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Teledentistry: An Appraisal of Google Play Store Applications

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Abstract

Objectives M-health technology facilitates and equips us with the required medical-related information and knowledge. This research work aims to provide an overview of m-health apps related to dentistry on the Google Play Store.

Materials and Methods This widely used official smartphone platform was screened for the most widely available apps by putting the Medical Subject Headings (MeSH) and keywords "teledentistry, dentistry, and dental" and the resultant apps were evaluated for the number of downloads, ratings, release date, and number of reviews.

Results The apps were categorized depending upon their applicability into different subgroups, which include patient education apps, dentist appointment apps, kid's apps, undergraduate apps, graduates and general dentist apps, postgraduate dentist apps, commercial and social networking apps, and other miscellaneous apps. The engagement of the users was evaluated in all the categories and the applicability of apps in respective categories was evaluated. The study concluded that despite plentiful apps in each category, the engagement of individuals with the m-health apps related to dentistry is relatively low. However, few creative apps in each category showed bright prospects for productivity and engagement.

Conclusion Centralization and appropriately supervised apps with quality information by some official health care platforms can enhance the effectiveness and prepare this platform for the future of dentistry in the world of semantic web and blockchain.

Keywords
- dental
- dentistry
- educational dentistry
- online applications
- android.

Introduction

The resurgence of interest in telehealth due to the Covid-19 pandemic is going to have an augmented impact on the future of teledentistry.[1] According to the World Health Organization (WHO), telehealth is defined as the following[2]:

> "The delivery of health care services where distance is a critical factor, by all health care professionals using

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information and communication technology for the exchange of valid information for the diagnosis, treatment and prevention of disease and injuries research and evaluation and for the continuing education of health care providers all in the interests of advancing the health of individuals and their communities."

Telehealth is a broader terminology and includes teledentistry as its subunit.[3] Teledentistry, according to the American Dental Association (ADA), employs the use of systems and methodologies related to telehealth when applied in dentistry. Teledentistry components, according to the ADA, includes live videos for health issues between patient and doctor, storing and forwarding of the health records for health information, remote patient monitoring for personal health, data collection from an individual to the health care provider in a different location, and the mobile health (m-health), which includes health care, public health practices, and educational support through mobile communication.[4]

M-health, the subunit of teledentistry, utilizes the use of smartphones for health care through technology driven by Internet. The most commonly used are the m-health apps, which are available on the official smartphone platforms that can supplement the quality of services delivered to the patients including education.[5] Potentiating the use of these services has been advocated by the WHO as it can have a constructive efficient and effective impact on service quality, accessibility, equitability, and in a timely manner.[2]

Smartphone apps with multiple features related to dentistry have increased manifold over the past few years but without regulation by the official scientific evaluation.[6] In dentistry, with limited supporting literature, m-health apps related to patient care have been shown to be productive.[7–9] Henceforth, the related evidence-based policy decisions need to be backed by supporting research and related literature and recommendations.

The number of smartphone users in the world today is estimated to be over 6.4 billion, of which 2.5 billion are android users.[10,11] An average user spends 3 to 4 hours a day interacting with different apps.[12,13] The apps available on the play store for teledentistry have variable quality with different features, which include online consultations, learning, and educational resources, communication tools, etc. The play store provides practical information regarding the features of the app, release date, number of downloads, and user rating. However, data regarding the efficiency and outcome of these apps are not centralized and not available.[14]

The objective of this study is to give a comprehensive assessment and stratification of the apps related to teledentistry available on the Google Play Store. Contemporary advancements in the field of information technology and easy access for a common person through these smartphones can be beneficial to the intended population of dental practitioners, dental students, dental patients, and even software developers. The findings in the study provide related information of all relevant apps and deep insight for future guidance. The study will assist the users in terms of the selection of apps in the relevant category based on their specific needs and aid the developers by emphasizing on the gaps.

Materials and Methods

Android smartphone platform such as the Google Play Store is one of the most widely used search engines to interact with a variety of apps. This enables an individual to search, understand, interpret, and appraise the information available within the m-health apps, thus enabling knowledge applications in solving a health-related problem and health-related evidence-based decision-making.[15]

In October 2021, android apps on the Google Play Store (Pakistan) related to dentistry were searched. The data extracted were tabulated, which included the name, number of downloads, rating, number of reviews, release date, and description.

Search Strategy

The search was done on Google Play Store using Medical Subject Headings (MeSH) and the keywords "teledentistry, dentistry, dental." All of these were individually searched on the play store on October 15, 2021, and were compiled in a table form with app names, number of reviews, ratings, downloads, and features as reflected in the play store. There were certain overlapping apps as well, which were hard to isolate. We sorted the apps according to categories and subcategories and placed them in their respective groups. Major categories were the following: "patient education apps," "dentist appointment apps," "kid's apps," "undergraduate apps," "Graduates/general dentist apps," "postgraduate apps," "commercial/social networking apps," and "other/miscellaneous apps."

Inclusion and Exclusion Criteria

In our study, the criteria for including the apps were (1) apps having a rating of 3.0 and above, (2) free and accessible for all and not requiring any subscription, and (3) 50K+ downloads for games. We excluded the following apps: (1) apps that were not in the English language, (2) games having less than 50K+ downloads, (3) name-/person-specific apps, (4) apps having no ratings or reviews, (5) paid apps/requiring subscription, and (6) telemedicine apps.

Selection of Studies:

The number of apps that appeared after the search included the following: teledentistry (451), dentistry (456), and dental (448). Duplication and exclusion criteria were applied and the final number of apps was reduced to 221, which were then placed into their respective categories and subcategories.

Results

A total of 206 apps were categorized into six groups based on their productivity and apps. There were apps for patient

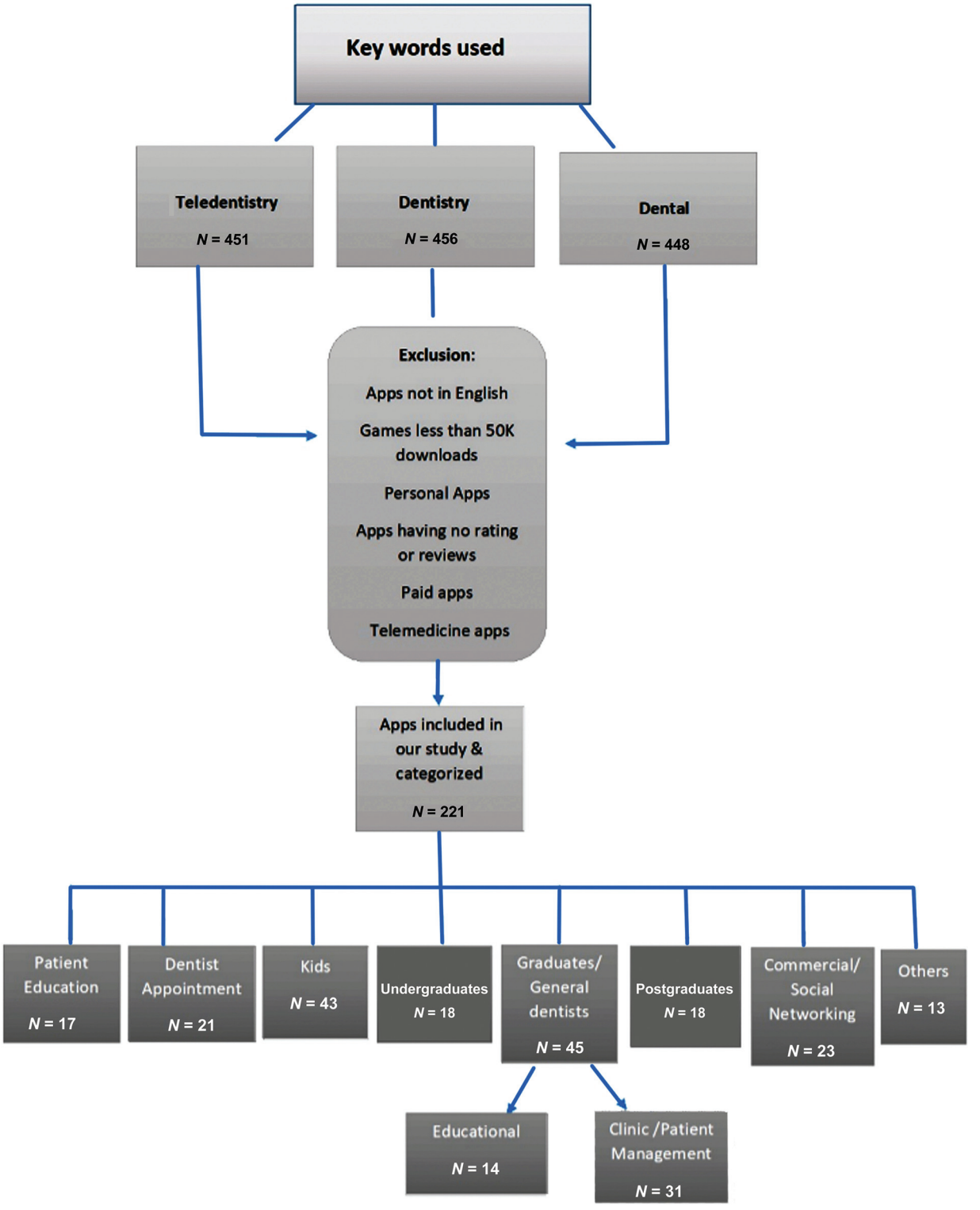

Fig. 1 Search strategy for google applications.

education (7.76%), dentist appointments (20.87%), apps for kids (games [20.87%]), apps for undergraduate dentists (18.93%), educational apps for general (6.79%) and postgraduate dentists (8.73%), and miscellaneous apps, which include commercial socializing (11.16%) and others (5.82%). The stratification of apps in respective categories is shown in ►**Table 1**.

The top-drawer apps in each category according to the ranking and number of downloads were Dental 3D Illustration for Patient Education (70,000), Practo-Online Doctor Consultations (5 million), Children Doctor Dentistry (100 million), Medscape (5 million), DentiCalc: the dental app (100,000), Dentist Pro (100,000), and MedShr: Discuss Clinical Case (1 million).

Table 1 Stratification of teledentistry apps in respective category

Sl. no.	Category	Most downloaded	Least downloaded	Most reviews	Least reviews	Highest rating	Lowest rating
1.	Apps for patient education	Dental 3D Illustration for Patient Education	Asnaniq-NAP International	Dentacare-Health training	Dental Coach-Dental coach	Dentist G	Dental Trauma first aid
2.	Apps for dentist appointment	Practo-Online Doctor Consultations	Practice Tools Telemedicine	Practo-Online Doctor Consultations	eClipboard	1. Practice Tools Telemedicine 2. eclipboard	MEDIFI for Patients: Telemedicine on demand
3.	Apps for kids	Children's doctor: dentist	1. Dentist games 2. Virtual dentist orthodontist-stimulator 3. Dental doc-Dentist games	Children's doctor: dentist	Virtual dentist orthodontist-stimulator	Fantastic cat dentist-Brick breaker	1. Zoo dentist-Doctor games for kids 2. Shake dentist 3.Christmas dentist office santa-doctor xmas games
4.	Apps for undergraduate dentists	Medscape	Relax its dentistry	Medscape	Dental students	1. Pedo-dontics 2. Basic dental surgery 3. Video boklet-Mahmoud Ammar 4. Dental Anatomy-dental pencil	Real tooth morphology-free
5.	Educational apps for general dentists	DentiCalc-its simple	Osteo-Bio	MDS Online Academy	Osteo-Bio	ADAT Advanced Dental Admission test	Dental simulator
6.	Apps for postgraduate dentists	Dentist Pro	1. Dentulu Provider(HAD)-Teledentistry App 2. Jotno Expert-For Doctors	Jiyyo: A TeleHealth Platform for Doctors	Dental Mirror	1. Implantoo 2. Jiyyo: A TeleHealth Platform for Doctors	1. Dental Clinic-Mega solve 2. Dental Planner:Tx Plan
7.	Miscellaneous apps	MedShr: Discuss Clinical Case	1. Hygiene town 2. Ap dental jobs	MedShr: Discuss Clinical Case	Smileneo	Cedent online dental store	Dental implants

Discussion

This is the first meticulous screening of the freely accessible apps related to dentistry in the Google Play Store. Overall the data analyzed, especially that of ranking and number of downloads, showed that all the categories have apps with an interesting description, indicating their potential usefulness and practical application. In the "patient education" category, there were apps for education about dental problems, reminders for tooth brushing, flossing, and hygiene maintenance, and addressing the queries on dental problems and recommendations. Apps for "dentist appointment" included a broad category of apps that also provide online consultations with the medical practitioner. These have prolific numbers and comparatively higher ranking and downloads, depicting the engagement by both the patient and the health care provider. These types of apps recently gained significance due to Covid-19.[16] Gamification has a stringent inclusion criterion, but it has the highest number of downloads and ratings due to massive interest from the kids. Nevertheless, these apps provide simulated experience, brushing instructions, and hygiene maintenance for basic understanding, and hence are involved in education and learning for the kids. Apps for "undergraduate dentists" have some worthwhile apps, especially Dental anatomy visual 3D Science having 360 degrees and 3D model including X-ray and 3D model. BoneBox - Dental Lite has information about the detailed anatomic model of dental anatomy. Other apps were a 3D model of cavity preparation, micro-computed tomography (micro-CT) scan data of teeth, a dictionary, lectures, multiple-choice questions (MCQs), and quizzes. Likewise, apps for "general and postgraduate dentists" include DentiCalc-its simple, explaining the treatment to the patient, a Dental simulator, and apps for professional examination preparation. In the category of "miscellaneous socializing apps," there was an app MedShr: Discuss Clinical Case for discussing and sharing knowledge about clinical cases. Others were some commercial apps including online shops for buying dental material and equipment.

Underwood et al, in their study, concluded that using m-health technology motivated, increased knowledge, and promoted oral hygiene in patients.[17] A recently published randomized controlled trial by Scheerman et al revealed that utilizing the m-health app (Telegram) for delivering information and educational content to the participants engendered better oral health outcomes in adolescents and brushing behavior than in the control group.[18] da Costa et al showed that teledentistry has wide usage in public health dentistry, especially in scenarios of limited trained professionals.[19]

Generally, findings herein disclosed that many of the apps related to dentistry were not downloaded in huge numbers as compared to other apps, except for games or a few in each category. This indicates that android users do not prefer these apps frequently or only prefer apps with a higher number of downloads and ranking, which were highlighted in this study. Promotion of usage of teledentistry apps with credible information and educational resources for the patient can be achieved by recommendation by dental surgeons. Furthermore, engaging the health care provider in the development of these apps by liaising with universities and the IT sector should be a priority. It is imperative that teledentistry apps be developed with the health care provider with quality content tailored to the requirements so that the best information is readily available.[20,21]

Due to the digitization of health care, a wide variety of apps requires diverse skills including a broader understanding and capabilities of e-health to properly utilize the information known as e-health literacy.[22] The bright prospect, theoretical foundation, and evolution of the Internet from Web 1.0 (read only) to Web 2.0 (read and write) and moving toward Web 3.0, also known as the semantic web, in combination with blockchain, will enable machine-readable material and human–machine cooperation.[23–25] It is believed that this upcoming transformation will facilitate unstructured free data into a reliable interpretable form of knowledge embeddings and for medical education including clinical procedures of complex surgeries through the metaverse.[26]

Several criteria need to be evaluated regarding medical app quality. In this study, we just evaluated the sentiments of the users, but better validation criteria are Xcertia, DISCERN, and Patient Education Materials Assessment Tool (PEMAT),[27–29] which were difficult to conduct on such a large number of apps in this study and preferably should be applied to the follow-up studies on top apps in each category. Second, the main concern regarding m-health apps recently evaluated on a large scale was the security of data and exposing the user to security risks.[30]

There are a few limitations of our study. First, we did not apply the Mobile Application Rating Scale (MARS), which is used to evaluate the quality and content of m-health apps,[31,32] as this was not the objective of our study. Second, the keywords we searched for were specific to dentistry and did not include the subject subject-specific apps, so potentially some useful apps might not have been included in our data. Another limitation is optimization of the app search for teledentistry. It was observed that few of the apps regarding dentistry were not hit by these keywords. Similarly, the rating of the applications is evolving rapidly and some potential apps may appear or disappear from these platforms. In future research, improved methodology to develop and design with a health professional on board and content validated by some official dental platform with evidence-based information for proper guidance and decision-making is a must.

The data in this study provide useful information regarding teledentistry for future direction. The most important of these is the involvement of an official controlling agency to ensure the quality of the content available for education and practices. Although we reviewed only the free apps available on the Google Play Store, we did not find many apps that only had a paid version.

Conclusions

It is useful to have teledentistry apps on Google-compatible Android smartphones. There are diverse teledentistry apps according to individual requirements and personal preferences. Features of the top downloaded apps in each category were noted, and engagement with the apps in their respective category was compared for a recommendation. Nonetheless, since the future of dentistry revolves around digital technology, involvement of the regulatory sector for controlling the quality of apps is warranted.

Data Availability

All the data are extracted from the Google Play Store and is available/downloadable via android application.

Supplementary Materials

All the applications available on Google Play Store are tabulated in respective category and attached as a supplementary file.

Conflict of Interest

None declared.

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