The use of an application to record information on Dentistry patients from the perspective of dental surgeons

Uso de una aplicación para registrar información sobre pacientes estomatológicos desde la perspectiva de los cirujanos dentales

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ABSTRACT

Dental records are complex documents and not all dental surgeons have been careful to fill them correctly. On the other hand, a number of apps for professional support has been observed on the market aimed at healthcare. The purpose of this study was to show how dental surgeons have noticed the technology of mobile devices and how it would help in their work routine by analysing an application for recording patient information. This study was exploratory, qualitative, descriptive, and transversal, with data obtained through a semi-structured interview with open-ended questions applied to ten dental surgeons who have downloaded the App OdontoExame as study population. The answers were analysed by the content analysis technique. The results showed that this technology could be useful in storing information. Besides, 90 % of respondents stated that the application would help in clinical practices, while 10 % considered such a technology still limited to this function.

Key words: dentists; dental records; smartphone; handheld; mobile applications

RESUMEN

Los registros estomatológicos son documentos complejos y no todos los cirujanos dentales han sido cuidadosos al llenarlos correctamente. Por otra parte, un conjunto

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de aplicaciones de apoyo profesional ha aparecido en el mercado, las que están dirigidas a la atención médica. El propósito del presente estudio es mostrar cómo los cirujanos dentales han notado la presencia de la tecnología de dispositivos móviles y cómo esta los podría ayudar en su trabajo diario, a partir del análisis de una aplicación para el registro de información de los pacientes. Se trata de un estudio exploratorio, cualitativo, descriptivo y transversal, basado en datos obtenidos mediante una entrevista semiestructurada con preguntas abiertas dirigidas a una población de diez cirujanos dentales que han descargado la aplicación OdontoExame. Las respuestas se analizaron aplicando la técnica de análisis de contenidos. Los resultados mostraron que esa tecnología puede ser útil para almacenar información. El 90 % de los encuestados plantearon que la aplicación podría ser útil en la práctica clínica, mientras que el 10 % consideró que esta aún estaba limitada a esa función.

Palabras clave: estomatólogos; registros dentales; teléfono inteligente; portátil; aplicaciones móviles.

INTRODUCTION

The World Health Organisation (WHO) has emphasized the mobility as a fundamental factor to improve the quality of health information systems.[1] Among Brazilians, 40 % of them use smartphones every day at least, 27 % prefer to have no television instead of smartphones, and 73 % of mobile users do not leave their homes without their devices.[2]

Among other functions, such devices have been used by health professionals in studies, information exchanges, image evaluation, and interpretation of lab results, leading to rapid and accurate decision-making.[3] Furthermore, these intelligent mobiles have been considered handheld computers for personal use everywhere 24 h a day. Thus, such devices can facilitate healthcare, since professionals of this acting area frequently transit through institutions that provide services and among different workplaces.[4] Due to the improvement of web browsers in smartphones, information in free applications became easier to be found. In 2017, more than 1.7 billion people are predicted to download healthcare applications, generating a revenue around 26 million dollars in the m-Health market (information and decisions on health through mobiles, smartphones, and tablets). This market of mobile applications in health is aimed at professionals, patients, and people interested in such a type of information.[5] Smartphones combine conventional functions with advanced computing, thus enabling the use of applications (Apps), which are downloaded in smartphones,[6] providing accessibility, low cost, mobility, multimedia experience, geolocation, and information exchanges.[7]

The advent of information age in health combined with technology overcame administrative functions for other areas including prevention support, health promotion, control of diseases, and drug prescriptions. The expansion and the constant evolution of the Information and Communication Technologies (ICT) have facilitated managerial and professional decision-making objectively and rapidly,[8] and its use has been widely described as Electronic Health (e-Health), which includes telemedicine, electronic medical records, healthcare decision support systems, e-Learning tools, and mobile health. This technology showed to be a facilitator in the

development of healthcare delivery systems, providing improvements in this sector, promoting access to healthcare, increasing the coverage of services, helping in the solution when human resources for health are scarce, and improving the quality and the refinement of interventions in primary healthcare.[9] Thus, e-Health has emerged as a model involving concepts of health, technology, and trade in health services, considering that wireless communication also led to an advance in this area, especially in telemedicine. In this context, a new segment of e-Health emerged: Mobile Health or m-Health.[10] The WHO defined m-Health as "practices of medicine and public health supported by mobile decision-making (mobile devices) through mobile computers (smartphones and tablets), using wireless technology" *(World Health Organization [WHO] s.d.).*

RATIONALE FOR THE STUDY

Dental surgeons have a work of great responsibility in society for acting directly on the health of people. Due to its ability, ethical and legal standards guide them in their work activity, including clinical activities, procedures related to the elaboration of drug prescriptions, dental certificates, filling of medical records, anamnesis records, radiographs, and photos, i.e. anything that may constitute a legal document. Thus, dental records are used in the performance of their functions.[11]

Dental records are a group of documents containing all information on the clinic or hospital life of people. Such information are stored in clinics, offices, health centres or hospitals and are confidential, since their access is only authorized to health professionals and patients. [12] They are used as instruments of consultation, follow-up, medical-hospital statistics, confirmation of appropriate patient care, information exchanges among healthcare professionals, and as exculpatory and incriminatory documents.[12] Furthermore, it must be emphasized that dental records are also used for human identification when the professional is requested for this purpose.[13] All documents involving and recording dental procedures can be considered documentation in dentistry, including copies of prescriptions, written guidelines, e-mails, radiographs, and study models. Their elaboration and maintenance must be legible and updated. The conservation must be in own file physically or digitally.[13]

Dental treatment is a complex activity, exceeding technical aspects of clinical procedures. Thus, dental records are not coadjuvant in dental practices, but unfortunately this professional category seamlessly lets pass the real importance of having such documents with complete and adequate information.[14] Studies have reported several errors in filling records, including unreadable writing, erasures, incomplete records, incorrect identification of professionals, and lack of patient signature.[15] Despite seeking to end the treatment properly, dental surgeons have not done the same in their records, often not writing information observed from beginning to end of treatment.[14]

In 2017, three billion people are predicted to have smartphones and half of them will use applications (Apps).[16] Thus, such a technology can be more easily used to help work activities of people who deal with these devices.[4] In this sense, smartphone applications in healthcare have been developed, offering solutions to several tasks, thus becoming frequent their use in decision-making and changes in clinical practices.[17] The use of smartphone applications has become increasingly popular and with potential health care, although their clinical utility and efficiency are still unknown.[18] The following main research question was defined in order to direct the present study: What is the perception of dental surgeons on the use of applications for recording patient information to help their clinical practice?

LITERATURE REVIEW

Innovation in health

In the last few decades, unprecedented transformation and technological innovation processes has been observed in healthcare. Thus, processes need to be reviewed in public and private sectors, as well as investing in technologies capable of increasing the control and improving healthcare quality.[8] Besides consisting of an area with particular characteristics due to its involvement in human life, health belongs to the sector of services, thus sharing lineaments in the production process of the tertiary sector and regarding technological innovation.[19] However, the technology assumes the training of professionals who will use it in order to make this resource a conduit and not a purpose itself.[20]

For an effective innovation, all its connections must be established in their proper places and with a suitable functioning among them. [21] The popularization of laptops and smartphones have been considered by many people as the most shocking technological revolution recently, after revolution caused by Internet and social networks.[22] For years, mobile computing overcame the number of personal computers, becoming an interpersonal communication system quintessentially. [23]

Information and Communication Technologies (ICT) for WHO have emphasized the care provision to public health, studies, and health-related activities. They mainly benefit developing countries, offering strategic support tools for the evolution of healthcare as to planning, assistance, study, and education.[24] ICT facilitate the meeting of specialists, help in diagnoses, and provide opportunity for continuing education, thus promoting the satisfaction of the healthcare team. Furthermore, they reduce the distance between the professional and the patient, shortening the wait time of forwarding, leading to a higher efficiency of processes and lower expenses.[25]

The Brazilian Society of Health Informatics (SBIS) classify the action of ICTs into the following areas: Health Information Systems, Electronic Patient Record, Telemedicine, Decision Support System, Biological Signal Processing, Medical Image Processing, Internet in Healthcare, and Standardization of Health Information.[26] The use of ICTs in healthcare is named e-Health,[27] which is defined as health information available on the Internet, enabling rapid information exchanges among doctors, patients and health professionals with other specialists regardless of the distance.[25]

The e-Health has increasingly become an important method to access healthcare. It can reduce its disparity and improve population health as a whole. It enables clinical decision-making, the sharing of information between professionals and patients, scheduling, preventions, and monitoring of chronic diseases.[28] On January 09, 2007, *Steve Jobs*, Chief Executive Officer (CEO) of Apple Inc., presented to the world the iPhone 2G and its operating system, iOS. This event triggered a rapid evolution of smartphones and applications, which opened new potentials for studies and development whether freely or not freely downloaded, including applications for m-Health.[5]

Mobile Health or m-Health is the term used in medical and public health practices supported by mobile devices (smartphones and tablets). This area is a sub-segment of e-Health, consisting of the use of Information and Communication Technology to help healthcare. Its utility can include the use of mobile devices to collect clinical data of patients and community; health information for professionals, researchers, patients; besides a direct care provision via mobile telemedicine.[29] Such devices have a range of functions of mobile communication using text messages (Short Message Service - SMS), photos and videos (Multimedia Messaging Service - MMS), phone (in

smartphones) and access to Internet for reproduction of multimedia and support to software applications.[30]

The m-Heath is basically aimed at consumers and can be a promising tool of health support. However, its interventions have a little theoretical background, with limiting factors to its use, including costs of applications and devices, increased workload, workflow disturbed by professional colleagues, and lack of familiarity with the technology, although mobile communication is part of the daily life of most people.[30] With more than 1 billion smartphones and 100 million tablets worldwide, such devices can be a precious tool in healthcare management,[31] although their clinical utility and efficiency are known.[18]

Decision-making is a common procedure in health practice. Thus, technological resources and computers can support this action.[32] Furthermore, health professionals need to know technologies enabling dynamism and productivity in their work.[33] Health area has been considered a great field for the development of mobile technologies aimed at facilitating the routine of professionals.[34] Smartphones and tablets are popular due to access to Internet and information, including the possibility of downloading applications (Apps) providing several tools to help professionals,[35] besides providing distance communication.[36] Although the number of health-related applications has increased, it is not certain how many of them are based on evidences or developed by reliable health organizations. Other concerns include the confidentiality of patient information and the use of applications in front of people.[6]

The documentation on patient care has become crucial, so that modest, incomplete, and disordered records can no longer be accepted, which are observed in great part of hospital services. However, a major problem has been detected in the training of health professionals dealing with patient records, including doctors, technicians, and nurses.[37] The lack of organization and attention to records make professionals vulnerable to declarations of patients regarding their defence. Furthermore, actions brought against dental surgeons have gradually increased, and they are frequently based on the lack of documentation, the type of obligation assumed by professionals or communication failure between patients and professionals.[13]

RESEARCH METHODOLOGY

This study was exploratory, qualitative, descriptive and transversal, with data obtained from interviews with ten dental surgeons who have downloaded the App OdontoExame as study population. The use of iPhone or tablets was considered as criterion of inclusion, since the proposed App is only available on Apple Store. The receptivity of professionals regarding the proposed theme was also considered, since affinity with the research was a facilitator at this stage. The sample was selected through social network of researchers, thus consisting of a convenience sample. The answers were analysed by the content analysis technique described by *Bardin.*[38] This study was approved by the Human Research Ethics Committee (protocol n. 1.487.249).

The application was selected based on a search for apps providing information similar to dental records. After this search through downloads, the application "Odonto Exame" was selected for largely attending the criteria of the booklet Prontuário Odontológico – a guideline for compliance with the requirement found in the subsection VIII, Article 5 of the Code of Ethics in Dentistry, final report of which was presented to the Federal Council of Dentistry by the Special Commission instituted by the Decree CFO-SEC-26, of July 24, 2002. Such an application was produced by the

company FUZE.cc, which fabricates applications for Mobile platforms (iOS and Android) and is established in João Pessoa Municipality, Paraíba State, Brazil.

Using Odonto Exame is possible to include the following information: general data; clinical history, physical, functional, laboratory, imaging, endodontic, periodontal, pre-surgical, odontopediatric and orthodontic examination; diagnostic summary; indicated treatment; clinical evolution; and odontogram. By clicking on a patient's name, the dentist visualizes all the above options. In "Clinical History", the person's situation is displayed according to the information that is marked, for example, if he or she has had an orthodontic treatment, if there is a prosthesis, some lesion, among others. In addition, the procedures done in each query are stored in descending order of date.

The sample size was based on the saturation, in which Minayo[39] considers a sufficient number of people when a certain recurrence of information is allowed, without disregarding odd observations, explanatory potential of which must be taken into account. A semi-structured interview with open-ended questions was used in the present study. Seven questions related to the use of the application OdontoExame in the work routine of dental surgeons were elaborated.

Required information for the study were sent by e-mail including an attached tutorial, besides a Free and Informed Consent Form for respondents. After each professional includes five patients into the App to familiarize itself and notice its limits and possibilities in its routine for two months, individual interviews were performed with previous scheduling aimed at the best form and time for the interviewee in order to stimulate the depth and the clarity of answers. Among 10 interviews, three of them were personally performed, while the others (seven) were performed through the application Facetime with video call during October 2016. Interviews were recorded and lasted around 30 or 40 minutes and, then, answers to the following questions were fully transcribed:

1. Do you record and archive patient information carefully, with the required detail level in the type of record you use?

2. Which difficulties did you notice in the application?

3. Which facilities did the application provide in your work?

4. Do you consult other applications for professional support?

5. Are information offered by such an application sufficient to a successful management of records? Justify.

6. What are the differences between the App proposed in this study and the procedure you adopt to use records and store information?

7. Might an application proposed to record and store patient information help dentists in their clinical activities? Justify.

RESULTS AND ANALYSIS

The exploitation of results was performed as shown in the table. All situations of records and principles indicated by Bardin[38] regarding the categorization of answers were considered. Each answer was integrated into its respective group according to the established categorization criterion and investigation purposes (table).

Table. Summary of categories and subcategories

Category	Subcategory
Type of record and information	- Paper record - contains all needed information and requires the signature. - Paper record - does not contain all information and does not require the signature. - Electronic record - contains all needed information and is printed for the signature of patients. - Electronic record - contains all needed information and is not printed for the signature of patients.
Difficulties of the App OdontoExame	- Lack of App resources. - Difficulties in the use of App.
Facilities of the App OdontoExame	- Specific facilities of the App.
Use of other Apps for professional support	- Use of drug therapy application. - No use.
Differences between the App and the paper record	- Ease of access to information. - Quantity of papers.
Differences between the App and the electronic record	- No significant differences between the electronic record and the App. - Screen size.
Successful management of records	- Yes. - No.
The support of the App for clinical practices by dental surgeons	- Yes. - No.

Among interviewed dentists, 40 % of them used paper record, did not fill out all needed information, and did not require the signature of patients. Furthermore, 10 % of the sample using electronic record did not required the signature despite registering patient information. Such descriptions corroborate the opinions of some authors,[14,15] who stated that a part of dental surgeons does not attach sufficient importance to have a record containing complete and suitable information. Although professionals seek to finalize the treatment correctly, they have not done the same in their records.

Among 50 % of dental surgeons who stated to record complete patient information including their signature, 20 and 30 % of them have used paper and electronic records, respectively. Such information corroborate the advantages of electronic records, since the digital environment contributes as a support tool for organization, management, storage, capture, and processing of patient information, facilitating

decision-making. Furthermore, the clarity of records, an increase in productivity, data redundancy elimination, ease of access to available information, a reduction in administrative costs, and the control and the evaluation of actions were also mentioned, thus obtaining a complete and consistent information base.[14] The category Difficulties in the Use of the App (table) is subdivided into two subcategories: lack of App resources and difficulties in its use.

Regarding the lack of App resources, the lack of options for the following tasks was considered: paediatric dentistry records, marking of treated teeth in the dental chart, alert of anamnesis, fields to be filled with essential patient information and financial statements, besides concern about its safety and legal validity.

Although the App does not include paediatric dentistry, mainly in its dental chart, the lack of resources detected by dental surgeons partly corroborates the authors *Almeida et al.*,[42] who stated that the diversity of the practice of dentistry in Brazil and the constant advances in dental science have stunted the production of a static and definitive document. However, the need for writing a document covering its several segments should be considered.[41] Thus, the speech of interviewees indicated elements regarding the lack of fields to be filled with certain data of documents including the number of personal documents and essential information of patients or their guardians.

Screen size, mentioned by *Oliveira* et al.[7] and fragility regarding information safety maintenance, mentioned by *Silva* et al.[31] were present in the considerations of respondents. According to *Torres* et al.,[33] smaller devices have limited storage capacity and depend on the use of batteries. Thus, other strategies need to be incorporated for preventing data loss. The use of systems or cloud computing is an option to store information or extensive applications, so that collected information can be sent to a server. Even the device runs out of battery or is misplaced, information will be assured, representing a great advantage.

Although the proposed App has the option of inserting information as required by professionals, this resource was considered as a limitation by 30 % of respondents, who reported a discomfort due to the need for typing patient information case by case. Thus, for these professionals, the expectation of agility to which such a technology is proposed was not met by the App. On the other hand, information typing was considered a facility for 50 % respondents. Among participants, 30 % of them detected the possibility to save information as PDF files and print them, enabling paper signatures by patients or professionals as needed, thus becoming a documentation with legal value. This practice has already been adopted by dentists interviewed in the present study who have used electronic records. When asked about the use of other Apps for professional support, drug therapy application was the most mentioned.

Clinical practices in a dental office often come across doubts and insecurities, mainly regarding outcomes of decision-making by dental surgeons, considering their risks and benefits. The annual appearance of new drugs has provided an increase in the expectation of users concerning the best control and/or treatment of diseases.[42] Dental professionals need to master drug therapy and use it in their patients, emphasizing possible contraindications in allergic patients, pregnant and breastfeeding women, or patients with systemic and neurological impairments or requiring special care.[43]

Brazil is among the largest drug consumers worldwide according to the WHO.[44] Drugs have influenced the lives of patients and, thus, can lead to benefits or major damages. The prescription can be the main intervention to be performed by health

professionals for patients, consisting of a personal and dynamic process subjected to promotional, economic, social, and cultural influences. Then, health professionals are obliged to keep up to date, since knowledge domain in this field reduces risks to health.[45] Finally, in this context, drugs have technical, economic, political, social and symbolic dimensions. Thus, they are complex elements in healthcare.[46]

The comparison between the use of the App OdontoExame and paper records by professionals indicated two subcategories of answers regarding facilities. In the first category - Ease of access to information - all respondents mentioned typical characteristics of mobile computing - mobility, speed, remote access, autonomy, independence of time and location by users, which corroborates the authors *Crispin* et al.[47] and ease of its understanding and use, corroborating *Oliveira* et al.[48] In addition to these advantages, a better documentation and ease of data recovery were also reported.[34]

Regarding the category No paper accumulation, only professionals using paper records mentioned advantages related to gain of time and space. The speech of professionals using electronic records indicated that they already have such an advantage. The comparison between the use of the App OdontoExame and electronic records by professionals indicated that half of the respondents did not observe significant differences between both of them. The other half mentioned a lower screen size than that of computers.

When asked about whether information offered in this application are sufficient for a successful management of records, 70 % of respondents answered affirmatively (Fig.), some of them remembered useful concepts that they had learnt and used only in the academic education, although they noticed some absences. They mentioned the possibility of inserting unavailable information of their interest.
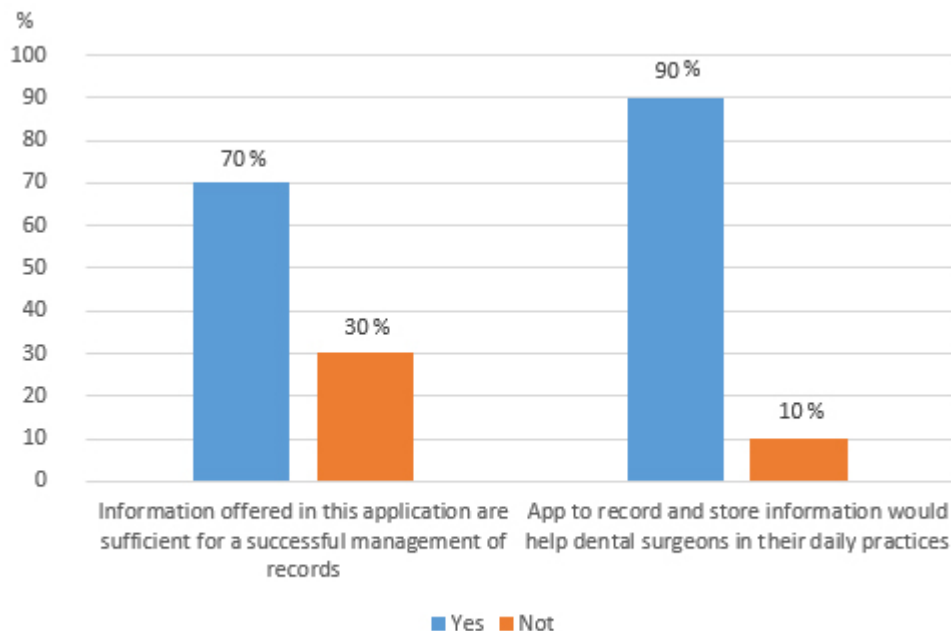

Fig. Participant responses about the informations and data records.

Among 30 % of respondents who did not consider application information sufficient for a successful management of records, the reasons reported were: precariousness regarding paediatric dentistry, especially the lack of dental chart for deciduous teeth; overload of information to be filled in, not always relevant to the clinical case; and the

need for inserting important information that are not available to be clicked. In dental practices, dental chart is intended for recording all particularities and procedures presented by patients.[48] Its use allows dental surgeons to remember the work to be done, the work performed, and information exchanges among professionals. It consists of a tool for human identification, enabling the comparison between the current and the previous oral condition. Thus, dental chart is a document of fundamental importance and should often be updated.[49]

When asked about whether the use of an App to record and store information would help dental surgeons in their daily practices, 90 % of respondents answered affirmatively (Fig.). Although younger interviewees showed greater enthusiasm and familiarity with the App technology, older respondents demonstrated ability to adapt to changes in the way of working towards technology regardless of their affinity. Such results corroborate the quarterly report of the Centre for Studies on Information Technologies and Communication in Brazil named "The Sector Overview of the Internet", which stated that the use of Information Technologies and Communication (ITC) leads to remarkable effects in healthcare in several sectors of society, mainly regarding the quality of citizen services, the insightful use of available information, and the efficiency in managing healthcare institutions.[50]

CONCLUSION

The respondents detected advantages in inserting mobile computing in their routine. Although such dental surgeons have noticed failures, difficulties and some expectations not met by the App at times, these professionals showed a positive view and sought solutions for limitations making it possible to obtain an affirmative answer to the question: how do dental surgeon observe the utility of an application to record and store patient information in their daily routine? The main contribution of this study was to show the opinion of professionals on the current technological level of m-Health in the field of dentistry regarding the record of patient information. Although this study has been carried out with a small group of dental surgeons, obtained opinions are probably common to professionals using such a technology. The present study contributed for a reflection on the use of mobile applications in daily practices, besides providing ideas for the improvement of applications to the dental office.

Participation of the authors

Aglae R. Tavares , *Anne M. Caetano*, *Sonia F. M. de Assis* and *Lara J. Motta*, designed the study, analyzed the data and they wrote the first version of the manuscript. *Aglae R. Tavares* was involved in the collection, processing of the data and *Lara J. Motta* was involved in statistical analysis of the data. All authors reviewed the writing of the manuscript and approved the version finally remitted.

Conflict of interests

The authors declare that there is no conflict of interest in this article

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