) system prevent hospital medical errors and adverse drug events? Perspect Health Inf Manag. 2014 Fall; 11:1b.

28. Pereira AM, Maranhão PA, Silva-Costa T, Cruz-Correia RJ. Impacto da informatização dos registros clínicos obstétricos na produção científica. Anais do 16º Congresso Brasileiro de Informática em Saúde; 2018 Out 01-04; Fortaleza, Brasil. São Paulo: Sociedade Brasileira de Informática em Saúde; 2018.

29. Cazorla LCM, Gaspar JS, Reis ZSN. Avaliação do impacto da informatização dos registros sobre o parto na produção do conhecimento científico, em um hospital universitário. Anais do 15ª Congresso Brasileiro de Informática em Saúde; 2016 Nov 27-30; Goiânia, Brasil. São Paulo: Sociedade Brasileira de Informática em Saúde; 2016.

30. Teixeira JF, Teixeira LF, Fonseca J, Jacinto T. Automatic Analysis of Lung Function Based on Smartphone Recordings. In: Fred A, Gamboa H, Elias D, editors. Biomedical Engineering Systems and Technologies: Biostec 2015. New York: Springer; 2015. 574 vol. p. 390-402.

31. Pinho B, Almeida R, Jácome C, Teixeira JP, Amaral R, Lopes F, Jacinto T, Guedes R, Pereira M, Gonçalves I, Fonseca JA. Automatic Quality Assessment of Smart Device Microphone Spirometry. In: Proceedings of the 8th International Joint Conference on Pervasive and Embedded Computing and Communication Systems (PECCS 2018); 2018; 2018 Jul 29-30; Porto, Portugal. Setúbal: Scitepress; 2018. p. 115-122.

32. Mukhi S, Dhiravani K, Micholson B, Yan L, Hatchard J, Mubareka S, Bergeron C, Beattie T. An innovative mobile data collection technology for public health in a field setting. Online J Public Health Inform. 2018; 10(2):e202.

33. Zeleke AA, Worku AG, Demissie A, Otto-Sobotka F, Wilken M, Lipprandt M, Tilahun B, Rohrig R. Evaluation of electronic and paper-pen data capturing tools for data quality in a public health survey in a health and demographic surveillance site, Ethiopia: randomized controlled crossover health care information technology evaluation. JMIR Mhealth Uhealth. 2019 Feb; 7(2):e10995.

34. Duane S, Tandan M, Murphy AW, Vellinga A. Using mobile phones to collect patient data: lessons learned from the SIMPle study. JMIR Res Protoc. 2017 Apr; 6(4):e61.

35. Lopez D, Torres M, Vélez J, Grullon J, Negron E, Perez CM, Palacios C. Development and evaluation of a nutritional smartphone application for making smart and healthy choices in grocery shopping. Healthc Inform Res. 2017 Jan; 23(1):16-24.

36. Goyal S, Morita P, Lewis GF, Yu C, Seto E, Cafazzo JA. The systematic design of a behavioural mobile health application for the self-management of type 2 Diabetes. Can J Diabetes. 2016 Feb; 40(1):95-104.

37. Pfammatter AF, Mitsos A, Wang S, Hood SH, Spring B. Evaluating and improving recruitment and retention in an mHealth clinical trial: an example of iterating methods during a trial. Mhealth. 2017; 3:49.

38. Kakkar AK, Sarma P, Medhi B. Mhealth technologies in clinical trials: opportunities and challenges. Indian J Pharmac. 2018; 50(3):105-107.

39. Yu SWY, Hill C, Ricks ML, Bennet J, Oriol NE. The scope and impact of mobile health clinics in the United States: a literature review. Int J Equity Health. 2017 Out; 16(1):178.

40. Eastern Research Group. Examination of clinical trial costs and barriers for drug development [Internet]. Washington: U.S. Department of Health and Human Services; 2014. Disponível em: https://aspe.hhs.gov/report/examination-clinical-trial-costs-and-barriers-drug-development.

41. Maranhão PA, Bacelar-Silva GM, Ferreira DGN, Calhau C, Vieira-Marques P, Cruz-Correia RJ. Nutrigenomic information in the openEHR Data Set. Appl Clin Inform. 2018 Jan; 9(1):221-31.

42. Braun M, Brandt AU, Schulz S, Boeker M. Validating archetypes for the multiple sclerosis functional composite. BMC Med Inform Decis Mak. 2014 Aug; 14:64.

43. World Health Organization. Action plan to strengthen the use of evidence, information and research for policy-making in the WHO European Region. Working document from Regional Committee for Europe 66th Session; 2016 Sep 12-15; Copenhagen, Denmark. Copenhagen: World Health Organization; 2016.

44. Freeman P, Robbins A, co-editors. The use and impact of digital technology on population health and health equity gains: a sponsored e-supplement. J Public Health Policy. 2016 Dec; 37(4):399-402.

45. De Pietro C, Francetic I. E-health in Switzerland: The laborious adoption of the federal law on electronic health records (EHR) and health information exchange (HIE) networks. Health Policy. 2018 Feb; 122(2):69-74.

46. Wilson K, Khansa L. Migrating to electronic health record systems: a comparative study between the United States and the United Kingdom. Health Policy. 2018 Nov; 122(11):1232-39.

47. World Health Assembly, 50. Cross-border advertising,promotion and sale of medical products through the Internet. Geneva: World Health Organization; 1997.

48. World Health Organization. Digital Health - Promoting health, far and wide, in the 21st century [Internet]. Geneva: World Health Organization; 2018. Disponível em: https://www.who.int/behealthy/digital-health/promoting-health-in-the-21st-century

49. Rappaport J. Terms of empowerment/exemplars of prevention: toward a theory for community psychology. Am J Community Psychol. 1987 Apr; 15(2):121-48.

50. Sherwin S. No longer patient: Feminist ethics and health care. Philadelphia: Temple Univ Press; 1992.

51. Barr PJ, Scholl I, Bravo P, Faber MJ, Elwyn G, McAllister M. Assessment of patient empowerment - a systematic review of measures. PLoS One. 2015; 10(5):e0126553.

52. Goodyear-Smith F, Buetow S. Power issues in the doctor-patient relationship. Health Care Anal. 2001; 9(4):449-62.

53. Roter D. Empowering patient communication. In: Kahan S, Gielen AC, Fagan PJ, Green L, editors. Health behavior change in populations. Baltimore: Johns Hopkins University Press; 2014. p. 473-484.

54. Calvillo J, Román I, Roa LM. How technology is empowering patients? A literature review. Health Expec. 2015 Oct; 18(5):643-52.

55. Lettieri E, Fumagalli LP, Radaelli G, Bertele P, Vogt J, Hammerschmidt R, Lara JL, Carriazo A, Masella C. Empowering patients through eHealth: a case report of a pan-European project. BMC Health Serv Res. 2015; 15:309.

56. Irizarry T, DeVito Dabbs A, Curran CR. Patient portals and patient engagement: a state of the science review. J Med Internet Res. 2015 Jun; 17(6):e148.

57. Bos L. Patient empowerment: a two Way road. In: Wickramasinghe N, Bali R, Suomi R, Kirn S, editors. Critical issues for the development of sustainable E-health solutions. Boston: Springer; 2012. p. 203-227.

58. Cahill JE, Gilbert MR, Armstrong TS. Personal health records as portal to the electronic medical record. J Neurooncol. 2014 Mar; 117(1):1-6.

59. Chen C, Weider K, Konopka K, Danis M. Incorporation of socioeconomic status indicators into policies for the meaningful use of electronic health records. J Health Care Poor Underserved. 2014 Feb: 25(1):1-16.

60. Bravo P, Edwards A, Barr PJ, Scholl I, Elwyn G, McAllister M. Conceptualising patient empowerment: a mixed methods study. BMC Health Serv Res. 2015; 15:252.

61. Snowdon A, Alessi C, Schnarr K. "It's All About Me": the personalization of health systems. [local desconhecido]: Western University; 2014.

62. Risling T, Martinez J, Young J, Thorp-Froslie N. Evaluating Patient Empowerment in Association With eHealth Technology: Scoping Review. J Med Internet Res. 2017 Sep; 19(9):e329.

63. Cerezo PG, Juvé-Udina M-E, Delgado-Hito P. Concepts and measures of patient empowerment: a comprehensive review. Rev Esc Enferm USP. 2016; 50(4):667-74.

64. World Health Organization. Health 2020: a European policy framework supporting action across government and society for health and well-being. Copenhagen: World Health Organization; c2013.

65. World Health Organization. What is the evidence on effectiveness of empowerment to improve health? Copenhagen: World Health Organization; 2006.

66. European Patients' Forum. Toolkit for Patient Organisations on Patient Empowerment. Brussels: European Patients' Forum; 2017.

67. Komaroff AL. The variability and inaccuracy of medical data. Proceedings IEEE. 1979 Sep; 67(9): 1196-207.

68. Hogan WR, Wagner MM. Accuracy of data in computer-based patient records. J Am Med Inform Assoc. 1997; 4(5):342-55.

69. Cruz-Correia R, Rodrigues PP, Freitas A, Almeida FC, Chen R, Costa-Pereira A. Data quality and integration issues in electronic health records. In: Hristidis V, editor. Information Discovery on Electronic Health Records. [local desconhecido]: CRC Press; 2009. p. 55-95.

70. Cruz-Correia R, Ferreira D, Bacelar G, Marques P, Maranhão P. Personalised medicine challenges: quality of data. Int J Data Sci Anal. 2018; 6(3):251-59.

71. Ferreira A, Cruz-Correia R, Antunes L, Chadwick D. Access control: how can it improve patients' healthcare? Stud Health Technol Inform. 2007; 127:65-76.

72. Guimarães R, Rodrigues P, Santos A, Dinis-Oliveira RJ. Reuse of clinical records for scientific research: legal issues related to the authorization of the holders and anonymisation. Acta Med Port. 2018 Jun; 31(6):4.

73. United States (U.S). Health insurance portability and accountability act of 1996: 104 Public Law [Internet]. Washington, DC: Congress of United States; 1996. Disponivel em:https://www.govinfo.gov/content/pkg/PLAW-104publ191/pdf/PLAW-104publ191.pdf

74. European Union. Directive 95/46/EcC of the European Parliament and of The Council of 24 October 1995, on the protection of individuals with regard to the processing of personal data and on the freemovement of such data [Internet]. Official J Euro Comm. 1995;50(281):31-50.

75. Fernandez-Aleman JL, Señor IC, Lozoya PÁ, Toval A. Security and privacy in electronic health records: a systematic literature review. J Biomed Inform. 2013 Jun; 46(3):541-62.

76. Goncalves-Ferreira D, Leite M, Santos-Pereira C, Correia ME, Antunes L, Cruz-Correia R. HS.Register - An Audit-Trail Tool to Respond to the General Data Protection Regulation (GDPR). Stud Health Technol Inform. 2018; 247:81-85.

77. Li Z, Oprea A. Operational security log analytics for enterprise breach detection. Anais do IEEE Cybersecurity Development (SecDev); 2016 Nov 3-4; Boston: IEEE; 2016: p. 15-22.

78. European Union. Directive (EU) 2016/680 of the European Parliament and of the Council of 27 April [Internet]. [local desconhecido]: European Union; 2016. Disponível em:https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32016L0680 &from=EN.

79. Healthcare Information and Management Systems Society. HIMSS Cybersecurity Survey [Internet]. Chicago: HIMSS, 2018. Disponível em: https://www.himss.org/2018-himss-cybersecurity-survey.

80. National Audit Office. Investigation: WannaCry cyber attack and the NHS [Internet]. London: National Audit Office; 2017. Disponível em: https://www.nao.org.uk/report/investigation-wannacry-cyber-attack-and-the-nhs/.

81. Williams PA, Woodward AJ. Cybersecurity vulnerabilities in medical devices: a complex environment and multifaceted problem. Med Devices. 2015 Jul; 8:305-16.

82. Pussewalage HSG, Oleshchuk VA. Attribute based access control scheme with controlled access delegation for collaborative E-health environments. Presented at IEEE 18th International Conference e-Health Networking, Applications and Services; 2016 Sep 14-17; Munich, Germany. [local desconhecido]: IEEE; 2016. p. 50-64.

83. Moura P, Fazendeio P, Marques P, Ferreira A. SoTRAACE: Socio-technical risk-adaptable access control model. Proceedings from International Carnahan Conference on Security Technology (ICCST); 2017 Oct 23-26; Madrid, Spain. [local desconhecido]: IEEE; 2017.

SECTION 2

USING EHEALTH TECHNOLOGIES AS TOOLS FOR IMPROVING HEALTH CARE

CHAPTER 1

DESIGN AND CREATION OF A VESTIBULAR RE-EDUCATION SUPPORT SYSTEM

Renata Parente de Almeida, José Eurico de Vasconcelos Filho, Carla Marineli Saraiva do Amaral, Erick Tomé de Lima

INTRODUCTION

Dizziness is considered one of the most common symptoms among the vestibular dysfunctions and it includes a variety of body balance sensations and disorders, with vertigo (rotational dizziness) being the most prevalent in the world population[1,2]. Moreover, body imbalance, instability, spatial disorientation, feelings of floating, of fogginess in the head, and feelings of intoxication are also symptoms described in vestibular disorders.

In general, patients with dizziness may show body balance difficulties, which interferes in their quality of life. Negative aspects, including dizziness with physical and functional discomfort, result in conflicts and social embarrassment, fear of physical incapacity or a severe illness and incidence of a greater risk of falls, considered as a relevant aspect in public health[3].

Vestibular re-education (VR), attained through personalized exercises, is very effective in the treatment aimed at restoring balance and alleviating vertigo caused by vestibular dysfunction [4].

Studies have shown that vestibular re-education, performed using a personalized and supervised method, has shown to be an effective therapeutic resource in symptom reduction and eradication, consequently improving individuals' quality of life [5,6]; and the lower the number of symptoms of dizziness and imbalance, the better the quality of life of the individual.

Patients undergoing vestibular re-education have been treated at the Center of Integrated Medical Attention (NAMI) of the University of Fortaleza (UNIFOR – *Universidade de Fortaleza*) since 2005. They are treated by speech-language pathology undergraduate students who are supervised by professors of the area. When analyzing treatment data and the students' evaluations, two problems were identified that required more attention. The first one was related to the difficulty patients or their caregivers have to correctly perform the prescribed home exercises during treatment, or simply remembering the time and/or how frequently to perform them. This difficulty greatly influences treatment, prolonging it or decreasing its effectiveness. The second perceived matter was related to the difficulty that students involved in the care activities had in adequately associating the problems patients reported to the appropriate exercises to be prescribed, very often requiring a professor's support, and in monitoring what the patients did at home.

Access to information in the health area for patients and professionals through digital information and communication technologies has been increasingly more common, especially with the developments in the eHealth research area.

Based on these difficulties experienced by students and patients and on the dissemination of eHealth technologies, we saw an opportunity to create a technology that could help solving the identified problems. Thus, the interdisciplinary project was designed to create a technological tool to support the training of speech-language

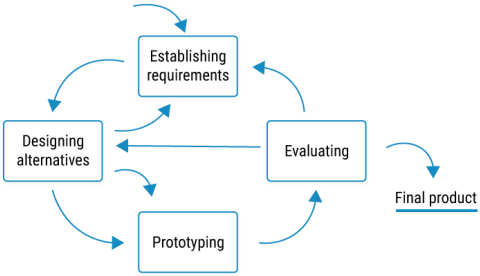
pathology students and to follow-up the treatment of vestibular re-education patients, the ReaV (Vestibular Rehabilitation) system.

The project, started in 2016 in the Technological Innovation Laboratory (InnoLab) of UNIFOR, consisted of a team comprising students and researcher professors in the areas of Speech-Language Pathology, Computer Science and Communication and Marketing. The project includes experimental and applied research, consisting of 4 phases.

The first phase included a literature review in the mHealth and neurotology areas, aiming at a deeper conceptual analysis of the problem, identification of associated studies and the concepts, methodologies and tools of the involved areas. Some tools related to vestibular re-education were identified, but these tools were just informative. No patient-oriented tool or technology was identified aimed at supporting the vestibular re-education treatment or that provided feedback and information to the health professional in charge of the treatment. Considering these findings, the design of a tool that met the proposed objective was justified.

The next step was the design phase of the technological artifact in the laboratory. The Interaction Design [7] was used to develop the tool, because it is focused on the user's needs and allows the active participation of all members of the project team. The Interaction Design contemplates four interactive activities: identifying needs (of users) and establishing requirements (for the system); alternative artifact designs; construction of an interactive version (functional prototype), and evaluation. Figure 1 shows both the association and flow of these activities, where the arrows returning to the previous activities indicate that this activity can be performed again, if necessary. Based on a design, a new requirement can be established, or an already existing requirement can be changed, and the need for a system redesign might be necessary, based on an evaluation (in this case, a usability test).

Figure 1 – Interaction Design [7]



During the first activity, design thinking meetings were held with the project team members and interviews were carried out with students and patients. Initially, the need for two integrated systems was identified: a web system for content management and a user management system (professors, students and patients), prescription and follow-up of patients' activities, and an application for mobile devices to support home treatment for the patients.

The main requirements for the web system were identified as the following:

- system access control through user ID and password authentication;
- management of trainee students;
- patient management (where anamnesis completion would be required);
- recording of patients' therapies;
- presentation of a vestibular re-education exercise library, with the respective descriptions and videos explaining their performance;
- history of patient treatment.

The main requisites for the app were identified as the following:

- app access control through the authentication of the medical record number and password;
- visualization of the description and an example video of each prescribed activity;
- notification warning that appears at the time chosen by the patient, reminding him/her to perform the exercises;
- patients' feedback input after performing the exercises at home.

Additionally, the web system also has an administrator user, in charge of managing all users, including professors, and the information found in the system.

Students will be able to register in the system, indicating who is the professor in charge of their class, and will only have access after this professor approves their registration. Subsequently, the students will have access to a library of vestibular re-education exercises provided by the professors, aiming to assist them in the creation of a treatment plan for the patient assigned to them.

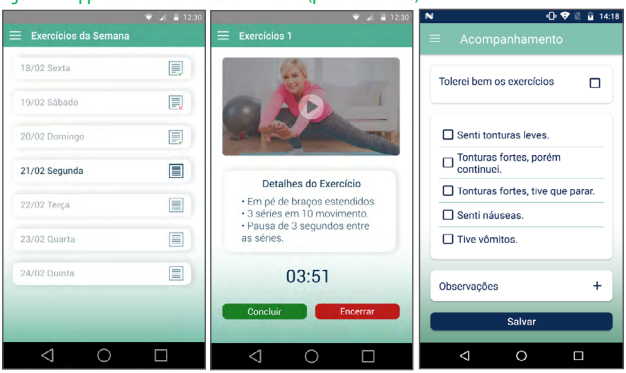
This library can also be used as study material and to help them solve clinical cases on the web system (exercises that are assigned by their professors to be solved within a timeframe determined by them), to further learning activities. The students can also record the anamnesis, the Dizziness Handicap Inventory (DHI) – a questionnaire that assesses the self-perception of the incapacitating effects caused by dizziness – and their patients' therapies, as well as follow the vestibular re-education sessions performed by patients at home.

Registered professors will be able to perform the same actions as the students concerning the patients. Furthermore, they will manage their classes, accepting or excluding students' registers, registering patients in the system and assigning them to a student, adding new exercises to the library, determining clinical cases to be solved by the

students, and monitoring their performance in creating therapies. Any inappropriate record made by a student regarding patient information can only be corrected by their advisor or system administrator.

Finally, patient users can have access to the app through an Android smartphone, which will help them with videos and detailed explanations (such as number of series, intervals and other observations) about the exercises selected to be performed at home. The patients will always have access only to the exercises to be performed on the current day, and they can indicate how they felt during the exercise (Figure 2).

Figure 2 – Application screen shots for Android (patient exercise)

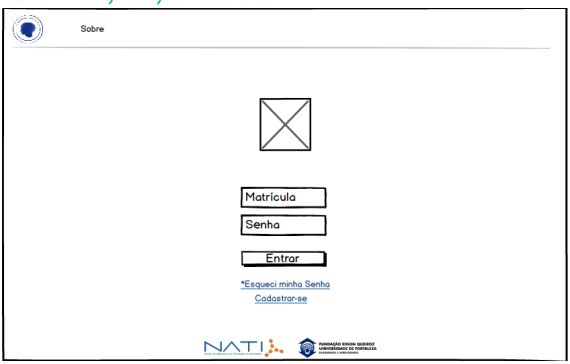


Source: Created by the project team

After these requisites were established, the design and redesign were carried out. During this phase, low-fidelity screens were created, with few details and visually presenting the functionality, whereas the high-fidelity screens faithfully represent what the system will look like after its implementation. Figures 3, 4 and 5 show the low-fidelity and high-fidelity system access screens for both the web

system and the Android application. Both prototypes were respectively evaluated and validated by the multidisciplinary team of the project and, subsequently, an interactive version was created.

Figure 3 - Low-fidelity web system screen shot



Source: Created by the project team

Figure 4 – High-fidelity web system screen shot

Source: Created by the project team

Figure 5 – Low-fidelity and high-fidelity screen shots of the Android application

Source: Created by the project team

Interactive prototypes can be created using tools such as Marvel[1] and Figma[2], which can promote interactivity between high-fidelity screens, or through system implementation, either as a whole or just what is necessary for the evaluation. In the case of ReaV, we chose to start with the web system implementation, aiming to evaluate the functionalities regarding professors and students. Ruby on Rails[3] framework, HTML5[4] and CSS3[5] were used to create this prototype.

After the prototype was finalized and validated by the team, preparations for usability tests were initiated. These tests focus on assessing the quality of interactions established between the users

1 https://marvelapp.com/
2 https://www.figma.com/
3 https://rubyonrails.org/
4 https://developer.mozilla.org/pt-BR/docs/Web/HTML/HTML5
5 https://developer.mozilla.org/en-US/docs/Web/CSS/CSS3

and the system. The objective is to verify usability problems due to an ergonomic nonconformity (which can prevent task performance or decrease their performance), measure their negative impact on the interactions and identify the possible causes in the interface[8].

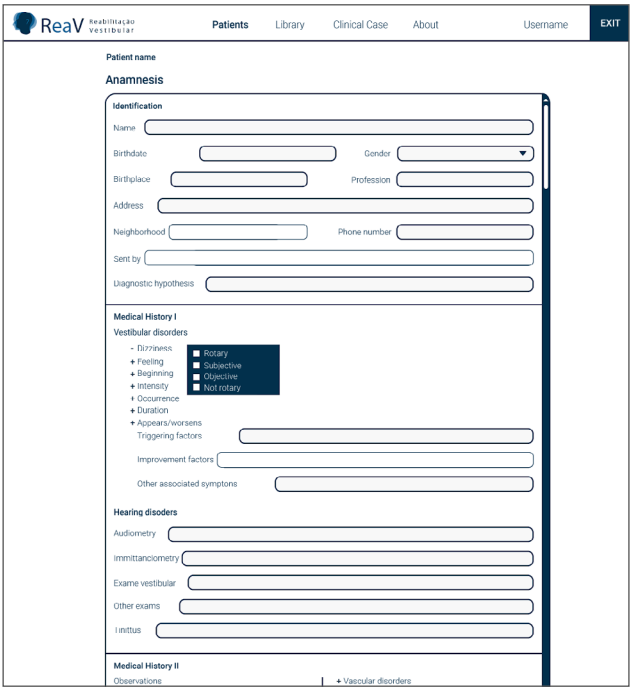
A group of 10 students and a group of 10 professors were invited to perform specific tasks through scenarios created by the project team that simulated the use of the main system functionalities. The research project was submitted to and approved by the Human Research Ethics Committee of UNIFOR (*Coética*). During the test, each user was accompanied by a monitor that recorded the time and number of clicks required to perform each task, as well as users' expressions during the performance. After that, each user was asked to answer a post-test questionnaire, where they could explicitly indicate the positive points of the system and suggest improvements.

With the data obtained through the tests, the team returned to the project to redesign some of the screens, to make it both more aesthetically pleasing and user-friendly. Figures 6 and 7 show the "Patient Anamnesis Record" screen, before and after the redesign, respectively.

Figure 6 – High-fidelity screen shot of "Patient Anamnesis Record"

Source: Created by the project team

Figure 7 – High-fidelity screen shot after redesign of the "Patient anamnesis record".



Source: Created by the project team

The ReaV web system is being used at UNIFOR by the disciplines of Auditory Disorder Interventions and Speech-Language Pathology classes since the second semester of 2018. The students reported that the web system helped in learning, giving the students more information about the content addressed in class. Another important point described by the students was having access to anamnesis and the DHI questionnaire at any time, enabling the creation

of exercises for vestibular re-education.

The team's next step was to complete the implementation of the Android application and test it with NAMI patients. In the beginning of 2019, the ReaV application was made available in the Play Store[6], where patients can download it to their smartphones.

We are currently using ReaV in patients' smartphones for vestibular re-education. The patients described how easy it is to use the tool and perform the exercises at home.

The ReaV allows the contents of vestibular re-education and the prescription of exercises and follow-up of the patients undergoing treatment to be consulted by digital and remote means. The bibliographical search has shown us that other institutions possibly have professionals and patients going through the same difficulties that ReaV proposes to attenuate. Moreover, these same problems can also be found in the most diverse areas of health care that include home exercises. ReaV can be seen as a precursor in this field, serving as a model for other institutions and/or areas to use eHealth for health promotion, and even ReaV itself may in the future open its doors to assist them with these difficulties.

REFERENCES

1. Konnur MK. Vertigo and vestibular rehabilitation. J Postgrad Med. 2000; 46(3):222-3.
2. Blakley BW, Goebel J. The meaning of the word vertigo. Otolaryngol Head Neck Surg. 2001 Sep; 125(3):147-50.
3. Moreira DA, Bohlsen YA, Momensohn-Santos TM, Cherunini AA. Estudo do handicap em pacientes com queixas de tontura, associada ou não ao sintoma do zumbido. Arq Int Otorrinolaringol. 2006; 10(4):270-7.

6 https://play.google.com/store/apps/details?id=unifor.br.reav

4. Garcia FV, Borges NF, Benzinho TA. Reeducação vestibular. In: Maia FCZ, Albernaz PLM, Carmona, S. Otoneurologia atual. Rio de Janeiro: Revinter; 2014. p. 501-533.
5. Nishino LK, Ganança CF, Manso A, Campos CAH, Korn GP. Reabilitação Vestibular Personalizada: Levantamento de prontuários dos pacientes atendidos no ambulatório de otoneurologia da ISCMSP. Rev Bras Otorrinolaringol. 2005; 71(4): 440-7.
6. Rocha PR Jr, Kozan ES, Moraes JFe, Pereira FG, Moreno AB. Reabilitação vestibular na qualidade de vida e sintomatologia de tontura de idosos. Ciênc Saúde Colet. 2014; 19(08): 3364-74.
7. Preece J, Rogers Y, Sharp H. Design de interação: além da interação homem-computador. 3a ed. Porto Alegre: Bookman; 2013.
8. Cybis W, Betiol AH, Faust R. Ergonomia e usabilidade: conhecimentos, métodos e aplicações. São Paulo: Novatec; 2007.

CHAPTER 2

DEVELOPMENT OF COMPETENCIES AND SKILLS THROUGH THE CREATION AND PROTOTYPING OF HEALTH APPLICATIONS

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INTRODUCTION

The teaching-learning process has gone through dramatic changes in recent years, resulting from the decentralization of exclusive knowledge of teachers/professors, strengthening students' empowerment and the development and use of more interactive and dynamic educational resources, and highlighting technological innovations [1]. Among these resources, digital technologies of information and communication stand out, which are capable of improving knowledge acquisition, connecting people, facilitating processes, standardizing languages, and being increasingly present in contemporary education.

Nursing informatics produces qualified and updated professional development, because it helps nurses in clinical decision-making with the use of new education technologies. Professors' performance must transform these technologies in educational tools ca-

pable of developing applications[2] The subject matter of this article focuses on recognizing the usefulness of technology in health in the context of a curriculum with modular structure, which requires investment in diversified educational environments. The literature shows that the use of technologies in health, such as applications, by students, generates a satisfactory and positive impact on learning, and enables implementing care with greater safety to the patient and future professional[3].

Currently and historically, the Nossa Senhora das Graças Nursing College of the University of Pernambuco (FENSG-UPE) is a reference in the state of Pernambuco - Brazil for qualifying health professionals from several municipalities. In 2006, FENSG-UPE participated in the Pró-Saúde project, which allowed upgrading skills, abilities and behavior of faculty and students, redefining logical and academic concepts from its history, thus building the Political Pedagogical Project of the Nursing Course (PPC).

This was based on theoretical reference in order to support the care process, the activities of health promotion, protection and recovery, a description of the health picture, the management of health systems and services, research and technological innovation. Graduates of this new curriculum must have a generalist, critical, reflective and ethical training, be technically able to intervene and contribute to the construction of knowledge, and be able to act: (a) in diseases of specific occurrence in his/her geopolitical space; b) in health programs developed by the municipality; (c) in the specialist assistances of the hospital network, including health management.

For this reason, the curricular reorganization and reorientation of professional training of FENSG-UPE sought pedagogical concepts that were capable of breaking with the traditional structure of education, enabling the transformation of relations between professors and students, and between them and the spaces of teaching and

learning, intensifying the institution's interaction with other sectors of society, seeking closer ties with community health needs. Based on the curricular guidelines, the proposed training entered into commitments with the real life of society, based on skills and abilities that come from the elaboration of community health diagnosis. In order to articulate contents in a perspective of knowledge construction, it distributed in 10 modules comprised of Thematic Units; whereas Health Informatics is transversal to all modules, with the objective of knowing and applying active methodologies and digital platforms that support the development of knowledge and skills in a constructivist way. It counts on the support of a virtual learning environment (VLE) in the development of the activities that are integrated into the thematic content of each module of the course.

FENSG-UPE, seeking to meet the demand for qualification of education, has been investing in new learning technologies with the purpose of integrating the Health Informatics Thematic Unit in the training of nursing professionals. Thus, it created a space-time of significant learning, where the following question emerged: How to conduct nursing graduate students to develop digital technology solutions for health promotion? What are the most suitable methods and techniques for this pedagogical challenge?

This chapter aims to report the experience of a group of professors from FENSG-UPE in the implementation of the health informatics thematic unit, seeking the development of competencies and skills through the creation and prototyping of health applications.

METHODS

An experience report was carried out in the Bachelor's Degree Course in Nursing of the Nossa Senhora das Graças Nursing College of the University of Pernambuco (FENSG-UPE), in the city of

Recife, Pernambuco, Brazil. The activity has occurred since 2016 resulting from the Module Completion Work (MCW) of the seventh course module.

The practice of teaching was fostered by initiatives such as "Hour of Code" [4] with the purpose of demystifying computational programming and showing that anyone can learn the basics and expand their participation in this science area. As well as the initiative "Hackday of Applications Marathon of FIAP - Google", of the College of Informatics and Administration of São Paulo – FIAP[5], which, in 3 days, lead middle school students to develop applications for solving educational problems they deal with daily. Some applications for health promotion awakened our inspiration, such as: Xô Aedes of Novetech - Technological Solutions LTDA (2018) and Drink Water, offered by Leap Fitness Group [6,7].

We shared that concern to professors and students from the seventh course module, which is entitled "The health of adults and elders", in the form of a challenge to be overcome during the semester: Ideation and prototyping of digital applications for the empowerment of the population in health matters through the Internet or mobile devices.

We sought support in the approach of Project-Based Learning[8], involving teams of students in the resolution of health issues in the contexts in which they work, providing other meanings to academic contents.

Using the PBL in the teaching and learning process of the health informatics thematic unit (HITU), we developed an educational environment in which teams delivered products at each stage of the creative process, and carried out investigations guided by the theoretical reference of themes, defending their idea of the prototype and the final version of the prototype.

The virtual learning environment (VLE) used by the course was the Modular Object-Oriented Distance Learning (Moodle), which provided the material of the HITU and the monitoring of students through the posting of products.

Class planning was performed at the beginning of each semester with the presence of the coordinator, other professors of the module and the thematic unit. The students were divided into groups of 5 or 6 students, following the formation used for practical classes, in order to develop prototypes of applications with themes of health assistance in the area of urgency, emergency, pre-hospital care, intensive care unit, and elderly person health. Applications on each theme were defined by the group with its tutor, a specialist professor in the module. This tutoring supported the theoretical foundation of the module completion work (MCW), the development of digital applications and the evaluation of the outcome.

Design Thinking methodology was chosen in order to guide the creative and productive processes of technological projects, considering the number of 12 lessons (4 hours) available to the HITU for preparation of students in the design and development of applications.

The term Design Thinking (DT) is used by Tim Brown[9] to describe "a set of principles that can be applied by various people for a wide variety of problems". These principles operate in one of two ways: "The first role is tactical; it is based on what already exists and, in general, takes a step forward. The latter is strategic; takes the 'design' of the studio and releases its disruptive potential, its ability to change the game".

The initial lessons were carried out in the classroom with the entire group in the form of workshops, and students were instructed on the implementation of this methodology in their projects, following the steps and techniques suggested in the book Design Thinking - Business Innovation[10]:

- Immersion - divided into two stages: Preliminary and In-Depth. The first one aims at the re-framing and initial understanding of the problem, while the second intends to identify needs and opportunities that will guide the generation of solutions in the next phase of the project, Ideation. After immersion, collected data were analyzed, crossing information in order to identify patterns and opportunities. Then, they were visually synthesized in order to provide inputs to the stage of Ideation. During this step, the students researched at national and international databases for the theoretical basis of the work.
- Ideation - this phase aims to generate innovative ideas for the project theme and, for this reason, the tools of synthesis created in the analysis phase were used to stimulate creativity and generate solutions according to the context of the subject at work. Starting with "Brainstorming" in the classroom and going up to low-level prototyping - in our experience it was a stencil of the screen, a "smartphone" printed on paper, where the students drew application components and mapped the browsability and usability. Performing part of the prototyping at this stage was an adaptation of the process due to restrictions of the class schedule.
- Prototyping - the step to make ideas tangible, the passage from the abstract to physical means to represent reality - even if simplified - and provide validations. It is an instrument of learning, being an agile way of abandoning alternatives that are not well received and, therefore, assisting in the identification of a more assertive final solution. In our case, the prototypes on paper were translated into digital prototypes ("storyboard" in Power Point), as a milestone for the validation of the idea, before starting the programming of the application with the Thunkable tool [11].

Thunkable is an integrated development environment (IDE) that provides the creation of applications for "smartphones" by visual programming; i.e., interactivity and application logic are constructed by dragging visual elements on a (simulated) "smartphone" screen. This procedure is performed without using any programming language syntax.

In classes held in the computer laboratory, Thunkable Classic version was used, which derives from the MIT App Inventor[12], an initiative led by Professor Hal Abelson, who stands at the core of an international movement of inventors and conducts research about its impacts. A main team keeps the development environment of free online applications, which serves more than 6 million registered users.

We chose Thunkable due to the improvements incorporated in some visual components, and in Thunkable X, we can create apps for iOS and Android platforms. In addition to the programming tool, students are supported with classes demonstrating the use of Thunkable, as well as tutorials available in the virtual environment (http://moodle.upe.br/fensg/) of the Module, and with support of HITU teaching assistants.

The students, in groups, coded and tested their applications on their mobile devices. This was the high-fidelity prototyping of Design Thinking methodology. At the end of this step, the applications were installed on mobile devices of the members of the groups for demonstration and "tasting" of applications during the presentation of the MCW.

The results were presented in the classroom with the presence of the tutor, professors of the thematic unit, and all of the students. For evaluation, a form with scores for each item was used: title, introduction, objective, methodology, results, discussion, conclusion, references.

RESULTS AND DISCUSSION

Each semester contemplated the production of an average of seven applications covering the module themes: Urgency and Emergency, ICU, Epidemiology and Elderly Person Health, in the timeframe from 2016 to 2018. For a detailed description of these results, the following table shows 18 prototypes of applications.

Table 1 – Description of the applications produced in the theme of Urgency and Emergency, characterized by name, objective and main technical characteristics. Recife, 2019.

Title	Objective	Main technical characteristics
Quiz Primeiros Socorros	To present first-aid instructions in an interactive way in emergency situations.	Game-format quiz. Score page. Curiosities page. Page with links for videos on first-aid
Salvar vidas é para todos	To guide which service (SAMU or FIRE DEPARTMENT) should be called according to the emergency situation.	To guide which service (SAMU or FIRE DEPARTMENT) should be called according to the emergency situation.
Samuflex	To build a direct communication tool with SAMU that can aid the assistance provided to victims of accidents or health problems from useful information made available by the user through the application.	Image captured by cell phone camera. Geographical coordinates of the place obtained by the GPS of the cell phone. Information about the victim's situation by filling in an electronic form. Indication of the location of victims' apparent injuries. Information sent by email or similar channel.
SOS infarto	To guide the untrained population in the search for early care by the geographical area in case of suggestive signs of acute myocardial infarction	Button to call SAMU on the homepage. Checklist page of symptoms with notification of providences. Instructional video page for resuscitation. Page with route to the nearest health service unit.

Com-Pressão não se brinca	Monitoring of users' arterial blood pressure	Information on personal and clinical data in the detection of Hypertension (such as age, race, weight, BMI, etc.). Arterial blood pressure monitoring data using a calendar. Reminder of medication time. Guidance on the disease.
Entalou, e agora?	To promote knowledge to the deaf public about upper airway clearance	Video guide pages with a BSL interpreter.
SOS Kids	To transmit necessary information to parents and guardians about childhood accidents	Educational content on residential risks.

Source: The authors.

Frame 2 – Description of the applications produced in the theme of intensive care unit, characterized by name, objective and main technical characteristics. Recife, 2019.

Title	Objective	Main technical characteristics
APACHE II	Measure the APACHE II Scale in the Intensive Care Unit	
UTI 28	To measure the degree of dependency of critically ill patients and the time of nursing care based on therapeutic intervention scoring system instrument	TISS 28 standard checklist page. Patient severity rating button. Button to calculate patient care time dedication.

Source: The authors.

Frame 3 – Description of the applications produced in the theme of Epidemiology, characterized by name, objective and main technical characteristics. Recife, 2019.

Title	Objective	Main technical characteristics
Escolas sem barbeiros	To communicate possible outbreaks of vectors of Chagas Disease; guide on the vector (triatomine), Chagas disease and how to prevent contamination; to account for cases of triatomines ("barber beetles") in schools.	Registration of educational establishment. Image captured by the cell phone camera of the suspect insect. Photo sent for contact of the health surveillance specialist. Information pages on prophylaxis on Chagas disease.
Ipositivo	Support adherence to HIV/ AIDS seropositive treatment	Reminder of medication schedule (polypharmacy); vaccination schedule (dose interval); dates of consultations; and record of the TCD4 score
InfoApp	To facilitate information and reduce the incidence of accidents involving venomous animals in the city	Pages with information and tips. Page with indication of georeferenced points of service.
VigilaApp	To assist the health professionals of Family Health Units in the epidemiological monitoring of the community	"Login" page. Mapping page of the health risk situation in the territory. Patient registration page. Page with graphs of diseases registered in the territory.
Se Liga na TB	To support users in the follow-up of tuberculosis treatment	Access login page. Registration of the patient under treatment. Information page about the disease. Medication calendar. Medication monitoring record. Links to useful information about the disease.

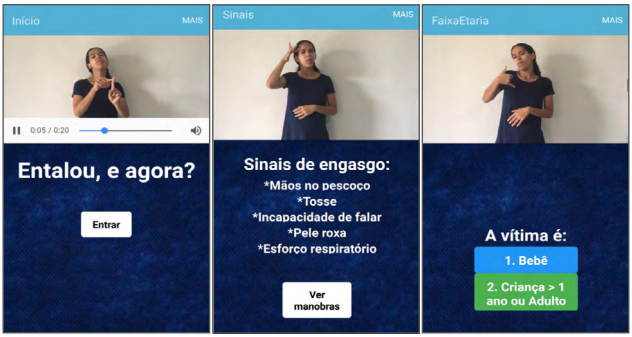
Source: The authors.

Frame 4: Description of the applications produced in the theme of Elderly Person Health, characterized the name, objective and main technical characteristics. Recife, 2019.

Title	Objective	Main technical characteristics
S!nal!ze	To warn the user when reporting violence against elderly persons	Checklist pages on signs of violence. Guidance page for reporting.
IAM em idoso	To guide on first aid for acute myocardial infarction in elderly persons	Sharp, larger-than-usual display. Action button with direct call to SAMU. Menu with: AMI concept and the main signs and symptoms; Checklist of symptoms; current location of the user so he/she can inform the rescue team and visualize some nearby first aid, and CPR guidelines for any layman who is witnesses the occurrence so that he/she can perform first aid properly.
InfoIdoso(a)	To assist in the care to the elderly person	Registration of the elderly person. Skin care registration page. Image capture of skin lesion with the camera of the cell phone. Record of performed medications.
Paraquedas	To guide elders, caregivers and family on preventive measures to reduce falls in the home environment	Pages with illustrative images and texts of tips for adaptation of rooms

Source: The authors.

Figure 1 – Images of the screens of the application Entalou, e agora? Recife, 2019.

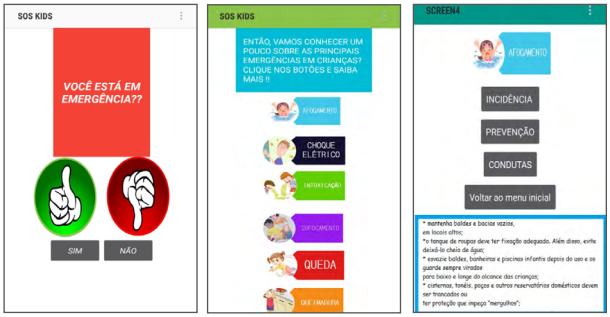


Source: The authors.

Figure 2 – Images of the screens of the application InfoApp. Recife, 2019.

Source: The authors.

Figure 3 - Images of the screens of the application SOS Kids. Recife, 2019.



Source: The authors.

Figure 4 – Images of the screens of the application Paraquedas. Recife, 2019.

Source: The authors.

The greater impact resulting from the use of the platform was in providing the opportunity for nursing students to associate their technical-scientific knowledge with computerization in health, in order to disseminate important guidelines in different situations. The development of applications, by Thematic Unit, has motivated and

approached professors and students of the course as a new perspective on the use of technology in health. The decision to use computer knowledge as a cross-sectional unit in the course emerged from the need to meet innovative trends for the training of nurses, provided for in the national curricular guidelines. However, this experience has been challenging, since FENSG-UPE is one of oldest nursing schools in Brazil, with 74 years of history; thus being necessary to substantially transform the teaching practice for performance in contexts of interdisciplinary pedagogical projects.

Throughout the semesters, the contents of informatics improved, bringing students greater clarity and the intention to "create" a technological tool whose product could subsidize the care for a person, family and community. This pedagogical practice makes the student a protagonist of his/her learning, with active participation in the development of models, processes and systems that may impact the nursing area. Therefore, experience has provided students the opportunity to build competences, not only in the incentive to clinical reasoning, but also ethical, communicative and political thinking that provide decision-making that speaks to the paradigms of the profession and the desire of health as people's right.

According to Tomazini and collaborators[13], the use of digital resources as interactive exercises, games and simulation can contribute to the construction of knowledge and confidence, in a dynamic and fun way, and encourages the participant to deal with the challenges that emerge from the scenarios of the professional practice, and thus, to imagine strategies that promote changes in reality. The valuation of these activities integrated into the curriculum allows the promotion of dialogs with different fields of knowledge and strengthens the interdisciplinary role in the teaching-learning process, regarding the complexity that surrounds the health-disease-care system[14].

For the technological area, health users and professionals represent a growing consumer audience of mobile technology, which is no different when it comes to using new tools for healthcare. In the study of Silva et al.[15], for example, the mobile technologies in the nursing area, applied to patients, focused on empowering them on their health, self-care and frequent monitoring of changes in their health conditions, complementing the nursing care process.

The ideation process of applications and games have common characteristics, focusing on both professionals' and users' demands, namely: increasing people's capacity of self-care, quality of life, prevention of accidents and violence, strengthening of healthy environments and interpersonal relations in different life scenarios, as well as qualification in health professionals' actions in urgency and emergency situations that require preparation and clinical-educational competence. Other applications focused on assisting users in access to some services provided by the healthcare network of the UHS, at primary, secondary and tertiary levels. As for the scenarios used for the applicability of the tool, students' focus ranged from school and family environments, which represent significant spaces for human development, all the way to scenarios of professional activity linked to the health care system.

The clinical recommendations and educational guidance provided by applications were based on clinical protocols or guidelines of the main policies of the Ministry of Health, because the students were conducted not only to work the usability and accessibility of the application, but also to provide scientifically based information.

The development of applications provided students with a new scenario for the teaching-learning process, articulating interdisciplinary knowledge to play into the production of knowledge committed to professional autonomy, creativity, innovation and the need to better qualify the processes of nursing and health care. Moreover,

the experience allowed the improvement of nursing students' training, which, when bringing theory and practice together, awakened them to the interest in seeking solutions to the various situations that demand care from the real world, i.e., the possibilities of care through technology.

To do so, health professionals must acknowledge that, currently, digital spaces and the use of mobile technology can be an area of health care production, being useful in educational practice, because it contributes to learning, mediates accessibility to health services, and allows working people's interest and interactivity on issues related to their life [16]. In a study conducted by Mendez et al.[17], the authors developed an educational mobile application for patients diagnosed with peripheral arterial disease, which showed potential to improve outcomes among those living with chronic diseases by means of surveillance of risk factors, stimulation of the patient's co-participation in his/her treatment and family participation, as well as stimulating health care. These elements were also covered by students during the design and development phase of applications in graduation.

In the clinical area, mobile applications have aroused the interest to assist in decision-making processes, quality and care safety. Particularly, nursing professionals have been improving research in the care management area through the development of technologies that may impact the work process, without losing sight of the patients' needs and the technological advances achieved[18].

An interesting point about this academic experience was that students relied on the technological tool to develop educational strategies in the context of meaningful learning, awareness, valuation of popular knowledge, exchange of information combined with new knowledge, and the update of technical-scientific knowledge in the nurses' environment. The experience has evolved and increased

the interest of professors and students, which generated the need for increasing research lines in the postgraduate course of the University of Pernambuco, with the aim of expanding the knowledge produced and acknowledge young researchers in the potential to act in the field. As mentioned by Santos et al.[19], investing in this process is of vital importance, so that one can receive the support from researchers, professors and students in the process of innovation in teaching in the health area.

The experience has benefited not only the students' learning, but also changed the professor-student relationship, which, collectively, has struggled to integrate computer knowledge and identify areas of intersection with the nursing care. The technical and functional quality of applications has been assessed by professors of informatics in health and of the course module, allowing verification of the improvement of items such as design, functionality, language, usability, portability, with the development of an evaluation sheet.

The next step of the experience is to seek partnerships with companies in the industry, which has already been initiated through the participation of developers in computer classes. There are many challenges, but the creative pedagogical possibilities were opened, and every moment has mobilized professors, students and coordinators/managers of the course in a collaborative work that induces advanced nursing practices, consistent with the population's health needs.

In the research field, students have become interested in developing their course completion works with the proposal of implementing and evaluating, with judges, some of the applications used, aiming to assess the impact of this digital feature in the clinical-assistance and public health programs and practices. This is an initiative that will be encouraged in future works, which will be able to count on the support of the Group of Research in Health Informatics (GPIS - Grupo de Pesquisa em Informática em Saúde) of UPE.

CONCLUSION

The development of applications in graduation course represents an ally in the teaching-learning process, directing competences and skills to advanced practices of health and nursing, and represents a clear objective tool, which allows the student to be the protagonists in the construction of knowledge. In addition, it leads to students' motivation and engagement to think about viable solutions to the problems arising from the real world and professional routine.

The digital resources developed in class show potential for the strengthening of humanized health practices, grounded in the principles of integrality and interdisciplinarity, and the commitment to health promotion in different scenarios of health and nursing care. Finally, the opening of health to digital technologies provides reflections on new features and/or care models, considering the complexity that involves human care, a healthcare work process marked by challenges in working conditions, and the need to qualify policies and practices.

REFERENCES

1. Okada A, Barros DMV. Ambientes virtuais de aprendizagem aberta: bases para uma nova tendência. Reva Digit Tecnol Cogn. 2010; (3):20-35.
2. Azevedo NPG, Bernardino FM Jr, Daróz, EP. O professor e as novas tecnologias na perspectiva da análise do discurso: (des) encontros em sala de aula. Ling (Dis)curso. 2014; 14(1):15-27.
3. Pereira FGF, Caetano JA, Frota NM, Silva MG. Use of digital applications in the medicament calculation education for nursing. Invest Educ Enferm. 2016; 34 (2):297-304.
4. Code.org. Hour of code [Internet]. Seattle: Code.org; 2019 [citado em 2019 mar. 23]. Disponível em: https://hourofcode.com/br.

5. Faculdade de Informática e Administração Paulista. Primeiro HACK-DAY da Maratona de Aplicativos FIAP –GOOGLE [Internet]. São Paulo: FIAP; [atualizado em 2015 ago. 15; citado em 2019 mar. 23]. Disponível em: https://www.fiap.com.br/2015/08/15/primeiro-hackday-da-maratona-de-aplicativos-fiap-google-2015-acontece-com-sucesso.

6. Novetech. Xô Aedes [Internet]. João Pessoa: Novetech; [atualizado em 2018 jun. 21; citado em 2019 mar. 23]. Disponível em: https://play.google.com/store/apps/details?id=br.com .novetech.xoaedes&hl=pt_BR.

7. Leap Fitness Group. Water drink reminder [Internet]. [local desconhecido]: Leap Fitness Group; [atualizado 2019 mar. 8; citado em 2019 mar. 23]. Disponível em: https://play.google.com/store/apps/details?id=com.northpark.drinkwater&hl=pt_BR.

8. Buck Institute for Education. Aprendizagem baseada em projetos: guia para professores de ensino fundamental e médio. 2a ed. São Paulo: Artmed; 2008.

9. Brown T. Ideo design thinking [internet]. [Local desconhecido]; [citado em 2019 mar 23]. 2019]. Disponível em: https://designthinking.ideo.com/.

10. Vianna M, Vianna Y, Adler IK, Lucena B, Russo B. Design thinking: inovação em negócios [Internet]. Rio de Janeiro: MJV Press; 2012 [citado em 20149 mar. 23]. Disponível em: http://www.livrodesignthinking.com.br/.

11. Thunkable. Learn computer science concepts [Internet]. [local desconhecido: editor desconhecido], c2019 [citado em 2019 mar. 23]. Disponível em: https://edu.thunkable.com/#/.

12. Massachusetts Institute of Technology. MIT APP inventor: about us [Internet]. Cambridge: MIT; c2012-2019 [citado em 2049 mar. 23]. Disponível em: http://appinventor.mit.edu/about-us.

13. Tomazini EAS, Tobase L, Teodoro SV, Peres HHC, Almeida DM, Alavarce DC. Curso on-line sobre suporte avançado de vida em parada cardiorrespiratória: inovação para educação permanente. Rene. 2018; 19:e32444.

14. Monteiro EMLM, Azevedo IGB, Veríssimo AVR, Silva ARS, Dourado CARO, Brandão W Neto. Interfaz entre formación en enfermería y actividades artístico-culturales en el espacio académico: visión de los estudiantes. Enferm universitária. 2016; 13(2): 90-8.

15. Silva AMA, Mascarenhas VHA, Araújo SNM, Machado RS, Santos AMR, Andrade EMLR. Tecnologias móveis na área de Enfermagem. Rev Bras Enferm. 2018; 71(5):2570-78.

16. Aragão JMN, Gubert FA, Torres RAM, Silva ASR, Vieira NFC. The use of Facebook in health education: perceptions of adolescent students. Rev Bras Enferm. 2018; 71(2): 265-71.

17. Mendez CB, Salum NC, Junkes, C, Amante LN, Mendez CML. Aplicativo móvel educativo e de follow up para pacientes com doença arterial periférica. Rev Latino-Am Enferm. 2019; 27: e3122.

18. Mello GRD, Erdmann AL, Magalhães ALP. Sepsiscare: avaliação de aplicativo móvel no cuidado de enfermagem ao paciente com sepse. Cogitare Enferm. 2018: 23(2): e52283.

19. Santos CA, Souza VD Jr., Lanza FF, Lacerda AJ, Jorge, BM, Mendes IAC. Jogos sérios em ambiente virtual para ensino-aprendizagem na saúde. Rene. 2017; 18(5):702-9.

CHAPTER 3

EXPHOBIA: DEVELOPMENT OF THE PROTOTYPE FOR TREATMENT OF ARACHNOPHOBIC STIMULUS WITH AUGMENTED REALITY

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INTRODUCTION

According to the World Health Organization[1], approximately 264 million people live with Anxiety Disorders worldwide, corresponding to an increase of 14.9% since 2005, which is also due to growing and aging populations. Brazil is the country with the highest prevalence of this type of disorder, with 9.3% of the population affected, i.e., 18.6 million people.

Anxiety disorders, based on DSM-V[2], are differentiated from adaptive anxiety or fear because they persist beyond regular time and are excessive; in other words, they are disproportionate to reality, occurring with a frequency greater than expected and often compromising the quality of life of the individual. Phobias are considered a type of anxiety disorder and one of its subdivisions include specific phobias. Approximately 40% of specific phobias belong to the category of insects (such as spiders), snakes, rats or bats[3]. Arach-

nophobia reflects a part of the specific phobias and corresponds to the disproportionate and excessive fear of spiders. These exaggerated fears, whether of spiders, snakes, or even heights, can become so overwhelming that they interfere with the person's daily life[4].

According to Zamignani and Banaco[5] and with most of the current literature on the subject, from an analytic-behavioral perspective, the behavioral pattern characteristic of anxiety disorders is phobic avoidance, that is, the individual will emit a response that softens, defers or eliminates (escapes / dodges) an aversive event, that is, a threatening or uncomfortable event.

Treatment for anxiety is usually performed with psychological, pharmacological or both interventions, but drug use is not always necessary[6]. Within psychology, some techniques can be used so that anxiety disorder or, more specifically, exacerbated and irrational fear (phobia) can be minimized or eliminated. Among the possible strategies, systematic desensitization (SD) is a very effective procedure for the treatment of specific phobias. It has been proven in several studies, such as those shown in the literature review by Turner [7]. SD was the first psychotherapeutic technique whose procedures were so explicit that it allowed a controlled evaluation of its efficacy [8].

Systematic desensitization is an intervention that aims to eliminate fear and avoidance syndromes through procedures that include a gradual exposure to fear-provoking stimulus [9]. This gradual exposure procedure was initially developed by Wolpe [10] and it comprises several steps such as the application of an anxiety scale, elaboration of a hierarchical scale of fears, relaxation training, and the combination of exposure, whether imaginative or *in vivo*. This type of exposure, while having many advantages, also has its limitations in clinical application because the therapist can lose control over several variables, such as the real element present and the environment that needs to be recreated. The therapist also has no way of ensuring

patient safety - such as animal phobia - and depending on the type of phobia, it can be an expensive treatment - such as fear of flying [11,12].

However, technological advances have provided new possibilities and benefits in the use of high technology in the field of mental health (MH), contributing favorably to new forms of interaction[13]. Among the developed technologies, some stand out as a handy tool for psychologists in interventions to treat specific phobias, which are virtual reality (VR) and Augmented Reality (AR)[14].

Studies suggest the efficacy of VR and AR in the treatment of specific phobias, however, many of them point out the need for more research in the field and, therefore, to support the use of these technologies as a complementary and facilitative form of therapeutic intervention [11,14,15]. It is important to highlight that these new technologies appear as a tool to assist the psychologist during therapy, not as a substitute for therapy.

However, Augmented Reality has some advantages over VR because it provides a more realistic experience in the interaction of the person with the virtual elements, it is easier to configure and does not remove the patients from their environment, as it does not "depend" on their capacity to build a sense of presence[15,16,17]. It also enhances the user experience through mobile applications designed specifically to use such technology.

Treatments with the use of Augmented Reality with exposure to phobic stimulus prove effective not only when compared to other treatments, but also through measurement with well-defined inventories and scales, as in the study by Wrzesien et al.[13]. In the reviewed articles used as bibliography, no studies were found that indicated the use of physiological measures to measure the degree of anxiety in the patients in which the phobic treatment was applied with the use of Augmented Reality as a tool, being found this application only in the use of VR as a tool for phobic treatment [18].

Considering the high prevalence of anxiety disorders, especially phobias, and the barriers encountered by the psychologist in the use of SD for such treatment, AR emerges as a viable alternative in the treatment of specific phobias (*e.g.* arachnophobia), with a clinical-therapeutic purpose. Thus, this work aims to describe the development of the first phase of the EXPhobia prototype that was created to be a model in the treatment of specific phobias through the use of AR and MI BAND®, using the SD technique. The combination of these features is what differentiates this project from the other existing ones. The first phase of the project used the spider as a target stimulus for the treatment of arachnophobia. For the design of the project, Analysis of Behavior was used as a theoretical base. Therefore, EXPhobia is a multidisciplinary project (Computer Science, Psychology, Communication, and Collective Health) and is part of NATI's Academic Integration Program of UNIFOR.

METHODS

Before applying and testing the prototype in participants with arachnophobia, three phases were performed: 1) development of the EXPhobia prototype, 2) usability test, and 3) development of an application protocol; and a phase is in progress which is: 4) intervention. In order to perform these phases, this research had as methodological basis the evaluation of programs, which had been developed to support the future application of the almost-experimental method.

The evaluation of programs "is about researches that propose and implement programs to achieve some positive effect on a group of individuals" [19]. Within the Program Evaluation, Rossi et al. [20] identified five (5) types of evaluations, namely: 1) necessity assessment; 2) evaluation of the program theory; 3) evaluation of the pro-

cess; 4) evaluation of the result and 5) evaluation of efficiency. The present study aims at the first two evaluations, that is, the necessity assessment, based on extensive bibliographic research, and the evaluation of the program theory, covering usability tests and development of a protocol.

For the future application of the prototype, the fourth phase aims to use an almost experimental method[19] and intends to use a single subject delineation, in which each participant will be exposed to an Initial Bond, then the measurement for the base line (A), then they will pass through the Intervention condition (B) and at the end it will be submitted to the new evaluation, in the Final Result (A)[21].

For data collection, one Questionnaire will be used to measure the level of the spider phobia - Fear of Spiders Questionnaire (FSQ), one Sense Inventory of Presence (SIP), adapted for Augmented Reality (AR), one Subjective Units of Discomfort Scale (SUDS), and a portable device to measure heart rate (MI BAND®). Besides that, a questionnaire about impressions of the prototype was created and used to collect information to the usability test.

In the initial Baseline (A) the FSQ and SUDS questionnaire will be applied to understand the level of phobia of the participant, in addition to exposing the participant to the equipment that will be used (Oculus Rift), while collecting the heart rate (MI BAND®) to have a base before the intervention. The Intervention (B) will be eight steps in total and each change from one stage to the next is already pre-determined, but the intervention does not have a necessary number of steps to be performed per session, always respecting the participant's time. Moreover, in the final result - Final Baseline (A) will be the reapplication of the SUDS, SIP and FSQ tests, being the same from the beginning of the treatment, for data collection and comparison between the Baseline and the Final Result; besides contrasting the data recorded in the MI BAND®, for physiological measurements.

For the statistical analysis of the collected data, IBM® SPSS program will be used. It should be emphasized that the experimental sessions are the primary data source and the questionnaire data are secondary.

PROCEDURES

Three phases were developed to achieve the objectives of this study and one phase is in progress.

Phase 1 - Development of the EXPhobia Prototype: In this first phase, the prototype EXPhobia was developed, along with the professionals and students of each area (Psychology, Computer Science, New Media and Visual Audio), whose objective is the treatment of arachnophobia with use of systematic desensitization. For this, an extensive bibliographic review was carried out in databases available on CAPES (PubMED, Scielo, Web for Science) and Scholar (scholar.google.com.br) with the descriptors "phobia", "augmented reality", "Virtual reality", "exposure therapy" and "systematic desensitization" and their Portuguese translations, thus twenty articles were selected. Benchmarking was also carried out, that is, a preliminary systematic survey in application stores, as well as in the database of articles (last 5 years) to verify the already existing applications in the market and in academia, in order to validate the system through its differentials. The survey was completed during the month of June 2017 and it used the descriptors: "phobia", "arachnophobia", "desensitization" and "augmented reality".

The program, which aims at the intervention based on a protocol, was planned to have the inventories and questionnaires applied in two conditions: pre-test (baseline - before intervention) and post-test (final result - after intervention), in addition to measuring the participant's heart rate throughout the session conduction period, using the MI BAND® portable device as an objective measure

of the anxiety response from a physiological point of view. In this phase, the hierarchical scale of fear was constructed by eight stages based on the systematic desensitization technique. The scale was created using the following characteristics: realism, movement, quantity and size of the spider. In each stage one of these characteristics of the spider was changed.

Phase 2 - Usability Test: After the prototype was developed by students and professionals in Computer Science, New Media and Visual Audio, we performed the usability tests of EXPhobia, which consisted of exposing 30 users to the mobile application of the prototype. At the end of the test, they answered a questionnaire to leave their impressions about the prototype. The testing procedures with users proposed in this work followed the norms contained in Resolution 466 of 2012, which provides the guidelines and norms of research involving human beings [22].

Phase 3 - Development of an Application Protocol: After the Usability Test and with the result the questionnaires in hand, an EXPhobia Application Protocol was developed, aiming to better delineate the use of the product, so as to improve its effectiveness.

Phase 4 - Intervention: After the complete development of the prototype and initial tests, it is planned to proceed to the intervention phase, which should evaluate the efficacy of EXPhobia in phobic participants, through an almost experimental, single subject study with an ABA design.

MATERIALS

The materials and tools needed to apply some phases are: (a) EXPhobia: functional prototype that was developed, which users can interact with and evaluate. Such a prototype was developed for a re-

sponsive web platform that will pass data from a psychologist-mediated session to a mobile application (Android) in which the patient visualizes the object of specific phobia in Augmented Reality with the help of Oculus Rift for better immersion; (b) A notebook, where the psychologist controls and follows the whole process, such as what the client is seeing at that moment and the stage that the client is in that session; (c) A device with Android developer system (e.g. smartphone) to use in phobic object exposure along with Oculus Rift; (d) Portable heart-monitoring device - MI BAND® to record a type of physiological change in anxiety scales before (baseline - pre-test), during and after treatment.

SOFTWARE

The following platforms were used for the development of the EXPhobia prototype: Blender® (for the modeling of the Spider); Unity® (to show the Spider in the mobile application); Android Studio® (mobile application for the client); Eclipse® IDE (web functions); Design of Alternatives: main design activity that consists of suggesting ideas to satisfy the requirements; Pencil® (for low-fidelity displays, where the concept and the initial idea of the product are shown); Photoshop® (for high-fidelity screens, which will look similar to the final product, used for exploration and testing).

RESULTS AND DISCUSSION - DEVELOPMENT OF THE PROTOTYPE *EXPHOBIA*

This project Phobia phase is the laboratorial phase of prototype development and the obtained results were: bibliographical gathering, usability evaluation, and development of an application prototype aiming at the future intervention.

A total of 130 applications and articles were found in the search, systematically. However, only 31 of them were related to the project goals and features described above - most of the applications were just games. Table 1 shows the evaluation of the essential functionalities and tools found in the main applications found. The values in the table represent: 1- the tool searched fully meets the described functionality; 2 - partially meets it, similar to the desired effect; 3 - does not meet what is proposed for the system.

Table 1 – Main features and tools found in other Benchmarking-based applications

	Use AR (3D phobic object)	**Provides Information**	**Tracks Treatment**	**Physiological Evaluation**	**Manages Patients**
AR – Spider phobia therapy	1	2	2	3	3
Fear nothing	1	1	2	3	3
Arachnophobia free	1	1	1	3	3
The therapeutic lamp	1	1	3	2	1
System to aid the treatment of arachnophobia using RA	1	1	3	3	2

Source: The authors.

Then, the intervention was elaborated based on the research done and the theoretical basis of the systematic desensitization technique [9]. The intervention has eight stages (St) (Table 2), as hierarchically pre-defined: a) Size (S) in three (3) levels: small, medium, and large (S, M and L); b) Realism (R) in three (3) levels: low (L), medium (M) and high (H); c) Quantity (Q) of spiders, being possible to see 1, 5 or 10; d) Movement (M), whether static (S) or mobile (M).

Table 2 – Stages of Systematic Desensitization

Stages (St)	Size (S)	Realism (R)	Quantity (Q)	Movement (M)
1	S	L	1	S
2	M	L	1	S
3	M	L	1	M
4	M	M	1	M
5	M	H	1	M
6	M	H	5	M
7	L	H	5	M
8	L	H	10	M

* underlined items indicate which variable was changed at step change.

Source: The authors.

After the elaboration of the DS hierarchical scale, which is consisted of eight progressive and gradual stages, as shown in Table 2, variation production of the four (size, realism, quantity, and movement) configurable variants from the phobic object in 3D (spider) was performed. Figure 1 represents the levels of realism – low, medium, and high – from the 3D spider.

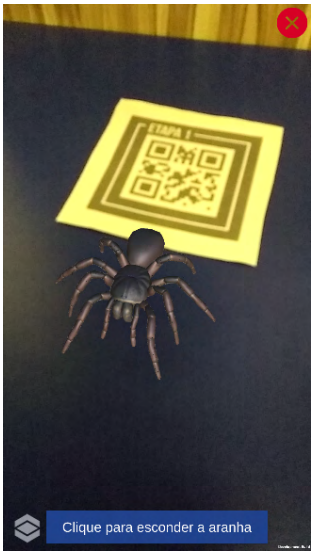
Figure 1 – Spider in low (L), medium (M), and high (H) realism.

Source: The authors.

In order to enable participants to see the 3D spider, the QR

code to access the AR in each one of the stages was developed by the technology team. Therefore, each code represents a stage that includes a set of variables with attributed values according to the proposition of systematic desensitization. For instance, the QR code in stage one entails the referring values of the proposition: small (size), pixelated (realism), one (quantity), and static (movement).

Figure 2 – Stage accessed by the patient



Source: The authors.

Usability Test

Stemming from the finalization of the functional prototype, usability tests of the mobile application were performed. Thirty non-phobic participants, in total, were invited to the usability test,

once the goal was to evaluate the technological artifact usability. For that matter, in order to collect the pieces of information concerning the patient view on the application, 20 users (one woman and 19 men) were selected, all adults at university education level. From these participants, 30% knew the application, however, they had never interacted with it prior to the tests. Yet, in order to obtain the professional view, 10 users (eight women and two men), adults with a university degree in the psychology area and no knowledge of the application, participated in the test. Before initiating the tests, the participants were instructed about the procedure and were asked to fill out a term authorizing the use of sound and image, since photographic records were taken during tests.

THE VIEW OF PSYCHOLOGY PROFESSIONALS

The test consisted of the performance of some tasks. Inside a hypothetical scenario, being as follows: 1) Accessing the app; 2) Verifying the percentage of concluded treatment of a particular patient; 3) Initiating the experience in AR and visualizing the spider using spectacles that allowed accessing the AR and QR code; 4) Searching for specific pieces of information; 5) Editing profile (photo and personal information), and 6) Leaving the app. Only two tasks presented different behaviors from the expected: the task of initiating AR and seeing the spider, where one participant became quite nervous; and the task of searching for specific pieces of information, where two participants confused the completed stages with the quantity of spiders proposed by the treatment. Some participants spent more time reading information and watching the 3D spider.

At the end of the test, participants answered a post-test questionnaire in order to leave their impressions regarding the EXPhobia prototype. The highlighted results of this stage are: 1) The spider did

not bring a personal discomfort, but it might probably be different to a phobic individual; 2) the spider (image and quality) could be enhanced, but it was not mentioned how, and; 3) the user could have a better interaction with the spider. Among positive topics, it may be mentioned that the app is well organized and user-friendly with its enjoyable interface, besides being differentiated (innovative) to the effective treatment of phobias.

USER-PATIENT VIEW

In an analogous way to the view of the psychology professionals, a scenario and some tasks were created to the hypothetical situation of the patient, being as follows: 1) Accessing the app; 2) Describing the levels of initial and final discomfort felt on a particular stage; 3) Initiating the experience in AR and visualizing the spider, without the use of specific spectacles; 4) Searching for specific pieces of information; 5) Identifying the register number of the Psychotherapist accompanying the treatment (Regional Council of Psychology); 5) Editing profile (photo and personal information), and; 6) Leaving the app. A post-test questionnaire was also elaborated to the participants that tested user-patient view. The most relevant items upon answers found in the questionnaire were: 1) Ease to identify the levels of initial and final discomfort; 2) Ease to initiate and utilize the AR experience and good degree of realism on the spider; 3) Ease to find pieces of information. Concerning points to be enhanced that were mentioned, for instance, it was suggested to enlarge the size of the writing on pieces of information, to unbind the patient's personal information from the therapist's, and positive points such as the simplicity of accessing the tools and the AR stability of the spider.

POST-TEST USABILITY ADJUSTMENTS

After tests of usability and collection of information, necessary adjustments were made to the functional prototype. The following modifications may be highlighted: 1) Changing the term "level of discomfort" for "level of fear"; 2) Adding the functionality of accessing the AR through an "initiate AR" button; 3) Visualizing all the existent stages, emphasizing the stages which the patient went through (they show in black). The stages that were not performed yet remain disabled (they show in gray); 4) Allowing access only to the stages that were concluded or are in progress. In trying to access a non-performed stage, feedback is shown; 5) Separating the psychotherapist's pieces of information from the patient's private information; and 6) Enlarging the font size used on the pieces of information.

DEVELOPING AN APPLICATION PROTOCOL

The protocol was developed with the goal of minimizing the possible errors on the application and also as a way of guiding the correct use of EXPhobia. The protocol is comprised of some phases, searching since the development of an initial bond to the return to the baseline for comparison; in fact, the data and promoted changes. The phases are: 1) Initial Bond; 2) Preliminary Baseline; 3) Intervention; 4) Final Baseline;

PHASES OF THE APPLICATION PROTOCOL

INITIAL BOND

In the application room, the patient is instructed about the functioning of the program. After that, if the participant is interested and follows the inclusion criteria, the Free Informed Consent Term

(FICT) must be signed. At that point, the Initial Bond is established, which serves to provide trust between both parts, as well as clarifying whatever possible doubts.

PRELIMINARY BASELINE (A)

At this first moment, the FSQ and SUDS questionnaires will be applied in order to comprehend the participant's level of phobia. Following, the participant will wear the Oculus Rift and will be exposed to the ambient, aiming to explore the scenario, without the presence of the phobic stimulus (spider in AR). In parallel, one will be connected to the device MI BAND® – monitoring the heart rate. The MI BAND® is activated 40 seconds before exposure and remains activated for 40 seconds after the end of the exposure, to enable the measurement of physiological data during the whole process.

INTERVENTION (B)

During the intervention, the number of sections is not pre-determined, due to variation depending on the patient. The intervention has eight stages, all previously defined hierarchically. Each stage has three equal repetitions of exposure (1 – Adaptative; 2 – Real; 3 – Confirmative) with a duration of 20 seconds each and an interval of 1 minute between one exposure and another. There is one extra minute for other questions that might be necessary. Each stage has an equal duration of five minutes and this time is clocked. The interval between stages is five minutes long. If there is no difficulty during the whole intervention (exposition to the eight stages), the process is finished in approximately two hours.

Before proceeding to the next stage – between one stage and another – it is asked to the patient whether he/she is comfortable to

proceed to the next stage. When affirmative, the process is repeated after five minutes. When contrary, there is a break of five minutes, the equipment is removed and a relaxation exercise is performed. After the procedure, if the discomfort remains, the intervention is postponed or ended.

Another way of verifying whether the patient is apt to proceed to the following stage is by checking the final average of heart rate. In case it is more than 120 BPM, it is recommended repeating the stage or pause the intervention. During the whole process, the patient may stop the exposure to the phobic object stimulus raising their hand, culminating in an immediate suspension in the intervention.

Every new stage needs a baseline (BL per stage), where it is included (a) the question about the level of fear on the individual, (b) the measure of heart rate, and (c) the application of the scale of level of discomfort SUDS.

FINAL BASELINE(A)

After the intervention, ISP, SUDS, and FSQ tests are performed. The latter two tests are the same as at the beginning of the treatment, in order to collect and compare data between the initial baseline and the final result. The data of heart rate collected through MI BAND® are also compared before and after.

GENERAL VIEW OF THE PROTOTYPE: A PANORAMA ON THE DEVELOPMENT AND APPLICATION.

Taking into account that the project is extensive, the construction of the system was divided into steps, thus this present study has as primary objective the development of a Model of Application Protocol to EXPhobia. This need arose after the results of the prior

steps, mainly on the usability test. Namely, the formulation of an Application Protocol comes as a result of two preceding steps (development of prototype and usability test) and aims at enhancing the application/intervention. For that matter, improvements included a favorable ambient for application, as well as useful graphics and measurable variables for more objective results.

Nevertheless, seeing that the two first steps were already tested, it has been noticed that the app had good feedback, given the positive ones. Part of the enhancements proposed by the users was validated. This project was created to be a treatment model to specific phobias; as such, it may be expanded to include other phobic stimuli. However, initially, it was tested with the spider to obtain its validity of usability.

The methodology proposed is the Evaluation of Programs, which is related to the development of applicable researches, aiming at the compliance of previous steps to better acquire results and achieve study control and future interventions. The present study focused on phase two, that being the Evaluation of Programs Theory, which comprehends verifying the viability and better planning to a nearly quasi-experimental application.

As aforementioned, EXPhobia is an extensive project that embraces several areas; for that matter, it is essential that before the intervention, all or most of the variables may be evaluated in order to realize the necessary adjustments, promoting the betterment of the system in the intervention. The next phase of the project is the application of the prototype on phobic patients. As well as the intervention itself, an ABA (Applied Behavior Analysis) delineation is recommended, using questionnaires, inventories, and measures of heart rate, besides keeping records of the level of flight/evasion, in order to have a controlled situation and for the results to be as efficient as possible.

CONCLUSIONS

The current paper is a tangible result of the junction between health and technology, aiming at the treatment of the phobia of spiders (arachnophobia). The developed prototype has as final focus the improvement participants' life quality, but it also aims at the psychologist who will work with the technology, providing new ways of treatment.

This system was designed so that there is a natural and fluid interaction for the professional at the time of application, so that he/she has the technology as an ally, not excluding or substituting therapy, but as an addition of new tools to professional practice. Thus, the prototype performed well in the usability test, which facilitates the next step for the application in phobic patients. It is understood, therefore, that new technologies, such as augmented reality, can be combined with health treatments, facilitating procedures or expanding techniques.

REFERENCES

1. World Health Organization. Global health estimates 2015: disease burden by cause, age, sex, by country and by region, 2000-2015. Geneva: World Health Organization; 2016.
2. American Psychiatric Association. Diagnostic and statistical manual of mental disorders (DSM-5®). Washington, DC: American Psychiatric Pub; 2013.
3. Chapman T. Epidemiology of fears and phobias. In: Davey GC, editor. Phobias: a handbook of theory, research and treatment. Hobroken: Wiley; 1997. p. 416-34.
4. Winerman L. Figuring out phobia. Monitor on Psychology. 2005; 36(7): 96.
5. Zamignani DR, Banaco RA. Um panorama analítico-comportamental sobre os transtornos de ansiedade. Rev Bras de Ter Comp Cogn. 2005; 7: 77-92.

6. Haydu VB, Fornazari SA, Borloti E, Haydu NB. Facetas da exposição in vivo e por realidade virtual na intervenção psicológica no medo de dirigir. Psico. 2014; 45(2):136-46.

7. Turner RM, Ditomasso RA, Delaty, M. Systematic desensitization. In: Turner RM, Ascher LM editors. Evaluating behavior therapy outcome. New York: Springer; 1985. p. 15-55.

8. McNally RJ. Mechanisms of exposure therapy: how neuroscience can improve psychological treatments for anxiety disorders. Clin Psychol Rev. 2007; 27(6):750-59.

9. Caballo VE. Manual de técnicas de terapia e modificação do comportamento. São Paulo: Santos editor; 1996.

10. Wolpe J. The practice of behavior therapy. New York: Pergamon Press; 1982. Chapter Systematic desensitization.

11. Haydu VB, Kochhann J, Borloti E. Estratégias de terapias de exposição à realidade virtual: uma revisão discutida sob a ótica analítico-comportamental. Psicol Clín. 2016; 28(3):15-34.

12. Juan MC, Alcaniz M, Monserrat C, Botella C, Banos RM, Guerrero B. Using augmented reality to treat phobias. IEEE Comput Graph Appl. 2005; 25(6): 31-37.

13. Wrzesien M, Burkhardt JM, Alcañiz M, Botella C. How technology influences the therapeutic process: a comparative field evaluation of augmented reality and in vivo exposure therapy for phobia of small animals. In: IFIP Conference on Human-Computer Interaction. Berlin: Springer; 2011. p. 523-540.

14. Opriş D, Pintea S, García-Palacios A, Botella C, Szamosközi S, David D. Virtual reality exposure therapy in anxiety disorders: a quantitative meta-analysis. Depress Anxiety. 2012 Feb; 29(2): 85-93.

15. Juan MC, Pérez D. Using augmented and virtual reality for the development of acrophobic scenarios. Comparison of the levels of presence and anxiety. Comput Graph. 2010; 34(6):756-66.

16. Baus O, Bouchard S. Moving from virtual reality exposure-based therapy to augmented reality exposure-based therapy: a review. Front Hum Neurosci. 2014 Mar; 8:112.

17. Dünser A, Grasset R, Farrant H. Towards immersive and adaptive augmented reality exposure treatment. Stud Health Inform. 2011; 167:37-41.

18. Wiederhold BK, Jang DP, Kim SI, Wiederhold MD. Physiological monitoring as an objective tool in virtual reality therapy. CyberPsychol Behav. 2002 Feb; 5(1):77-82.

19. Cozby PC. Métodos de pesquisa em ciências do comportamento. São Paulo: Editora Atlas; 2003.

20. Rossi RH, Freeman HE, Lipsey MW. Evaluation: a systematic approach. Thousand Oaks: Sage; 1999.

21. Sampaio AAS, Azevedo FHB, Cardoso LRD, Lima C, Pereira MBR, Andery MAPA. Uma introdução aos delineamentos experimentais de sujeito único. Interação Psicol. 2008; 12(1):151-64.

22. Conselho Nacional de Saúde (Brasil). Resolução nº 466, de 12 de dezembro de 2012. Brasília: CNS; 2012.

CHAPTER 4

ELECTRONIC RECORDS PROGRAM IN SURGICAL CENTER FOR INTEGRAL CARE TO THE PATIENT

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INTRODUCTION

Technology follows human development and, undoubtedly, it provides much convenience, process optimization, dynamism and connection. The world has evolved with technology, creating instruments that can help different professionals or services in any area of human activity. Therefore, the accelerated technological evolution, the introduction of information technologies in the Health System and the connections between the multiple Systems will conform several improvements in the quality of health care, particularly the optimization of Electronic Records. In this sense, the heterogeneity of health systems, coupled with the complexity of interactions among the different stakeholders in the health ecosystem, supports a wide range of innovative solutions that may contribute to the promotion of less secure relationships with health care. This results in the need to find less bureaucratic, more integrative, accessible and efficient solutions in existing systems.

This article intends to publicize the creation of an integral electronic registration program in a surgical center, which aims to confer greater surgical safety to the patient, to standardize surgical procedures, to adapt clinical interventions to the needs of the patient treated at the surgical center, to optimize the surgical process in the center management, to contribute with the reduction of costs inherent to surgical patients, to produce indicators of care improvement in surgery (production, management and development), in accordance with the recommended practices, norms and guidelines in surgery.

CONSTRUCTION OF ELECTRONIC REGISTRATION PROGRAM IN SURGERY

On the global scale, the evolution of information and communication technologies in healthcare is a constantly improving reality, since Electronic Medical Records and Clinical Decision Support Systems are exponentially used. Its acceptance and use by health professionals and managers have become crucial, given their impact on the quality of patient care and on hospital administration/management efficiency[1,2].

Information systems can improve the performance of health professionals and the quality of patient outcomes[3], since they are computerized systems designed to manage the various valences of a hospital, namely clinical, administrative and financial[4,5]. In order to be properly formalized, some aspects should be considered; in particular, the organization of the provision of health services, quality/quantity of information, automation of information management systems and cost minimization. It should be emphasized that it monitors the international mobility of patients, encourages

the standardization of nomenclatures, provides a better interconnectivity, and is a basic tool to support decision making, training and research[6].

The implementation of Information and Communication Technologies (ICT) should integrate the processes of health care reform, allowing a higher level in the articulation, integration and improvement of quality of care. Therefore, the development of a program of electronic records is pertinent, aiming to aggregate all essential health information of each individual throughout their life cycle, making it constantly accessible, safe and sustained in the continuity of clinical care[6]. The automation and interoperability of health information increasingly leads to optimization of public health care, cost reduction, increased efficiency, reduced errors, increased patient satisfaction and less time of patient hospitalization[7,8,9,10].

The use of information systems in the hospital area[11] is a primordial tool in several domains, especially those that involve the management of patient care services. The use of data they produce serves not only for health care but also for planning, clinical objectives, control of epidemiological research and production of other important indicators for the management and development of the health system. In this way, the opportunity arises to place the patient at the center of care, guaranteeing the safety, efficiency, effectiveness, accessibility, equity and quality of the services provided in the various stages of health care. According to Campos, Saturno and Carneiro[6], the goals of the Information and Communication Technologies in Health are to establish fast, continuous and effective communication among the agents, and to provide information and produce knowledge so all benefit from its implementation.

This electronic registration program for patient care at the surgical center, based on the WindevR integrated development platform, has the primary objectives of providing greater safety in

perioperative patient care, standardizing perioperative nursing procedures, optimizing the management process, contributing to the reduction of costs, to the adaptation of nursing interventions to the needs of the patient and to improve the quality of patient care.

We emphasize that an electronic records program essentially aims to aggregate all the essential health information of each patient throughout their life cycle, making it constantly accessible in a safe way, supporting the continuity of care, training and research[6]. A structural and integrative program, which guarantees the safety of care, the international mobility of patients, promotes the standardization of nomenclatures, greater interconnectivity, and serves as a clearing tool for decision support, training and research[6]. In this follow-up, the implementation of Information and Communication Technologies in Health aims to aggregate processes of health care reform, enhancers of a higher level of articulation, integration and improvement of the quality of care.

METHODOLOGY FOR THE CONSTRUCTION OF THE ELECTRONIC REGISTRATION PROGRAM

In order to build the electronic registration program in the surgical center, intervention strategies were drawn up in the various sectors involved, namely, meetings with the Board of Directors, the Hospital Directorates (Nursing, Clinic, Surgery and Anesthesia), and the Computer Service director, computer engineers and computer technicians), with the Prevention and Control of Infection Program Coordination Group, the nurses of the surgical services, the nurses of the surgical center, the chief nurses of the respective units and, also, the group in charge of Electronic Nursing Records, as shown in the table below (Table 1).

In order to encourage all professionals to actively participate in the creation of the program and in the organization of the spaces for the development and implementation of the electronic registration program in the surgical center, with a patient-centered focus in the peri-operative phase, concerted activities were developed. In addition to the meetings, training and workshops were organized in a formal context for all program users. These trainings were given by peri-operative nursing experts, with presentations in small groups and individually. A list of materials needed to install the program at the surgical center was made and the purchase of laptops was made, with 2 per operating room. Surgical services also acquired this type of equipment. During the placement of the computers in the mentioned spaces, the safety conditions for the users, patients and their surgical material were preserved, in compliance with the requirements stipulated as good practices in the surgical center[12].

Table 1 – Interventions/meetings with the various sectors involved in the process.

Recipients	*Goals*	*Result*
Administrative Council Technical Directions	- Inform about the electronic registration program in the surgical center - Get feedback - Obtain consent for the execution of the electronic registration program	- Progress of the process for the construction of the program - Obtaining a favorable opinion
Technology Service and Information systems	- Schedule sessions for program development - Build the program on the hospital's electronic registration platform - Monitor the implementation of the program	- Holding of 25 sessions for discussion and implementation for different phases - Implementation and monitoring of the program

Recipients	*Goals*	*Result*
Prevention and Control of Infection Program Coordination Group	- To obtain useful information in the control of infections at the surgical center - Include infection indicators in the program	- Inclusion of monitoring of infections in the surgical center - Extraction of infection indicators in surgery
Head Nurses of surgical services	- Inform about the electronic registration program at the surgical center and its objectives - Get collaboration in the implementation of the program surgical services	- Progress of the process for the construction of the electronic registration program - Implementation and monitoring of the program
Electronic Nursing Records Group (CIPE).	- Obtain collaboration in the inclusion of the electronic nursing records in the care program	- Include in the program nursing records according to the scientific methodology and use of the CIPE language

Source: The authors.

Existing procedures, inherent to the surgical patient, as well as the nursing practices performed, were subjected to an exhaustive review in order to be included in the program. The peri-operative Clinical Guideline Norms, including standards in the area of quality in the surgical center, were primordial in the creation and installation of the program of electronic registration in the surgical center.

The electronic records are a repository of clinical data obtained from various sources, stored electronically, which provide detailed information about the patient and enforce scrupulous compliance with ethical-legal aspects. In the field of health, Ethics and information privacy are very delicate areas, as their focus is the Person in need of health care. The data contained in the information systems belongs to the patient and concerns him, so confidentiality of the

information is a right, as recommended in the letter of the patient's rights. Hospitalized patients are entitled to confidentiality of all clinical information and identifying elements that concern him/her. It is also a duty of health professionals to respect the confidentiality of patient information as determined, for example, by the Code of Ethics of the Nurses' Order, Decree Law nº. 104/98 of April 18, 2010, article 85, of the duty of secrecy.

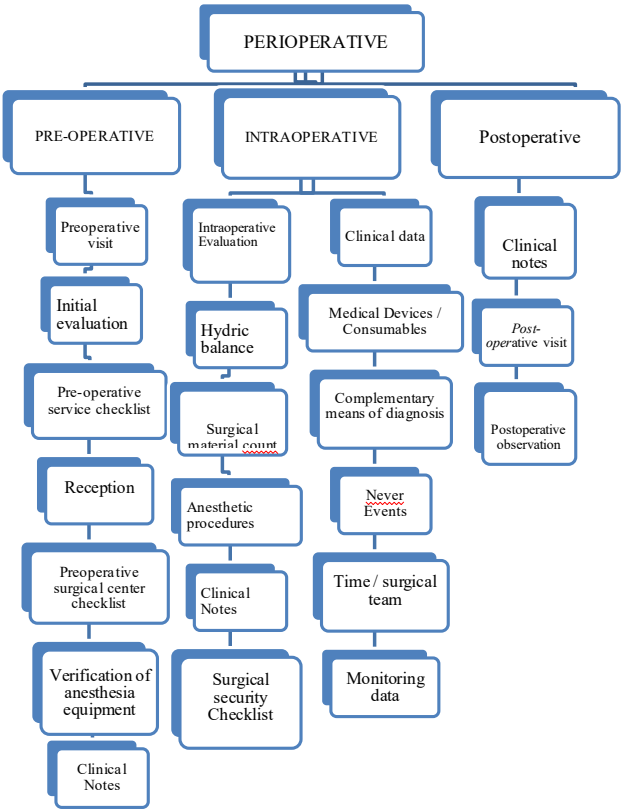
The actions considered in the installation of the electronic registration program and the indicators that it can generate led to the construction of a graphic representation to be presented in the next section.

DESCRIPTION OF THE ELECTRONIC REGISTRY PROGRAM IN SURGICAL CENTER

The application built from scratch constitutes a specific item (management of surgical interventions) of a program that intends to respond to the needs and adapt to the hospital reality of the institution. Thus, considering the various applications that included clinical, imaging, laboratory, prescription and clinical records of patients, among others, there was a need to create a means of management of surgical interventions for the surgical center.

Considering the diversity of technicians who use it and the wide range of records needed in the perioperative period, a guide has been developed for the use of the electronic records program, aiming at systematizing records in surgery. This guide, in flowchart, guarantees the standardization of the language in the use in the electronic registration program, using the reference nomenclature, and contemplates the different stages of the preoperative, intraoperative and postoperative surgical process (Figure 1).

Figure 1 – Layouts of the electronic registration program in a surgical center



Source: The authors.

The following is a brief description of the constructs that underpin the electronic registration program and are shown in the above flowchart.

The concept of peri-operative actions appears in the European Operating Room Nurses Association, as a set of activities performed by a nursing professional during the pre, intra and postoperative periods of the patient's surgical experience[13].

The preoperative period begins when the need for surgery is recognized and ends when the patient enters the operating room. It is subdivided into a mediate period (from the indication for surgery to the day before it) and an immediate one (corresponds to the 24 hours before surgery). The objective is to evaluate the general health status of the surgical patient, to identify irregularities that may increase surgical risk or to unfavorably influence their recovery. During this period the areas of registration of the Nurse, Anesthesiologist, Surgeon and other specialties are observed.

Nursing records indicate the form of information issues. At this stage, the nurse describes the interventions that are planned, executed and evaluated, whose goal is to ensure continuity of care, to document and evaluate the provided care, to promote nursing research and to optimize management. The pre-operative nursing record includes the preoperative visit, initial nursing evaluation, reception, preoperative checklist of the service and block, verification of anesthesia equipment and all nursing clinical notes inherent to this period.

The preoperative visit is one of the autonomous activities of perioperative nurses that represents the beginning of the perioperative care process[14]. It is performed the day before the surgery, more properly, 24 hours before it, with the completion of the initial assessment of the patient. This visit intends to:

- Reassure to the patient who will undergo a surgical process;
- Psychologically prepare the patient for surgery;
- Identify problems that may influence the intraoperative

period;
- Plan nursing interventions;
- Promote the interaction between the nurse of the block and the patient;
- Transmit to all agents in the process the information provided by the patient, so that, together, they can plan the care to be provided in the intraoperative period;
- Minimize the patient's fear/anxiety so that the patient feels more confident about the demystification of some aspects related to the operating room, anesthesia and surgical intervention; and
- Prevent complications in the intra and postoperative periods.

The initial Nursing evaluation is performed preferably during the preoperative visit, according to the ROPER model, in which, in addition to the biographical data, twelve activities of daily living are evaluated.

The Preoperative Checklist of the service and surgical center provides guidance to the nurses of surgical service and the operating room about procedures to be taken into account in the preoperative process. The purpose is to ensure the safety of all procedures inherent to the preoperative period and to ensure compliance with the standards of good surgical practice.

Reception in the surgical center is a unique moment in which the perioperative nurse makes the first contact with the patient, who at this moment can demonstrate a high level of stress, anxiety and fear of the unknown. At this stage, it is intended for the nurse to establish a connection with the patient, aiming to contribute to the reduction of anxiety and insecurity. It is at this stage that the perioperative nurse and the health professional who accompanied

the patient validate the preoperative checklist of the service with that of the surgical center, ensuring compliance with all the necessary requirements for performing the surgery.

The verification of the anesthesia equipment contemplates an exhaustive list of anesthetic procedures to be reviewed before the beginning of the surgery and aims to guarantee the safety of the patient and of the perioperative nursing care.

The clinical note contains clinical information on the health status of the patient after any intervention by a health professional (nurse, doctor and others), with the purpose of assisting in the provision of health care, supporting clinical decision-making, ensuring quality care and cooperation in the management and planning of health resources.

The intraoperative period begins when the patient is transferred to the operating room and ends when he is admitted to the Anesthetic Care Unit (recovery). The aim is to provide patient safety, maintain an aseptic environment, ensure proper functioning of the equipment, provide surgical instruments to the surgeon, provide emotional support to the patient during induction of anesthesia and assist in patient positioning on the operating table.

The Intraoperative Assessment describes the type of patient positioning, patient skin conditions, analytical exams, implant records in the patient, devices used in surgery, among others.

The patient's hydric balance is extremely important, requiring a strict record in the monitoring of inputs and outputs. It is a record field shared by the nurse and anesthetist. The Surgical Material Count must be confirmed by the instrumental and circulating room nurses aloud during and at the end of the surgery in order to ensure the safety of the surgical procedure for the patient and safety for the surgical team.

The anesthetic procedure reveals all the anesthetic actions performed during the surgical procedure as well as all the devices used. The registry is validated in partnership with the nurse and the anesthetist who ensure the anesthetic-surgical procedure for the patient and anesthetic-surgical team.

The Clinical Data includes technical aspects such medical devices, consumables, safety checklist, operating times, surgical team, Never Events, among others that aim to guarantee the safety of the surgical patient and the surgical team.

The Surgical Safety Checklist is a mandatory list, standardized by the World Health Organization (WHO). It is used to identify, compare and verify a set of perioperative procedures, ensure patient and professional safety during and after the surgical procedure, reduce morbidity and mortality, and measure the impact of the use of risk management tools on the quality of the results obtained with the surgical procedures.

The Complementary Diagnostic Means include laboratory tests/material, imaging, sampling, which provide information about the patient's clinical situation.

Never Events are errors that should never arise because they can cause serious damage or even death, such as incidents or surgical occurrences in the wrong place, forgetting instruments or other objects inside the patient, administering drugs in the wrong place, among others. Never Events aims to promote patient safety in the perioperative period and provide surgical center quality indicators.

Operation times begin at the time the patient arrives at the surgical center and end at the end of the operating room preparation for the next surgery.

The turnover is characterized as the time needed between the end of one surgery and the beginning of the preparation for the next one. It is a very important indicator for the management of surgeries in the surgical center.

The surgical team respects the identification of all those involved in the surgical procedure (surgeons, anesthesiologists, nurses and others), which information each member can register or which can be registered by someone else, as long as they provide their identification number in the institution. The goal is to provide patient surgical safety, provide professional safety and produce management indicators.

The Monitoring Data includes all the data collected from the patient, related to their clinical evolution, namely vital signs, evaluation scales, measurement of parameters such as capillary glycemia, among others. These data facilitate the promotion of surgical safety of the patient.

The postoperative period starts from the patient's exit from the operating room and lasts until their full recovery. It is subdivided into: mediate (after 24 hours and up to 7 days thereafter); late (after 7 days of discharge). The purpose is to evaluate the perioperative nursing interventions, adjust them to the needs of the patients and promote the continuous improvement of the provided postoperative care.

The Clinical Notes in the Post-Anesthetic Care Unit (recovery) correspond to the patient's progress notes in the recovery period.

The postoperative visit is an action that promotes the articulation of the three periods of operation of the peri-operative nurse that must be performed 24 to 48 hours after surgery[15]. It aims to ensure the safety and quality of peri-operative nursing care, patient feedback on the intraoperative period and to evaluate perioperative interventions.

Postoperative observation is performed by completing an assessment questionnaire, where the nurse concomitantly interviews the patient and assesses their physical condition and the area being treated.

CONCLUSION

The program of electronic registration in an operating room is a unique and original document, consisting of a set of recorded information, signs and images that is generated from facts such as events and situations of patient health and provided care, which facilitates communication between the members of the multi-professional team and the continuity of the care provided to the individual. There are many benefits of electronic health records, namely information retrieval, better communication, systematically organized information, use of universally accepted standards, simultaneous use by various health services and professionals, multicenter studies and comparison of results , improved quality of patient care, faster access to health history and interventions that the patient has undergone; flexibility of data layout, absolute readability of information, integration with other information systems, continuous data processing, and easy collection of indicators (quality control of records, productivity and costs, quality of service).

During the process of construction of the electronic registration program in a surgical center, some constraints emerged that were overcome in the medium and long term, such as: the need for investments in hardware and software, training of users, resistance of professionals to the use of computerized systems, fear that the information produced by the professional is viewed by others, and also resistance to the obligation to fill a series of information.

The study of the applicability of the full electronic register program seems essential. However, it is believed that its usability has become an added value evidenced in hospital dematerialization, error mitigation, record keeping, interconnectivity among health professionals, process streamlining , access to patient history and especially in the efficiency and effectiveness of the provided health service.

REFERENCES

1. Evans RS. Electronic health records: then, now, and in the future. Yearb Med Inform. 2016 May; (Suppl 1): 48-61.
2. Thomas R, Walport M. 'Data sharing review report' ministry of justice independent review [Internet]. [Local desconhecido: editor desconhecido]; 2008 [citado em 2019 jun 21]. Disponível em: http://www.justice.gov.uk/review/docs/data-sharing-review-report.pdf.
3. Harrison JP, Palacio C. The role of clinical information systems in health care quality improvement. Health Care Manag. 2006; 25(3):206–12.
4. Alipour J, Lafti SS, Majdabadi HA, Yazdiyani A, Valinejadi A. Factors affecting hospital information system acceptance by caregivers of educational hospitals based on technology acceptance model (TAM): a study in Iran. IIOAB. 2016; 7(8):119–23.
5. Nilashi M, Jannach D, Ibrahim O, Esfahani MD, Ahmadi H. Recommendation quality, transparency, and website quality for trust-building in recommendation agents. Electron Commer Res Appl. 2016; 19: 70-84.
6. Campos L, Saturno P, Carneiro AA. Plano Nacional da Saúde 2011-2016: qualidade dos cuidados e dos serviços. Lisboa: Universidade de Lisboa; 2010.
7. Alves AD, António C, Marcelino F, Lemos M, Moreira, S. Identificação de projetos inovadores em hospitais do SNS. Lisboa: Serviço Nacional de Saúde; 2017.
8. Imison C, Castle-Clarke S, Watson R, Edwards N. Delivering the benefits of digital health care: research report. London: Nuffield Trust; 2016.
9. Black AD, Car J, Pagliari C, Anandan C, Cresswell K, Bokun T, Mckinstry B, Procter R, Majeed A, Sheikh A. The impact of ehealth on the quality and safety of healthcare: a systematic overview. Plos Med. 2011; 8(1):e1000387.
10. Henriksen K, Battles JB, Keyes MA, Grady ML, editors. Advances in patient safety: New directions and alternative approaches. Rockville: Agency for Healthcare Research and Quality; 2008. 1 vol.
11. Sousa P. Sistemas de informação em enfermagem: novos desafios, novas oportunidades. Rev Esc Enferm USP. 2012; 46(5); 1-2.

12. Associação dos Enfermeiros de Sala de Operações Portugueses. Enfermagem perioperatória: da filosofia à prática dos cuidados. Loures: Lusodidacta; 2014.
13. Ferrito C. Conceitos básicos da enfermagem peri operatória. In: Duarte A, Martins O, editoras. Enfermagem em Bloco Operatório. Lisboa: Lidel; 2014. p. 3-9.
14. Jesus J, Abreu V. Humanização em bloco operatório. In: Duarte A, Martins O, editoras. Enfermagem em Bloco Operatório. Lisboa: Lidel; 2014. p. 39-45.
15. Cambotas C. As funções do enfermeiro peri operatório. In: Associação dos Enfermeiros de Sala de Operações Portugueses, editor. Enfermagem perioperatória: da filosofia à prática dos cuidados. Loures: Lusodidacta; 2014. p. 105-169.

CHAPTER 5

OCARIOT (SMART CHILDHOOD OBESITY CARING SOLUTION USING IOT POTENTIAL) - THE POWER OF GAMIFICATION AND IOT TECHNOLOGIES TO LEARN AND PROMOTE HEALTHY HABITS AMONG CHILDREN.

Leire Bastida, Ana Moya, Gloria Cea, Eugenio Gaeta, Macarena Torrego Ellacuría, José Eurico de Vasconcelos Filho

INTRODUCTION

Long term behavioral disturbances and interventions in eating and physical activity (and, as a consequence, an energy imbalance between consumed and expended calories) are the primary cause of obesity; therefore, obesity is largely preventable by making healthier eating choices and exercising regularly[7]. In the case of children, childhood obesity is one of the biggest health problems worldwide. Nowadays, child obesity is the major pediatric public health concern, affecting around 224 million school-age children in the world. Its prevalence has tripled in many European countries since 1980, increasing in an alarming rate. According to estimates from WHO's Childhood Obesity Surveillance Initiative [1,2], childhood obesity al-

7 http://www.who.int/mediacentre/factsheets/fs311/en/

ready affects more than one in three school-aged children in Brazil, Chile, Greece, Italy, Mexico, New Zealand, United Kingdom (England), Spain (especially in boys), Portugal (especially in girls) and the United States. Its prevalence is increasing in many countries; for example, in Brazil, childhood obesity has increased by 600% over the past forty years, with studies indicating that more than 30% [3] of the nation's children are overweight or obese. Besides, over 60% of children who are overweight (including obese) before puberty will be overweight in early adulthood and inequities in obesity are passed on from generation to generation.

According to the EU Action Plan on Childhood Obesity 2014-2020[4], poor diet, the rapid loss of the traditional and healthy Mediterranean diet towards the increasing habit of eating highly processed foods and less healthy options, as well as physical inactivity, are important determinants that lead to overweightness and obesity in childhood [5]. Therefore, the prevalence of obesity among children and adolescents in Europe and Brazil is high and urgently needs mechanisms to prevent those risk factors and also to reduce their impact in the short term.

THE OCARIOT APPROACH

Childhood is an important period for forming healthy behaviors in order to reduce obesity inequities. This also implies the need to involve a wide range of stakeholders, from family counselling, behavior modification, physical activity training and nutrition and dietetics and, where necessary, to medication [6]. Proving that point, training of children up to 12 years of age to eat and move in a non-pathological way has been demonstrated effective in obesity and changing behaviors in randomized control trials [7,8]. Behavioral

treatment is an approach used to help individuals develop a set of skills to achieve a healthier weight. It is more than helping people to decide what to change; it is helping them identify how to change [9]. So, a healthy lifestyle, with adequate nutrition and active physical activity condition from early age, is the most effective prevention strategy to grow in good health. Thus, it is important to start educating children in order to promote healthy nutritional and lifestyle behaviors in the future. Schools and families provide opportunities to ensure that children understand the importance of good nutrition and physical activity, and how they can benefit from both. Teachers, families and health professionals are often involved as providers of health and nutrition education [10].

To promote the improvement of eating and physical disorders and also the prevention of obesity onset for children (between 9 and 12 years old), the main objective of OCARIoT is to provide an IoT-based personalized coaching solution guiding children to adopt healthy eating and physical activity behavior. The IoT network makes it possible to observe child activity patterns of daily living, health evolution, physiological & behavioral parameters and environmental data. All this information combined with medical patterns allows us to provide a customized healthy coaching plan while enabling children to remain active and engaged in their well-being and health habit management.

Considering this, the OCARIoT project provides a digital health platform based on IoT concept to increase children's health awareness and their healthy lifestyle in order to prevent further increases in obesity and reduce as much as possible the risk of related health problems.

The solution empowers children (and also educational staff and families) in taking control of their health by collecting real-time information about nutrition and physical activity, and interconnect-

ing health professionals and children (including parents and tutors) in order to adapt the individual health coaching plan. The solution also provides immediate feedback of efficacy of intervention and lifestyle changes while driving behavioral change in children for prevention and for better management of intervention compliance.

From a technological perspective, OCARIOT is using the UniversAAL middleware as IoT platform combined with a microservice approach in order to minimize the dependency of the solution with any specific IoT platform. This facilitates the integration of OCARIoT with different IoT middleware in future versions of the platform.

For measuring physical activity, the health professionals from the Brazilian and Greek pilots have chosen the Fitbit Flex 2 smart band to perform the first stages of the pilot studies, since it presents relatively low acquisition costs, and is able to collect all its required parameters. Another reason for choosing it over the other options in the market is that it provides open connectivity through a REST API (Open API Specification).

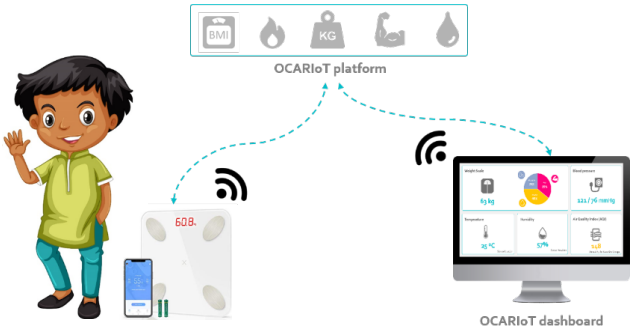
On the other hand, the Spanish pilot has chosen the CVE (Colegio Virgen de Europa, Madrid, Spain) smartwatch, a biomedical and human activity monitor, which allows the storage and sending of the collected information during the day and night for its respective analysis. Both hardware and software have been fully designed and developed exclusively for the context of OCARIoT. Besides providing all the required parameters, this wearable also provides a set of extra parameters that may be used to perform specific studies.

THE OCARIOT SCENARIOS

A set of scenarios has been defined detailing the IoT devices and health parameters to be monitored:

Scenario 1. Improve data collection with IoT smart weight scale

Figure 1 – OCARIoT Scenario 1



Source: Author.

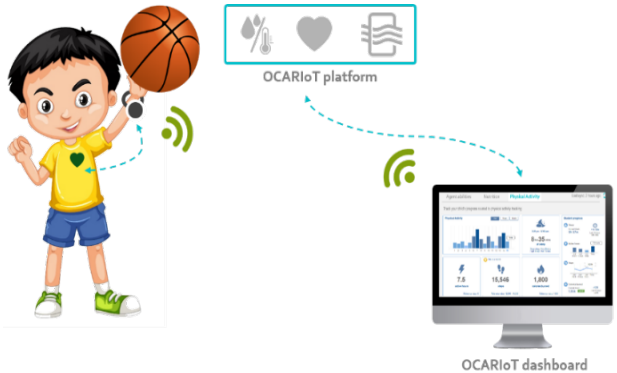
IoT devices: Smart weight scales and body composition devices.

Parameters to be measured: BMI, Body composition.

Scenario description: During baseline data collection of the project pilots, novel IoT devices for measuring BMI and body composition will be used. Supported by the teacher, the BMI and body composition of children will be measured in an easy and seamless way through the smart weight scale and a mobile app. The measurements will be automatically updated to the OCARIoT platform and become accessible to the health professional for review and data analysis.

Scenario 2. Monitoring the intensity of physical activity

Figure 2 – OCARIoT Scenario 2



Source: Author.

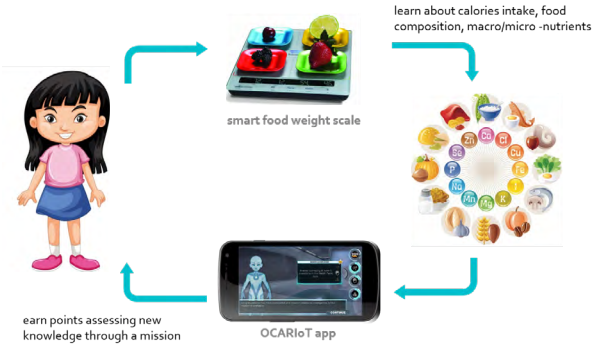
Wearable and IoT devices: Heart Rate monitor (e. g. Polar or CVE Smartwatch); OCARIoT embedded gateway with: temperature, humidity and air-pollution sensor.

Parameters to be measured: Effectiveness of physical activity, Environmental variable of school gym.

Scenario description: This scenario deals with the monitoring of effectiveness of physical activity. During a physical activity at gym, pupils of the teacher´s class are monitored though heart rate monitors or CVE smartwatch as well as the temperature, humidity and air-pollution of the gym (or school stadium where the children are training) are measured.

Scenario 3. Learning about food composition and healthy food

Figure 3 – OCARIoT Scenario 3



Source: Author.

IoT devices: Smart diet scale

Parameters to be measured: Food Intake

Scenario description: This scenario is related to education about food intake. The smart diet scale is able to measure the daily calorie intake of every single meal. By using this IoT technology in class, the teacher explains the basis of calorie intake, food composition and macronutrients. After the class the teacher uses the dashboard for triggering a mission in order to address the new knowledge about food intake to children of his/her class.

Scenario 4 – Monitoring weekly activity and sleep patterns of the children

Figure 4 – OCARIoT Scenario 4

Source: Author.

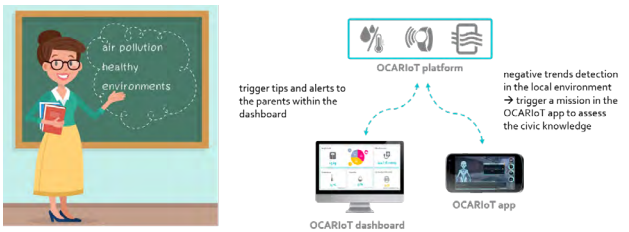
IoT devices: Wearable device with: Accelerometers and at least one of the following parameters: Distance, Steps, Location.

Parameters to be measured: Physical activity and sleep patterns.

Scenario description: This scenario is about continuous monitoring through wearables and intervention through the missions in the OCARIoT app. The children are monitored by means of their wearable devices that are able to detect physical activity and sleep patterns. The DSS (the Decision Support System, explained below) personalizes the missions according to the identified child profile and sends it to the OCARIoT app, that will propose the missions to the children through the mentor. On the other hand, parents will receive tips and recommendations about healthy outdoor activities they can do with their children.

Scenario 5. Learning about healthy habits and health environment

Figure 5 – OCARIoT Scenario 5



Source: Author.

IoT devices: Outdoor/Indoor embedded gateway including: Humidity, Temperature, Air- Pollution.

Parameters to be measured: Environmental variables: Humidity, Temperature, Air- Pollution.

Scenario description: This scenario is about civic education in relation to air-pollution, climate and health. The teacher explains in class the impact on health related to air-pollution and climate change, describing the risky human behaviors that are causing the problem and how personally each child can contribute to its reduction. When OCARIoT detects negative trends in the local environment, it triggers a mission in the OCARIoT app in order to assess the civic knowledge of the children and also triggers tips and alerts to the parents within the dashboard.

THE HEALTH MODEL

One relevant pillar of the project is to be able to acquire a great range of data; mainly data regarding children's behavior, in addition to the feedback freely provided by the parents, teachers and healthcare professionals involved in the child's daily life. This data is necessary to be able to trace the behavioral pattern of the child, and with it, be able to compute the obesity risk in which the child is actually under.

Based on previous clinical models of obesity[11,12,13,14,15], a general model of childhood obesity is being created with a set of health variables to be collected in the initial baseline in pilot sites. This model is going to be a predictive model with a criterion variable stratified in 4 levels (low weight, normal weight, overweight, obese) obtained by categorizing a quantitative variable (BMI). A preliminary analysis will be made to select the statistically significant variables that contribute to the predictive model, as well as to study the possible interactions between them. Once the definitive model has been established, its predictive power is going to be assessed through the following adequacy indexes: sensitivity, specificity and % of correct classification.

This health model will be used by a Decision Support System (DSS) based on a rule-based model, which associates observable data collected through the pilots with rules used to trigger associated actions. Those actions are countermeasures that have been specified to act against unhealthy behaviors. However, before acting against an unhealthy behavior (an unhealthy range of parameters) it is necessary to design a computational model to identify such unhealthy behavior in advance. In addition, it is also necessary to try and predict if a given unhealthy behavior is supposed to be perpetuated by the child in the foreseeable future as to avoid acting against seasonal behaviors (temporary behaviors).

THE OCARIOT EXPERIENCE: GAMIFICATION

Using as basis all the data collected through the IoT devices, the health model and the recommendations from the DSS, the OCARIoT experience is composed by a gamified app targeting children and a dashboard for families, educators, and healthcare professionals. The goal of using gamification is to motivate children towards a healthy lifestyle for a long-term behavioral change while involving families, educators, and health professionals as supporters.

OCARIOT GAMIFIED APP

After a set of co-creation sessions with children, the OCARIoT experience has been associated with a storytelling aspect, as children play they are becoming a secret agent of an international organization to promote healthy habits and destroy a major health hazard that can cause serious illness and even death among the population. The children (as agents) have to develop three abilities related to the healthy habits.

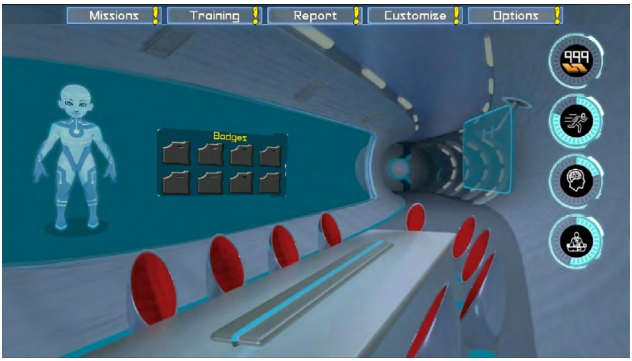
Figure 6 - Agent abilities and relation with OCARIoT experience

Ability	Relation
Dexterity	Agility, power, endurance, resistance to overcome the tests. OCARIoT experience: It is related to physical activity.
Intelligence	Knowledge about healthy habits. OCARIoT experience: we can use this ability to teach children all the things related to the healthy habits that will be put in practice with the challenges.
Discipline	Awareness and self-control over your impulses and actions. OCARIoT experience: we can use this ability to provide children awareness and self-control over the impulses for eating and actions related to sleeping actions and to teach them to make better choices with daily food and on weekends.

Source: Author

The look & feel of the app has followed the aesthetics of this secret agent storytelling, challenging children with a set of missions to be completed in the real world about healthy habits (e.g. physical activity, food intake). The missions can be individual, to be performed by the child alone, or social, that is, to be performed together with family or at school.

Figure 7 – OCARIoT App Home screen

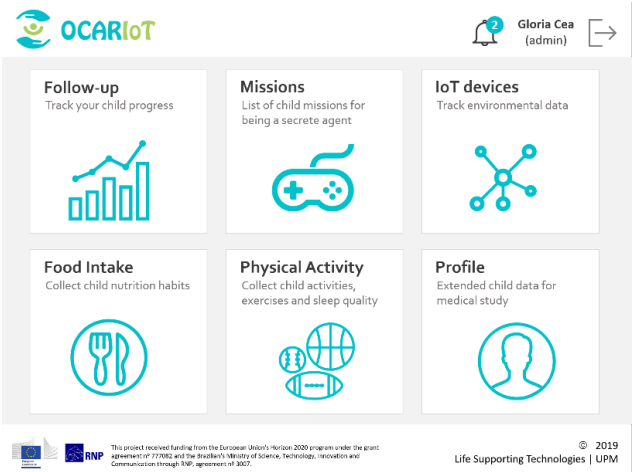


Source: Author

OCARIOT DASHBOARD

The OCARIoT dashboard, as a complement to the app for children, enables the usage and sharing of generated data to families, educational staff (such as teachers) and healthcare professional staff, so they can get access to real data anytime, playing a vital role in the prevention of childhood obesity.

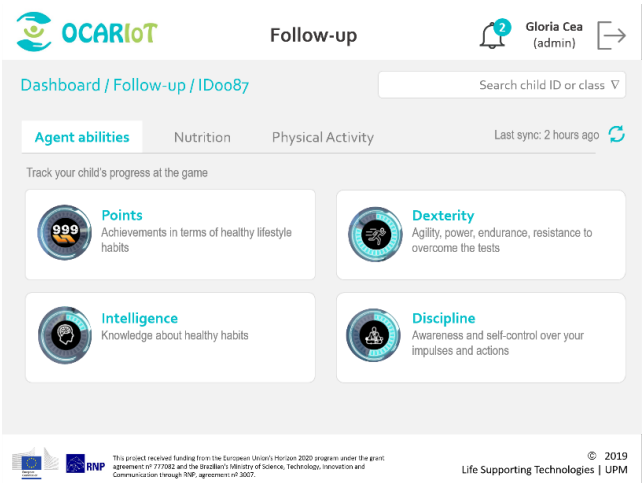
Figure 8 – OCARIoT Dashboard Home screen



Source: Author

From a high level perspective, the dashboard components are: 1) Data Management System, it is a user interface for management of user profiles and student data, such as sociodemographic data, anthropometric data, dietary habits; 2) Data Analytics Tool, statistical visualization related to the children and the overall pilots; 3) Gamification Management System, it is a user interface for management of educational and motivational contents, such as tips and recommendations on healthy habits, that includes a messaging infrastructure.

Figure 9 – OCARIoT Dashboard agent abilities follow-up screen



Source: Author.

The dashboard provides the main functionalities related to obesity prevention and healthy lifestyle promotion: 1) Nutrition tracking: food habits, food frequency and groups of food ingested by the children; 2) Physical activity tracking: visualization of the data collected from the wearable devices such as steps, distance, exercise intensity or detection of type of activity performed; 3) Motivational and educational activities: it allows the interaction between children, families and educators through the customization of health tips, recommendations and educational contents about healthy habits.

PILOT VALIDATION

In order to validate the first developments done in the project, a set of workshops and focus groups with the different stakeholders (mainly children for the app and families, educators & health professionals for the dashboard) has been done. This initial validation activities have focused on validating technical usability and acceptance. For the app evaluation, we organized five workshops in four schools (CVE in Spain, EA in Greece and Colégio Ari de Sá & Colégio Dáulia Bringel in Brazil), with a total of 56 children between 9 and 12 years old involved: 29 girls and 27 boys to balance gender aspects. The feedback from these workshops, which was very positive, allowed us to validate the different aspects about the gamification strategy defined for the OCARIoT app. For the dashboard evaluation, two online meetings and three local workshops in Brazil, Spain and Greece were organized. The received feedback was positive, demonstrating that the initial design of the dashboard is in line with the expectations of the users.

CONCLUSIONS AND FUTURE WORK

The project is in the middle of its duration and, though several advances have been done, there is still a long way for demonstrating the added value of IoT and gamification for healthy habits acquisition in children. We are currently working on improving the implementation of the IoT monitoring modules, the health model, the DSS, the app and the dashboard based on the feedback we are collecting for the second phase of validation in the pilot sites.

REFERENCES

1. World Health Organization. 9th meeting of the WHO European Childhood Obesity Surveillance Initiative (COSI): meeting report [Internet]. San Petersburg: WHO; 2016 [citado em 2016 jul 23]. Disponível em: http://www.euro.who.int/__data/assets/pdf_file/ 0009/325782/9th-COSI-meeting-report-en.pdf?ua=1
2. OECD. Health at a glance 2015: OECD Indicators [Internet]. Paris: OECD Publishing; 2015 [citado em 2019 jul 23]. Disponível em: http://dx.doi.org/10.1787/health_glance-2015-en
3. Pitangueira JCD, Silva LR, Santana MLP, Silva MDCM, Costa PRF, Almeida V, Assis AMO. Síndrome metabólico y factores asociados en niños y adolescentes de un municipio brasileño. Nutr Hosp. 2014; 29(n04):865-72.
4. The European Union. EU Action Plan on Childhood Obesity 2014-2020 [Internet]. Brussels: EU; 2014 [updated 12 March and 28 July 2014]. Disponível em: http://ec.europa.eu/health/nutrition_physical_activity/docs/ childhoodobesity_actionplan_2014_2020_en.pdf.
5. Branca F, Nikogosian H, Lobstein T. The challenge of obesity in the WHO European Region and the strategies for response: summary [Internet]. Geneva: World Health Organization; 2007 [citado em 209 jul 23]. Disponível em: http://www.euro.who.int/en/publications/abstracts/challenge-of-obesity-in-the-who-european-region-and-the-strategies-for-response-the.-summary.
6. Aiello AM, Mello LM, Nunes MS, Silva AS, Nunes A. Prevalence of obesity in children and adolescents in Brazil: a meta-analysis of cross-sectional studies. Curr Pediatr Rev. 2015; 11(1):36-42.
7. Huh YH, Mougios V, Kabasakalis A, Fatouros I, Siopi A, Douroudos II, Filippaios A, Panagiotou G, Park KH, Mantzoros CS. Exercise-induced irisin secretion is independent of age or fitness level and increased irisin may directly modulate muscle metabolism through AMPK activation. J Clin Endocrinol Metab. 2014 Nov; 99(11):E2154-61.
8. Sola D, Couturier J, Scarso G, Raiciu C. How can the Internet of Things help in overcoming current challenges and make healthcare sustainable. Commun Strateg. 2012; 3(87):67-81.
9. Foster GD, Makris AP, Bailer BA. Behavioral treatment of obesity. Am J Clin Nutr. 2005 Jul; 82(1 Suppl):230S-235S.

10. Bemelmans WJ, Wijnhoven TM, Verschuuren M, Breda J. Overview of 71 european community-based initiatives against childhood obesity starting between 2005 and 2011: general characteristics and reported effects. BMC Public Health. 2014; 14:758.

11. Pigeot I, Baranowski T, De Henauw S. The IDEFICS intervention trial to prevent childhood obesity: design and study methods. Obes Rev. 2015; 16(S2):4-15.

12. Haemer MA, Ranade D, Barón AE, Krebs NF. A clinical model of obesity treatment is more effective in preschoolers and Spanish speaking families. Obesity (Silver Spring). 2013 May; 21(5):1004-12.

13. Dev DA, McBride BA, Fiese BH, Jones BL. Risk factors for overweight/obesity in preschool children: an ecological approach. Child Obes. 2013 Oct; 9(5):399-408.

14. Raman J, Smith E, Hay P. The clinical obesity maintenance model: an integration of psychological constructs including mood, emotional regulation, disordered overeating, habitual cluster behaviours, health literacy and cognitive function. J Obes. 2013; 2013:240128.

15. Swinburn B, Egger G, Raza F. Dissecting obesogenic environments: the development and application of a framework for identifying and prioritizing environmental interventions for obesity. Prev Med. 1999 Dec; 29(6 Pt 1):563–70.

CHAPTER 6

DESIGN, DEVELOPMENT AND VALIDATION OF EHEALTH TECHNOLOGIES THAT SUPPORT A VOCAL HEALTH STRATEGY - 'EVOICE' PROGRAM

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INTRODUCTION

This chapter aims to present the design, development and validation of eHealth technologies – VoiceGuard app and distance learning course "Vocal Health in Focus" – that support a Vocal Health strategy - 'eVoice' Program. The aforementioned technologies were developed at UNIFOR and have shown their relevance to help the promotion of vocal health for professionals that use their voice as a working tool.

Technologies move forward with modern life, providing new opportunities that make the labor routine of many professionals easier by using practical and accessible tools for promoting health. Studies report that technologies have been more and more used in the health field, as mobile health (mHealth) technologies gain ground through applications for smartphones and tablets[1].

mHealth technologies belong to the subfields of Electronic Health (eHealth) - which constitutes the universe of technological tools that offer support to health promotion and care. Thus, Electronic Health (eHealth) contributes to the accessible and safe use of resources for the transference of information; besides offering support to health services, surveillance, literature review and education in health, as well as the expansion of knowledge and research[2].

It is important to point out that mobile applications for health reach a large populational diversity, such as health professionals, patients, caregivers and healthy people[3]. Furthermore, their purposes are varied, since they offer information about different health fields, enabling adherence to treatment(s) and the management of diseases[4].

The benefits of information technology applied to health are well known, since several studies report many of their uses, such as: improvement of interventions, higher precision in clinical decision making, patients' and health professionals' education. Another widely studied aspect is the use of mobile technology as a support to the programs of continuous education directed to health professionals in developing or vast countries[5].

Mobile computing may be applied to several segments inside the health field, besides creating conditions for the continuous evaluation of health parameters, constituting a new scenario of incentives for healthy behaviors and helping in the self-management of chronic conditions[6].

In Speech Therapy, for example, there are software related to the voice, language, orofacial motor function, besides videos with instructions about health promotion. Wide popularization of the use of mobile devices shows that interventions with the support of these tools facilitate the acquisition of knowledge, by the population, about their health conditions, expanding the efficiency and the effectiveness of health promoting strategies, due to their easy use[7,8].

The Internet, on the other hand, is another means that offers several possibilities through computer networking conferences and multimedia workstations. In this sense, distance learning is a modern resource of education applied through the use of technologies of information and communication. Nowadays, distance learning has been used more and more in elementary education, higher education, open courses, among other contexts [9]. Distance learning courses have been considered a powerful educational tool, since they enable the transmission of information that reaches a large number of people, being highlighted by Alves and Aerts [9] due to the dimensions that they reach worldwide.

Teaching is one of the professions with highest incidence of voice disorders, due, in most cases, to inappropriate work conditions, high vocal demand and abusive use of the voice. The high vocal intensity applied by many teachers is a mark of the profession, being strongly linked to the existence of environmental noise in the classroom [10,11].

Dysphonia is one of most common vocal disorders among teachers and it is characterized by any alteration or difficulty in the vocal emission that blocks the natural production of the voice, resulting in a unpleasant sound [12,13,14].

Literature on the topic is extensive and converges to indicate the main vocal symptoms in the teaching category, which are: hoarseness, vocal fatigue, weak voice, voice failures, pain or discomfort while speaking, dry throat, throat clearing, constant coughing, difficulty in projecting the voice, among others [8]. These symptoms are signs of vocal abuse or intensive use of the voice in inappropriate working conditions, which may contribute to the occurrence of occupational diseases [15].

Due to the technological advances and the need of promoting the vocal health of teachers, an app was developed for promo-

tion and management of vocal health – VoiceGuard [16]; as well as a distance learning course – "Vocal Health in Focus" - that addresses the promotion of vocal health and offers instructions about the use of the VoiceGuard app. Both resources contribute for vocal health promotion and for the processes of Education in Health, being supported by digital technologies. The association of both resources in a vocal health program (eVoice) enables a better preparation of the teachers to use their voice as a working tool, reducing occupational risks, improving vocal quality and optimizing the use of the app.

Both developed technologies offer solutions that allow teachers to monitor their vocal health in real time, creating a connection with the users and the environment; enabling the interpretation of daily vocal behavior, producing new actions; offering the support that teachers need in their daily routine, bringing tips on vocal health; besides allowing teachers to be alerted about situations of risk for vocal health [8].

In the context of vocal health, both for the promotion and for the prevention and rehabilitation of grievances, technology may become a great ally; since, due to the lack of existing activities of vocal health promotion, the use of applications and distance learning courses may be efficient strategies to face the risk factors for the voice, besides being tools that provide the expansion of knowledge.

It is relevant to highlight that the acquisition of knowledge about health, supported by science, associated to the establishment of meanings and interpretations in the living context, is an important step for behavioral change. Thus, the use of VoiceGuard and the course 'Vocal Health in Focus', in association, supports a strategy of vocal health promotion - the Program 'eVoice', since the performance of health professionals may be optimized by the use of the technologies at stake.

METHODS

From a diagnosis made for Brasil [8] about the vocal health conditions of teachers in the Municipal Education Network of Fortaleza, it was noticed that there is a need for the creation and implementation of new strategies to face an old and recurrent problem that includes vocal misuse and abuse, besides exposure to risk factors for the voice. This context leads many of these professionals to withdraw from the classrooms, compromising their quality of life and the educational system. In this perspective, a group of researchers from UNIFOR first idealized the VoiceGuard app.

During the process of design and development of VoiceGuard (January, 2015 to November, 2016), a survey was conducted, in AppStore and Google Play, regarding applications that address issues related to vocal health, and some applications have been identified that aim to help in therapy and rehabilitation of language, hearing, orofacial motor function and voice; no application related to the promotion of vocal health was identified.

In the first stage, VoiceGuard was designed and developed in a laboratory, and it has been completed with the high-fidelity prototype. Afterwards, the app was subjected to the usability test by three voice specialists. In the third stage, adjustments required by the specialists, as a result of the usability test, were done. The app-validation test was done in the fourth stage, with seven voice-specialized speech therapists. Finally, the app was evaluated by teachers of elementary and primary school, in Brazil and in Portugal, who demonstrated a great level of satisfaction.

With the VoiceGuard app, the user has the possibility of self-managing his voice, monitoring his vocal quality, the level of environmental noise and water ingestion. Thus, the features of the app are:

a) **Function "try your voice"** – allows the test of voice through a sound test (Maximum Phonation Time - MPT) and a questionnaire, in which the user will indicate the vocal symptoms he already noticed. This resource enables the user to have an idea about the performance of the vocal folds, providing tips and feedback about the performed tests, what also has an educational function in health;

b) **Function "signal-noise"** – this resource enables the user to measure the level of environmental noise, checking if it is competing with the voice of the teacher. It is important to stress that, from 63dB, a sound alarm informs the app user that the intensity of noise may offer risks to his voice. Disabling the function, a screen presents the measuring time of environmental noise, as well as the peaks that exceed the acceptable intensity for the preservation of vocal health;

c) **Function "water time"** – after programming the class schedule, this function sends programmed reminders for the teacher to keep himself hydrated. After drinking the glasses of water indicated by the app, the teacher records that in the cell phone screen. By the end of the working shift, the program counts the amount of water that was ingested during the professional use of the voice, considering that a glass corresponds to 250 ml;

d) **Function "tips"** – provides tips on what is good and what is not good for the voice, showing what must be done to take better care of vocal health;

e) **Reports** – it is a tool that shows the user's performance in all used features of the application, showing results, day and hour;

It is important to point out that the evaluations carried out with specialists and users showed that the functions of VoiceGuard meet the users' needs, leading to greater motivation for its full use.

From August 2016 to June 2017, the distance learning course "Vocal Health in Focus" was designed and developed, emerging from the need of vocal health training mentioned by the teachers during the validation tests of VoiceGuard app.

The first three stages of development of the distance learning course "Vocal Health in Focus" were carried out in a laboratory. In the fourth stage, a validation test of the course was run with specialists, who are also named, in this study, "speech therapy-specialists". Later on, the distance learning course was evaluated by teachers of elementary education in the Municipal Education Network of Fortaleza, Ceará, and Recife, Pernambuco, both of them cities in Brazil. They demonstrated an excellent level of satisfaction with the resource, in face of the images, interactivity, content and texts, which are differentials that enable vocal health training and support the use of VoiceGuard app.

The design stage of the distance-learning course took place between August and September 2016, when a review of literature was done in the following main databases: Capes journals, EBSCO, BVS, PubMed, Scielo, *Acadêmico* and Library of UNIFOR. For this, the following keywords were used, associated or not, in Portuguese, English and Spanish: *promoção da saúde; educação a distância; voz e professor; plataforma virtul; docentes; tecnologia; software;* voice and vocal health program; health promotion; distance education; voice and teacher; virtual platform; teachers; technology; software; *promoción de la salud; educación a distancia; y voz del profesor; la plataforma virtual; maestro; tecnología; y software.*

Besides the literature survey, a research about distance learning courses related to vocal health promotion was carried out at web-

sites. Few results that combine technology, virtual platforms, software, vocal health, voice and teachers, were found. It was noted that the articles and websites related to this issue, as well as the distance learning courses about vocal health, do not offer support to the use of other digital technologies.

The second stage (August to October 2016) consisted in the production of content for the development of the distance learning course of vocal health promotion. For this, based on the research done in the first stage, a guide composed of four modules was drafted, which was used for the structuring of the course in a laboratory, as follows:

Table 1 – Modules of the Distance Learning Course about Vocal Health

	Contents
Unit I	Concept of voice, anatomy and physiology of vocal production, besides providing tips for good breathing.
Unit II	Concept of voice professional, risk factors that cause problems in the voice and main vocal diseases.
Unit III	Main vocal symptoms, tips on vocal care and hygiene, as well as exercises that bring benefits for the voice before and after professional use.
Unit IV	Guide for Use of VoiceGuard App and References.

Source: Own Authorship.

This project is based on Participatory Interaction Design [17], since users' perspectives were taken into account for the creation process of the technological tools. Thus, both VoiceGuard app and the distance learning course "Vocal Health in Focus" were structured from the needs indicated by the teachers that used both technologies during the test period, what enabled improvement through the stages of design, redesign and validation.

Interpretation of the test results was based on Symbolic Interactionism [18], Participatory Interaction Design [17], and user journey mapping [19,20], besides references about teachers' vocal health.

With both technologies, the Program 'eVoice' was drafted, based on five face-to-face workshops and the support for the developed technologies. In the topic "results" of this chapter, details about the technologies will be presented, reaching the designing and the programming of 'eVoice'.

It is important to highlight that all ethical principles related to research involving humans were carefully followed. Thus, the teachers and specialists that participated of the usability and validation tests of the technologies signed an Informed Consent Term, consenting to be part of the study sample, which had the approval of the Research Ethics Committee of UNIFOR, under Opinion nº 1.615.489.

RESULTS AND DISCUSSION

After the development of VoiceGuard and the usability tests, the app was submitted to wide validation, with the participation of a greater number of teachers. It is relevant to stress that, before the beginning of this stage, tests were done in Brazil and Portugal, which showed the need of a review of the operational system of the tool, due to connection failures, as well as little adjustments in the screen layout and in the content. This activity took place in the Laboratory of Technology Innovation of NATI/UNIFOR, from February to July 2018. Thus, the app was updated and its new version was made available for Android and IoS systems.

During the process of wide validation of VoiceGuard, tool functionality was evaluated with the teachers of six municipal

schools of Fortaleza, being one school in each of the six districts of education. Forty teachers of elementary education took part in the process, being 27 female and 13 male, aged 39.7 years on average. Firstly, the app was introduced to the teachers, and those who agreed to be part of the sample filled out the questionnaire on socioeconomic profile and health conditions.

The average performance in classroom is of 12.28 years, while 82.50% of the teachers work from 100 to 200 monthly hours, 62.50% report to have more than six vocal symptoms, while 47.7% consider to be exposed to more than six vocal risk factors. None of the teachers in this study had attended any vocal health promotion program offered by the schools where they work, but 67.5% consider it important to use the app to take care of their vocal health.

VoiceGuard was used for a period of two months, with a questionnaire being implemented for monthly monitoring after a month of use of the tool, through which the frequency of VoiceGuard use was informed, as well as negative and positive aspects of the tool, conditions of operation, acquisition of knowledge with app use, behavior changes noticed regarding the care of vocal health, and other considerations.

Afterwards, by the end of two months, an experience evaluation form was applied, regarding the use of the app, and six focus groups were organized, through which it was possible to observe the feelings, thoughts and behavior changes from the use of the app. From this stage, four issues have arisen, which deepen the experiences of the teachers with the use of VoiceGuard.

The first issue concerns the "motivations for using the app", which includes questions regarding the satisfaction of the participants, from the collection of information about their voice and the necessary care for the reduction of risk-factor exposure and vocal symptoms.

The second issue addresses "thoughts, feelings and behavior changes from the use of the app", considering the awakened awareness about self-management of their voice, the feeling of support from app use, besides the behavior changes that lead to the reduction of vocal involvements.

The third issue refers to the "potentialities and fragilities of the experience", in which the improvement of knowledge about vocal health and the possibility of personal data storage are considered as potentialities. As a fragility, dissatisfaction was demonstrated regarding the lack of reminders for app use and for the practice of exercises. Although these aspects came forth, adjustments will be made to correct the indicated fragilities.

Finally, the fourth issue brings "suggestions for improvement", such as: improvement of data related to the results, implementation of use alerts and practice of exercises.

Data interpretation was based on "Experience Mapping". The theories of experience mapping consider that people interact with the products and, from these experiences, shape their behaviors, holding two criteria as starting points: the involved people and the kind of focused experiences. It is important to point out that an experience mapping usually includes actions, thoughts, feelings and critical aspects [19,20], and there is not a unique form, but many possibilities of construction of a template that meet the needs of the product and the studied population.

Regarding motivation, the participants found in the app a possibility of expanding their knowledge, since, according to Caposori and Ferreira [21], the teachers, in their training process, do not have a preparation for the use of their voice. In their reports, the teachers informed that they had never received instruction regarding voice care. Others mentioned to be aware that their voice is their working tool and that it demands care, but also informed not to

know how to take that care, what evidenced the need of strategies for the promotion of vocal health addressed to this public.

The use of mobile devices is already a reality in people's daily routine. Health information, in this kind of device, has an extremely dynamic nature, such as the alarms and reminders that increase the strategies of health promotion, in face of the provided meaningful learning. Thus, the advantages and benefits of these technologies are countless, which includes the context of health promotion [22].

The distance learning course "Vocal Health in Focus", after its development, was validated by five speech therapist-specialists that work in the field of voice and/or collective health, in May 2017. For this, a structured questionnaire was used, based on the Likert scale, which considers a group of items that make it possible to assess the opinion of the specialists regarding the course, in a structured form, from the score given to three categories: objectives (10 questions); structure and presentation (15 questions); and relevance (4 questions)[23]. The categories are organized in the following groups:

Group 1 – Objectives: it has items that evaluate the purposes, targets or goals that should be reached with the distance learning course.

Group 2 - Structure and Presentation: includes aspects that address the form of organization; structure; of image, text and video presentation strategies; coherence and formatting.

Group 3 – Relevance: the questions are related to aspects that evaluate the level of relevance of the distance learning course.

For the analysis of the data collected from the questionnaire, the items were presented in four levels of valuation: Inappropriate (value 1); Partially Appropriate (value 2); Appropriate (value 3) and Totally Appropriate (value 4). Under each group of questions, there were, also, spaces for the specialists to register comments or suggestions about the evaluated course.

Wynd, Schimidt and Schaefer [24] affirm that the CVI considers "the proportion of items that receives a score of 3 or 4 by the judges", thus, the number of items that had an appropriate (value 3) and totally appropriate (value 4) evaluation. It is relevant to point out that, to be approved, the item needs to get a value from 0.76 to 1 (one). Values below 0.76 mean that the item needs to be reviewed.

From the results, it was noted that the course is relevant for the promotion of teachers' vocal health, with a Content Validation Index (CVI) of 0.8 to 1 in the majority of items in the questionnaire. Besides the results of the CVI, the opinion of the participants showed a high satisfaction level with the course, especially regarding the content, the physical structure and the achievement of goals.

The VoiceGuard app and the distance learning course "Vocal Health in Focus" inspired the Program 'eVoice', as a strategy for promoting teachers' vocal health, supported by the technologies at stake. The aforementioned program is developed into five face-to-face workshops, with the mediation of a speech therapist, whose program is presented in table 2.

Table 2 – Program of the Course of Vocal Health Promotion, Fortaleza, Ceará, 2019.

WORKSHOPS	ACTIVITIES
First workshop	Vocal evaluation of the teachers before participating in the vocal health program, through the Questionnaire of Teachers' Vocal History, Questionnaire of Voice-Related Quality of Life – QVRQOL and Voice Handicap Index – VHI. General presentation of the vocal health program.
Second workshop	Notions of vocal health and hygiene. Presentation of VoiceGuard. Guided use of VoiceGuard App.
Third workshop	Discussion about the use of VoiceGuard in the classroom. Presentation of the "Vocal Health in Focus" Course and access to units I and II of the 'Vocal Health in Focus" Course. Guide the teachers to explore, in detail, units I and II of the course at home.

WORKSHOPS	ACTIVITIES
Fourth workshop	Discussion about units I and II of Vocal Health in Focus Course in classroom. Access to units III and IV of the Vocal Health in Focus Course. General notions of preventive vocal exercises. Guide the teachers to explore, in detail, units III and IV of the course at home.
Fifth workshop	Discussion about units III and IV of Vocal Health in Focus Course in classroom. Questionnaire for evaluation of the workshops. Vocal evaluation of the teachers after participating in the vocal health program through the Questionnaire of Voice-Related Quality of Life – QVRQOL and Voice Handicap Index – VHI.

Source: Self Authorship.

For the validation of 'eVoice' Program, a pilot program was implemented from September to November 2018, with 15 teachers of primary and elementary education, both female and male, in three schools, being two of district VI and one of district II of the Municipal Education Network of Fortaleza, Ceará, Brazil. Five fortnightly workshops were organized aiming to expand the knowledge of the target audience about vocal health and enhance the solution of the vocal problems mentioned by the teachers [8] and by literature [25,26]. Although the study is still in progress, the feedback of the teachers has been very positive.

The next stage, which will start in January 2019, will consist of the efficiency evaluation of the program, will have a widened sample, and will feature the implementation of instruments for collecting data about the teachers' vocal health in the beginning and by the end of the process, which will make it possible to compare vocal performance before and after participation in the program, such as the following questionnaires: teacher's vocal history, Voice-Related Quality of Life – VRQOL and Voice handicap Index – VHI.

CONCLUSIONS

Development of the VoiceGuard App and the distance learning course "Vocal Health in Focus", from teachers' perspective, is very important for supporting the promotion of vocal health. These resources may also be used by other professional voice users, since most of them, during academic or working life, are not informed about the necessary care to and the problems that may affect vocal health.

Regarding the experience of teachers with the presented technologies, the users' high level of satisfaction is clear, since the tools provide detailed and accessible knowledge about voice care, besides facilitating the comprehension of some harmful factors for vocal health. Besides, the participants reported that the applications brought new possibilities of behavior changes, making the constant care of the vocal health easier, regardless of where they are, either at work or at home.

Teachers reported feeling happiness and support with the use of the app, as they consider VoiceGuard a tool developed especially for their voice care that meets great part of their needs. They also highlighted that the app makes the routine of voice care easier because, in face of the little knowledge that most about the issue, the most important information is offered by the tool, besides the resources that enable to test the voice, remind the moment to drink water and measure environmental noise.

The course "Vocal Health in Focus" was positively evaluated by specialists and it is considered a resource that offers vocal health training and supports the use of VoiceGuard App.

The teachers' high level of satisfaction with the presented technologies inspires the creation of the 'eVoice' Program and shows the potential that these tools have to be incorporated to the daily routine of teachers, extending the reach of its use and fulfilling the roles for which they were designed and developed.

In this sense, new studies are required for the evaluation of the efficiency and effectiveness of these technologies, either in the form of technologies eHealth, or as the eVoice Program. These findings will make it possible to verify the effects and the reach of the purposes, leaving the empirical field and reaching the practical field, changing, thus, the existing reality.

REFERENCES

1. Whittaker R. Issues in mHealth: findings from key informant interviews. J Med Internet Res. 2012;14(5):e129.
2. Lopes AR. Avaliação da qualidade de serviços da ehealth online na pespectiva do utilizador [Dissertação de mestrado]. Coimbra: Faculdade de Ciências e Tecnologia, Universidade de Coimbra; 2016.
3. Free C, Phillips G, Felix L, Galli L, Patel V, Edwards P. The effectiveness of M-health technologies for improving health and health services: a systematic review protocol. BMC Res Notes. 2010; 14(5): 2-7.
4. Riley WT, Rivera D, Atienza A, Nilsen W, Allison S, Mermelstein R. Health behavior models in the age of mobile interventions: are our theories up to the task?Transl Behav Med. 2011 Mar;1(1):53-71.
5. Oliveira TR, Costa FM. Desenvolvimento de aplicativo móvel de referência sobre vacinação no Brasil. J. Health Inform. 2012; 4(1):23-7.
6. Rocha T, Fachini LA, Thume E, Silvia NC, Barbosa AC, Carmo M, Rodrigues J. Saúde Móvel: novas perspectivas para a oferta de serviços em saúde. Epidemiol Serv Saúde. 2016;25(1):159-70.
7. Lavaissieri P, Melo PE. Protótipo de aplicativo para terapia vocal: analise por pares. Codas. 2017; 29(1):e20150300.
8. Brasil CCP. A voz da professora não pode calar: sentidos, ações e interpretações no contexto da integralidade em saúde [Tese de Doutorado]. Fortaleza: Universidade Estadual do Ceará, Universidade Federal do Ceará e Universidade de Fortaleza, Associação Ampla; 2015.
9. Alves GG, Aerts D. As práticas educativas em saúde e a estratégia saúde da família. Cien Saude Colet. 2011; 16(1):319-25.

10. Guimarães MA. Análise de programas de saúde vocal na docência [Monografia]. Curitiba: CEFAC; 2001.

11. Lima-Silva MFB, Ferreira LP, Oliveira IB, Silva MAA, Ghirardi ACAM. Distúrbio de voz em professores: autorreferencia, avaliação perceptiva da voz e das pregas vocais. Rev Soc Bras Fonoaudiol. 2012;4(17):391-7.

12. Moreti F, Zambon F, Behlau M. Voice symptoms and vocal deviation self-assessment in different types of dysphonia. Codas. 2014;26(4);331-3.

13. Duffy M, Hazlett E. The impact of preventive voice care programs for training teachers: a longitudinal study. J Voice. 2004; 18(1):63-70.

14. Abrahão M, Cervantes O, Haddad L. Voz e disfonia. In: Fukuda Y. Guia de otorrinolaringologia. São Paulo: Manole; 2003. p. 321-29.

15. Mendes AL, Lucena BTL, Araujo AMGD, Melo LPF. Voz do professor: sintomas de desconforto do trato vocal, intensidade vocal e ruído em sala de aula. Codas. 2016;28(2):168-75.

16. Carlos DA, Magalhães TO, Vasconcelos JE Filho, Silva RM, Brasil CCP. Concepção e avaliação de tecnologia m Health para promoção da saúde vocal. RISTI, 2016; (19):46-60.

17. Rogers Y, Sharp H, Preece J. Design de interação: além da interação humano-computador. 3a ed. Porto Alegre: Bookman; 2013.

18. Blumer H. Symbolic interactionism, perspective and method. California: Prentice-Hall;1969.

19. Atlassian. Mapeamento da jornada[Internet]. Sydney: Atlassian; 2017 [citado em 2019 jun 10]. Disponível em: https://br.atlassian.com/teamplaybook/plays/journey-mapping.

20. Kalbach J. Mapeamento de Experiências. Rio de Janeiro: Alta Books; 2017.

21. Camporossi C, Ferreira LP. Sintomas vocais e fatores relativos ao estilo de vida em professores. Rev CEFAC. 2011; 13(1):132-9.

22. Oliveira ARF, Alencar MSM. O uso de aplicativos de saúde para dispositivos móveis como fontes de informação e educação em saúde. RDBCI. 2017;15(1):234-45.

23. Teixeira E, Mota VMSS. Tecnologias educacionais em foco. São Paulo: Difusão; 2011.

24. Wynd CA, Schmidt B, Schaefer MA. Two quantitative approaches for estimating content validit. West J Nurs Res. 2003;25(5):508-18.

25. Servilha EAM, Correia JM. Correlações entre condições do ambiente, organização do trabalho, sintomas vocais autorreferidos por professores universitários e avaliação fonoaudiológica. Dist Comun. 2014; 26(3):452-62.

26. Valente AMSL, Botelho C, Silva AMC. Distúrbio de voz e fatores associados em professores da rede pública. Rev Bras Saúde Ocup. 2015;40(132):183-95.

CHAPTER 7

MHEALTH TECHNOLOGY FOR SUPPORTING BLOOD DONATION

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INTRODUCTION

The strong influence of the new Information and Communication Technologies (ICT) on the structuring of social relations becomes increasingly evident. As a result of globalization, networking has brought people closer together, overcoming geographic barriers, facilitating access to information and boosting knowledge. Because every movement may present adversities of interest, with the advancement of virtualization people have lost the notion of social interaction, pulverizing relationships and enhancing individualism[1].

The need for information and connection of human beings has favored the growth of some technologies, among which the mobile technologies can be highlighted. The use of the mobile network for communication has shown a considerable growth in recent years and the use of several cell phone applications (apps) has accompanied this growth[2]. Because of its versatility and frantic updating, this market has demanded from mobile developers more and more creativity, intelligence, connectivity and experience.

As a result of the constant search for continuous improvement in health conditions, mobile health (mHealth) technology is emerging, bringing health promotion into line with new media and new technologies, specifically mobile resources (e.g., smartphones and sensors), which facilitate the population's access to information. As a result, health care providers and users are increasingly adopting mHealth technology as a strategy that can meet the diverse requirements of citizens' wishes and needs[3], such as care orientation about health, disease prevention, social engagement, promotion of citizenship and solidarity movements.

With regard to the transfusion demand in society, hemotherapy services need to create new strategies that allow satisfactory care of the population, generating safety to health units and patient recovery.

This way, the adoption of mHealth technology as a marketing strategy used by the blood collection centers may meet the diverse requirements of citizens who are interested in participating in social campaigns, solidarity movements and collective aid, in addition to benefiting patients and their families in a vulnerable situation, affected by some hematological disease or trauma.

Based on the premise that blood donation represents a resource for the maintenance of collective health and social balance, this can be understood as a health promotion practice, meeting the prerequisite of equity. Making these services available through apps enables the blood center to customize its relationship with donors and non-donors, creating a true Customer Relationship Management (CRM) tool. This bond with the citizens generates empathy, broadens the loyalty of donors and the capture of new ones. It should be emphasized that a balanced blood supply guarantees prevention of mortality and clinical complications, and it is also the implementation of collective health actions, through the promotion of blood donation in a conscious and effective way.

The present study is a cross-section of the research entitled "mHealth technology to encourage blood donation and support for health promotion" and intends to describe the theories that supported the methodology of this scientific research.

THEORETICAL-METHODOLOGICAL GROUNDS

The research is based on the method of creating Interaction Design (ID) [4] supported by Symbolic Interactionism [5]. The first theory consists of a multidisciplinary field of study that can contribute to the areas of engineering, architecture, marketing, advertising, communication and health, and will subsidize the guiding questions for the design, development and validation of the application. Symbolic Interactionism, in turn, subsidizes the understanding of the feelings, actions and interpretations of the users and experts to be observed in the usability and validation tests of the application, this being an mHealth technology that proposes to increase citizen knowledge and self-management in the context of blood donation [6].

INTERACTION DESIGN (ID)

ICTs increasingly influence day-to-day activities, becoming conditions to intermediate personal and work relations, even relations between states and between countries. In addition, they cover all areas of knowledge, since they make it possible to control and treat diseases, monitor climate and natural phenomena, the process of learning in schools, dissemination and democratization of information, accelerate communication, allow for social control, in short, generate dependence between the human being and the various technologies. Barbosa and Silva [7] affirm that "ICTs are changing

not only what is done and how it is done, but also who does it, when, where and even why ..."

In the area of computing technologies, a specific field has been in expansion, Human-Computer Interaction (HCI). HCI uses the concept of interface for communication between man and the computer. The concept of interface first appeared as a communication component and its universe was restricted to the creation of hardware and software architecture to mediate human-computer communication. Over time, other aspects were considered, such as cognitive and emotional ones, perfecting HCI [8].

The ID comes to take part in and expand the possibilities of HCI regarding the diversity of design, communication and technology processes. Design is understood as the creative process that seeks to represent or illustrate something new; it implies a lot of study, interaction and exploration of requirements and solutions for the project [9].

The ID seeks to understand the universe of interaction, contextualizing and seeking its reasons, "favors the senses and gives us the power to listen, to prove, to see, to touch and to feel. It is about communication..." [10]. Winograd [11] simplifies the concept and affirms that ID is the "design of spaces for communication and human interaction". Rogers, Sharp and Preece[4] understand ID as "a creative process that aims to assist and design interactive products to support how people communicate and interact in their everyday lives, whether at home or at work."

All definitions harbor understandings of the human-computer relational process through interactive design. Thus, we can distinguish HCI from ID as follows: HCI is focused on the design, evaluation and implementation of interactive computer systems, considering the context and influencing phenomena in the construction of the prototype, having a narrow scope. The ID will work with

theories, research and design practice, from the user experience, for any type of system or product [4]. Thus, it is verified that the ID is a field of HCI.

The process of developing the ID in HCI is focused on identifying the profile of the user and/or the stakeholders, their desires and needs. To do so, this approach involves the user in their creative process, collecting requirements that direct the architecture of the artifact. This creative process is often referred to as "user-centered ID" and involves user participation in the development of the artifact. This participation can happen in one step, in several or all stages of development (participatory design) [12].

Participatory design is related to the user's understanding of the entire process of developing a technology so that he/she can modify it when necessary. The participatory user is usually part of a working group that will use the tool and needs to appropriate its resources. User-centered ID can be participatory or not, depending on the intensity of user involvement[12].

Methodologically, Rogers, Sharp and Preece[4] define four steps for the construction of user-centered DI (Figure 1), based on an iterative process:

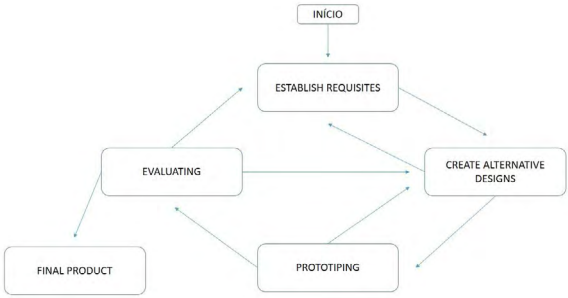
a) establishing requirements;

b) creating design alternatives;

c) prototyping;

d) evaluating.

Figure 1 – Interaction Design (DI) life cycle mode



Source: Adapted by the author from Rogers, Sharp and Preece [4].

This process is characterized as iterative, due to the inability of the product to emerge ready for use at once, requiring inputs, outputs, experiments, evaluations and tests to complete the cycle and allow continuous improvements [4,13]. These steps, as Figure 1 itself demonstrates, are complementary and can be accessed multiple times until one achieves excellence in product delivery.

The first stage of development is the requirements survey, which has two objectives to be achieved: (1) identifying the user, their activities and the context of the activities; and (2) relating a set of stable, enforceable, and solidly based requirements.

The second step is to transform the requirements into a conceptual model that describes the potential of the tool, the possibilities of use and the knowledge needed to produce it. With the elaboration of conceptual design, the third step begins with the creation of a prototype. A prototype can be a sketch of screens, an electronic image, an explanatory video, a model, in short, a form of representation that can illustrate the artifact and allow the user to interact with it and know its functions and potentialities.

The fourth and final step is to validate the product through careful analysis, in order to identify whether it is aligned with the established requirements. At this stage, experts, users and stakeholders can participate. It is worth noting that the four steps can be accessed several times during the design process until the expected success is achieved.

This study followed all the steps established for the construction of interactive design, with the participation of users and stakeholders in some stages of the development and validation process in order to provide a desirable, accessible, pervasive, agile, intuitive and interactive interface, so that it meets the wishes and needs of the user and generates a satisfactory experience.

SYMBOLIC INTERACTIONISM

From a humanistic approach to social interpretation through the systematic analysis of human behavior, Symbolic Interactionism emerged at the Chicago School, University of Chicago, United States, in the 1930s, from sociological researchers who deepened social interpretation stemming from American pragmatism.

According to Mead, in his work Mind, Self, and Society [14], the understanding of Mind through the interpretation of language, gestures, thought, communication and symbols in line with the study of Self, the "I" and the "me", their relationship with the social and with the process of creativity, interpolate themselves in the construction of Society, within the perspective of being ontological and of social phenomena, Symbolic Interactionism.

Mead, despite being considered the father of the interactionist theory, died in 1931 and his works were published based on lecture notes and other documents that were organized and systematized by his followers after his death.

Thus, the term Symbolic Interactionism was created by American sociologist Herbert Blumer in 1937[5], considered by the interactionists the great developer of this theory, since he was one of Mead's disciples and worked tirelessly in the organization of his writings, having deepened and systematized the theory. In his most important work, Symbolic Interactionism, Perspective and Method, 1969, Blumer discusses the assumptions of Symbolic Interactionism, pointing to "meaning" as the essential point in the interpretation of human behavior.

Supported by Mead's studies in this line of research, Blumer deepens the reading of psychosocial interpretations and affirms that "meaning" is a product of society arising from the process of human interaction and, from this understanding, defines the nature of Symbolic Interactionism based on three premises[5,14].

The first is that the human being directs his actions towards the things in function of what they mean for him ... The second is that the meaning of these things arises as a consequence of the social interaction that each one maintains with his neighbor. The third is that meanings are manipulated and modified through an interpretive process developed by the person in confronting the things that he encounters in his path [5].

The interpretation of psychosocial and human behavior in the light of Symbolic Interactionism qualifies the study in several areas of knowledge, especially in psychology, sociology and communication. The observation and understanding of the physical and psychological manifestations of the human being before a given situation provide new qualitative elements in scientific research, generating interpretations more faithful to the object in question.

Within this approach, eHealth technologies have offered a series of possibilities for interaction with the population that can facilitate actions to encourage health care, within the approach of

Symbolic Interactionism, considering the meanings of and meanings attributed to health issues by the public to be worked on.

Only by identifying the universe of the meanings of the human being and of the different population groups, it is possible to move effective actions of health promotion in the context of blood donation, internalizing healthy habits and altruistic actions. Those are actions that require behavioral changes and that can be encouraged and optimized through mHealth technology.

METHODS

It is a methodological research of applied nature and qualitative approach. Methodological research is a form of study that seeks to deepen new approaches to knowledge and offer a scientific contribution[15]. Generally, this modality is adopted when the object in question can generate methods and practices that contribute to the construction of knowledge. Polit and Beck [16] corroborate and affirm that this type of research can be used in quantitative, qualitative or mixed approaches and, usually, they are configured as non-experimental studies, resulting in the construction of new instruments or research methods.

Concerning problem approach and data analysis, the qualitative modality that considers the dynamism of social relations - self, society and their meanings - and the interpretation of human behavior in the face of new technologies was used. The understanding of these nuances was essential to subsidize the construction of a relevant technological artifact with a strong social contribution.

The combination of theories - Symbolic Interactionism[5] and Participatory Interaction Design[4] - characterizes the differentiated look of this research, since the object under study deals with the con-

ception of mHealth technology that seeks to achieve a strong power of social action, starting from the individual to the whole collective and therefore integrating the senses and meanings of communicational languages, focusing on the humanitarian potential of each person.

Implementation of the research was carried out in three stages. The first stage occurred from September 2015 to July 2016 and consisted of the design and development of the app in the laboratory. In this step, three phases of the interactive processes included in User-Centered Interaction Design life cycle (Figure 1) guided by Rogers, Sharp and Preece[4] were considered, which are: (1) requirements survey and identification of user's needs (2) design of alternatives and (re)design and (3) construction of the prototype.

The second step occurred in November 2016 and included the assessment of users' use of the app - blood donors. At the time, the performance of the tool and the interaction of the users with the technology were evaluated. Within the ambit of the Rogers, Sharp and Preece[4] model, after this test, the tool can also go through (re) design to ensure continuous improvement of the system. The (re) design process took place from February to May 2017 to implement the adjustments in the application and sought to address the pertinent considerations made by the usability test participants, fully aligned with the Interaction Design life cycle model User[4] - Figure 1 - with regard to the search for effectiveness.

The third and last step occurred in July 2017; it was of the validation of the application by specialists, and it had the objective of submitting the tool to a functional and content evaluation by professionals of hemotherapy, aiming to ensure coherence in the information, its alignment with the target audience and the app effectiveness at its performance. Also, at this step, a Focus Group was held with the mentioned specialists to gather opinions, feelings and meanings about the technological artifact.

As for the participants of the second step, it was decided to include people from the age of 18, with a maximum age of 69 years. According to Dumas and Redish [17], the ideal number of users for the usability test should be between five and twelve people. In this study, 11 volunteer blood donors participated in the usability test, five men and six women, from 20 to 53 years old. All of them had good physical and mental health conditions, alleging availability to participate in the meeting.

About the participants of the validation test by specialists, there are eight professionals - 4 medical doctors, 2 nurses, 1 social worker and 1 occupational therapist - 1 man and 7 women, between 33 and 61 years old, with ample experience in the blood center in the fields of hemotherapy and hematology. The specialists specifically work on the process of recruitment and engagement of blood donors (3), blood processing (1), transfusion medicine (2), traceability and surveillance of the transfusion process (1) and the blood center's general directory (1), which were selected at the public blood center according to the degree of technical knowledge, time of experience in the area, interest and availability to collaborate with the study.

According to Nielsen [18], the number of participants in validation tests must be at least three and maximum five. It is emphasized, however, that there is no parameterization or consensus of this number in literature. Cockton and Woolrych[19] argue that the number of specialists in this test depends on the type of problem and the complexity of the artifact. Thus, the validation test, the third and last stage of the research, was attended by eight professional experts, according to Dumas and Redish[17].

The focus group participants were seven of the eight specialists who comprised the validation test sample.

For data collection, structured and semi-structured questionnaires were used. The research tools made it possible to capture the

satisfaction of donor users and specialists, in specific tests, regarding the structure, presentation, objectives and relevance of the app. Besides, it was possible to identify, in the third stage of this research, the perceived dissatisfaction to direct the necessary adjustments in the tool.

Qualitative data collected through the steps and the research instruments, as well as the video records of the usability, validation and focus group tests, were analyzed based on the Content Analysis method in the thematic modality [20], following the steps of pre-analysis, material exploration, treatment of results and interpretation[21].

The result of the material exploration stage was the organization of the content in thematic modalities, divided by test, as follows:

a) Evaluation of the use of the app by blood donor users

- Theme 1: user-donor perceptions of application functionality and design of the app;
- Theme 2: indications on the satisfaction and relevance of the app through the eyes of donor users.

b) Validation of Content by the Experts and Focus Group:

- Theme 1: scope of objectives, structure and functionality of the app in the view of the specialists;
- Theme 2: relevance of the app: what experts say.

Afterwards, the treatment of the results and the interpretation made it possible to elaborate a synthesis of the findings, the establishment of a dialogue between the identified themes, the objective, the assumptions of the study and the alignment with literature. In this context, inferences and interpretations about the participants' perceptions about *DoeSangue* were made.

The analysis of the data collected from the app evaluation, based on Likert's Scale, was performed with the specialists considering the content validation index (CVI). The instrument was divided into three evaluation blocks, which are: Block 1 - contemplated the objectives of the app, consisting of 9 items; Block 2 - corresponded to the structure and presentation of the tool, with 15 items and Block 3 - hosted questions about the relevance of the technology, with 5 items.

CVI identifies the number of Likert's Scale items that received scores "3" and "4" within the total response universe, where the score 3 means that the tool is adequate and the score 4, fully adequate [22]. From the answers attributed by the participants, the calculation of the CVI is made based on the following formula:

$$\text{CVI} = \frac{\text{number of responses "3" or "4"}}{\text{total number of responses}}$$

The final values of CVI vary from 0 to 1. In this classification scale, values equal or above 0.79 attest to the validity of the technology, according to the participants of the tests[23] . Values below 0.79 indicate the need for adjustments of the tool, block or item that received this score.

The interpretation of the findings in an associated way, integrating the speeches and the results of the instruments based on Likert's Scale, was based on the User-Centered Participatory Interaction Design [4] and on Symbolic Interactionism[5], since it was possible to verify from the feelings, actions and interpretations mobilized by the app's handling, the positive and points, and the tool improvement needs.

To protect the identities of donor users and experts who participated in the tests, the choice was made to represent their contributions by a capital letter and a number. In the case of blood donors, the stipulated letter was "D", with numbers from 1 to 11,

which represents the entire sample present in the usability test. For the validation of content by the specialists, the letter "E" followed by the numbers 1 to 8, corresponding to the sample of attending professionals, was selected.

The ethical-legal procedures of the research followed the regulations contained in Resolution 466, of December 12, 2012, of CONAS, which points out the directives and norms of research involving human beings [24]. The research was approved by the Research Ethics Committee of UNIFOR, under Opinion n ° 2.110.185.

CREATION OF DOESANGUE APP AND EVALUATION

The prototype of the app was designed to foster the needs of users and the public blood center of Fortaleza, Ceará, regarding access to donors' own information, as well as to increase the number of blood donors, respectively. Thus, the solution adopted was the construction of a mobile technology (figure 2) that could be integrated into the blood center database through a web interface or web service. The system integration feature, using the Internet, enables remote access to information and data transfer in an agile and secure way.

Figure 2 - Screens of the DoeSangue's app

1– Login	2 – Main menu	3 – Where to donate	4 – Did you know?	5 – Donor`s History	6 – Donor`s Goals

Source: The authors.

From the usability test with blood donors, two themes emerged that show significant data about the app. The first one deals with the perception of donor users as to the functionality and design of the technological artifact. Besides, in the second theme, it was possible to perceive evidence of participants' satisfaction and the attribution of meanings to the importance of the tool, which translates into the relevance of the app to the target audience under study. Finally, suggestions for improvements were made by donors who came to support the Interaction Design life cycle pointed out by Rogers, Sharp and Preece[4], in search of continuous improvement regarding (re) design and application adjustments.

The general design of the app and the features 'ease of access', 'scheduling of donation of blood or platelets' and 'information on the amount of donations already performed at the blood center' were identified as the main strengths of the tool, "*Well-crafted layout and easy-to-identify icons ...*" (D2); "*The platform is very attractive ...*" (D4); *"... ease of finding a place of closest donation and the convenience of scheduling a donation*" (D6). Other participants ratified the same perceptions in their evaluations.

Galvão and Püschel [25] affirm that the use of images can generate motivational incentive and promote intuitive knowledge, besides facilitating the understanding of messages and concepts more effectively. What is perceived is that if the information were only arranged in texts, it would take more time to be internalized and memorized. The adoption of visual resources focused on intuitive communication in mobile apps has been a widely used technique in User-Centered Participatory Interaction Design.

This aspect can be reinforced by the facilitation of knowledge, which is recommended by Blumer [5] as one of the most important premises for the promotion of personal changes and/or social behav-

ior. In this case, the tool, being evaluated satisfactorily by the users, offers indications about the adhesion of the users and, consequently, can promote changes of behavior in relation to the act of blood donation.

Mead [14] within the dialectical process of the self, consisting of the interpretation of the self (I) and me (me), for understanding social relations affirms that "the attitude of the other generalized is the attitude of the whole community". In his approach, the 'generalized other' is the symbolic understanding of the collective will. It is about the social rules, customs and culture, of the normative dimension of the social community that is structured in the form of a horizon orienting people's behavior [26].

The 'generalized other' is what we want to identify and understand in the actions and manifestations of the participants who, during the usability test, were in empathy with the initiative to build strategies to support blood donation, which presented, of the tool, a mixture of anxiety and satisfaction in participating in the research and contributing to the social cause, as expressed in the following testimony:

> I found it very interesting [the app] because it covered all the necessary points for blood donation. They worried about information about nearby places, letting the user know how much a blood donation is important and how many people he [the donor] might be helping. They also worried about the donor's health, leaving tips. In one app, they were able to put the before, the during and the after process of the blood donation. It was very well thought out! (D3).

The bonus features offered by the app to each task performed by the user reached a maximum score (CVI 1.0), this strategy was recognized as a strategy for capturing blood donors with a vast amount of social engagement, and therefore, of direct interest to the

blood center of Ceará and, possibly, of the other blood centers of the country. The specialists at the blood center emphasized:

> "*It is very nice to work with this question of punctuation because it instigates the person to seek for more ...*" (E6);

> "The bonus is the best part [of the app], very good indeed! ..." (E4);

> "*... have your donation score, have the score of your friends, you realize that you are doing good independently of your presence and there are other people doing good, it is very rewarding ... Another good thing is to be able to interact with friends.* "(E8);

> "*It is very important that you share this in a social network ... that is the most positive point, the engagement!*" (E4)

The gamification is characterized by the high power of users to engage in the activities of a cause/business, traveling the path of assimilation to action, becoming part of an undeclared social movement, being able to extend this path to the summit of advocating to an idea, product, service or cause. Kotler et al.[27] states that the gamification "helps improve engagement by including the right sets of customer behavior".

Regarding the structure and presentation (Block 2), the app obtained an average CVI of 0.90, showing that the level of expert satisfaction with the tool was high. During the focus group with the experts, several suggestions emerged and some questions were clarified about the functionality and technological potential of the application. With regard to doubts, functions such as: scheduling a donation, recording a testimony, generating social mobilization campaigns, generating news, inviting donors and friends of donors to attend the blood center, they all depend on the integration of the app with the blood center database, but they had not understood:

> "[...] *I made a wrong appointment, but I did it on purpose. I scheduled a donation of platelet to the IJF and the application scheduled, that date is invalid, for example I can't donate platelet on Sunday at the hospital IJF*[...] "(E4).

Regarding the doubts and suggestions, Minayo [28] states that this format of group data collection may have a complementary function to the study, since it aggregates research tools such as brainstorming, raising questions that were not mentioned before and previously hidden or unfelt expectations. The perceived desires and inferences captured during the Focus Group consolidate the iterative thinking of Participatory Design [4], suggesting the continuous process of improvement to be implemented during the execution of the technological development cycle.

CONCLUSIONS

Suggestions for improvement were present in the two applied tests, usability and validation, which contributed greatly to the improvement of the tool. Regarding the objective and the relevance of the technological artifact, both categories of participants were unanimous in affirming the expressive contribution that it can offer to the cause of blood donation, which goes beyond the walls of any blood center and has a collective meaning, bringing knowledge and guidance to the population aiming at promoting health as a resource for life. Thus, from the look and need of donor users and experts, there was a lot of possibilities for enhancing existing blood donation mHealth technologies to expand donor recruitment and the donors' loyalty processes.

Regarding data collection and interpretation, it was possible to capture some conclusions: there were positive results about the functionality and the presentation of the app, since, in general, they

showed a good acceptance of the donor public; it was noticed that the availability of self-services in the app was seen in a positive way - possibility of scheduling the donation itself, identifying the nearest place of donation and the best day for a donation - generating donor expectation and involvement; the provision of personalized information, such as blood type, date of last donation, and donor performance in the app, can generate a sense of empathy with the cause and blood center; the possibility of personalizing the application with the language of the blood center can generate adhesion of the other blood centers of the country; the manifestation of some experts in extending the functionality of the app refers to the potential perceived from the use of technology and, finally, recognition of the tool's modern features - bonuses and integration with the blood center database - can contribute to a culture change conducive to the practice of blood donation, building a 'generalized other' that is more aware and involved with the cause.

REFERENCES

1. Castells MA. Sociedade em rede: do conhecimento à política. In: Castells MA, Cardoso G, organizadores. A sociedade em rede: do conhecimento a acção política. Lisboa: Imprensa Nacional: Casa da Moeda; 2006. p. 17-30.
2. Associação Brasileira das Empresas de Software. Mercado brasileiro de software: panorama e tendências. São Paulo: ABES; 2015.
3. Roman F, Mensones FG, Marinas I. Mobile Marketing: a revolução multimídia. São Paulo: Thomson; 2007.
4. Rogers Y, Sharp, H, Preece J. Design de interação: além da interação humano-computador. 3a ed. Porto Alegre: Bookman; 2013.
5. Blumer H. Symbolic interactionism, perspective and method. California: Pretice-Hall, 1969.

6. Jia G, Yang P, Zhou J, Zhang H, Lin C, Chen J, Cai G, Yan J, Ning G. A framework design for the mHealth system for self-management promotion. Biomed Mater Eng. 2015;26(suppl):S1731-40.
7. Barbosa SDJ, Silva BS. Interação humano-computador. Rio de Janeiro: Elsevier; 2011.
8. Rocha HV, Baranauskas MC. Design e avaliação de interfaces humano--computador. Campinas: Unicamp; 2003.
9. Benyon D. Interação humano-computador. 2a ed. São Paulo: Pearson Prentice Hall; 2011.
10. Thackara J. The design challenge of pervasive computing. In: Thaler RH, Sunstein CR. Nudge: Improving decisions about health, wealth and happiness. Londres: Penguin books; 2001.
11. Winograd T. From computing machineryto interaction design. In: Denning P, Metcalfe R, editors. Beyond calculation: the next fifty years of computing. Amsterdan: Springer-Verlag; 1997. p. 149-62.
12. Pimentel M, Fuks H, organizadores. Sistemas colaborativos. Rio de Janeiro: Elsevier; 2012.
13. Gould JD, Lewis CH. Designing for usability: key principles and what designers think. Communic ACM. 1985; 28(3):300-11.
14. Mead GH. Mind, self and society. Morris: University of Chicago Press; 1934.
15. Demo P. Metodologia da investigação em educação. Curitiba: InterSaberes; 2013.
16. Polit DF, Beck CT. Fundamentos de pesquisa em enfermagem: avaliação de evidências para a prática da enfermagem. 7a ed. Porto Alegre: Artmed; 2011.
17. Dumas JS, Redish JC. A practical guide to usability testing. [local desconhecido]: Intellect; 1999.
18. Nielsen J. Heuristic evaluation. In: Nielsen J, Mack RL, editors. Usability Inspection Methods. New York: John Wiley & Sons; 1994. Capítulo 2.
19. Cockton G, Woolrych A. Understanding inspection methods: lessons from an assesment of heuristic evaluation. In. Blandford A, Vanderdonckt J, Gray P, editors. People & Computers XV. Berlim: Springer; 2001. p. 171-91.

20. Minayo MCS, Deslandes SF, Gomes R. Pesquisa social: teoria, método e criatividade. 33a ed. Petrópolis: Vozes; 2013.

21. Bardin L. Análise de conteúdo. Lisboa: Edições 70; 2011.

22. Wynd CA, Schmidt B, Schaefer MA. Two quantitative approaches for estimating content validity. West J Nurs Res. 2003; 25(5):508-18.

23. Polit DF, Beck CT. The contente validity index: are you sure you know what's beingre ported? Critique andre comendationas. Rev Nurshealth. 2006; 29:489-97.

24. Conselho Nacional de Saúde (Brasil). Resolução 466, de 12 de dezembro de 2012. Diretrizes e normas regulamentadoras de pesquisas envolvendo seres humanos. Lex: Diário Oficial da União. 2013 jun; 1(2): 59.

25. Galvão ECF, Püschel VAA. Aplicativo multimídia em plataforma móvel para o ensino da mensuração da pressão venosa central. Rev. Esc. Enferm. USP. 2012; 46(Esp.):107-15.

26. Casagrande AC. G.H. Mead & a educação. Belo Horizonte: Autêntica Editora; 2014.

27. Kotler P, Kartajaya H, Setiawan I. Marketing 4.0: do tradicional ao digital. Rio de Janeiro: Sextante; 2017.

28. Minayo MCS. O desafio do conhecimento: pesquisa qualitativa em saúde. 14a ed. São Paulo: Hucitec; 2014.

CHAPTER 8

CREATION AND IMPLEMENTATION OF EHEALTH TOOLS IN THE CONTEXT OF CHRONIC KIDNEY DISEASE: THE RENAL HEALTH MODEL

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INTRODUCTION

The worldwide increase in chronic non-communicable diseases (NCDs), including chronic kidney disease (CKD), creates a fertile ground for the development of strategies that aim to attenuate the adaptive process and coexist with long-term treatment, shared by health professionals, patients, family and caregivers.

Multimorbidity, described by the World Health Organization (WHO) as "the coexistence of two or more chronic conditions in the same individual" [1], is a worldwide reality that can impair the coordination of care, since it is necessary to align several actors and the management of different prescriptions.

In Brazil, researchers found that multimorbidity affects approximately 24.2% of the adult population [2]. Overall, CKD is associated with multimorbidity, since its main causes are Systemic Arterial Hypertension (SAH) and Diabetes Mellitus (DM) [3], that

is, the treatment of CKD needs to be incorporated into other ongoing therapies.

Added to this scenario is the educational status of the Brazilian population, of which 11.5 million individuals are illiterate [4] and 3 out of 10 citizens are considered functionally illiterate, that is, have great difficulty in reading, writing and performing routine mathematical operations [5]. Considering this instructional context, achieving full understanding of the therapeutic plan by patients and family members is not always an easy task.

However, according to a survey carried out by the Brazilian National Functional Illiteracy Indicator (*Indicador Nacional de Analfabetismo Funcional* – INAF) and published by the BBC News Brazil news network in November 2018, despite difficulties in reading and interpreting simple texts, functionally illiterate people are frequent users of social networks. Of these, 86% use WhatsApp, 72% are Facebook fans and 31% have an Instagram account[6], thus demonstrating that this group of individuals is not digitally excluded.

In times of unrestricted access to information, available on the Internet, one of the objectives of health services and professionals should be to expand the offer and access to safe and easy-to-understand content. In the context of health promotion, it is a matter of providing those involved individuals with information and tools that can provide the necessary support to the new care routine. We believe that it is health professionals' responsibility to provide patients and their families with coping strategies, as well as ways to facilitate the incorporation of treatment into their daily routine.

So-called "eHealth", or electronic health, according to the WHO [7], is "the accessible and safe use of information and communication technologies for health care and associated fields, including services in care, surveillance, literature, education, knowledge and research", and it comprehends four distinct components, as follows:

- Mobile Health (mHealth): Provides health information and services through mobile and wireless technologies;
- Health Information Systems (HIS): Systems for collecting, aggregating, analyzing and synthesizing data from multiple sources for the issuing of health reports;
- Telemedicine: Provides healthcare services at distance; can be used for inter-professional communication, communication with the patient and remote consultations;
- Distance Learning (eLearning): Education and training in electronic form for health professionals [7].

The partnership between the health sector and information and communication technology (ICT) has produced excellent results that are considered "customizable", that is, that come closer and closer to each individual's needs. For the researchers and developers of these systems, the advent of mobile technologies through smartphones has created a new window of approach to the "final consumer" as it "takes advantage" of the low cost, easy transportation and other uses attributed to the devices, such as the clock, calendar and access to social networks, making the most of these advantages, as well as approaching their health needs.

With approximately 7 billion mobile phone subscriptions worldwide, in many places, the population is more likely to have access to a smartphone than drinking water [8].

Defined by WHO as "the use of mobile devices for medical practice and public health" [9], mHealth has the potential to transform the current model of health care worldwide, providing new perspectives of time, place, means and people by whom care is provided and accessed[7].

Based on the diagnosis of CKD, professionals and patients are introduced to the delicate scenario of treatment adherence, suscep-

tible to multiple variables. The patient with CKD, regardless of the stage of the disease, receives a series of guidelines on new health care actions, including dietary restrictions, the incorporation of healthy lifestyles and monitoring of worsening signs, and whose personal decision to adhere to or not can determine the course of treatment, with direct effects including on their survival. It is therefore of utmost importance that those involved, patients and family members, be fully informed about the consequences of non-adherence on the clinical outcomes.

Considering the low rates of adherence to CKD treatment found in previous studies [10,11,12,13], the Renal Health application was created aiming at contributing to increase information about the disease, considering the impact of the lack of this knowledge on the actions of disease prevention and control [15], and to help patients with CKD regarding the treatment, aiming at better adherence rates and, consequently, better outcomes.

It should be emphasized that the development process of a tool aimed at assisting in health care should be based on strict criteria of information security and software efficiency, as well as be closely connected with the characteristics and needs of the target population.

Therefore, the following steps comprise the trajectory of the Renal Health application:

1. Knowledge of the clinical context (care practice)
2. Identification of the gap (literature review, benchmarking)
3. Study aimed at identifying the needs of the target population
4. Tool creation (brainstorming, requirements survey, product design, prototyping)
5. Test with end-users (Usability)
6. Test with health professionals (Judges)
7. Making adjustments (redesign)

8. Study of acceptability of eHealth technologies with users and health professionals
9. Longitudinal study with chronic renal patients using the application
10. Adjustment and improvement

This chapter will briefly present each of these steps and point out the perspectives and challenges of this project.

BRIEF HISTORY

Started in the year 2015, the Renal Health Project, of which the Renal Health application is the main product, was created based on the concerns arising from the care practice of its creators, a nephrologist and a Nephrology-specialist nurse.

With the initial objective of developing knowledge dissemination and self-monitoring of CKD treatment strategies, we observed the need to create a group with diversified expertise that would meet the health needs, detailed by the area professionals, with efficient technological solutions. Thus, a partnership was established with the Nucleus of Information Technology Application (NATI) and the Innovation Laboratory (InoLab), both of which belong to UNIFOR, which includes students from several areas, such as Information Technology, Computer Sciences, Communication, among others.

The choice of the application name aimed at the union of a word in Portuguese, common in several languages (Renal), and the English term "Health" (Saúde, in Portuguese), considering that English is one of the most spoken languages worldwide, which would allow the brand standardization in future versions of the application in other languages.

With the aim of publicizing the application, as well as disseminating information about CKD prevention and control, a YouTube

channel was created in December 2017 and a profile on the Instagram social network in June 2018. Subsequently, in July 2018, the initial version of the Renal Health application was launched on Google Play. Currently, the Project receives funding from the International Society of Nephrology (ISN), through the Clinical Research Program, and from the Research Development and Innovation Executive Board (DPDI) of UNIFOR, as well as institutional support from the Brazilian Society of Nephrology.

CLINICAL CONTEXT KNOWLEDGE (CARE PRACTICE)

As previously mentioned, the Renal Health application was initially conceived based on the care experience of the chronic renal patients of its authors. Detailed knowledge of the context where the target audience is immersed is one of the primary requirements for the success of the tool. This prior knowledge provides subsidies that guide the first steps of the development process, as it indicates the most fragile sectors in the line of care.

Armed with this information, the researchers started conceiving the basic idea of the Project: to create a technological tool to help patients with CKD undergoing treatment. However, amidst the discussions on the main focus of actions to be carried out, the need arose to include the general population as a target audience as well, that is, those individuals who are not undergoing CKD treatment, but who might be interested in learning about the disease. The main goal of reaching out to this group of people would be prevention.

IDENTIFICATION OF THE KNOWLEDGE GAP (LITERATURE REVIEW, BENCHMARKING)

A literature review was carried out in 2016 to support the need for a tool to elucidate the general population about CKD and to support patients with CKD regarding their treatment management. It was observed that studies carried out in several countries showed limited knowledge of the general population on CKD [15,16] including those with risk factors such as hypertension and DM [17].

Quick searches carried out in the virtual stores showed a great variety of applications for health professionals, such as atlases, current protocols, handbooks, specialized journals, calculators, etc. Some applications created for renal patients were related to dietary guidelines, but in order to access them, it was usually necessary to pay values ranging from US$ 1.99 to US$ 4.99.

At this stage, we verified the lack of Brazilian studies presenting tools that were similar to Renal Health. In Brazil, only Fernandes et al.[18] were developing a web system for the remote care of patients with stable CKD at non-dialytic stages. Therefore, it was observed that, despite international initiatives in this area, there was still a gap in Brazil regarding technological tools aimed at CKD prevention and treatment.

STUDY TO IDENTIFY THE NEEDS OF THE TARGET AUDIENCE

Aiming at identifying the issues that raise the greatest doubts and the aspects that generate the most difficulties in adapting to the treatment of CKD, interviews were carried out with the general population, that is, people who were not undergoing treatment, patients on hemodialysis and renal transplant recipients. The main informa-

tion needs among the general population were related to preventive measures, causes, symptoms and treatment of CKD. Among the patients on hemodialysis, the subjects of interest were: diet/nutrition, renal transplantation, complications during sessions, blood pressure control, causes of the disease and practice of sports. While kidney transplant recipients would like more information on diet/nutrition, transplant complications, medications to be avoided, and general guidelines.

It is noteworthy that, based on the results of this study, and the observation of the population's limited knowledge on CKD, a population-based cross-sectional study was initially carried out in the city of Fortaleza, Ceará, Brazil, to investigate the levels of knowledge of the general population about the disease and to analyze if they were related to socioeconomic aspects. The study is in its final phase of data collection, with more than 1,500 people interviewed, and the preliminary results indicate that, regardless of the level of schooling background, the lack of basic knowledge about CKD has a high prevalence.

TOOL CREATION (BRAINSTORMING, REQUIREMENTS SURVEY, PRODUCT DESIGN, PROTOTYPING)

The laboratory phase, carried out from July to October 2016, had its own methodology for the development of the tool, the User-Centered Interaction Design [19], consisting of four interactive activities: identification of needs and establishment of requirements, design and re-design of the tool, creation of an interactive version (functional prototype) and evaluation. The first version of the Renal Health application was developed, of which sessions are described in Table 1.

Table 1 – Sessions of the Renal Health application according to the target audience, Fortaleza, Ceará, 2019.

Target audience	Sessions	Specifications
General Population	Information	Kidney Function: What are the kidneys? What are the main functions of the kidneys? What is DRC? Main causes Main symptoms Treatment How to prevent CKD Frequently Asked Questions Without tests:
	Tests	Hydration testing CKD risk questionnaire With tests: Glomerular filtration rate test
Patients undergoing hemodialysis	Your treatment	Fluid intake control Weight control Tests History
	Schedule	Medications Exams Consultations
	Information	General information About the treatment Stay tuned:
	Nutritional Table	Amount of phosphorus in food Amount of potassium in food Amount of sodium in food
Renal transplant recipients	History	Creatinine Blood Pressure Glycemia Weight
	Schedule	Medication Exams Consultations
	Information	Stay tuned: Signs and symptoms Recommendations: About medications General information Nutritional information Frequently Asked Questions

Source: Renal Health Application

TEST WITH END-USERS (USABILITY)

After finishing the pilot version of the application, a usability test was performed with 10 patients on hemodialysis. The test consisted in performing seven tasks of greater relevance in the application and filling out a form with one's impressions about the software and questions about the degree of difficulty of the performed tasks. While the users performed the tasks, the evaluators filled out an individual form about the assessment. Right after the evaluation, users were asked to fill out a form with their impressions about the software and the degree of difficulty they had when performing the application tasks. Most patients considered the questions "normal", "easy" and "very easy".

TEST WITH HEALTH PROFESSIONALS (JUDGES)

Subsequently, in October 2016, a test was carried out at the InoLab with six specialists in Nephrology (physicians, nurses, nutritionists and psychologists), all of which had been working in the area for more than 5 years, aiming to validate the contents and analyze the relevance of the tool in the context of CKD treatment.

The guests were instructed to login to the app for evaluation and then answer a form about the app goals, structure, functionality and relevance. The percentage of approvals regarding the sentences was 89.6% and the main suggestions for adjustments were related to the possibility of enlarging the font or size of the screen due to the visual impairment observed in many patients, reduction of texts and content adjustments to improve users' understanding.

ADJUSTMENTS (REDESIGN)

To support Renal Health's further development and testing phases, a survey was carried out in 2017 on applications that addressed CKD, which were available in the two leading virtual application stores, Andoid and iOs operating systems, of which results are shown in the tables below. The search was carried out in the months of September and October and there was no restriction of language and nationality.

Table 2 – Characterization of the applications available in the Google Play virtual store regarding the target audience and content. Fortaleza, Ceará, 2017.

Google Play		
Word – "Renal" (n=245)		
Target audience	**Content**	**Quantity**
Renal patient	Information on diet	5
	Information on CKD	6
	Games	4
	Social networks	2
	Information and self-monitoring	4
Health professional	Calculators (renal function and medication adjustment)	39
	Handbook	7
	Journals	4
	Guidelines	3
	Information on CKD	4
	Other topics	167
Word – "Kidney" (n=252)		
Renal patient	Information on diet	4
	Information on CKD	13
	Games	9
	Information post-renal transplant	1
	Information and self-monitoring	4
Health professional	Calculators (renal function and medication adjustment)	16
	Handbook	4
	Journals	7
	Information on CKD	4
	Other topics	190

Source: Google Play

The category "Information and self-monitoring" stands out as the applications that are closest, in terms of characteristics and functionalities, to the Renal Health app. They were: "Renal Diet 1", "Kidney Disease Recommendation", "Kidney Health", "Kidney Renal Disease Diet", "Kidney Care", "My Kidney Care", "Smart Kidney" and "My Kidney My Health My Handbook".

Table 3 – Characterization of the applications available in Apple Store regarding target audience and content. Fortaleza, Ceará, 2017.

Apple Store		
Word – "Renal" (n=125)		
Target audience	**Content**	**Quantity**
Renal patient	Information on diet	8
	Information on CKD	6
	Games	1
	Social networks	1
	Information and self-monitoring	1
Health professional	Calculators (renal function and medication adjustment)	20
	Handbook	2
	Journals	5
	Guidelines	0
	Information on CKD	3
	Other topics	
Word – "Kidney" (n=209)		78
Renal patient	Information on diet	12
	Information on CKD	7
	Games	1
	Medication control	1
	Information and self-monitoring	1
Health professional	Calculators (renal function and medication adjustment)	19
	Handbook	3
	Journals	15
	Information on CKD	5
	Other topics	
		143

Source: Apple Store

The applications classified as "other topics" covered: acute kidney disease, lithiasis, kidney disease in animals, games not directed to CKD, medical congresses, yoga, homeopathy, numerous culinary recipes, radiology, general anatomy, among others. It should be emphasized that the search results can be considered overestimated, because in some cases, the same application was available in both stores.

Aware of the pioneering nature and importance of an application in the Brazilian Portuguese language aimed at the increasing group of people with CKD in our country, the research team chose, based on the searches, on the suggestions of adjustments from the usability tests, on the judges' opinion, and the need for an iOS version, to carry out the development of a new version of Renal Health using hybrid technology, of the Ionic type, in which it is possible to develop multiplatform applications (Android and iOs). At the same time, changes were made throughout the application's layout to make it more user-friendly and easier to use, and the internationalization process of the tool was initiated for future tests in other countries.

STUDY OF THE ACCEPTABILITY OF EHEALTH TECHNOLOGIES BY USERS AND HEALTH PROFESSIONALS

With the increased access to technology by a large part of the world's population, there has been an increase in the scientific community's interest in knowing the acceptability and viability of the eHealth tools among patients and health professionals [20,21,22,23,24], as well as the investigation of their effectiveness in actual health care contexts [26]. It is believed that, in addition to developing these innovative health care models using eHealth and mHealth tools, it is crucial to measure the acceptability, reach, and impact of using these tools on health outcomes. As this is a new field, that analysis will be the base of new studies and guide future health promotion actions.

For these reasons, a need to study the receptivity/acceptability of chronic renal patients regarding the use of treatment-assisting applications arose. Therefore, a cross-sectional study was carried out, initially with a group of renal transplant recipients and the health professionals involved in post-transplant follow-up, performed at the Transplantation Outpatient Clinic of Hospital Geral de Fortaleza (HGF), Fortaleza, state of Ceará, Brazil, from January to May 2019.

Individual interviews were carried out in a reserved place, with a script consisting of items of sociodemographic characterization, clinical information, possession and use of technologies, interest in using an eHealth tool to assist in post-transplant treatment. Patients and professionals were asked about the relevance in the treatment of certain functionalities (monitoring and storage of data on creatinine, weight, blood pressure, blood glucose, alerts for medications, exams and consultations), the efficiency of the current communication media with the Transplant Service and the relevance of developing a channel in the eHealth tool for Service access. The results suggest that renal transplant recipients use daily tools that use ICT, and both patients and professionals show high acceptance of the strategies in this follow-up for post-transplant treatment.

LONGITUDINAL STUDY WITH CHRONIC RENAL PATIENTS USING THE APPLICATION

In addition to assessing the interest that chronic kidney patients have in using eHealth / mHealth tools, it is known that the survey does not end at this point. Subsequently, after the presentation and incorporation of the application by the target-audience, aiming to assess the effects on the modifiable aspects of treatment, such as adherence and self-care, it is necessary to follow up with episodic clinical analysis, associated to interviews, to identify the per-

ceptions about the use of the technological tool and its contributions in the context of the disease.

A longitudinal study is currently under development with groups of patients undergoing hemodialysis and renal transplant recipients that use the application, whose clinical parameters and degree of adherence to the treatment will be compared to a group of non-users, so that it will be possible to conclude whether the use of the Renal Health application actually has influence on health outcomes.

ADJUSTMENTS AND IMPROVEMENT

Of all the described phases, this one is considered permanent, because it is the continuous tool modernization process, so that it accompanies the frequent updates of the operating systems. The new versions of these systems almost always aim to correct errors, improve performance, and launch new features, among others.

In line with the advances in technology and Medicine, we believe in the constant improvement of the Renal Health application. For this purpose, meeting the demands of end-users, developing new attributes, being aware of the trends in the Digital Health sector and the application market are some of the actions that comprise the goal planning of this project.

PERSPECTIVES AND CHALLENGES

Our constant researches have disclosed no similar projects in Latin America. Therefore, the Renal Health Project, with its innovative and diversified approach, has great potential for CKD prevention and control. It is worth mentioning that the internationalization of the application is expected, with the necessary translations

into English and Spanish of all the developed contents and tools, aimed at reaching an increasing number of people, as well as investigating the tool acceptability in several parts of the world.

The Renal Health Project has grown a lot in recent years through the incorporation of new health education and promotion strategies, as well as important partnerships with researchers from other Brazilian states, Portugal and the Netherlands. In addition to expanding our field of activity, these partnerships allow the exchange of transcultural experiences and the improvement of our tools.

It is emphasized that, in parallel with the design and improvement of Renal Health, our group has developed sensor prototypes using the principles of the Internet of Things (IoT), which can capture in real time the patient's weight and temperature, the taking of medications, among other things, and, through a Bluetooth connection, transmit this information to the application, reducing the manual insertion of data.

Overall, the challenges involving such a broad project are related to adherence and continued use of the tool by the target audience. For that purpose, it is believed that some strategies are essential, such as being attentive to the users' opinions through interest surveys, diffusion actions, constant updating of the tool with the incorporation of new functionalities, review of the content based on the most recent guidelines and the maintenance of a technical team ready to solve possible problems effectively and fast.

CONCLUSIONS

In the last decades, the so-called Technological Revolution has changed the social scene all over the world. The use of technological tools, based on artificial intelligence, machine learning and

the internet is establishing trends, changing behaviors, extinguishing professions, streamlining processes and engendering consequences, including the process of illness.

In the health sector, ICT has broadened the possibilities of access to the patient and led healthcare providers to rethink the processes of assistance in the digital era. Aligning the technological evolution with strategies to control and contain the progress of chronic diseases, such as CKD, is the current challenge for the scientific community and the pillar of the Renal Health Project. Better clinical outcomes, including fewer complications caused by CKD and possibly lower mortality rates, with increased adherence to treatment, are objectives of this project, which should be observed in the next steps of this study.

REFERENCES

1. World Health Organization. Multimorbidity: technical series on safer primary care[Internet]. Geneva: World Health Organization; 2016 [citado em 2019 mar 03]. Disponível em: https://apps.who.int/iris/bitstream/handle/10665/252275 /9789241511650-eng.pdf?sequence=1.
2. Rzewuska M, Azevedo-Marques JM, Coxon D, Zanetti ML, Zanetti ACG, Franco LJ, Santos JL. Epidemiology of multimorbidity within the Brazilian adult general population: Evidence from the 2013 National Health Survey (PNS 2013). PLoS ONE. 2017;12(2):e0171813.
3. Sociedade Brasileira de Nefrologia. Censo 2018 [Internet]. São Paulo: SBN; 2018 [citado em 29 abr 20]. Disponível em: http://www.censo-sbn.org.br/censosAnteriores.
4. Instituto Brasileiro de Geografia e Estatística (IBGE). Analfabetismo cai em 2017, mas segue acima da meta para 2015 [Internet]. Rio de Janeiro: Agência IBGE; 2018
5. [citado em 2019 Abr. 27]. Disponível em: https://agenciadenoticias.ibge.gov.br/agencia-noticias/2012-agencia-de-noticias/noticias/21255-analfabetismo-cai-em-2017-mas-segue-acima-da-meta-para-2015.

6. Ação Educativa; Instituto Paulo Montenegro. Indicador de Analfabetismo Funcional (INAF) Brasil 2018 [Internet]. São Paulo: IPM; 2018 [citado em 2019 mar 15]. Disponível em: https://www.ipm.org.br/relatorios.

7. Fajardo V. Como o analfabetismo funcional influencia a relação com as redes sociais no Brasil [internet]. [local desconhecido]: BBC News Brasil; 2018 [citado em 2019 mar 19]. Disponível em: https://www.bbc.com/portuguese/brasil-46177957.

8. World Health Organization. Global observatory for ehealth series. MHealth: new horizons for health through mobile technologies: Based on the Finding of the Second Global Survey on eHealth[Internet]. Genebra: WHO; 2011 [citado em 2015 dec 10]. Disponível em: http://www.who.int/goe/publications/goe_mhealth_web .pdf.

9. World Health Organization. Digital health. Be he@lthy, be mobile. Scaling up digital health [Internet]. Geneva: WHO; 2019 [citado em 2019 apr 12]. Disponível em: https://www.who.int/ncds/prevention/be-healthy-be-mobile/en/.

10. World Health Organization. Global diffusion of eHealth: making universal health coverage achievable. Report of the third global survey on eHealth [Internet]. Geneva: WHO; 2016 [citado em 2019 mar 03]. Disponível em: https://apps.who.int/iris/ bitstream/handle/10665/252529/9789241511780eng.pdf;jsessionid=6F5D38051CEBF7FD9FBEE74853EA7D0D?sequence=1.

11. Rocha DF, Canabarro ST, Figueiredo AE, Sudbrack AW. Avaliação da adesão à terapia imunossupressora por autorrelato de pacientes submetidos ao transplante renal. Scientia Medica. 2017;27(4):ID28181.

12. Ghimire S, Castelino, RL, Jose MD, Zaidi STR. Medication adherence perspectives in haemodialysis patients: a qualitative study. BMC Nephrol. 2017 May;18(1):167.

13. Marsicano EO, Fernandes NS, Colugnati FA, Fernandes NM, De Geest S, Sanders-Pinheiro H. Multilevel correlates of non-adherence in kidney transplant patients benefitting from full cost coverage for immunosuppressives: a cross-sectional study. PLoS ONE. 2015;10(11):e0138869.

14. Ibrahim S, Hossam M, Belal D. Study of Non-Compliance among Chronic Hemodialysis Patients and its Impact on Patients' Outcomes. Saudi J Kidney Dis Transpl. 2015;26(2):243-49.

15. Moraes KL, Brasil VV, Oliveira GF, Cordeiro JABL, Silva AMTC, Boaventura RP, Munari DB. Functional health literacy and knowledge of renal patients on pre-dialytic treatment. Rev Bras Enferm. 2017;70(1):147-53.

16. Stanifer JW, Turner EL, Egger JR, Thielman N, Karia F, Maro V, Kilonzo K, Patel UD, Yeates K.. Knowledge, attitudes, and practices associated with chronic kidney disease in northern tanzania: a community-based study. PLoS One. 2016; 11(6):e0156336.

17. Wang S, Chen R, Liu Q, Shu Z, Zhan S, Li L. Prevalence, awareness and treatment of chronic kidney disease among middle-aged and elderly: the china health and retirement longitudinal study. Nephrology. 2015; 20(7):474-84.

18. Oluyombo R, Ayodele OE, Akinwusi PO, Okinola OO, Gbadegesin BA, Soje MO, Akinsola A. Awareness, knowledge and perception of chronic kidney disease in a rural community of South-West Nigeria. Niger J Clin Pract. 2016;19(2):161-9.

19. Fernandes NMS, Bastos MG, Oliveira NAC, Costa AV, Bernardino HS. Telemedicina: Desenvolvimento de um sistema para atendimento à distância de pacientes com doença renal crônica pré-dialítica. J Bras Nefrol. 2015; 37(3,):349-58.

20. Preece J, Rogers Y, Sharp H. Design de interação: além da interação homem-computador. 3a ed. Porto Alegre: Bookman; 2013.

21. Vanhoof JMM, Vandenberghe B, Geerts D, Philippaerts P, De Mazie`Re P, DeVito AD,De Geest S, Dobbels F; Picasso TxConsortium. Technology Experience of Solid Organ Transplant Patients and Their Overall Willingness to Use Interactive Health Technology. J Nursing Scholarsh. 2018; 50(2): 151–62.

22. Bonner A, Gillespie K, Campbell KL, Corones-Watkins K, Hayes B, Kelly JT, Havas K. Evaluating the prevalence and opportunity for technology use in chronic kidney disease patients: a cross-sectional study. BMC Nephrol. 2018;19(1):28.

23. Wong D, Cao S, Ford H, Richardson C, Belenko D, Tang E, Ugenti l, warsmann E, Sissons A, Kulandaivelu Y, edwards N, Novak M, Li M, Mucsi I. Exploring the use of tablet computer-based electronic data capture system to assess patient reported measures among patients with chronic kidney disease: a pilot study. BMC Nephrol. 2017;18(1):356.

24. Israni A, Dean C, Kasel B, Berndt L, Wildebush W, Wang CJ. Why do Patients Forget to Take Immunosuppression Medications and Miss Appointments: Can a Mobile Phone App Help? JMIR Public Health Surveill. 2016;2(1):e15.

25. Chan R, Dear BF, Titov N, Chow J, Suranui M. Examining internet-delivered cognitive behaviour therapy for patients with chronic kidney disease on haemodialysis: A feasibility open trial. J Psychosom Res. 2016; 89:78–84.

26. Cueto-Manzano AM, Gallardo-Rincon H, Martinez-Ramiirez H, Cortes-Sanabria L, Rojas-Campos E, Tapia-Conyer R, Martínez P, Cerrillos I, Andrade J, Medina M. A pilot study of a mobile phone application to improve lifestyle and adherence of patients with kidney disease. J Telemed Telecare. 2015; 21(2):119–120.

CHAPTER 9

VALIDATION OF 'GESTAÇÃO' APPLICATION WITH NURSES

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INTRODUCTION

Prenatal assistance aims to monitor pregnancy evolution, enabling a healthy pregnancy, without negative influences on the health of the mother-child binomial[1]. In Brazil, the coverage of prenatal assistance is considered satisfactory and reaches almost the whole Brazilian territory. It involves pregnant women of different sociodemographic and reproductive characteristics, but it still faces persistent challenges that reflect on the quality of this assistance[2].

In 2016, in the state of Ceará, a decrease of 31% of maternal death was noted in comparison to the year of 2014, decreasing from 135 to 93. However, direct maternal mortality, defined as a complication that occurs during pregnancy, delivery or puerperium, due to omissions, interventions and/or inappropriate treatment, has a higher percentage, 47,3%, followed by indirect obstetric causes at 24,7%. Thus, appropriate prenatal monitoring is essential[3].

Technological innovations in health constitute a significant part of the efforts in research and global development in the contem-

porary society of knowledge (nanotechnology, biotechnology, information and communication technology, among others). However, the necessity of deepening knowledge in health and implementing measures to seek a model of economically competitive and socially inclusive development must be acknowledged [4].

Mobile technologies enable the dissemination of information on health in different ways: phone calls, text messages, videos, access to Internet and use of apps for smartphones and tablets. Such tools are known as "Mobile Health" or "*mHealth*" and are becoming more and more present in the daily routine of people, due to easy access, being self-explanatory, and it may serve, among unlimited possibilities, as a support to inform, guide and monitor the user and the community about different topics in health [5].

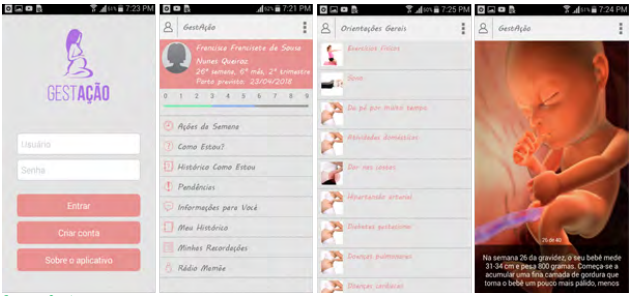
In this sense, international studies emphasized the benefits of using apps in health interventions regarding the improvement of clinical decision-taking, patient education and qualification of health professionals [6,7]. Most available health apps are considered strategies for promoting health, well-being and disease prevention.

Based on these perspectives, the app *GestAção* was developed by an interdisciplinary group, comprised of researchers from the Collective Health group and from the Nucleus of Technologies of the University of Fortaleza, with the purpose of improving the prenatal assistance quality and acting as a secondary tool to women and professionals. The app corresponds to a technological device directed to empowering pregnant women regarding self-care, addressing information about the gestational period, using language of easy comprehension and resources to monitor maternal and fetal health [8].

Since its conception, the app *GestAção* has had some updates resulting from evaluations regarding its use in the Primary Health Care (PHC), such as the tests of usability and the validation with pregnant women [8]. In the sequence of these evaluative steps, this

chapter refers to validation, based on Likert scale, of the updated version of the app with nurses from PHC. Some *GestAção* interface shots are presented below:

Image 1 – Illustration of the *GestAção* Interfaces



Source: Queiroz.

METHODS

Research of applied and methodological nature, with quantitative approach, was carried out, since a wide validation of a technological resource developed in laboratory was pursued, whose content was validated with nurses, in the sense of verifying the contributions of the app for acquisition of knowledge, in the process of behavioral change of pregnant women during the prenatal period.

The research was done from January to March, 2019, at three Units of Primary Health Care (UPHC), in the city of Fortaleza, Ceará, Brazil.

The subjects that participated in the research were 13 nurses, selected from the pre-established requirements that follow: nurses that perform prenatal monitoring for at least six months in the unit;

the ones that did not assist pregnant women were excluded.

Regarding the location where the study took place, three UPHC of Regional VI were selected. This 'health region' has the majority of population and health demand of Fortaleza, besides having the highest number of health services, providing a total of 27 UPHC. In addition, it is inserted, geographically, in the same regional of UNIFOR (Research proponent Institution).

Initially, centers of UPHC, from Regional VI, were visited to create an approach with the research field, as well as to explain the purposes of the study to their coordination. Afterward, interviews were scheduled in accordance with the availability of the participants.

The next stage was the application of a questionnaire to get the sociodemographic characterization of the participants and to obtain the data related to their professional qualification. In this moment, the app was presented to the nurses, who were advised to use the app during a period of 1 hour and a half.

Finally, a questionnaire was applied to the participants, which was structured based on the Likert scale, considering three groups of questions for the validation of the tool, among them: purposes (16 questions), structure and presentation (15 questions) and relevance (4 questions) [9]. This scale was selected because it has scientific relevance and requires minimum resources and processing time.

The sociodemographic and professional data of the nurses were organized and described according to absolute and relative frequencies.

The results, analyzed based on the scale of Likert, indicated the Content Validation Index (CVI) of the app [10].

Regarding the ethical precepts, the study had the approval of the Research Ethics Committee of UNIFOR, under Opinion nº 1.666.807, being the result of an unfolding of the project "mHealth

for promotion of women's health: technological innovation for the improvement of prenatal assistance quality", sponsored by Cearense Foundation to Support Scientific and Technological Development (FUNCAP - *Fundação Cearense de Apoio ao Desenvolvimento Científico e Tecnológico*). Thus, the recommendations of Resolution 466/12, from the Brazilian National Health Council (*Conselho Nacional de Saúde*)/ Ministry of Health, which rules the research ethical principles involving human beings, were observed [11].

RESULTS

SOCIODEMOGRAPHIC AND PROFESSIONAL PROFILE OF THE NURSES

The consolidation of the sociodemographic profile of the 13 nurses who participated of the study is expressed in Table 1, from which 12 nurses (92,3%) are female and 1 (7,7%) is male. Their ages range from 25 to 43 years old. Among the participants, 53,8% are married or live in a civil union, while 38,5% are single and 7,7% divorced. Regarding the number of children, 53,7% do not have kids, 15,4% have from 3 to 4 children and only 30,8% decided to have 1 or 2 children. Regarding religion, 76,9% are catholic, 15,4% evangelical and 7,7% spiritualist.

With regards to educational degree, 38,5% have concluded specialization, 23,0% are coursing their specialization and 38,5% do not have a post-graduate degree. Regarding length of service, 15,4% have from 14 to 18 years of service, 7,7% from 9 to 13 years, 15,4% from 4 to 8 years, and the majority, 61,5%, have from 1 to 3 years of service. Regarding kind of work contract, 53,8% are service contractors, 23,1% are employees and only 23,1% are public servants.

Table 1- Sociodemographic Characteristics of the nurses who participated of the validation process of the app *GestAção*.

Variants	n	%
Gender n (%)		
Female	12	92,3%
Male	1	7,7%
Age		
25-29	6	46,1%
30-35	3	23,1%
38-43	4	30,8%
Marital Status		
Married	7	53,8%
Single	5	38,5%
Divorced	1	7,7%
Nº of Children		
None	7	53,8%
1-2	4	30,8%
3-4	2	15,4%
Religion		
Catholic	10	76,9%
Evangelical	2	15,4%
Spiritualist	1	7,7%
Educational Degree		
Specialization	5	38,5%
Specialization in course	3	23,0%
Do not have post-graduate degree	5	38,5%
Length of Service		
1-3 years	8	61,5%
4-8 years	2	15,4%
9-13 years	1	7,7%
14-18 years	2	15,4%
Kind of work relations		
Employee	3	23,1%
Service Contractor	7	53,8%
Public Servant	3	23,1%

Source: Elaborated by the authors.

VALIDATION OF THE APP BY THE NURSES

In this stage of the study, validation of the app was done by the nurses, aiming at the evaluation of the tool. From the application of the questionnaire, based on the Likert scale, it was considered that, for the items evaluated with Content Validation Index (CVI) lower than 0,79, a review and adjustments for their adequacy would be required. The items evaluated with CVI 0,79 or above were considered satisfactory and appropriate [12].

Chart 1- Content Validation Index (CVI) of the analysis of app *GestAção* purposes. Fortaleza-CE, January to March, 2019.

PURPOSES	CVI
1. Compatibility of the language with the target audience	1
2. Adequacy of the content for advice and clarification of doubts about pregnancy	1
3. Adequacy of the content for providing tips about health care during pregnancy	1
4. Adequacy of the content about baby development	1
5. Adequacy of the content for identifying possible risk factors in pregnancy	1
6. Does the content stimulate the continuance of app navigation?	1
7. Does the content help other women in obtaining information about pregnancy?	1
8. Promotion of behavior changes of the pregnant women in the decision taking about pregnancy cares	1
9. Dissemination in the scientific community in the field of women health (prenatal assistance)	0,92
10. The channel mom (radio) clarifies doubts about pregnancy	1
11. The channel mom (radio) clarifies doubts about delivery	1
12. The channel mom (radio) clarifies doubts about prenatal care	1
13. The channel mom (radio) clarifies doubts about nutrition	0,92
14. The channel mom (radio clarifies doubts about nursing	1
15. The channel mom (radio) clarifies doubts about physical activities during pregnancy	1
16. The channel mom (video) clarifies doubts about teenage pregnancy	0,76
Average of CVI	**0,97**

Source: Elaborated by the authors (2019).

According to Chart 1, it is observed that the evaluation of the professionals regarding the purposes of the app *GestAção* was positive, with CVI of 0,97.

The information inserted in the app was classified, mostly, as totally accepted. The items: adequacy of the language related to the target audience; advice and doubts about pregnancy; tips regarding health care during pregnancy; information about baby development; identification of possible risk factors and promotion of health, obtained CVI equal to 1.

The aspect of dissemination in the scientific community in the field of women's health and the channel 'mom' about nutrition tips, obtained CVI of 0,92. Regarding the aspect of the channel 'mom' related to information about delivery, prenatal, nursing and physical activities, CVI was 1. The videos about teenage pregnancy obtained CVI equal to 0,76. Consequently, lower than the acceptable value, thus why they need to be reviewed.

Chart 2- CVI of the structure analysis and presentation of the app *GestAção,* Fortaleza-CE, January to March, 2019.

STRUCTURE AND PRESENTATION	CVI
1. Is the technological device, of the type of app, appropriate to advice/ support the pregnant women and nurses?	0,92
2. Is the presented information scientifically correct?	0,84
3. Is the material appropriate for the sociocultural level of the proposed target audience?	1
4. Is there a logical sequence of the proposed content?	1
5. Are the content and messages attractive?	1
6. Is the language clear and objective?	1
7. Is the information directed to the object of interest sufficient and appropriate?	0,92
8. Are the illustrations (images) applicable to the content?	1
9. Are the illustrations (images) clear and easy to comprehend?	1

STRUCTURE AND PRESENTATION	CVI
10. Is the quantity of illustrations appropriate for the content of the educational material?	1
11. Are the icons appropriate and helpful for the pregnant women to comprehend and use the app?	0,92
12. Are the colors applied to the text appropriate and enabler of reading?	1
13. Is the size of the letters of the titles, subtitles and text appropriate?	1
14. Does the type of font make reading easier?	1
15. Is the quantity of information inserted in the app appropriate?	0,92
Average of CVI	**0,97**

Source: Elaborated by the authors.

Chart 2 shows the analysis made by nurses about the structure and presentation of the app, whose average CVI was 0,97. Thus, all items obtained satisfactory levels with the tool, with values of CVI ranging from 0,84 to 1. This information emphasizes the adequacy of the tool *GestAção.*

Among the 15 items, one of them presented value of 0,84 (item 2), with the existence of scientifically incorrect information being reported by the nurses, which requires updating.

The evaluation of the last group refers to the relevance of the app, which is presented in chart 3.

Chart 3- CVI of the analysis of app *GestAção* relevance, Fortaleza-CE, January to March, 2019.

RELEVANCE	CVI
1. Does the material address the necessary issues for prenatal monitoring?	0,92
2. Is the material appropriate to help a pregnant woman to identify the changes in her body during pregnancy?	0,92
3. Does the material address the necessary issues for the monitoring and accession of medication, immunization and supplement?	0,84
4. Is the material appropriate to help a pregnant woman reach pregnancy care?	0,92
Average of CVI	**0,90**

Source: Elaborated by the authors.

Chart 3 obtained average value of the CVI equal to 0,90, showing that it is appropriate for daily use during pregnancy, ranging from 0,84 to 0,92, i.e., it presented relevance.

In item 3, the average value of CVI was equal to 0,84, since some nurses reported outdated information about immunization. Thus, it was considered that all items related to the group 'Relevance' were satisfactory and, even with acceptable CVI, of 084, item three was updated according to the answers of the specialized nurses.

Therefore, the app *GestAção* was validated and obtained a satisfactory result regarding its purposes, structure and presentation, and relevance of the tool.

DISCUSSION

The evaluation of a technology shall be continually made due to constant innovations, evolutions and technological improvement requirements [13]. Therefore, these evaluative processes of educational technologies, developed for the health field, must be stimulated, mainly because research for the evaluation of efficiency and reliability of these resources are frequently made, presented as an important step in the process of wide use of apps and other technologies [14].

This evaluation of technologies is an essential stage, aiming to verify the adequacy of the items that compose the material to the result of the construct [15].

In this sense, validation of the use of the app *GestAção* made by nurses indicated satisfactory and appropriate results, showing that it is an important tool for information support, which is incentive to self-care during pregnancy and health promotion.

Regarding the purposes of the app, the nurses revealed the expansion of knowledge with the information in the app and high-

lighted the aspects that they consider important to complement the practices of health care during prenatal period. It is noted, through the results of the study of Carlos et al.[16], that technology works in alliance to health professionals more and more, and that the intensive use of technology is a tendency, showing significant and increasing organizational impact on the health sector for the next years.

The apps directed towards health hold a great potential for good practices of professional care in health promotion, stimulating users to be more aware and co-responsible for the adoption of healthy lifestyles [17].

In this aspect, Sarno, Canella and Bandoni [18], added that apps are a promising opportunity to render better services, mainly in patient education, self-management of the disease, and remote monitoring of patients. This last characteristic allows health professionals the opportunity to advise the use of some applications [19]).

Analysis of the 15 items of group 2 (chart 2), related to structure and presentation of *GestAção*, showed that the tools present information of easy comprehension, appropriate images, appropriate colors, among other characteristics that express the good quality of the app. Similarly, another research, whose purpose was to develop and evaluate an app to manage vocal health, showed that the interaction of the user with hypertext and images promotes speed in the learning process, besides enabling the acquisition of new knowledge [16]. Other authors emphasize that for having effectiveness regarding the functionality of a tool, structure and presentation shall be clear, easy and accurate to comprehend [20].

In addition, the means of communication *GestAção* app, through illustrations, is highlighted, since this kind of tool makes it possible for the target audience to understand the context more easily. It is true that when images are associated with text they maximize the power of information for the users who handle apps in mobile devices [21].

When evaluators were questioned about the scientific character of the information, some answers showed the need of reviewing content, being crucial implementations and further updates for improving the app in accordance with the suggestions of the nurses.

In this sense, information inserted in the apps has to be expressed in a safe and direct way to clarify the doubts of the target audience in a clear manner and inspire safety. This is very important and directly impacts the process of empowerment of the users [22]. Studies show that the process of evolution of technologies shall be constantly improved and that the suggestions of the evaluators to the tool in process of development are essential to reduce possible obstacles [14,23].

Regarding relevance, the value that the nurses granted the evaluated device is noteworthy, being satisfactory for daily use during pregnancy. However, they emphasized the need of updating some information, for example, immunization data. In a nutshell, the credibility given to the information offered by the app is expressed positively by the professionals in the validation test, showing the important impact of the tool on the context of health promotion, risk prevention and execution of good practices of care.

Camacho et al. [24] reaffirm that good pregnancy monitoring is capable of managing risk factors appropriately through support information with advice about healthy nutrition; body care, such as practice of physical exercises and emotional support; taking into account the big changes caused by pregnancy. The educational approach shall be present in all actions to promote health and prevent diseases during the pregnancy-puerperium cycle [25].

In this aspect, it is important to point out the continuation of this study in the qualitative perception of the participants, aiming to take, mainly, comprehensions arising from the use of *GestAção,* for them to know the tool better, and probably recommend it to preg-

nant women, and so, be one more positive strategy, even providing a better professional-patient relationship.

It is worth noting that it is a necessary and required process for its wide adhesion and implementation in health services, which may, also, be made with different target audiences to expand its coverage.

It shall be stressed as limitations of this study, the unavailability of using the app in the IOS platform, as well as the outdating of the app in the Android version, which made the use of the app impossible for a longer time by the nurses.

CONCLUSION

The app *GestAção* represents an additional resource for the actions of prenatal assistance in primary health care, being a tool to help nurses in the actions that promote health from the perspective of the nurse.

mHealth technologies may maximize the nursing appointments and guarantee the autonomy of pregnant women regarding self-care during pregnancy and puerperium. In this study, the evaluation of the experience of using the app *GestAção* by nurses obtained global CVI of 0,97, showing a high index of satisfaction with this technology on the support of pregnancy.

It is expected that new studies may keep improving and evaluating the app GestAção, giving more access to necessary information during this period and stimulating the search for self-care for the health of women and children.

REFERENCES

1. Ministério da Saúde (Brasil). Atenção ao pré-natal de baixo risco. Brasília: Ministério da Saúde; 2012.
2. Viellas EF, Domingues RMSM, Dias MAB, Gama SGNG, Theme MM, Filha, Costa JV, Bastos MH, Leal MC. Assistência pré-natal no Brasil. Cad Saude Pública. 2014;30(1):85-100.
3. Ceará. Secretaria de Saúde do Estado. Boletim epidemiológico de mortalidade materna, infantil e fetal. 2017[Internet]. Fortaleza: Governo do Estado do Ceará; 2017 [citado em 2019 maio 16]. Disponível em: http://www.saude.ce.gov.br/index .php/boletins?download=2600%3Aboletim-epidemiologico-mortalidade-materna-infantil-e-fetal.
4. Gadelha CAG, Costa LS. Saúde e desenvolvimento no Brasil: avanços e desafios. Rev Saúde Pública. 2012; 46(suppl1):13-20.
5. Kennelly, A. M. et al. Pregnancy, exercise and nutrition research study with smart phone app support (Pears): Study protocol of a randomized controlled trial. Contemporary Clinical Trials. 2016;(49): 92-99.
6. Peng W, Shaheen K, Shupei Y, Syed AH. A qualitative study of user perceptions of mobile health apps. BMC Public Health. 2016;16(1):1158.
7. Kraschnewski LJ, Chuang CH, Poole ES, Peyton T, Blubaugh I, Pauli J, Feher A, Reddy M. Paging "Dr. Google": Does technology fill the gap created by the prenatal care visit structure? Qualitative focus group study with pregnant women. J Med Internet Res. 2014;16(6):e147.
8. Silva RM, Brasil CCP, Bezerra IC, Queiroz FFSN. Mobile health technology for gestational care: evaluation of the GestAção's App. Rev Bras Enferm. 2019;72(Suppl3):266-73.
9. Lucian R, Dornelas JS. Mensuração de atitudes: a proposição de um protocolo para a elaboração de escalas. Jundiaí: Paco Editorial; 2014.
10. Sampieri RH, Collado CF, Lucio MDPB. Metodologia de pesquisa. 5a ed. Porto Alegre: Penso; 2013.
11. Conselho Nacional de Saúde (Brasil). Resolução 466, de 12 de dezembro de 2012. Diretrizes e normas regulamentadoras de pesquisas envolvendo seres humanos. Lex: Diário Oficial da União. 2013 jun; 1(2): 59.
12. Polit DF, Beck CT. Fundamentos de pesquisa em enfermagem: avaliação de evidências para a prática da enfermagem. 7a ed. Porto Alegre: Artmed, 2011.

13. Kayyali, R. et al. Awareness and use of mhealth apps: a study from england. Pharmacy. 2017; 5(2):33.

14. Heffernan KJ, Chang S, Maclean ST, Callegari ET, Garland SM, Reavley NJ, Varigos GA, Wark JD. Guidelines and recommendations for developing interactive eHealth apps for complex messaging in health promotion. JMIR mHealth and uHealth. 2016; 4(1):e14.

15. Salvador PTCO, Mariz CMS, Vitor AF, Ferreira MA, Junior, Fernandes MID, Martins JCA, Santos VEP. Validation of virtual learning object to support the teaching of nursing care systematization. Rev Bras Enferm. 2018;71(1):11-9.

16. Carlos DA, Magalhães TO, Vasconcelos JE, Filho, Silva RM, Brasil CCP. Concepção e avaliação de tecnologia m Health para promoção da saúde vocal. RISTI, 2016; (19):46-60.

17. Delgado M, Miranda S, Rodrigues PF. Uma avaliação das aplicações mobile classificadas em saúde e fitness. Acta Port Nutr. 2017 Mar;(8): 22-6.

18. Sarno, F.; Canella, D.; Bandoni, D. Mobile health e excesso de peso: uma revisão sistemática. Rev. Panam. Salud Publica. 2014; 35(5/6):424–31.

19. Mosa, ASM, Yoo I, Sheets L. A Systematic Review of Healthcare Applications for Smartphones. BCM Med Inform Decis Mak. 2012;12:67.

20. Frazer C, Boch E, Squire M. Pregnancy app: a closer look at the implications for childbird educators. Int J Childbirth Educ. 2015;30(3):12-6.

21. Perry GT, Eichler ML, Resende G. Avaliação de usabilidade do Mobiteste, um aplicativo educacional para dispositivos móveis. Info Design. 2012; 9(2):70-87.

22. Conceição JQ. A utilização do aparelho celular como ferramenta de aprendizagem: contribuições para o ensino de ciências e biologia [Trabalho de conclusão de Curso]. Cruz das Almas: Universidade Federal do Recôncavo da Bahia; 2018.

23. Lavaissieri P, Melo PE. Protótipo de aplicativo para terapia vocal: analise por pares. Codas. 2017; 29(1):e20150300.

24. Camacho KG, Vargens OMC, Progianti JM, Spindola T. Vivenciando repercussões e transformações de uma gestação: perspectivas de gestantes. Cienc. Enferm. 2010;16(2):115-25.

25. Guerreiro EM, Rodrigues DP, Queiroz ABA, Ferreira MA. Educação em Saúde no ciclo gravídico-puerperal: sentidos atribuídos por puérperas. Rev. Bras Enferm. 2014; 67(1):13-21.

CHAPTER 10

WOMEN'S PERCEPTION ON THE PROFESSIONALISM OF OBSTETRIC DOCTORS: A NETNOGRAPHIC NARRATIVE

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INTRODUCTION

The expectations of a competent physician transcend technical abilities and clinical excellency, demanding a set of desirable postures such as humanism, compassion, empathy, commitment and responsibility [1]. Relational skills become therefore crucial to clinical practice, making the physician-patient relationship an intrinsic component of ethic care in health [2]. In this context, the evaluation of the ideally expected attitudes from a professional doctor requires hearing about the expectations of the users of these services.

Recent scientific evidence unveils the crisis of medical profession, whose activities in the last decade have been frequently marked by an exaggerated technicism in detriment of relational skills and of attention to the real necessities of people and communities [3,4,5]. This collapse culminated in a context of tension between medical class and society [4].

As a means of tackling this issue, the construct "medical professionalism" emerges, which can be defined as a set of competences related to the following fields: ethics, honesty, contribution to the learning environment, respect for diversity, resolution of conflicts, professional language and mindfulness, protection to patient confidentiality and professional clothing [6,7].

The theme of professionalism has gained prominence in the field of medical education in the last ten years, particularly because of two aspects: its relevance to medical practice and its difficulty of measurement [8].

Medical professionalism, as a construct, has been restrained to academic issues and evaluations centered on the judgements of professors and specialists [8].

Although the importance of qualitative evaluation of the attributes related to medical professionalism is recognized [8], very few studies have been carried out on this field about the expectations of assisted people on the necessary attributes to an ideal medical practice[9]. A systematic literature review has revealed that medical professionalism has been evaluated only in the (personal, assessed by the students themselves) behavioral aspects and their development in medical practice, being faulty in the aspects related to the subjects [8]. This fact is contradictory to a construct which has patient autonomy as one of its main aspects [8].

Based on the abovementioned assumptions and considering that patients' voice and experiences must occupy academy spaces more vividly, the necessity of analyzing their perspectives on what is an ideal medical practice emerges. Before the diversity of possible interactions in medical practice, it was necessary to limit the Universe of this study to a single field, being Obstetrics the chosen specialty. This choice was not done randomly. On the contrary, it was based on the singularity which marks recent transformations in childbirth

assistance: they emerge from the struggle of women's movements, being a clear representation of social control [10].

These movements have been organizing themselves as a form of resistance to status quo in many fronts, including in interpersonal social relations, public manifestations and internet networks [11]. In this context, cyberfeminism has been contributing to innumerous social, political and cultural changes related to the protection of rights and woman autonomy during childbirth, insofar as it has fostered the exchange of experiences and enabled not only the access to information but also the structuration of a support network [12].

Therefore, we present in this chapter a netnographic study whose objective is to analyze the perception of women members of a certain Facebook group on the ideal profile and professional posture of the Obstetrician.

METHODS

This a netnographic study[13] which can be defined as a variant of ethnography. Ethnography studies the culture of a community and describes it based on participant observation and analysis of collected data. Netnography utilizes communications in a virtual environment as a data source to reach ethnographic representation of a cultural phenomenon in Internet [14].

The chosen virtual community for research was the self-titled "Parto Normal Fortaleza (PNF)" Facebook group, which proposed a space to discuss, exchange ideas and clear doubts about vaginal birth. This group numbered 20.245 followers at the time of this study.

After identifying the virtual community, observation of the forms of interaction between its members was initiated. It was observed that debates occurred either through thematic forums or

disparaging questions which gathered comments about them. The existing forums were visited in search of questionings and comments which talked about the ideal profile of the Obstetrician. After this initial observation, the trigger question was launched in October 2018: "how would the ideal Obstetrician be to you?".

This question achieved 11 comments in the space of a week. It was then asked that they shared striking experiences with the Obstetrician. This question garnered 12 comments in a week. Data collection occurred through capture of page content, responses to the forums and researchers' notes on the interactions. Collection comprehended posts made in October 2018.

Initially, depositions (comments) were transcribed in full to the tool "Followers' accounts on the ideal Obstetrician", being later analyzed based on content analysis in thematic modality, following the steps of pre-analysis, data exploration, treatment of results and interpretation. In this course, aspects related to the profile of the ideal Obstetrician, positive experiences and professionalism lapses were identified, which enabled the interpretation of the perception of the followers on these aspects.

In pre-analysis, an in-depth reading of data and accounts of the PNF Group was done for familiarization with the ideas and behaviors of the target audience. Data was then explored, which allowed the identification of three themes: multidimensional construct of professionalism; positive experiences; and professionalism lapses.

The posted depositions numbered 23 participations of the followers of the PNF group in the abovementioned period. To preserve identities, the letter "F" (follower) was adopted, associated with numbers. Therefore, F1 means "Follower 1". It is highlighted that translations of the depositions are presented in the results to illustrate the study themes, some of which containing deviations to English grammar, in order to respect the language adopted in social media.

RESULTS AND DISCUSSION

Comments relative to the two forums of discussion launched during the time of this study were analyzed. Data obtained from the different forms of gathering converged to three thematic nuclei: Ideal obstetrician: multidimensional construct of professionalism, positive experiences and professionalism lapses. In the positive experiences theme, two nuclei of meaning were observed: respect to autonomy and women's protagonism. In the professionalism lapses theme two nuclei of meaning were also highlighted: negative communication and inadequate interventions.

Ideal obstetrician: multidimensional construct of professionalism

Eleven followers manifested their opinions on the obstetrician they considered ideal. The ideal obstetrician, according to results, must be empathetic, careful, available, mindful, attentive to the needs of the patients, with assistance centered on the person, humble, confident, tranquil, up to date, ethic and minorly invasive. The speech excerpts below exemplify and synthesize the found characteristics:

> *Human, mindful, up to date (scientific evidences), available and who knows that "the star there is the family that is beginning" not him/her (F3)*
>
> *An ideal obstetrician to me is that who aims to comprehend the woman in her particularity. They are those who practice empathy and have the capacity of putting themselves in the place of the patient which they attend. That are up to date, and that pass quality information and transmit tranquility and safety to the woman. (F8)*
>
> *The ideal obstetrician is the one who is humble and intelligent in acknowledging that they studied 10 years to intervene only when necessary. (F11)*
>
> *The one who takes away all doubts, even through WhatsApp; who aims to the maximum to solve problems without leaving you worried, who has ethics. (F6)*

> *"who calls me by name, who remembers me when I call or send a message, without me needing to remind him of my entire life, who answers Whats[App] in the very same day, who doesn't ask for three thousand exams, but asks of me the sufficient exams for us to know if everything is alright and for me to feel safe, who gives me information, who stimulates me to study, who respects, understands my decisions and discusses with me without superiorities the adequate conducts, who sees me as an equal, not as inferior, who understands that the birth is mine and he is only the candidate to the Oscar of best supporting actor, who doesn't underestimate my feats, afflictions and doubts, who isn't too mellow, is serious, centered and goes straight to the point with no fuss". (F5)*

The participants' narratives are in consonance with the desired performance for the doctor manifested in the charter on medical professionalism, a mark of the millennium, published by the European Federation of Internal Medicine together with the American College of Physicians – American Society of Internal Medicine (ACP-ASIM) and the American Board of Internal Medicine (ABIM). In this charter are highlighted the principles of welfare, autonomy and social justice and its commitments: competence, honesty, confidentiality, relationship with patients, commitment to the improvement of quality of service, of access, to the just distribution of limited resources, to the rational and just use of scientific technology, management of conflicts of interest and professional responsibility [15].

POSITIVE EXPERIENCES

The experiences that were considered positive by the participants present two nuclei of meaning: respect to autonomy and respect to women's protagonism. Those were the anointed characteristics, as we can observe in the accounts:

> *"It was 48h in total, the last 14h in Hospital da Unimed, with SLOW dilatation…. All this time I had only achieved 5cm of dilatation…. I asked for cesarean yes, and was VERY respected by my Obstetrician, she even gave me time to think things through, but I couldn't hold the hunger and the fatigue any longer… She stayed with me during my entire hospital labor, without pressure, with the patience of Job, I will never forget!!! I'm only gratitude!!!! (F4)*

> *"she was super available, even though I was in another city (500km of Fortal) after taking the blood glucose test and sending the result through Whats[App] she told me it was collected wrongly, I return to the lab and there they ask for the doctor's contact, to sum up, she lost time arguing and explaining to the lab the correct form of collecting the exam, it was roughly 3 phone calls" (F3)*

> *"From the very first day of consultation she treated me super well. She calmed me up me during my entire prenatal. And as if it weren't enough, she assisted my labor even though I didn't pay her availability!" (F14)*

Successful experiences in physician-patient relationship are observed in these narratives, which corroborate the recommendation of the *Fédération Internationale de Gynécologie et d'Obstétrique* (FIGO) that the performance of the gynecologist-obstetrician is based in a model of professional responsibility where ethics is inserted. The concept of ethics requires of the physician three commitments: competence in clinical performance; interests related to patient health above their own and evidence-based medicine at service of the greater good [16].

The World Health Organization (WHO), when defining demonstrably useful and reiteration-worthy practices, reinforces the importance of respect to the autonomy and protagonism of the parturient in labor assistance[17].

PROFESSIONALISM LAPSES

In the professionalism lapses thematic category, two nuclei of meaning are observed: negative communication and inadequate intervention. The negative experiences reported unveil lapses of professionalism which can thus be grouped: excess of intervention, disrespect to the autonomy and desires of the patient, use of narratives which spread fear and interfere in the decisions of the patients.

> *I went to 5 obstetricians while I was pregnant. Each with their own particularities and availabilities. I really wanted normal labor… My husband was already tired of so many doctors and I didn't feel my right being respected (F9)*

> *My Probable Date of Birth was January 5th 2012, but my doctor soon decided to schedule the caesarian to December 23rd (after all, it would be a super Christmas gift for me to have my child soon in my arms, she thought). In December 7th my tampon started to exit (really lightly) and as I didn't know what it was, I soon called my gynecologist-obstetrician, who oriented me to go to her clinic. There, she examined me and concluded that my surgery had to be done that day. I was scared and said I still had doubts on Caesarean, that I wanted to try normal, and her words were: "Look, I will be really sincere, this is your first child, you are young and still doesn't have passage. You may even try, but after he's hooked and you become scared of pain it will be too late to go back and do the Caesarean, you will have to get by on your own to find strength and give birth". And it was so that I went to a Caesarean totally forced by fear. I will never forget this moment nor her words (F15)*

> *I search for an Ob-gyn who works with my healthcare plan, I go to the one nearest to my house. After an afternoon of waiting, it is finally my turn, he examines me, prescribes exams and begins indoctrination. Says that Normal Birth is too risky, that the child may die, that the mother ends with sequels and concludes with this gem: this business of normal birth is a PT [Partido dos Trabalhadores,* Worker's Party*] thing, before it all my patients accepted caesarean without complaining… I ran away and searched for another doctor (F17)*

In the accounts, disrespect to the basic bioethical principles of medical performance are observed: autonomy, non-maleficence, beneficence, justice and equity[18]. The excess of interventions and the propagation of fear to obtain patient consent also hurt the principles of the charter on medical professionalism in the new millennium: wellbeing, autonomy and social justice [15]. World Health Organization[17] preconizes practices which include empathic support, respect to the physiological process and dynamics of each birth, where technological resources should be used judiciously and the excess of information avoided[10].

CONCLUSIONS

This study shows the approximation between the perception of women on the ideal performance of a professional obstetrician and the dominions of Medical Professionalism. The lapses in professionalism contained in the accounts are highlighted for contradicting the principles of bioethics that must guide medical practice, evidencing possible failures in the formation of these obstetricians, either because of an inadequate or insufficient approach in graduation and medical residency, or because this formation was incapable of preparing professionals based on solid principles that do not mold to the most frequent professional vices.

It is made necessary to bring to light this discussion in the programs of medical residency, creating situations which promote reflection on the practice of the Gynecologist and Obstetrician, that today presents itself as one of the specialties under higher demand of ethical and judicial lawsuits due to failures of professionalism and ethics.

Therefore, the importance of bringing patients' voice forward is unveiled to exemplify the importance of the mastery of medical professionalism, as well as the most recurrent failures in the conduct

of these professionals. Medical education must prime itself in forming professionals that unite the attributes herein highlighted and that this assimilation be sustainable and perennial, not only cosmetic.

REFERENCES

1. Cruess SR. Professionalism and medicine's social contract with society. Clin Orthop Relat Res. 2006;449:170–76.
2. Ferreira LR, Artmann E. Pronouncements on humanization : professionals and users in a complex health institution. Ciênc Saúde Coletiva. 2018;23(5):1437–50.
3. Glenn JE. The Eroding Principle of Justice in Teaching Medical Professionalism. HEC Forum. 2012;24(4):293-305.
4. Goldie J. Assessment of professionalism: a consolidation of current thinking. Medical Teacher. 2013; 35(2): e952-e956.
5. Rego S. O Profissionalismo e a formação médica. Rev Bras Ed Médica. 2012:36(4):445–6.
6. Batalden P, Leach D, Swing S, Dreyfus H, Dreyfus S. General competencies and accreditation in graduate medical education. Health affairs. 2002;21(5);103–11.
7. Accreditation Council for Graduate Medical Education. Milestones by specialty[Internet]. Chicago: ACGME; 2018 [citado em 2018 out 17]. Disponível em: https://www.acgme.org/What-We-Do/Accreditation/Milestones/Milestones-by-Specialty.
8. Mendonça ET, Cotta RMM, Lelis VP, Carvalho PM Junior. Assessment of professionalism in students of health-related courses: a systematic review. Interface. 2016;20(58):679–90.
9. Papageorgiou A, Miles S, Fromage M, Kemmy J, Leinster SJ. Cross-sectional evaluation of a longitudinal consultation skills course at a new UK medical school. BMC Med Educ. 2011;11:55.
10. Nakano AR, Bonan C. Cenas de parto e políticas do corpo[Resenha]. Cad Saúde Pública. 2016 Nov;32(11):1–2.
11. Machado LZ. Feminismos brasileiros nas relações com o Estado. Contextos e incertezas. Cad Pagu. 2016;(47):e16471.

12. Oliveira RS, Pinto GR. Mães de suas decisões: o papel do ciberfeminismo no empoderamento da mulher e na reivindicação de direitos relativos ao parto a partir do acesso à informação. RVMD. 2016;10(2):378-405.
13. Kozinets RV. Netnografia: realizando pesquisa etnográfica online. Porto Alegre: Penso Editora; 2014.
14. Corrêa MDV, Rozados HBF. A netnografia como método de pesquisa em Ciência da Informação. Encontros Bibli. 2017;22(49):1.
15. Meakins JL. Medical professionalism in the new millenium. J Am Coll Surg. 2003;196(1); 113–4.
16. FIGO Committee for the Ethical Aspects of Human Reproduction and Women's Health. Professionalism in obstetric and gynecologic practice. Int J Gynecol Obstet 2017; 136: 249–51.
17. World Health Organization. Care in normal birth: report of the technical working group meeting in normal birth. Geneve: World Health Organization; 1996.
18. Beauchamp TL, Childress JF. Principles of biomedical ethics. Oxford: Oxford University Press; 2001.

CHAPTER 11

EVALUATION OF THE (RE) DESIGN OF A MOBILE APP TO PREVENT SUICIDE IN OLDER ADULTS – PREVSU

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INTRODUCTION

The aging of the world population has been increasing in the last decades. Between the years 2015 and 2030, the number of people older than 60 will increase 56%, from 901 million to 1.4 billion. In 2050, it is estimated that the world population of older persons will be of approximately 2.1 billion, i.e., greater than twice the number in 2015 [1]. It is estimated that in 2060 the Brazilian population will be composed by, approximately, 58.2 million (25.5%) older persons. In this same year, in the state of Ceará, for example, 25.4% of the population will be over the age of 65 years old or more[2].

Challenging the health systems, the aging process brings negative consequences for health, however, it is possible to minimize them if the older person adopts a healthy life style [3].

Changes in the biological, psychological and autonomy processes may induce the older person to the decision of self-destruction, justifying the increase of deaths by suicide in this age group. Suicide appears as a relevant problem of public health, taking place in

all regions of the world. Regardless of gender, greater rates of suicide (8.9/100 thousand inhabitant) have been observed in older persons [4].

The strategies used in the assistance to older persons with depression showed to be efficient when applied by professionals who are specialized in individualized treatment. Among them, there are the means of communication, which cover several kinds of technologies and are used in assistance to the older person with relative success in reducing their rate of suicide [5]. The implementation of these new strategies related to health issues occurs through electronic health (eHealth), which consists of tools that enable the improvement of care autonomy[6].

Nowadays, there are several technologies that are used in the care of populations that are more vulnerable to suicide, however most of them do not contain all necessary information to achieve the objective - preventing suicide, thus being appropriate to evaluate the functionality and reliability of these technological tools and to develop new proposals.

Thus, the development of technology enables health professionals and caregivers of older persons early acknowledgment of behaviors that indicate suicidal ideation and/or suicide attempts. The technological tool used in the research may be under constant update and evaluation, to make it possible to test its efficiency. This investigation aims at evaluating an mHealth technology to prevent suicide in older persons after its (re)design.

METHODS

This is an applied evaluative research. According to Barros and Lehfeld[7], applied research appears from the need of producing knowledge to contribute, in a practical way, to solve a problem found in reality almost immediately.

Evaluative research considers the adequacy between the intervention and the resulting matters; among the purposes of intervention and the strategies used to reach them, and among the used means and the created tools. As a general rule, this kind of research requires, from the researcher, conceptual and methodological knowledge, thus demonstrating, the importance of an evaluation made by judges[8].

Initially, a bibliographic review was made with studies according to the subject. Actions for the care of the older person, aiming at suicide prevention, were identified. At the same time, aiming at identifying technological solutions related to the older person and suicide, search was carried out in virtual app stores for mobile devices Google Play and Apple Store, using the key-words (in Portuguese and English), "suicide", "older person", "app", "depression", "caregiver".

As a result of the search, five apps that presented some correlation with the purpose of the PrevSU project were identified. It was verified that none of the identified apps met the proposed actions, justifying, thus, the development of a specific technology.

Afterwards, the screen prototypes of the proposed solution were produced. These prototypes allowed discussions about the solution, creating several redesigns even before its codification. Prototypes were developed, aiming at evaluating usability and functionality of a new system. After the result of this evaluation, a necessity for adjustments in the system was noticed, answering to the proposed objectives.

After the adjustment of the prototype, the evaluation of the (re)design of the app PrevSU was conducted.

The study was carried out from February to June 2019, at the houses of older persons who are assisted by primary health care units of the Municipality of Fortaleza-Ceará. The app was evaluated by caregivers of older persons regarding image, content and importance of each screen. The population sample is composed of ten caregivers.

Family members or professional caregivers with high-school level education were included in the study. Participants that did not have smartphones and did not use technological tools were excluded.

As an instrument of data collection for the evaluation of the app, after the (re)design was made, a questionnaire represented by the Likert Scale was used[9].

Data was analyzed in a quantitative mode, based on the Content Validity Index (CVI). In this study, valuation given on the Likert Scale ranges from 1 to 4 (1, without relevance, up to 4, totally relevant) and its calculation was done by the concordance sum of the answers that were marked by "3 or 4" divided by the total number of relevant answers and total number of answers[10].

CVI was calculated from the formula that follows:

CVI = (number of answers 3 or 4)/total number of answers

This study had the approval of the Research Ethics Committee on Ethics of UNIFOR, under Opinion nº.2.785.332/2018, whereas observing the provisions of Resolution nº. 466/2012 of the Brazilian National Health Council (*Conselho Nacional de Saúde*)/ Ministry of Health [11].

RESULTS

Table 1 shows the sociodemographic characteristics of the ten older adult caregivers who participate of the evaluation. Among them, 6 (60%) were female and 4 (40%) were male. This data was not manipulated, since the participants were selected on free demand. Regarding the age of the caregiver, most were between 40 and 49 years old, with an average age of 47.3 years old and standard deviation of 15.1. Concerning the marital status of the caregiver, 4 (40%) were married, 4 (40%) were single and 2 (20%) were divorced. With regard to religion 6 (60%) were Catholics and 4 (40%) were Evangelicals.

Table 1 – Sociodemographic Characteristics of the caregivers of older adults that participate of the evaluation process of PrevSU app.

Variants	Statistics
Gender n (%)	
Female	6(60)
Male	4(40)
Age (average ± standard deviation)	47.3 ± 15.063
Marital Status n (%)	
Single	4(40)
Married	4(40)
Divorced	2(20)
Religion n(%)	
Evangelical	4(40)
Catholic	6(60)
Time at the job	
1-5	5(50)
11-20	2(20)
21-30	1(10)
Kind of relationship	
Family	6(60)
Professional	4(40)
The caregiver has formation in the field of older adult health assistance n(%)	
Yes	4(40)
No	6(60)

Source: The authors.

Regarding the kind of caregiver, it was noted the prevalence of family caregivers, with 6 (60%) individuals. Caregivers that never had been trained in the field were represented by 6 (60%) participants and the ones that had qualification in the field of older person health assistance were 4 (40%). Regarding time at the job of caregiver, 5 (50%) presented between 1 and 5 years, 2 (20%) between 6 and

10 years, 2 (20%) between 11 and 20 years and 1 (10%) between 21 and 30 years. The caregivers' average schedule of daily service ranges between 8 and 24 hours.

The caregivers who use the technology evaluated images of the app screens according to the items of evaluation. In table 2, it is noted that, from 28 screens, 27 presented CVI of 1 and one screen CVI of 0.80. The screen that presented CVI of 0.80 was the screen "Map: Where to find support", that refers to places where to find support based on the map of the city of Fortaleza.

The rate of acceptable agreement among the judges for individual evaluation of the items must be higher than 0.78. To verify the validity of the new tool, in general, there shall be a minimum agreement of 0.80 and, preferentially, higher than 0.90 [9].

Table 2 – Distribution of the frequency of users' answers regarding clarity and comprehension of the screen images.

	This image is clear and comprehensible				
Screens	**Non comprehensible**	**Little comprehensible**	**Comprehensible**	**Really clear and comprehensible**	**CVI**
Registration	-	-	1 (10%)	9 (90%)	1
Login	-	-	1	9	1
Options of the app	-	-	-	10	1
Information and news	-	-	-	10	1
About the older adult	-	-		10	1
About suicide	-	-	-	10	1
How to prevent	-	-	-	10	1
Be aware	-	-	-	10	1
Map: where to find support	1	1	1	7	0.8
List of places where to find support	-	-	-	10	1
Caregiver's profile	-	-	-	10	1
Older Adult's profile	-	-	-	10	1
"Has the older adult acted carelessly with himself?"	-	-	-	10	1

This image is clear and comprehensible

Screens	Non comprehensible	Little comprehensible	Comprehensible	Really clear and comprehensible	CVI
"Regarding the older adult's medical treatment, has he demonstrated dissatisfaction or despair?"	-	-	-	10	1
"Has the older adult demonstrated signs of agitation, anxiety, insomnia or drowsiness?"	´-	-	-	10	1
"Has the older adult demonstrated signs of anger or desire for revenge?"	-	-	-	10	1
"Has the older adult increased the use or misused any substance, such as: Alcohol, Cigarette, Sleeping Pills or others?"	-	-	-	10	1
"Has the older adult reduced the contact with family and friends or the interest in doing leisure activities?"	-	-	-	10	1
"Has the older adult demonstrated signs of despair thinking that there is no way for his situation, that his life will never improve, that his current problems are hard to overcome?"	-	-	-	10	1
"Has the older adult expressed that his life is hopeless and that he would like to die or disappear?"	-	-	1	9	1
"Has the older adult threatened to violate himself or take his own life?"	-	-	-	10	1
"Has the older adult expressed a plan of suicide?"	-	-	-	10	1
"Has the older adult looked for means to commit suicide?"	-	-	-	10	1
"Has the older adult already tried to commit suicide?"	-	-	-	10	1
Identification of the patient's warning level	-	-	-	10	1
Older adult monitoring	-	-	-	10	1
About the app	-	-	-	10	1

CVI= 0.99

Source: The authors.

Table 3 presents the content evaluation, regarding its clarity and comprehension and got as result a CVI of 0.98, so the screens were considered clear and comprehensible.

Table 3 – Distribution of the frequency of users' answers regarding clarity and comprehension of the screen contents.

	Content is clear and comprehensible				
Screens	**Not comprehensible**	**Little comprehensible**	**Comprehensible**	**Really clear and comprehensible**	**CVI**
Registration	-	-	1	9	1
Login	-	-	1	9	1
Options of the app	-	-	-	10	1
Information and news	-	-	1	9	1
About the older Adult	-		4	6	1
About suicide	-	-	-	10	1
How to prevent	-	-	1	9	1
Be aware	-	-	1	9	1
Map: where to find support	-	3	-	7	0.7
List of places where to find support	-	-	-	10	1
Caregiver's profile	-	-	1	9	1
Older Adult's profile	-	-	-	10	1
"Has the older adult acted carelessly with himself?"	-	-	-	10	1
"Regarding the older adult's medical treatment, has he demonstrated dissatisfaction or despair?"	-	-	-	10	1
"Has the older adult demonstrated signs of agitation, anxiety, insomnia or drowsiness?"	-	-	1	9	1
"Has the older adult demonstrated signs of anger or desire for revenge?"	-	-	-	10	1

Content is clear and comprehensible

Screens	Not comprehensible	Little comprehensible	Comprehensible	Really clear and comprehensible	CVI
"Has the older adult increased the use or misused any substance, such as: Alcohol, Cigarette, Sleeping Pills or others?"	-	-	-	10	1
"Has the older adult reduced the contact with family and friends or the interest in doing leisure activities?"	-	-	-	10	1
"Has the older adult demonstrated signs of despair thinking that there is no way for his situation, that his life will never improve, that his current problems are hard to overcome?"	-	-	-	10	1
"Has the older adult expressed that his life is hopeless and that he would like to die or disappear?"	-	-	-	10	1
"Has the older adult threatened to violate himself or take his own life?"	-	-	-	10	1
"Has the older adult expressed a plan of suicide?"	-	-	-	10	1
"Has the older adult looked for means to commit suicide?"	-	-	-	10	1
"Has the older adult already tried to commit suicide?"	-	-	-	10	1
Identification of the patient's warning level	-	-	-	10	1
Older Adult Monitoring	-	-	-	10	1
About the app	-	-	2	8	1

CVI = 0.98

Source: The authors

The 10 older adult caregivers evaluated the screen "Questionnaire: question 01" as appropriate and with strong agreement (CVI=1) and 3 judged the screen "Map: where to find support" with moderate comprehension (CVI=0.7). The screen "Questionnaire: question 01" represents the beginning of a questionnaire to evaluate the older adult's warning level for suicide. In the screen "Map: where to find support", it may be identified, through a map, where to find support in cases of suicidal ideation.

Table 4 presents the evaluation of the importance of the screens in the app. Twenty-eight screens were evaluated and all of them were validated with CVI higher or equal to 0.90.

Table 4: Distribution of frequency of users' answers regarding the importance of the screens.

	The presence of this screen is important in the app				
Screens	**It is not important**	**Little relevant**	**Important**	**Very important**	**CVI**
Registration	-	-	2	8	1
Login	-	-	2	8	1
Options of the app	-	-	-	10	1
Information and news	-	-	2	8	1
About the older adult	-	-	-	10	1
About suicide	-	-	-	10	1
How to prevent	-	-	1	9	1
Be aware	-	-	-	10	1
Map: where to find support	-	1	2	7	0.9
List of places where to find support	-	-	-	10	1
Caregiver's profile	-	-	1	9	1
Older Adult's profile	-	-	-	10	1
"Has the older adult acted carelessly with himself?"	-	-	1	9	1
"Regarding the older adult medical treatment, has he demonstrated dissatisfaction or despair?"	-	-	1	9	1

"Has the older adult demonstrated signs of agitation, anxiety, insomnia or drowsiness?"	-	-	-	10	1
"Has the older adult demonstrated signs of anger or desire of revenge?"	-	-	-	10	1
"Has the older adult increased the use or misused any substance, such as: Alcohol, Cigarette, Sleeping Pills or others?"	-	-	-	10	1
"Has the older adult reduced the contact with family and friends or the interest in doing leisure activities?"	-	-	-	10	1
"Has the older adult demonstrated signs of despair thinking that there is no way for his situation, that his life will never improve, that his current problems are hard to overcome?"	-	-	-	10	1
"Has the older adult expressed that his life is hopeless and that he would like to die or disappear?"	-	-	-	10	1
"Has the older adult threatened to violate himself or take his own life?"	-	-	-	10	1
"Has the older adult expressed a plan of suicide?"	-	-	-	10	1
"Has the older adult looked for means to commit suicide?"	-	-	-	10	1
"Has the older adult already tried to commit suicide?"	-	-	-	10	1
Identification of the patient's warning level	-	-	-	10	1
Older Adult Monitoring	-	-	-	10	1
About the app	-	-	1	9	1

CVI = 0.99

Source: The authors.

DISCUSSION

Apps developed for older persons' health and care are important tools, since the information they transmit through mobile networks may improve patients' lifestyle and help in the early detection of potential health problems [12].

Among the main benefits of interventions made through apps, there are accessibility and easy operation, besides the access to different segments of the population, such as the older adult public [13]. In this sense, apps with information about older adult health and care may be enablers for emancipating users by obtaining information about health.

Several transformations associated to age lead older persons to need the constant presence of a caregiver. Therefore, family members become the main responsible parties for their care [14]. The family caregiver is a member of the family, with no qualification in the field of older persons' health, who dedicates himself to the care of the older person and is responsible for his needs [15].

For the family members who act as caregivers of older persons, apps help in the care procedures, because they work as an additional source of information. For health professionals, apps help in assistance, making it easier to perform interventions, monitor expected results and provide support and continuous evaluation [16].

The app entitled PrevSu was developed and validated, being the first technological application designed to help caregivers in the prevention of older person suicide. The app provides information about the issue, tools to monitor and evaluate risks, an interactive map of all health centers where to find support and a helpline.

After the validation of the tool, (re)design of it was carried out with the adjustments suggested by the evaluators. This research evaluated the technology in its best version, with the users, bringing as a result the approval of most items found in the app.

To be considered reliable, methodological research needs to follow a standard path, with the use of accurate indicators and using safe instruments that are coherent with the model of research [10].

During data collection, it is important to choose questionnaires that take the object of research into consideration. The advantages and disadvantages shall be analyzed, observing whether the disadvantages surpass the advantages[17]. In the app there is a questionnaire, answered by the caregivers every three months, which evaluates the risk of suicide or suicidal ideation of the older persons, and it classifies the risk level in which this older person is inserted.

The evaluative questionnaire is very important, because it is composed by a group of questions created to collect the necessary data for reaching the objectives of the study[18].

The tool also brings to the users, as a support, a map of the city of Fortaleza with all places in charge of assisting older persons in case of emergencies or high risk of suicide. This map was evaluated by the caregivers, who classified it as of moderate comprehension.

The qualification of moderate comprehension happened due to a lack of mastery, knowledge and ability in the handling of maps in apps in general. From these assumptions, we can think about alternatives that allow the digital inclusion of persons with less technological knowledge. The dissemination of new technologies has required continuous learning from individuals, so they can interact autonomously with technological devices.

Georeferencing may be described as a delimitation of the localization of something, through latitude, longitude and altitude, in a specific area. Although the use of mobile apps to replace paper search presents an advancement, existent technological capacities shall be taken advantage of, in order to update and bring significant benefits for the users [19].

CONCLUSIONS

Aging is part of the challenges imposed to the health sector. In this stage of life, there are physical and mental changes which make older persons more dependent of the care of their families. Loss of autonomy in the older persons may cause several problems of psychological nature and increase their vulnerability for suicide.

Therefore, it is important to create mobile technologies that help the caregivers of older persons in the early detection of suicidal ideation signs. These technologies shall be frequently evaluated regarding usability and reliability.

The app PREVSU is an mHealth technology that aims to help older adults' caregivers in the early detection of suicidal ideation signs.

This technology was evaluated by older adults' caregivers regarding its usability, with emphasis on image, content and importance of each screen. The users of the technology evaluated the images of the app screens as appropriate for its purposes, with only the image of the Map screen being considered as of moderate comprehension. Regarding clarity and comprehension of app content, all screens presented appropriate CVI, thus it is possible to state that the screens are clear and comprehensible. The interfaces were evaluated according to the level of importance and the results were positive, since all the screens were indicated as important, with CVI equal or higher than 0.99.

REFERENCES

1. United Nations. World Population Ageing 2015. New York: United Nations; 2015.
2. Instituto Brasileiro de Geografia e Estatística (IBGE). Projeção da população do Brasil e das Unidades da Federação. Brasília: IBGE; 2018.

3. Miranda GMD, Mendes AC.G, Silva A.L.A. O envelhecimento populacional brasileiro: desafios e consequências sociais atuais e futuras. Rev. Bras Geriatr Gerontol. 2016;19(3):507-19.

4. Ministério da Saúde (Brasil). Suicídio: saber, agir e prevenir: Boletim epidemiológico. Brasília: Ministério da Saúde; 2017.

5. Pinochet LHC, Lopes AS, Silva JS. Inovações e Tendências Aplicadas nas Tecnologias de Informação e Comunicação na Gestão da Saúde. RGSS. 2014;3(2);11-29.

6. Cowie MR, Bax J, Bruining N, Cleland JGF, Koehler F, Malik M, Pinto F, Van der Velde E, Vardas P. E-Health: a position statement of the European Society of Cardiology. Eur Heart J. 2016;37(1):63-6.

7. Barros AJS, Lehfeld NAS. Fundamentos de metodologia: um guia para a iniciação científica. Brasília: Makron Books; 2000.

8. Samico I, Felisberto E, Figueiro AC, Frias PG, organizadores. Avaliação em saúde: bases conceituais e operacionais. Rio de Janeiro: MedBook; 2010.

9. Polit DF, Beck CT, Hungler BP. Fundamentos de pesquisa em enfermagem: métodos, avaliação e utilização. Rio de Janeiro: Artmed; 2011.

10. Alexandre NMC, Coluci MZO. Validade de conteúdo nos processos de construção e adaptação de instrumentos de medidas. Ciênc. Saúde coletiva. 2011;16(7):3061-68.

11. Conselho Nacional de Saúde (Brasil). Resolução 466, de 12 de dezembro de 2012. Diretrizes e normas regulamentadoras de pesquisas envolvendo seres humanos. Lex: Diário Oficial da União. 2013 jun; 1(2): 59.

12. Corrêa AK, Santos RA, Souza MCBN, Clapis MJ. Metodologia problematizadora e suas implicações para a atuação docente: relato de experiência. Educ Rev. 2011;27(3):61-77.

13. Muellmann S, Forberger S, Mollers T, Bröring E, Zeeb H, Pischke CR. Effectiveness of eHealth interventions for the promotion of physical activity in older adults: a systematic review protocol. Syst Rev. 2016; 5:47.

14. Cattani RB, Girardon-Perlini NMO. Cuidar do idoso doente no domicílio na voz de cuidadores familiares. Rev Elet Enferm. 2004;6(2);254-71.

15. Tibes C, Dias J, Zem-Mascarenhas S. Aplicativos móveis desenvolvidos para a área da saúde no Brasil: revisão integrativa da literatura. Rev Min Enferm 2014;18(2):471-78.

16. Ministério da Saúde (Brasil). Secretaria de Políticas de Saúde. Manual de assistência domiciliar na atenção primária à saúde. Porto Alegre: Serviço de Saúde Comunitária do Grupo Hospitalar Conceição; 2003.
17. Castro RR. Elaboração e validação de questionário para avaliação do controle do HIV/AIDS na atenção básica [Dissertação de Mestrado]. Mossoró: Programa de Pós-Graduação em Saúde e Sociedade, da Universidade do Estado do Rio Grande do Norte; 2015.
18. Martins GA. Sobre confiabilidade e validade. São Paulo: RBGN; 2006.
19. Jesus C, Silva LJOL. Potencialidades dos serviços móveis de realidade aumentada aplicados ao turismo. Actas do 8º Congresso LUSOCOM; 2009 Abr 14-15; Lisboa: Universidade Lusófona; 2009. p. 2296-314.

CHAPTER 12

EVALUATION OF SELP APP WITH HEALTH PROFESSIONALS

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INTRODUCTION

Vertical transmission of syphilis during pregnancy may lead to serious fetal outcomes in the second or third quarters of pregnancy, including early fetal death, fetal death, neonatal death, premature delivery, low birth weight and congenital infection in children [1].

The global prevalence of maternal syphilis was 0.70% in 2012 and 0.69% in 2016. Prevalence of the infection remained stable in most regions (Africa, Europe and Western Pacific), except for non-significant increases in American Regions from 0.64% to 0.86% and Eastern Mediterranean Region, from 0.69% to 0.77% and a decrease in the Southeast Asia from 0.32% to 0.21% [2].

Although there was a slight decrease between the years 2012 and 2016, the number of affected women and children remains high. Thus, it is mandatory that health services may guarantee tests and early treatment of syphilis to children, women and their sexual partners and monitor possible re-infections as part of the prenatal procedures[3].

In Brazil, from 2012 to 2016 there was an increase in the number of cases of syphilis in pregnant women - 37.436 congenital syphilis records, 6.8 cases per one thousand births, and 87.593 acquired syphilis cases. In 2016, there were 87.593 reported cases of acquired syphilis, 37.436 cases of syphilis in pregnant women, and 20.474 cases of congenital syphilis - among them, 185 deaths [4].

In light of these negative consequences, it is essential that health professionals and community be aware of the importance of early diagnosis and efficient treatment of women and their partners [5].

Another strategy used by health professionals are mobile technologies. They create opportunities to prenatal assistance and monitoring of Sexual Transmitted Infections (STIs) in an accessible, coordinated and efficient way [6].

The expansion of mobile telephony brought significant opportunities for the health sector. *Mobile Health* or *mHealth* is considered a sub-segment of *eHealth* for assistance of public health supported by mobile devices, mainly by *smartphones* patient monitoring devices, personal digital assistants and *tablets* [7,8].

MHealth has potential to solve many challenges faced by countries in development, including labor shortage, lack of information of the population about health, limited training of health professionals and difficulty in monitoring patients [9].

Thus, a visually attractive app, with simple information about syphilis, may contribute to increase the level of testing, treatment and reduction of infection cases among pregnant women. In this sense, this research is intended to evaluate the pictures, functions and importance of the screens in SELP app from health professionals' perspective. ,

METHODS

This is a methodological research with descriptive approach, which aims to evaluate a tool for the use of professionals that assist pregnant women with syphilis [10].

App conception was made at the Technological Innovation Laboratory of UNIFOR. The researcher held meetings with the group of Information and Communication Technology (ICT) for the development of interfaces and screens.

A semi-structured instrument was developed, containing all screens of the app divided into 3 parts. In the first part, the professionals evaluated the pictures, functions and importance of screens of the app through three questions: Does this picture seem to be clear and comprehensible? Does this function seem to be clear and comprehensible? Is its presence important? Each question had two options (yes or no) as answers to be marked.

In the second part, the level of importance of the screens was validated. Each professional replied to a questionnaire with valuation assigned in a Likert scale with five items (1 not important, to 5 very important). For the quantitative analysis of evaluators' validation, the Content Validation Index (CVI) was calculated to verify the adequacy of representation of the proposed items. The valuation suggested by Alexandre and Coluci [11] was chosen in this study, which considers an index of agreement as appropriate whenever items are rated higher or equal to 0,78, up to 1.

In the third part, the professionals' comments and the suggestions were analyzed, once they were grouped by items and later analyzed according to the applicable literature for improvement of the app.

Ten specialists took part in the study, considering their professional qualification, performance in research and teaching, and experience in assisting patients with STIs.

The number of participants was defined by convenience and sampling availability. Data collection was done during February and March 2017, with five nurses and five doctors who provide prenatal care at public health services in Fortaleza-Ceará. Aiming to protect the identities of the participants, they were nominated by the letter "P" (professional) followed by numbers (1- 10).

The study was approved by the Research Ethics Committee (REC) of UNIFOR (Opinion 1.615.503). Data were collected upon the signature of the Free and Informed Consent Form (FICF) by the study participants.

RESULTS AND DISCUSSION

The age group of the participants ranged from 33 to 53 years old and their period of academic formation was from 1993 to 2010. Among the participants, two were specialists in Infectiology, four in Family Health, one in Collective Health, one in Adolescent Health, and two in Gynecology and Obstetrics.

Regarding post-graduation *strictu sensu*, one was a doctor in Infectiology, four in Collective/Public Health and one in Child Health; one held a master's degree in Clinical Nursing Care, one in Child and Adolescent Health, six in Collective/Public Health, one in Family Health, and another one in Infectiology.

Table 1 - Evaluation of pictures, functions and importance of SELP app screens, Fortaleza - CE, October, 2017.

SELP Screen	Does this picture seem to be clear and comprehensible?		Does this function seem to be clear and comprehensible?		Is its presence important?	
	YES	NO	YES	NO	YES	NO
Screen 1: Home screen	7	3	9	1	10	0
Screen 2: Questionnaire home screen	9	1	9	1	10	0
Screen 3: How old are you?	9	1	9	1	10	0
Screen 4: What is your gender?	9	1	9	1	10	0
Screen 5: What is your marital status?	8	2	9	1	9	1
Screen 6: Have you had sex with another person during the current relationship?	8	2	8	2	10	0
Screen 7: How many people have you had sex with during the last 6 months?	7	3	7	3	10	0
Screen 8: Do you use condoms in all sexual relations?	9	1	8	2	10	0
Screen 9: Have you ever made any test to know if you have syphilis?	8	3	7	3	10	0
Screen 10: Classification of high risk	7	3	6	4	10	0
Screen 11: Classification of medium risk	8	2	7	3	10	0
Screen 12: Start menu	9	1	8	2	10	0
Screen 13: Information about syphilis	9	1	9	1	10	0
Screen 14: What is syphilis.	8	2	9	1	10	0
Screen 15: Primary Syphilis	9	1	9	1	10	0
Screen 16: Secondary Syphilis	9	1	10	0	10	0
Screen 17: Tertiary Syphilis	7	3	10	0	10	0
Screen 18: Ways of transmission	9	1	9	1	10	0
Screen 19: I want to know if I have syphilis	9	1	9	1	10	0
Screen 20: Syphilis during pregnancy	10	0	10	0	10	0
Screen 21: Treatment	10	0	10	0	10	0
Screen 22: Health Regionals	9	1	10	0	10	0
Screen 23: Addresses of healthcare units	10	0	10	0	10	0
Screen 24: Maps of healthcare units	8	2	8	2	10	0
Screen 25: Syphilis Treatment	8	2	9	1	10	0
Screen 26: Number of doses for the treatment	10	0	10	0	10	0
Screen 27: Notify partners	7	3	7	3	10	0
Screen 28: Notify by e-mail or telephone call	9	1	9	1	10	0
Screen 29: Notice of notification sending	9	1	9	1	10	0

Source: The authors.

As per Table 1, most screens had positive answers regarding comprehension and clarity of pictures and importance of the screens. Among the results, it may be highlighted that three pictures (screens 20, 21 e 23) got maximum level of agreement among the professionals, since all of them agreed that "Picture" is comprehensible. It is important to point out that these screens correspond to the pictures that represent aspects related to congenital syphilis; screen 20 - syphilis during pregnancy; screen 21 - treatment; and screen 23 - addresses of the healthcare units in Fortaleza-Ce. It is important to stress that in 15 pictures, the level of agreement was equal to nine.

Regarding content clarity, 6 screens had maximum level of agreement among the evaluators. The content of these screens corresponds to secondary syphilis (screen 16), tertiary syphilis (screen 17) and congenital syphilis (screen 20), treatment (screen 21), list of health Regionals (screen 22) and their respective healthcare units (screen 23). Thirteen screens got a level of agreement equal to 9 among the evaluators.

Maximum level of agreement was obtained in 28 of the 29 screens, since all evaluators agreed that their presences were important in the app.

Table 2 - Evaluation of screens of SELP app by evaluators according to the Likert scale, Fortaleza-Ce, October, 2017.

SELP Screens	Level of importance					Content Validation Index (CVI)
	NI[1]	LI[2]	I[3]	RI[4]	VI[5]	CVI
Screen 1: Home screen	0	0	3	0	7	0,7
Screen 2: Questionnaire home screen	0	0	2	1	7	0,8
Screen 3: How old are you?	0	0	4	1	5	0,6
Screen 4: What is your sex?	0	0	3	1	6	0,6
Screen 5: What is your marital status?	1	0	2	0	7	0,7

SELP Screens	Level of importance					Content Validation Index (CVI)
	NI[1]	LI[2]	I[3]	RI[4]	VI[5]	CVI
Screen 6: Have you had sex with another person during the current relationship?	0	0	1	0	9	0,9
Screen 7: How many people have you had sex with during the last 6 months?	0	0	1	1	8	0,9
Screen 8: Do you use condoms in all sexual relations?	0	0	1	0	9	0,9
Screen 9: Have you ever made any test to know if you have syphilis?	0	0	1	0	9	0,9
Screen 10: Classification of high risk.	0	0	1	1	8	0,9
Screen 11: Classification of medium risk.	0	0	2	0	8	0,8
Screen 12: Start menu.	0	0	1	1	8	0,9
Screen 13: Information about syphilis.	0	0	1	0	9	0,9
Screen 14: What is syphilis	0	0	1	0	9	0,9
Screen 15: Primary Syphilis	0	0	0	1	9	1
Screen 16: Secondary Syphilis	0	0	0	0	10	1
Screen 17: Tertiary Syphilis	0	0	1	1	8	0,9
Screen 18: Ways of transmission	0	0	0	1	9	1
Screen 19: I want to know if I have syphilis	0	0	0	1	9	1
Screen 20: Syphilis during pregnancy	0	0	0	1	9	1
Screen 21: Treatment.	0	0	0	1	9	0,9
Screen 22: Health Regionals.	0	0	0	0	10	1
Screen 23: Addresses of healthcare units.	0	0	1	0	9	0,9
Screen 24: Map of healthcare units.	0	0	0	0	10	1
Screen 25: Treatment of syphilis.	0	0	1	0	9	0,9
Screen 26: Number of doses for the treatment.	0	0	0	0	10	1
Screen 27: Notify partners.	0	0	0	1	9	1
Screen 28: Notify by e-mail or telephone call.	0	0	1	0	9	0,9
Screen 29: Notice of notification sending.	0	0	0	0	10	1
CVI total						

1NI= Not Important; 2LI= Little Important; 3I= Important; 4RI=Really Important; 5VI= Very Important

Source: The authors.

According to table 2, which shows data on the evaluation of the level of importance of each screen in the app, we conclude that 10 screens presented CVI equal to 1, 13 screens got CVI 0.9, three screens had CVI between 0.7 and 0.8, and in two screens CVI was 0.6, thus being necessary to perform adjustments in the latter screens to satisfy the criteria of agreement (0.78 up to 1).

After the specialists replied to the proposed questions, they made suggestions and recommendations which were analyzed and discussed in accordance with the applicable literature.

The possibility of re-watching the informative video about syphilis before going to the next screen, or inserting it in other screens, besides increasing the font size of the subtitle, are recommendations made by evaluators.

> *Facilitating access to the video more than once, before passing to the next screen* (P1).

The icon of SELP app, according to the opinion of the evaluators, should refer to the theme and have contrasting colors to attract users' attention. Among the 10 professionals that evaluated the app, seven rated the picture as comprehensible, nine marked that the function is clear and 10 that the presence of the screen is important (table 1).

> *Make the icon clearer. The figure does not have association or refers to the content* (P2).

The icon of SELP app was strategically developed to not have association with the theme, once it is related to an STI, which brings implied stigma and discrimination. It is believed that without this association, users will install the app and enjoy its functions.

Keeping privacy was the main concern among participants of another study, therefore the app shall be protected by a password to

keep user information safe and have a neutral icon to avoid stigma [12].

In general, the specialists suggested to insert images, highlight the main information with colors and fonts of different sizes, insert the option of audio in all screens, besides objective information with little text. The screens "Home screen", "How many people have you had sex with during the last 6 months?", "Tertiary Syphilis" and "Notify partners" got scores equal to seven. However, the other screens got scores between eight and ten.

> *Put audio in all screens* (P3).
> *Reduce the quantity of information* (P1).
> *The font could be bigger* (P4).
> *Improve the screen inserting more attractive pictures* (P5).

Interventions based on apps for STI have to be fast, useful, fun, efficient, friendly and contain little text [13]. The design of the app must include interactive components, such as games and avatars, feedback of health professionals, incorporate social networks and guarantee privacy and discretion [14].

In the questionnaire about personal information, an evaluator considered it irrelevant to ask about the user's age. The CVI of "Level of Importance" of the screen was equal to 0.6, nevertheless, the picture of the screen and its function were deemed clear and comprehensible, getting a score equal to nine. Regarding the presence of the screen "How old are you?" it got a score equal to 10 among all professionals.

> *I do not consider this information so important because, regardless of age, the treatment will be the same* (P6).

SELP app was created not only to provide information about syphilis, but also to generate data about the number of people that used the app, aiming to notify their sexual partners about the infec-

tion, how many recommendations were sent for the use of the app, what age group and gender the users are.

In 2012, a quarter of the Brazilian population started sexual activity before the age of 15, besides this, almost 30% of the population aged between 15 and 49 reported having multiple partners, increasing the index of infection by syphilis [15]. In the same year, data from WHO about the global incidence of syphilis was 1.5 cases per 1000 in women and the same incidence in men, with prevalence of the age group between 15 and 49 [16].

Regarding the question of the fourth screen: "What is your sex?", it was recommended to replace sex by gender and insert another option to mark as "others" or keep the word sex in the question and insert the option "inter-sexual". The clarity of the figure and function got a score equal to nine and its importance equal to ten.

> *Instead of sex, I suggest gender and to include the item "others" or all genders. If sex is kept, it is needed to insert the option "inter-sexual"*(P7).

The app was developed to provide information related to syphilis for all publics; despite the fact intervention begins with pregnant women and their partners, the app does not exclude transsexual and homosexual individuals, nor heterosexual men that have same-sex relations.

The app may be useful to reach unknown and not contemplated populations in the notification of the conventional partner, such as transsexual and homosexual individuals, as well as Men who have Sex with Men (MSM). MSM that identify themselves as heterosexual are a difficult group to reach [17].

It is important to point out that publications about the apps to the prevention and treatment of STIs are directed to Men that have Sex with Men (MSM) and few are directed to heterosexual

men. In this sense, it is necessary to evaluate the factors associated to the behavior of heterosexual men about STIs. It is an important risk group, many times neglected, acting as an intermediate population, since through casual or paid sexual relations, they may transmit STIs to their spouses and permanent partners [18,19].

Another suggestion consists in emphasizing the information about condoms and their use during genital, anal and oral sexual relations to prevent syphilis. Screen number eighteen corresponds to "ways of transmission" and got a score of nine for the clarity and comprehension of its pictures and functions, and ten about its presence.

> *Highlight the information about condoms* (P1).
> *Specify if the relation is genital, anal, oral* (P6).

Interventions based on *mHealth* showed to be efficient in stimulating the use of condoms and having healthy sexual behavior [20,21,22,23], mainly if there were components of gamification [13]. Gamification is a unique and sophisticated opportunity that involves users in the use of components and principles of gaming design, with persuasive design used in psychology, in the context of non-traditional games [24,25].

The pilot of CyberSenga, an Internet site, is efficient to prevent AIDS/STIs and to increase the use of condoms among young people that have anal and vaginal sexual relations, besides promoting healthy sexual relations[26].

The information on the ninth screen has the sentence: "The test is free and can be done at any healthcare unit. It is not necessary to schedule an appointment to do the test". The evaluators report that some healthcare units require prior scheduling, according to the schedule of the family health group, to do the syphilis test. The score related to clarity and comprehension of the pictures and functions were eight and seven respectively, and the presence of the screen scored ten.

> *Review the information, because there is scheduling in some healthcare units* (P8).
>
> *Improve the information about access to a health unit to do the test /schedule the test (*P9).
>
> *Correct the information: in the healthcare unit it is necessary to schedule according to the schedule of the family health group that assists the person* (P5).

The VDRL (*Venereal Disease Research Laboratory*) is the test used to diagnose syphilis in the healthcare units. Scheduling to do the test, the working time of the healthcare units and the delay in delivering the results are lost opportunities for the testing of syphilis, mainly for the male population [27,28].

Regarding the places to do the quick test, there is some dissent among the evaluators about the place where the patient may be referred to.

> *The places for quick test of syphilis are the CTC and not any healthcare unit* (P3).
>
> *Correct the information: he shall go to a reference unit according to his home address* (P7).

The places to do the quick test, according to Ordinance Nº 3.242 of December 30th, 2011, are the health facilities and services without appropriate laboratory infrastructure, the Center of Testing and Counseling (CTC) and basic health units that act within the framework of "Rede Cegonha" [29].

In the context of Fortaleza, Ceará, pregnant women and their partners are the priority public of Basic Care for the diagnosis and treatment of syphilis. Men and not-pregnant women with syphilis are referred to CTC. In Fortaleza, CTC operates at Carlos Ribeiro Health Unit and at three other health units of Regional I, where tests for HIV/Aids and Syphilis are provided, besides assisting all people of all neighborhoods of Fortaleza.

CTC is a service of primary health care, which offers, for the vulnerable population, services of counseling and approaches for risk reduction; free, confidential and anonymous tests for HIV and syphilis; emotional support; and referral for treatment of reagent cases [29].

The SELP app provides a series of questions that classify the user under medium or high risk. This resource aims to help the user to identify the probability of having syphilis. The evaluators gave scores regarding the clarity of the pictures in screens "classification of high risk" and "medium risk" seven and six, and for their function, eight and seven.

> *Does low risk exist? Because the person may be scared by seeing that even with only one partner and using condom during sexual relations he/she presents medium risk of having the disease. Why?* (P6).
>
> *This screen scares the people that have preventive sexual behavior* (P8).

The risk classification of SELP is based on a research made by the Ministry of Health, which aims to collect data, through national survey, that makes it possible to evaluate indicators related to knowledge, behaviors and practices of the Brazilian population related to STIs, HIV/AIDS and viral hepatitis [30]. Thus, knowing the habits and behaviors of the population instigates public policies for population groups that are more vulnerable to contract STIs.

The users, after replying to the questions of the app, are classified under medium and high risk. The objective of this action is to raise user awareness about the adoption of preventive measures. The classification of low risk was not inserted in the app because, according to the literature, the perception of low risk is an important barrier in the control of STIs, since people that do not realize the risk of getting an infection are less prone to do the tests and take preventive measures, such as the use of condoms, comparatively to those with a higher perception of the risk [31].

The SELP app addresses issues related to the treatment for acquired and congenital syphilis, providing information about the medication used for the treatment. The suggestions of the professionals for the screen "treatment" were directed towards penicillin, the drug used for the treatment of syphilis, and its possible allergic reaction.

> *Include the information that in case of allergy to penicillin the professional may suggest another treatment* (P2).

Penicillin is the drug chosen for the treatment of pregnant women with a diagnosis of gestational syphilis. Allergy to this drug in the general population and in pregnant women is a very rare event. Concerns about having adverse reactions are not a deterrent factor for the administration of benzathine penicillin in Basic Care. Adrenalin is the drug chosen for the treatment of these reactions, if they occur, and the person shall be referred to the specialized unit [27].

The diagnosis of allergy shall be evaluated by the clinical history, avoiding, in the majority of the cases, tests of sensibility, which shall be done in reference units. Desensitization with oral administration of progressive doses of penicillin shall always be done at hospitals. In the impossibility of doing the desensitization during pregnancy, treated with Ceftriaxone, in the general population the drugs chosen are Doxycycline and Ceftriaxone[27].

The app provides to the user a list with all healthcare units in Fortaleza. This function helps the user to find the healthcare unit which he has a relation with, besides creating reminders of the doses of medication, date, time and place. The score given by the professionals for the picture and functions was eight, and ten for the presence of the screen "map of health posts".

> *I suggest highlighting those facilities that are CTC* (P8).
>
> *I think that in this screen it should be highlighted the healthcare unit the user may go to, which is the one related to his home address* (P3).

Similar findings were reported in two studies, Aliabadi et al. [12] and Schnall et al. [32], in which the users look for apps that can identify the health service where they could have information about transmission, prevention and treatment of STIs, besides a group that could offer emotional support.

Thus, *smartphones* that do not offer only the standard resources – voice and text communication - present also advanced resources of computing and communication, including access to the Internet and systems of geolocation. The geographic information can be used by health professionals to show users the localization of reference services where tests and treatment of STIs can be done [17]. *Wi-Fi* network uses cellphone signals to get the geolocation of the user, even when there is no satellite coverage [33].

One of the functions that apps offer their users is the option of creating reminders, scheduling the day and hour of medication and scheduling the day of medical appointments [32]. It is a valorous function, because it offers users the opportunity of self-management of their disease.

For the screen "notify my partners", the evaluators recommend replacing the word "notify" by "communicate", besides emphasizing the privacy, the necessity of treating the sexual partners, as well as the possibility of inserting more than one telephone number or e-mail address. The professionals gave score nine for picture and function, and for its importance score ten was given.

> *Replace the word notify by inform* (P5).
>
> *Change the word notify for convocation of partner* (P10).
>
> *There should be a better explanation about the confidentiality and the anonymity for the one who is going to send it* (P9).

It is known that stigma performs an important role in the process of recruitment of friends and sexual partners [34]. A strategy used

for the notification of partners and to reduce stigma is the motivational interview, which consists in a customer-focused approach proposing a change of specific behavior, according to his needs and skills [35]. When applied in the context of health professionals, it becomes a valorous tool that aims to reduce the patient's resistance in the NP [36].

Respondent Driven Sampling (RDS) is an acceptable strategy among health professionals, because it helps to structure the appointment and increase the awareness about the risk of infection by an STI, besides stimulating the patient to recruit his net of sexual partners[34].

CONCLUSIONS

The present study states an important step towards the expansion of the use of *mHealth* technology in facing STIs. SELP app is an important tool that will support health professionals and users in the adherence to syphilis treatment.

SELP app was well evaluated by the professionals that provide prenatal care at public health services in Fortaleza-Ceará. The layouts and the functions of SELP were based on knowledge and on practices that promote health, regarding the impacts on the personal and social lives of syphilis patients.

The specialists suggested changes in the app, in the sense of improving it. The present study also identified that, for obtaining satisfactory results with the use of SELP app, there may have to be a re-organization of the Basic Healthcare Units, i.e., all people infected by syphilis might receive treatment and assistance at Basic Healthcare Units.

Nowadays, Basic Healthcare Units assist, as a priority, pregnant women and their partners with syphilis. Others, when diag-

nosed in a Basic Healthcare Unit, are referred to the Centers of Treatment and Counseling and to the Emergency Care Units.

Health professionals have to be duly trained to raise people's awareness about syphilis and, at the same time, to mitigate the stigma, adopt preventive measures and stimulate patients to notify their sexual contacts exposed to syphilis.

Changes in the structuring of the course of graduation in Nursing should incorporate the study of Technologies of Information and Communication to respond to the demands arising from the expansion of mobile technology and wireless networks.

REFERENCES

1. Gomez GB, Kamb ML, Newman LM, Mark J, Broutet N, Hawkes SJ. Untreated maternal syphilis and adverse outcomes of pregnancy: a systematic review and meta-analysis. Bull World Health Organ. 2013;91(3):217-26.
2. Korenromp EL, Rowley J, Alonso M, Mello MB, Wijesooriya NS, Mahiané SG, Ishikawa N, Le LV, Newman-Owiredu M, Nagelkerke N, Newman L, Kamb M, Broutet N, Taylor MM. Global burden of maternal and congenital syphilis and associated adverse birth outcomes-Estimates for 2016 and progress since 2012. PLoS One. 2019;14(2):e0211720.
3. World Health Organization (WHO). WHO publishes new estimates on congenital syphilis.Global decrease but cases remain high, causing 200.000 stillbirths and newborn deaths every year [Internet]. Geneva: WHO; 2019[citado em 2019 maio 16]. Disponível em: https://www.who.int/reproductivehealth/congenital-syphilis-estimates/en/.
4. Ministério da Saúde (Brasil). Boletim Epidemiológico da Sífilis. Secretaria de Vigilância em Saúde. 2017;48(36).
5. Padovani C, Oliveira RR, Pelloso SM. Sífilis na gestação: associação das características maternas e perinatais em região do sul do Brasil. Rev Lat-Am Enferm. 2018;26:e3019

6. World Health Organization (WHO). World health statistics 2012. Geneva: World Health Organization; 2012.

7. Chatzipavlou IA, Christoforidou SA, Vlachopoulou M. A recommended guideline for the development of mHealth Apps. Mhealth. 2016:2:21.

8. Free C, Phillips G, Watson L, Galli L, Felix L, Edwards P, Patel V, Haines A. The effectiveness of mobile-health technologies to improve health care service delivery processes: a systematic review and meta-analysis. PLoS Med. 2013;10(1):e1001363.

9. Watterson JL, Walsh J, Madeka I. Using mHealth to improve usage of antenatal care, postnatal care, and immunization: a systematic review of the literature. Biomed Res Int. 2015;2015:153402.

10. Polit DT, Beck CT, Hungler BP. Fundamentos de pesquisa em enfermagem. Porto Alegre: Artmed; 2011.

11. Alexandre NMC, Coluci MZO. Validade de conteúdo nos processos de construção e adaptação de instrumentos de medidas. Cien Saude Colet.2011;16(7):3061-68.

12. Aliabadi N, Carballo-Dieguez A, Bakken S, Rojas M, Brown W 3rd, Carry M, Mosley JP, Gelaude D, Schnall R. Using the Information-Motivation-Behavioral Skills Model to Guide the Development of an HIV Prevention Smartphone Application for High-Risk MSM. AIDS Educ Prev. 2015;27(6):522–37.

13. Muessig KE, Pike EC, Legrand S, Hightow-Weidman LB. Mobile phone applications for the care and prevention of HIV and other sexually transmitted diseases: a review. J Med Internet Res. 2013;15(1):e1.

14. Goldenberg T, McDougal SJ, Sullivan PS, Stekler JD, Stephenson R. Preferences for a Mobile HIV Prevention App for Men Who Have Sex With Men. JMIR Mhealth Uhealth. 2014;2(4):e47.

15. Ministério da Saúde (Brasil). Protocolo clínico e diretrizes terapêuticas (PCDT): atenção integral às pessoas com infecções sexualmente transmissíveis (IST). Brasília, DF: Departamento de IST, Aids e Hepatites Virais Secretaria de Vigilância em Saúde; 2015.

16. World Health Organization. Global health sector strategy on sexually transmitted infections 2016–2021: towards ending STIs. Geneva: WHO; 2016.

17. Sun CJ, Stowers J, Miller C, Bachmann LH, Rhodes SD. Acceptability and feasibility of using established geosocial and sexual networking mobile applications to promote HIV and STD testing among men who have sex with men. AIDS Behav. 2015:19(3):543–52.

18. Yi S, Tuot S, Chhoun P, Pal K, Tith K, Brody C. Factors associated with induced abortion among female entertainment workers: a cross-sectional study in Cambodia. BMJ Open. 2015; 5(7):1-8.

19. Lim RBT, Wong ML, Tan PH, Govender M. Heterosexual men who patronise entertainment establishments versus brothels in an Asian urban setting – which group practises riskier sexual behaviours? BMC Public Health. 2015;15:777.

20. Gold J, Aitken CK, Dixon HG, Lim MS, Gouillou M, Spelman T, Wakefield M, Hellard ME. A randomised controlled trial using mobile advertising to promote safer sex and sun safety to young people. Health Educ Res. 2011;26(5):782-94.

21. Downing SG, Cashman C, McNamee H, Penney D, Russell DB, Hellard ME. Increasing chlamydia test of re-infection rates using SMS reminders and incentives. Sex Transm Infect. 2013;89(1):16-9.

22. Ko NY, Hsieh CH, Wang MC, Lee C, Chen CL, Chung AC, Hsu ST. Effects of Internet popular opinion leaders (iPOL) among Internet-using men who have sex with men. J Med Internet Res. 2013;15(2):e40.

23. Michie S, Richardson M, Johnston M, Abraham C, Francis J, Hardeman W, Eccles MP, Cane J, Wood CE. The behavior change technique taxonomy (v1) of 93 hierarchically clustered techniques: building an international consensus for the reporting of behavior change interventions. Ann Behav Med. 2013;46(1):81-95.

24. Starks K. Cognitive behavioral game design: a unified model for designing serious games. Front Psychol. 2014; 5:28.

25. Brox E, Fernandez-Luque L, Tollefsen T. Healthy Gaming - Video Game Design to promote Health. Appl Clin Inform. 2011;2(2)128–42.

26. Ybarra ML, Bull SS, Prescott TL, Korchmaros JD, Bangsberg DR, Kiwanuka JP. Adolescent abstinence and unprotected sex in CyberSenga, an Internet-based HIV prevention program: randomized clinical trial of efficacy. PLoS One. 2013;8(8):e70083.

27. Ministério da Saúde (Brasil). Caderno de boas práticas: o uso da penicilina na Atenção Básica para a prevenção da sífilis congênita no Brasil. Brasília, DF: Ministério da Saúde; 2015.

28. Oliveira MP, Matos, MAD, Silva AMC, Lopes CLR, Teles SA, Matos MA, Spitz N, Araújo NM, Mota RMS, Kerr LRFS, Martins RMB. Prevalence, Risk Behaviors, and Virological Characteristics of Hepatitis B Virus Infection in a Group of Men Who Have Sex with Men in Brazil: Results from a Respondent-Driven Sampling Survey. PLoS One. 2016;11(8):e0160916.

29. Ministério da Saúde (Brasil). Departamento de DST, Aids e Hepatites Virais. Diretrizes para Organização e Funcionamento do CTA no Brasil. Brasília, DF: Ministério da Saúde; 2010.

30. Ministério da Saúde (Brasil). Pesquisa de conhecimento, atitudes e práticas na população brasileira. Brasília, DF: Ministério da Saúde; 2016.

31. Lim RB, Tham DK, Cheung ON, Tai BC, Chan R, Wong ML. What are the factors associated with human immunodeficiency virus/sexually transmitted infection screening behaviour among heterosexual men patronising entertainment establishments who engaged in casual or paid sex? – Results from a cross-sectional survey in an Asian urban setting. BMC Infec Dis. 2016;16(1):763.

32. Schnall R, Mosley JP, Iribarren SJ, Bakken S, Carballo-Diéguez A, Brown Iii W. Comparison of a user-centered design, self-management app to existing mhealth apps for persons living with HIV. JMIR mHealth uHealth. 2015;3(3):e91.

33. Donaire-Gonzalez D, Nazelle A, Carrasco-Turiga G, Jerrett M, Crespo AV, Ambros A, Nieuwenhuijsen M. Benefits of Mobile Phone Technology for Personal Environmental Monitoring. JMIR Mhealth Uhealth. 2016;4(4):1-13.

34. Theunissen K, Hoebe C, Kok G, Crutzen R, Kara-Zaïtri C, de Vries N, van Bergen J, Hamilton R, Van der Sande M, Dukers-Muijrers N. A web-based respondent driven sampling pilot targeting young people at risk for chlamydia trachomatis in social and sexual networks with testing: a use evaluation. Int J Environ Res Public Health. 2015;12(8):9889-906.

35. Rollnick WR, Miller SR, Butler CC. Motivational interviewing in health care: helping patients change behavior. New York: Guilford Press; 2007.

36. Op de Coul EL, Spijker R, Van Aar F, Van Weert Y, Bruin M; Partner Notification Group. With whom did you have sex? Evaluation of a partner notification training for STI professionals using motivational interviewing. Patient Educ. Couns. 2013;93(3):596-603.

CHAPTER 13

MHEALTH IN THE CONFRONTATION OF SEXUAL VIOLENCE AGAINST WOMEN: THE EXPERIENCE OF EVISU APP

Ludmila Fontenele Cavalcanti, Raimunda Magalhães da Silva

INTRODUCTION

This article aims to analyze the experience of EVISU App – Information about the confrontation of sexual violence against women.

Sexual violence is one of the cruelest and most persistent demonstrations of gender violence, considered a multifaceted phenomenon with historic-cultural roots, fueled by ethnic-racial issues as well as class and generation matters. Sexual violence against women involves control, domination and subordination of women's sexuality in the relations of gender that emphasize hierarchy and sexual inequalities. It is considered a public health problem and a violation of sexual and reproductive rights and, thus, of human rights [1]. Sexual violence against women is relevant in the society both by its high incidence and by its impact on sexual and reproductive health.

According to Krug et al [2], the definition of sexual violence includes a variety of acts or attempts of sexual relation under coercion or physical force, during marriage or any other relationships. In Brazil, sexual violence is considered as any kind of unwanted sexual

activity. The right of having a satisfying sexual life, free of violence, coercion or risks of an undesired pregnancy and diseases is one of the most fundamental sexual and reproductive rights of women. In accordance to the 2018 Violence Atlas, the health system registered 22.918 rapes, while 49.497 were registered by the police[3], which shows the high magnitude of this phenomenon.

The idea of confrontation inserted in the Brazilian National Policy of Confrontation of Violence Against Women, based on international frameworks (conventions and conferences) and on the national legal system, is not limited to the issue of fighting, but also includes the dimensions of prevention, assistance and guarantee of women's rights. Confrontation, in this perspective, requires the joint effort of several sectors involved in the issue, such as health, public safety, justice, education, social assistance, among others.

Humane and qualified assistance to women in a situation of violence implies the continuous training of public and community agents in the appropriate operation of specialized services. It is essential to implement/improve the Assistance Network through the mobilization of governments – federal, state, municipal – and through the general public for the establishment of a network of partnerships for the confrontation of violence against women, aiming to ensure complete attention and care.

The complexity related to situations of sexual violence and to the consequences imposed to the victims requires a multi-professional approach, able to prevent, detect and address at issues different times [4]. The steps of assistance, including the measures of detection, notification, emergency procedures, monitoring, rehabilitation and treatment of the impacts of the sexual violence on women's health, require appropriate training by health professionals, for them to realize this issue as a social phenomenon which may cause serious damage to women's health.

The topic of the sexual violence prevention has been achieving, on the one hand, the necessary exposure in the implementation of public policies, and on the other hand, it has been facing, in the field of planning and organization of services, limited professional actions, due to the lack of information about this subject. The universities, thus, take an essential role for the professional training and for the production of knowledge, capable of meeting the demands of society.

In this scenario, placing information about the prevention of violence at the disposal of professionals and administrators may be a strategy for the incorporation of the sexual violence issue in public policy actions, as well as it may contribute for the improvement of professional actions. Car et al.[5] provide preliminary evidence showing that digital education to address delicate social issues, such as sexual violence, may improve certain educational results in health professionals, although it indicates a gap in digital education regarding violence.

According to Rocha et al. [6], mHealth or mobile health, as a public health practice supported by mobile devices, has been helping several health fields, from the promotion to the management of healthcare, both to the users of services and to the professionals and institutions that provide care, besides being an important and promising tool for use in different levels of healthcare.

In the sense of expanding the knowledge about sexual violence through mobile devices, this study aimed to analyze the experience with the design, use and evaluation of the EVISU app, available in the Android and iOS platforms.

METHOD AND REPORT OF THE EXPERIENCE

This is a descriptive study regarding the experience of designing of a mobile app based on the development of research about

healthcare for women in a situation of sexual violence, and of a website directed to the prevention of sexual violence against women. Besides the steps of the design process, the use and the challenges to be faced will be analyzed.

The development of seven evaluative researches[8] throughout ten years, concerning the healthcare of women in a situation of sexual violence in different contexts, indicated insufficient dissemination of information that is capable of giving exposure to the topic of prevention of sexual violence. On the other hand, it was observed that there is great difficulty, by health professionals, to find updated information related to the confrontation of sexual violence against women.

Due to the analysis of the demand for information, which took place from 2005 to 2012, in the scope of the Extension Project "Prevention of Sexual Violence against women", the website www.prevencaoaviolenciasexual.ess.ufrj (Figure 1) was developed with the purpose of contributing with the qualification of health professionals and with the qualification of care services provided to victims of sexual violence.

8 Actions of prenatal assistance directed to the prevention of sexual violence: representation and practices of health professionals; Prevention of sexual violence: Evaluating the Primary Attention in the Program of Full Assistance to Women's Health; Evaluation of the centers of attention to women in situation of sexual violence at municipal maternities of Rio de Janeiro; Mapping of health attention to people in situation of domestic and sexual violence in the State of Rio de Janeiro; Evaluation of the services of attention to women in situation of sexual violence in the State of Rio de Janeiro; Pilot of Monitoring of the priority municipalities of health attention to people in situation of domestic and sexual violence in the State of Rio de Janeiro; and Analysis of health services in the attention to women in situation of sexual violence: comparative study at two Brazilian capitals.

Figure 1 - Website Prevention of Sexual Violence against women

For the design of the website, containing 18 main links, the following aspects were considered: use of appropriate and easy-to-understand language, choice of colors and images with a visual identity related to the social movements and to the reality of services, and selection of relevant content. Updates were made regarding: kinds of violence against women; kinds of prevention of sexual violence;

summary of the developed research projects; service networks; social control; educational material; study centers; libraries; documents for consultation (legislation, conventions, plans, programs and policies); monographs produced in the research projects; websites; videos and events related to the subject.

The opinion surveys and the "Contact Us" area became spaces of communication with the competent team. The most frequent demands were requests of material about the subject, followed by requests of orientation for the confrontation of demonstrations of gender violence against women. The senders, in their majority, were professionals of different fields of public policies - health and education, students of several courses that requested orientation directed to professional intervention and literature related to the issue, women in a situation of gender violence or their family members (mostly female and from the southeast region of Brazil).

The use of the website, as a strategic and pedagogical performance, contributed to: a) access to information both from professionals and administrators and from researchers and students; b) referral of women and families in situation of sexual and domestic violence to the service network; c) qualification of Professional actions; and d) institutional exchange[7].

Considered a successful experience due to the adherence to published information by readers, this initiative summarized the information about sexual violence against women in a simple and easy-access interface, besides allowing questions related to the issue to be sent.

In the context of development of the research "Analysis of health services in the attention to women in situation of sexual violence: comparative study at two Brazilian capitals"[9], it was foreseen

9 Made by the Post-Graduate Program in Social Service of the Federal University of Rio de Janeiro in cooperation with the Post-Graduate Program in Collective Health of University of Fortaleza and supported by CNPq through the Notice MCTI/CNPq/SPM-PR/MDA Nº 32/2012 – Relations of Gender, Women and Feminisms. This research integrated the internship of post-doctorate of one

that as one of its products would be the development of educational material directed to professionals and administrators involved with the attention to women in a situation of sexual violence.

In this opportunity, intensification in the use of information technologies, with the increasing use of apps in the health promotion field, was noticed. However, an interface with teaching-learning, regarding the health/disease process, was still little explored [6].

The complexity related to situations of sexual violence, one of the demonstrations of gender violence, requires a multi-professional approach capable of preventing, detecting and addressing it at different times. This implies simplified access to updated information[4].

Thus, the app "EVISU - Information about confrontation of sexual violence against women" was designed and built, initially for iOS platform, by a multidisciplinary team, formed by professionals and students on the fields of Social Service, Nursing, Publicity and Advertisement, and Information Technology.

In this sense, mapping about the available information and its means of dissemination was carried out, mainly at websites and national and international apps, what made it evident that the information, although being accessible, was spread over different domains and almost absent in the field of apps.

In the field of gender violence, different apps were designed in the last years in Latin America, directed to women in a situation of gender violence, with focus on protection. The high incidence of violence against women in Brazil encouraged a large network of digital support via mobile services directed to denunciation and to the creation of a female support net to women in risk situations. Only a Spanish app about sexual and reproductive health has an approach with emphasis on sexual violence as one of the demonstrations of gender violence[8].

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of the authors of this article.

From this mapping, it was established as an objective the dissemination of information about sexual violence against women in the field of public policies and universities. Thus, the target-public was defined as professionals, administrators, students and researchers from the fields of health, social assistance, public safety, human rights and others that work with the issue.

Regarding the contents to be published, a theoretical ground was pursued, based on a bibliographic review related to the research projects about attention to women in a situation of sexual violence in different contexts, developed by the Group of Research and Extension "Prevention of sexual violence" from the Federal University of Rio de Janeiro (UFRJ), which subsidized this initial design of the program.

With a simple interface, easy-access and free use, the app, besides the institutional presentation about the activities of teaching, researching and extension of both developer universities, is divided into four groups of information (Figure 2).

Figure 2 - EVISU App

The first group, named **"What is sexual violence?"** (Figure 3), is comprised of conceptual information based on national and international references in approaching the subject. In this group, it is possible to access the definition of violence, according to the Krug et al [2], 14 kinds of sexual violence, the magnitude of the phenomenon[3], its causes and repercussions, with emphasis on the damage to sexual, mental and reproductive health.

Figure 3 – What is sexual violence?

The second group offers information about **"Confronting sexual violence"** (Figure 4), including information about public policies, the Technical Rule "Prevention and treatment of damage arising from sexual violence against women and adolescents"[4] and legal protections.

These public policies are divided into the fields of Social Assistance, Human Rights, Brazilian National Policy of Confrontation of Violence Against Women, Health and Public Safety. The fields of Health and Confrontation of Violence against women concentrate the largest amount of information, due to the protagonism of these fields in the confrontation of the phenomenon[9].

Information about service networks and social control are essential to the efficiency of these public policies [10]. The definition of Network of Assistance to Women in Situation of Violence refers to organized action among governmental and non-governmental institutions/services and the community, aiming at the expansion and improvement of assistance quality; identification and appropriate referral of women in a situation of violence; and the development of efficient strategies of prevention[11].

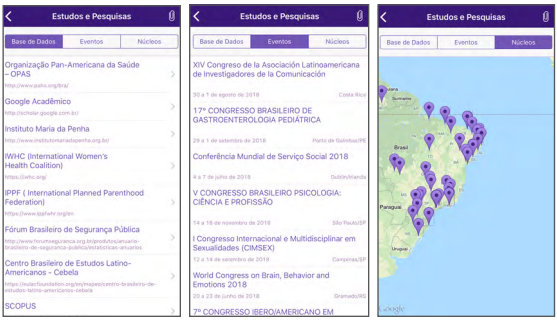
Figure 4 – Confronting sexual violence

The third group, named **"Studies and Research"** (Figure 5), is comprised of national and international, governmental and non-governmental databases; research centers located in Brazil; and national and international scientific events. Available databases are concentrated in the international organizations, research institutes linked to the third sector and scientific production portals.

The addresses of the research centers that study the subject in Brazil are made available through an interactive map, which presents information for contact.

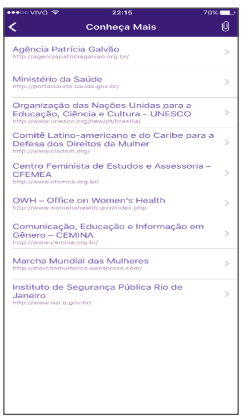
The events released in the app involve the topics of sexual violence, gender violence and violence against women, found from descriptors in Portuguese.

Figure 5 – Studies and Research



The fourth and last group, named **"Learn More"** (Figure 6), makes 61 websites of institutions that address the subject available. Most of them are focused on the production and diffusion of knowledge, but there is also a strong presence of the ones that disclose debates, events and projects about the topic. Regarding the nature of institutions, it was noted that they are, in their majority, linked to the Third Sector.

Figure 6. – Learn More



In 2018, EVISU app was made available in the Android platform in the context of the Project "mHealth for the promotion of women's health"[10]. This app is often updated by a multi-professional team, composed by students and professionals of Nursing, Medical Science, Psychology and Social Service from UFRJ.

Nowadays, it is used as an institutional tool in different contexts of public policies, such as the Military Police of the State of Ceará and the Health Secretariat of the State of Rio de Janeiro. It has been adopted at places of professional training, such as in-graduation and post-graduation courses of different universities, as a means for the qualification of professionals and administrators. It has also become a reference for the development of other apps, what demonstrates its efficiency in spreading relevant content about confronting sexual violence against women.

CONCLUSIONS

Considering the complexity of the phenomenon of sexual violence against women, this pioneer strategy for the dissemination of information directed to its confronting is evident the importance, especially when made through a tool of easy management that provides updated information. Up to this moment, it is suggested that the use of mHealth technology through the EVISU app has enabled new qualified forms of information management for students, professionals and administrators that act or are interested in the issue of sexual violence confrontation.

Divakar et al[12], evaluating the efficacy of digital education of professionals of health about violence, in comparison with the

10 The project "mHealth for the promotion of women health" is developed by the Group of Research and Extension in Women and Adolescent Health of UNIFOR, involves researchers from the Federal University of Ceará (UFC) and from UFRJ and has the support of Funcap through the Support Program for Centers of Excellence (PRONEX).

traditional forms or without intervention, indicates the efficacy of education in the comprehension of health professionals about domestic violence as a promising field, even considering the need of more research in this direction.

The EVISU app presents a simple, original and pioneer interface, with fast and remote access, which makes navigation easy. Its institutionalization in different contexts of confrontation shows a good adherence by users that have free access to updated information. It is important to highlight, however, the need of constant updating and dissemination of the app, to have a greater reach among the several professionals, sectors and institutions that work with the issue of sexual violence against women [13].

Many changes are needed in pedagogical practices and in the process of work oriented toward the construction of the entirety as a pillar of professional training; however, the use of the app in the management of information in health may contribute for a wider vision, closer to the needs of health service users.

Since 2017, the EVISU app has been linked to the research "Comparative analysis of the approach of sexual violence against women in the professional qualification in the health field at different universities". This study offers a compared perspective about the approach of sexual violence against women in the professional qualification in the health field at five Brazilian universities. It is inserted in the efforts for comprehending the challenges of professional qualification in different contexts and may contribute, on the one hand, to qualify the process of construction of entirety as a guiding principle of professional qualification and, on the other hand, build decisive answers for confrontation of sexual violence against women.

A tool was developed for evaluation of the use of EVISU app to be applied among students, professionals and administrators of health in different contexts. Future studies may be elaborated to

evaluate the effect of the use of the app in the practices of confrontation of sexual violence against women, which involves comprehension of the phenomenon and the ways to face it. The actions for prevention of sexual violence may be able to make changes in public policies and in society.

Aiming to disclose information and stimulate the use of EVI-SU app, the Facebook page "Group of Research and Extension Prevention of Sexual Violence" was created, where it is possible to share content related to news about the Group and about the app, legislation, events, care services, events, movies and articles about sexual violence against women.

REFERENCES

1. Organização Mundial da Saúde (OMS); Organização pan-americana de la Salud. Resumen: respuesa a la violencia de pareja y a la violencia sexual contra las mujeres. Directrices de la OMS para la práctica clínica y las políticas.Whashington, DC: OPAS; 2014.
2. Krug EG, Dahlberg LL, Mercy JA, Zwi AB, Lozano R, editors. Relatório mundial sobre violência e saúde. Genebra: World Health Organization; 2002.
3. Fórum Brasileiro de Segurança Pública. 12º Anuário brasileiro de segurança pública. São Paulo: Fórum Brasileiro de Segurança Pública; 2018.
4. Ministério da Saúde (Brasil). Prevenção e tratamento dos agravos resultantes da violência sexual contra mulheres e adolescentes: Norma Técnica. Brasília, DF: Ministério da Saúde; 2012.
5. Car J, Carlstedt-Duke J, Car LT, Posadzki P, Whiting P, Zary N, Atun R, Majeed A, Campbell J; Digital Health Education Collaboration. Digital education in health professions: the need for overarching evidence synthesis. J Med Internet Res., 2019; 21(2): e12913.
6. Rocha FS, Santana EB, Silva ES, Carvalho JSM, Carvalho FLQ. Uso de apps para a promoção dos cuidados à saúde. Anais do 3º Seminário

de Tecnologias Aplicadas em Educação e Saúde; 2017 maio 08-09; Salvador: UNEB; 2017.

7. Cavalcanti LF. Produção da informação na prevenção da violência sexual [Internet]. Rio de Janeiro: Universidade Federal do Rio de Janeiro; 2013. Disponível em: http://boletim.pr5. ufrj.br/index.php/artigos/direitos-humanos/9-producao-da-informacao-na-prevencao-da-violencia-sexual.
8. Lima IGAC, Barros MC, Lancelotti EFC, Pereira RB, Ferreira APS, Tiago AV. Uso de aplicativo para o enfrentamento à violência sexual contra a mulher. Revista do CFCH. 2017; (Ed Especial).
9. Benevides AB, Freitas MNLF, Barros MC, Ferreira JM, Ferreira APS, Silva MFP, Pereira RB. Navegando pelo aplicativo EVISU: análise da informação disponível sobre o enfrentamento à violência sexual contra mulher. Revista do CFCH. 2018; (Ed Especial).
10. Sagot M. Ruta crítica de las mujeres afectadas por la violencia intrafamiliar en América Latina: estudios de caso de diez países. Washington, DC: OPAS; 2000.
11. Secretaria Especial de Políticas para as Mulheres. Política nacional de enfrentamento à violência contra as mulheres. Brasília: Secretaria Especial de Políticas para as Mulheres; 2011.
12. Divakar U, Nazeha N, Posadzki P, Jarbrink K, Bajpai R, Yan Ho AH, Campbell J, Feder G, Car J. Digital Education of Health Professionals on the Management of Domestic Violence: Systematic Review and Meta-Analysis by the Digital Health Education Collaboration. J Med Internet Res. 2019; 21(5):e13868.
13. Benevides AB, Silva MFP, Barros MC, Manzani APM, Castro CAS, Tsuboi AP, Vieira TT. Contribuições do mHealth no uso do aplicativo EVISU - Informações sobre o enfrentamento à violência sexual contra a mulher. Revista do CFCH. 2019; (Ed Especial).

CHAPTER 14

USE OF MHEALTH AND ARTIFICIAL INTELLIGENCE IN SUPPORTING DECISION-MAKING OF HEALTHCARE PROFESSIONALS REGARDING TOPICAL THERAPY FOR BURNED PATIENTS

José Eurico de Vasconcelos Filho, Gilka A F Aguiar, Matheus Mafra, Rita Neuma D. C. de Abreu

INTRODUCTION

Burn injuries are a major public health problem. It is estimated that one million burn accidents occur in Brazil each year, resulting in 200,000 emergency room visits and 40,000 hospitalizations, with 2,500 deaths directly or indirectly due to burn injuries [1,2].

The Brazilian Unified Health System (SUS) spends approximately 55 million *reais* annually to treat these patients [3]. Considering that burning events constitute high-complexity trauma and require effective, appropriate and immediate treatment, accidents with burn victims have high morbidity and mortality rates.

Burns are tissue injuries caused by agents (thermal, chemical or electrical energy) capable of producing excessive heat, damaging body tissues and causing cell death. Such injuries can be classified as first-, second- or third-degree burns.

The classification of burns defines their severity and interventions to be adopted. This classification is based on factors such as depth and extent, being characterized by the type of injury. The first-degree burn is the most superficial one, presenting as local skin redness; edema may occur, and the degree of pain is variable. Second-degree burns affect a deeper skin layer, the epidermis. Blisters or peeling of the skin usually occur, with more severe pain. As for third-degree burns, these are injuries that destroy all skin layers, generating little pain, due to damage of nerve endings. It is the type of burn with the highest risk of death and it often requires surgical treatment [4].

Therefore, it is essential to have knowledge and effective control of the procedures to be taken in case of burn accidents, since, considering the complexity and severity of these injuries, they require not only competence but also skills and updated knowledge of the nursing team to care for the burned patient[5].

Despite the impact and relevance of burned patient treatment, a burn center or specialized staff is not always available at emergency health care settings. According to an interview with the professionals working at Instituto Dr. José Frota (IJF) Burn Center, which is a referral institute in the northeastern region of Brazil for the treatment of burns, it is a recurrent practice for nursing professionals from several health care centers in the state to remotely seek out consultations with nurses working at the specialized center, in search of burn classification confirmation, as well as treatment alternatives.

In this context, Information and Communication Technologies constitute an important tool to support the decision-making process of professionals regarding the classification and identification of treatment alternatives for burned patients outside the specialized centers. More specifically, mHealth [6] and Artificial Intelligence areas (through machine learning for automatic image classification) can be applied in the identified scenario, giving support to healthcare professionals. This study presents the design of the Pellis application (mHealth).

MHEALTH

MHealth or Mobile Health constitutes an area of eHealth or electronic Health that addresses medical and public health practices supported by mobile devices, such as mobile phones, tablets, monitoring devices, and other wireless devices [6].

mHealth technology warrants broader coverage and access to health knowledge, health promotion and disease prevention, as well as providing greater access to specialists. The technology also contributes to a better interaction with the healthcare team, providing more accurate diagnosis and personalized care, favoring compliance with the principles of the Unified Health System. It is known that there are many difficulties in achieving the health goals proposed in the Millennium Development Goals, and the growing demand from patients regarding health services has led managers to seek innovative ways to improve healthcare outcomes. International technical organizations, such as the World Health Organization (WHO), encourage the use of mHealth technologies to promote healthcare inside health systems to lower geographic barriers and improve health information provision.

MACHINE LEARNING AND WATSON

Machine learning is a branch of artificial intelligence that employs different statistical, probabilistic, and optimization techniques that allow computers to "learn" from examples and automatically detect patterns that are hard to differentiate from large, noisy, or complex data sets. This capability is particularly adequate for medical applications, such as diagnostic imaging support [7].

Deep Learning is a branch of machine learning that includes a set of algorithms and techniques based on the learning of data representations inspired by the interpretation of information processing

and communication patterns in a nervous system (neural networks), such as neural coding, which tries to define a connection between several stimuli and the associated neuronal responses in the brain [8].

This technology allows the machine to be able to create patterns based on the provided images and to establish coherent predictive models, for instance, by identifying injuries and suggesting disease diagnosis from medical imaging exams. IBM cloud, an IBM platform that offers services and infrastructure in a wide range of artificial intelligence areas, Internet of Things (IoT), analytics, and blockchain, among others, offers Watson Visual Recognition services, which, among other features, uses Deep Learning algorithms to deliver cloud recognition services and automatic image classification. The service allows images to be sent while representing a given concept, training the algorithm, generating a model of knowledge for further classification of new images [9].

LEARNING MODEL

To use the Watson Visual Recognition service in the context of the project, it was necessary to have the data (images) classified and separated by first-, second- and third-degree burns. In addition to this classification, it was also necessary to train the model to identify false positive results, which are images that may look like burns, but in fact represent something else, such as skin with some kind of injury or even healthy skin. For this study, 150 images of burns of the three degrees (1st, 2nd, and 3rd), 50 for each, and 30 false-positive images, 10 for each degree were used to reduce data bias.

Therefore, an 180-image database was required to generate the model, with the images being classified as 1st, 2nd, and 3rd degree burns as well as the false-positive images, which were sent to Watson Visual Recognition for training using Deep Learning algorithms, ultimately generating a model that can be used to classify new images.

When a new image is classified, Watson Visual Recognition reports the classification accuracy, the percentage of similarity between the new image and the burn degrees; for instance, if a new burn image is sent, the service returns the possible classification of the burn image, (either 1st, 2nd, or 3rd degree) with a percentage of certainty that it is actually that type of burn.

The percentage is relevant for healthcare professionals because it represents how similar that image is to a first-, second- or third-degree burn, helping them to choose the appropriate treatment for the patient.

METHODS

Regarding its nature, this is an applied research, considering its objective of generating knowledge (including a technological artifact – application) for practical applications, aimed at solving specific problems. As for the objectives, the study is an exploratory and experimental research.

Regarding the procedures, the research involves two stages; 1) an integrative literature review, based on LILACS, PUBMED, SciELO, with the purpose of analyzing in detail the problems related to health professionals' difficulties working in the treatment of burned patients; 2) a design and laboratory development stage, carried out according to Participative Interaction and User Centered Design [10]; and 3) Regarding the ethical and legal aspects, the research was carried out after being approved by the Research Ethics Committee of *Instituto Doutor José Frota*, aiming to meet the requirements of the Brazilian National Health Council (*Conselho Nacional de Saúde*) on research with human beings, under Opinion number 1.815 .198.

INTERACTION DESIGN

The conception and development phase, based on Interaction Design [10], included four iterative and closely-related stages. The first stage included brainstorming meetings and interviews with the entire team to identify the needs in the healthcare area and establish technology requirements. The second stage included the design of the solution, with the construction and validation of low interface prototypes (only screen layout and interaction elements such as buttons) and high fidelity (already including typography, icons and color palette). In the third stage, a functional prototype was built, i.e., a mobile app, on the Ionic 3 platform using the Watson Visual Recognition service of the IBM platform [9].

In the fourth stage, a test was carried out with users [10], professionals working in the burn center, in the treatment of patients, aiming at evaluating the usability of the developed prototype.

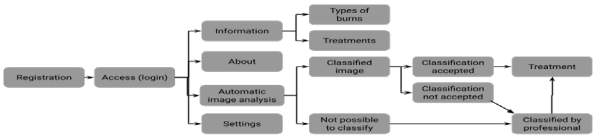
RESULTS

As preliminary results of the project, we have the definition of technological requirements, the product of the first stage of interaction design. The following are the most relevant requirements:

1. Registration (using the Regional Nursing Board - COREN – ID number) and access to the system (Login);
2. Enter a burn image using the device camera;
3. Load a burn image from the device image library;
4. Automatically classify the type of burn based on a documented or uploaded image;
5. Identify the treatments for the classified burn with a confidence level > 90%;

6. Allow the professional to confirm or reject the presented results;
7. Allow the professional to classify the image of a burn in case of automatic non-identification (confidence level < 90%), allowing feedback and application learning;
8. Offer overall information about burns and associated treatments.

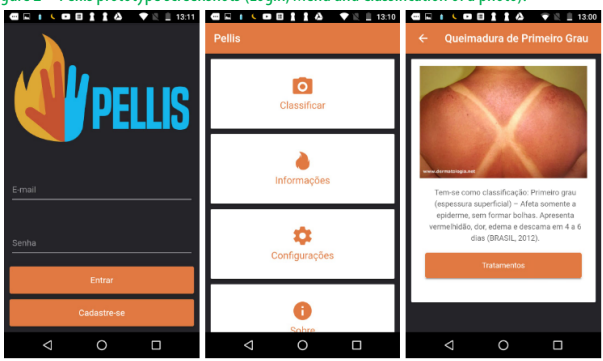
Figure 1 – Depicts the proposed flowchart, which is implemented in the application interfaces:



Source: The author

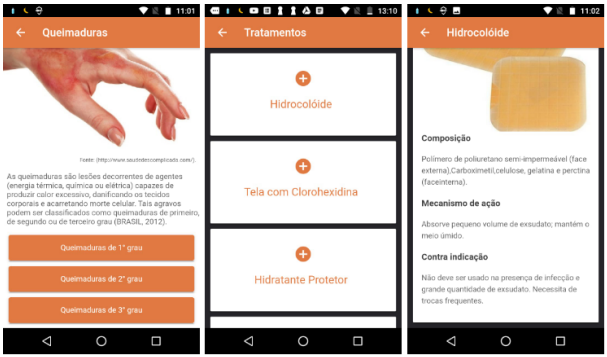
Another result is the functional prototype application shown below from its interfaces (see Figure 2):

Figure 2 – Pellis prototype screenshots (Login, Menu and Classification of a photo).



Source: The author

Figure 3 – Pellis prototype screenshots (Information, Treatments and Hydrocolloid Treatment).



Source: The author

Figure 2 shows, top to bottom, left to right, access and registration screen, home screenshot with function menu, image capture or reading screenshot, classification screenshot, classification result screenshot, treatment screenshot.

The data collected at this moment concerns the relevance of the application and how easy/difficult its use is. Regarding the relevance, these were the results:

- Important for the health professional as previous training as a multiplier agent in the health area, especially in places where there are no specialized burn centers.
- The application will contribute to the definition of care provided at the burn injury, as well as facilitate the decision-making regarding wound coverage-related conducts (dressings).
- It is important to be able to visualize and differentiate 1st, 2nd and 3rd degree burns

- How to qualify care and treatment, facilitating safe decision-making.

Additionally, the main difficulties found by the participants were related to the application use and image classification function. However, most participants emphasized the positive aspects, such as: content, simple and clear steps, practicality, speediness and objectivity.

The professionals who evaluated the software recognized its relevance in differentiating the degree of the burn, qualifying care, assisting in decision-making, as well as its use by lay people. It is noteworthy that the professionals who evaluated the software work in the abovementioned Burn Treatment Center. It is noteworthy that one of the participants stressed that the software could be used "as a multiplier agent in the health area". A systematic review study showed the effectiveness of using an application to reduce surgical time in a hospital in the United States. The application creators and the study authors showed, through statistical data, that the application acted as a facilitating tool in reducing surgical time, showing the improvement in service quality [10]. Some records showed evident difficulty in using the mobile device (Participants 3 and 6). However, the application showed to be practical, simple, clear, objective, and its content was considered excellent by the participants.

As for the evaluation regarding the different aspects related to the software, participant 1 suggested that some content be added to the first use; participant 2 reported that he was unsure how to use the photo-taking function in the app.

Participant 3 also stressed that the application use should be facilitated, while participant 4 reported he had difficulty concluding the use, as he had to return to the home screen before receiving the image classification. The last participant pointed out that he thought the application use was great.

Participants reported some difficulty to return to the home screen; difficulties in using the app, among others. Another observation was related to a faster presentation of the final outcome; in this case, the ideal topical therapy. When investigating the importance attributed to the application content assessment and its usability, it was observed that technology use had a positive impact on the perception of doctors and nurses. However, the professionals reported some difficulty in using the app.

However, considering this was the first contact with the application, which is a new tool, it is believed these difficulties can be reduced with frequent use. The interaction with these users resulted in a rapid learning process and provided professionals with relevant information on the uniform conduct regarding the treatment of burned patients.

CONCLUSIONS

This is an ongoing project, which still lacks clinical validation of the application, but preliminary results have given positive indications regarding the viability and usefulness of the developed tool. One of the future studies will consist in using other automatic image recognition algorithms to allow performance comparison.

It can be observed that the obtained results generated material for small improvements in the presented texts, in addition to suggestions and observations about the application. Overall, the test provided positive evidence of prototype usefulness and user satisfaction when having access to it. Thus, the application is useful to help professionals in the classification of burns and choice of topical therapy, and it can also be used for the transmission of knowledge in universities, when used by teachers and students, as it includes

educational content about the types of burns and treatments, as well as the possibility of being used by lay people.

The use of artificial intelligence to facilitate health processes and diagnostics through smartphones (mHealth) can optimize the actions of professionals to whom the population commonly has difficult access, especially in health situations that occur frequently, such as burns. One of the future studies will consist in using other automatic image recognition algorithms to allow performance comparison.

REFERENCES

1. Lima OBA, Arruda AJCG, Carvalho GDA. Enfermagem e o cuidado à vítima de queimaduras: revisão integrativa. Rev Enferm UFPE. 2013; 7(esp):4944-50.
2. Cruz BF, Cordovil PBL, Batista KNM. Perfil epidemiológico de pacientes que sofreram queimaduras no Brasil: revisão de literatura. Rev Bras Queimaduras. 2012;11(4):246-50.
3. Costa GOP, Silva JA, Santos AG. Perfil clínico e epidemiológico das queimaduras: evidências para o cuidado de enfermagem. Ciência Saúde. 2016;8(3):146-55.
4. Machado LO, Rufino ES, Echevarría-Guanilo ME, Tourinho FSV, Sebold LF. Produções científicas da enfermagem brasileira no cuidado de pacientes queimados: revisão bibliométrica. Rev Bras Queimaduras. 2015; 14(3):243-8.
5. Pereira MS, Souza ACS, Tipple AFV, Damaceno AP, Castro K. Assistência hospitalar ao paciente portador de queimaduras na perspectiva do controle de infecção: um estudo de caso. Rev Eletrônica Enferm. 2002; 4(1);40-50.
6. WHO Global Observatory for eHealth. mHealth: new horizons for health through mobile technologies: second global survey on eHealth. Geneva: WHO; 2011.

7. Wernick MN, Yang Y, Brankov JG, Yourganov G, Strother SC. Machine learning in medical imaging. IEEE signal processing magazine. 2010;27(4):25-38.
8. Goodfellow I, Bengio Y, Courville A. Deep learning. Massachussets: MIT Press; 2016.
9. Elhassouny A, Tam LN, Sayed D, Sri Lak. Building cognitive applications with IBM Watson Services: volume 3 visual recognition watson. [local desconhecido]: Redbooks; 2017.
10. Rogers Y, Sharp H, Preece J. Design de interação: Além da interação humano-computador. 3a ed. Porto Alegre: Bookman; 2013.

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