The Most Useful Free Mobile Applications for Clinical Microbiology, Diabetes Management, and Odontology

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Abstract: Apps are increasingly to facilitate the study of microbiology at various universities worldwide. In this article, we studied a range of useful Apps for microbiology. For quality control, a rating of ≥ 4 and $\geq 5,000$ reviewers were established as criteria for quality. Apps in Spanish and English were considered. Of the 120 microbiology Apps, we found in the various e-stores, only 30 met all the inclusion criteria. The most downloaded Apps were related to antimicrobial guidelines and doses. Finally, no differences were found between the Spanish and English Apps in terms of quality most downloaded Apss in terms of diabetes were to record results, and receive advices to healthy life style, lastly odontologist Apps were mainly used to improve the communication between patient and odontologist and improve the way of oral surgeon through simulators. After our larges study were we have assessed hundreds of Apps, we have realized that are very few Apps created by professionals to professionals. There are marketing digital agencies, which are able to write about any theme related with health. Apps in health themes are a promising tool, which should have more legal control.

Keywords: Apps, E-stores, Electronic Devices, Microbiology, Diabetes, Odontologist

1. Introduction

The boom in the development of mobile phone Applications has increased people's access to a wide range of quality scientific information, including topics related to life sciences, genomics, and biotechnology for health. However, to increase the functionality of these resources, specific software is required. This has massively increased through the development of Apps, which are computer Applications designed to run on smartphones, tablets, and other mobile devices, allowing the user to carry out a variety of tasks for professional, leisure, and educational purposes.

Apps are available through services such as MobileMe, the iTunes Store for the iPhone and iPad, and Google Play for mobile platforms such as Android, Windows Mobile, and BlackBerry [1]. Technology designers and developers, private individuals, or organisations can create these Apps.

According to distribution conditions, Apps can be classified as free, paid, and freemium, which are free to download for basic use but require in-App purchases to access more advanced functions.

2. Development of Smartphone Applications

2.1. Apps with Applications in Clinical Microbiology

Broadly, the type of content offered to the consumer can be

divided into two categories: educational or informative Apps and operational Apps. Apps in the first group are designed and developed as knowledge and information transmitters, prioritising access to content and research tools through an easy-to-use navigation interface. By contrast, operational Apps provide tools for specific troubleshooting or calculations that require immediate and rapid action, particularly in the business sector [2].

Our interest is focused on both types of Apps, but with specific content for users employed in microbiology, where there is a wide range of what could be classified as reference Applications, including microbiology textbooks, laboratory interpretations, diagnostic tests, and guidelines.

2.2. Online Medical Assistance and Stock Medical Assistance

Myriad educational Apps related to microbiology provide questions, test cards, self-assessments, educational talks, antibiotic and pharmacology guidance, dose calculators, and others, including general medicine textbooks, games, wallpaper Apps, and social media [3]. Of all the microbiological Apps available, the most in-demand are those related to reference Applications and education, with the most downloaded being those concerned with the correct use of antimicrobials. Therefore, more basic Apps that provide medicine textbooks (of which only a small proportion are dedicated to microbiology), as well as wallpapers and microbiology social media, will not be considered further in this article.

The ratings of the Apps in stores and the number of uses of these Applications. Many developers reached this conclusion after verifying that the proportion of free downloads and the income generated worldwide by Apps in all languages other than English has grown in recent years [2].

In this article, only Apps that met the following criteria were analysed: English or Spanish, a quality rating greater than or equal to four out of five stars, and over 50,000 downloads. Another factor that indicates the usefulness of an App is the frequency at which it is updated. However, this information was not disclosed for all Applications, so it was dismissed as a selection criterion.

One recently published (21 March 2022) App is Migraine Buddy: Track Headache developed by jenny@heatline.com. The App was downloaded over one million times in its first week of release, the last update [4]. It assists patients in managing migraine attacks and symptoms and extracts insights from previous episodes to predict and prevent future migraines. This is a freemium App.

Quiron Salud: Diagnostic tests, clinical reports, options to arrange emergency medical consultations via video calls and home visits. This App is also available on Google Commerce. It was last updated on 28 March 2002 [5].

Sanford Guide: With an in-App assistance service, this paid App (39.99 dollars if downloaded to a smartphone on 28 March 2022) was last updated The App, developed by Sanforguide, contains antimicrobial, HIV/AIDS, and hepatitis therapy guidance [6].

Doctoralia: An App that allows the user to find the contact details of 120,000 registered doctors and healthcare professionals. It was last updated on 29 March 2022 [7].

3. Assessment of Three Mobile Apps for Automatic Microbial Colony Counting

3.1. Background

At least three mobile Applications have been developed to count bacterial colonies grown in microbial cultures [8]. The aim of our study was to assess the performance of these Apps in a study on bacterial contamination in a hospital environment.

3.2. Materials and Methods

In October 2019, in the microbiology department at Hospital Donostia, Spain this study was performed. In a mid- to long-term inpatient rehabilitationard, Environmental samples were collected.

Overall, 95 samples were collected from two randomly selected rooms. Fifty-five samples (57.9%) were collected from the soap dispenser, nurse-call button, and the room and bathroom door handles using nylon swabs (FLOQSwabs®, COPAN diagnostics, USA) and cultured on 90 mm Trypticase Soy agar with 5% sheep blood (TSA, bioMérieux, France). The other 40 samples were taken directly from the arms of a chair and an armchair onto 65 mm contact plates (CT, bioMérieux, France).

The TSA and CT plates were incubated overnight at 35°C in an atmosphere of 5% CO_2.

Colony counting was performed manually. If the number of colonies was high, counting was performed with Microsoft Paint software to dot mark each colony. The colony count was also automatically performed with the following three Apps: APD Colony Counter [8], @BactLab [9], and Promega Colony Counter [8].

3.3. Results

APD Colony Counter [8] was discarded because colonies had to be added manually, similarly to when using Microsoft Paint, which would not save users time or resources. The only advantage over Paint is that it automatically counts the number of dot marks.

Promega Colony Counter [8] due to problems in acquiring images. was also ruled out.

Finally, a comparison between manual counting and the @BactLab [9] App was carried out. The mean and median were 106 and 41 cfu/plate when counted automatically with the @BactLab [9] App and 94 and 39 cfu/ plate when counted manually (Student's t-test, $p=0.206$). The range did not vary (0–1,392 cfu/plate), and the correlation index between the two methods was $r=0.90$. The detailed data based on the different plates and methodologies employed are shown in Table 1.

Table 1. Comparison between both technologies in colony counting as well as the difference of both protocols for TSA Agar plate Vs. CT agar plates.

Manual Counter				
Parameters	**TSA agar plates**	**CT agar plates**		
Mean	109.75	73.8		
Median	34	8		
Range	0-1000	5-378		
Student's t-test			P=0.06	P=0.04
Correlation Index			R=0.93	R=0.60

@Bactlab				
Parameters	**TSA agar plates**	**CT agar plates**		
Mean	137.23	66.07		
Median	36	45		
Range	0-1392	5-320		
Student's t-test			P=0.06	P=0.04
Correlation Index			R=0.93	R=0.60

@BactLab [9] proved to be a high quality; free Application for colony counting that provides considerable timesaving features.

4. Apps for Future Disease Prevention

4.1. Apps for Diabetes Management

Childhood obesity is increasing. If this trend is not stopped, the predicted rate of type 2 diabetes will be extremely high in the future [10]. In fact, there has been made a prediction that by 2018 there were 28 million of people user of an App for diabetes control [11].

Type 1 diabetes and gestational diabetes should also be closely monitored. On 6 January 2022, Healthline [12], a widely used American website, published a medical review by Kelly Wood on the best Apps to control diabetes.

Best for community conversations: Bezzy T2D is a forum to speak about anything related to diabetes; however, it has only been downloaded 10,000 times, so it was not included in our study [13].

Fooducate: Eat better. Lose weight. Get healthy. This App did not fulfil our download criteria, so we discarded it [14].

MySugr – Diary for diabetes: Forbes, TechCrunch, and the Washington Post declared this App for three consecutive years [15].

MySugr Junior by mySugr GmbH: this App is the second version of MySugr is an App directed to children who have to learn to cope with a chronic disease such diabetes. This App also allows parent control to their children through the App when they are alone, at school or with their friends.

This App is a game where the children obtain points each time the enter in the application with the objective to encourage to cope with their disease. The goal is to obtain a number of points every day. A little monster called "diabetes" gives a feedback of each children entry, analyzing glucose levels, food and insulin or take a picture of their food. However, the most important thing is that the App can send a message to parents or legal tutors to their phone or email. This way the children obtain a feedback about their doubts or insulin or carbohydrates [16].

Glucose Buddy Diabetes Tracker: Out of our parameters to be included in the study, due to the low number of downloads [17].

Diabetes: M - Management & Blood Sugar Tracker App: Recently updated, smartphone and tablet friendly and free (with in-App purchases). The user ratings were excellent; however, the number of downloads was not sufficient for inclusion in our study [18].

Beat Diabetes: For recently diagnosed patients and only in English. The reviews were critical of its complexity, and it had fewer than 3,000 downloads [19].

OneTouch Reveal® mobile App for diabetes: This App has guided more than one million users in the management of their type 1, type 2, or gestational diabetes. This App is free; however, some extras can be purchased [20].

One Drop: Better Health Today: This App also exceeded one million downloads and offers menus, exercise guides, and a glucose level-tracking feature. This App is free and includes in-App purchases [21].

Diabetic Recipes App [22]: Recipes to help people control glucose levels. Although it was downloaded over 100,000 times, the average user rating was below four stars, so it was excluded from our study.

Best for Personalised Tracking: Glucose tracker & diabetic diary. Your blood sugar [23]: Over 100,000 downloads with an excellent rating of 4.7 stars.

Dario [24]: This App is more than a glucose meter; it also controls blood pressure and proposes menus and activities related to out range.

Best for Simple Blood Glucose Tracking: Diabetes [25]: Free App with extra purchases. As its name indicates, it is a simple way to track glucose levels, and it is very highly rated by users. After check, that revision we have found two bullet points. The discrepancies between the rating that Appear on the Healthline webpage and the Google Play Store, one of the things that could be related is the update data because most of them are after the publication of the review on the webpage.

It is remarkable that some of these Apps, which are the top among diabetes management Apps, have low ratings or low downloads.

It is noteworthy that Apps for diabetes management were only available for Android or Apple. Moreover, the ratings between Apple and Android differed: 42.3 vs. 37 *(p*=0.1295*)*. This is a clear example in which the punctuation varied not only between the platform used, there were some Apps among the best ones that performed glucose tracking in that kind of patient, such as if they were a healthcare professional.

Undoubtedly, the use of electronic educational Applications can potentially facilitate learning and provide immediate access to knowledge, anytime and anywhere. For this reason, many educational institutions have developed mobile Apps for their study plans, as in the case of the Parasitology Department of the Autonomous University of Mexico [26].

Apps used in microbiology are tools that promote creativity, work, or simplify access to information. Over time, they have significantly improved, acquiring more functionality and providing an increase in productivity. For all these reasons, they can be a huge asset in improving both professional and individual performance.

Most of the downloaded Apps are designed in users' native languages and in a free-to-download format with embedded advertising. Users' comments point out that overuse of such advertising can compromise the functionality of an App. However, these are the individual users' opinions based on their experiences. In the source codes of Applications, App developers include libraries that are responsible for showing advertisements, thus generating income. Another interesting feature of some Apps is that they are offered in different languages or in two versions, free or paid. Unsurprisingly, the free versions have greater download numbers despite having some software limitations that are eliminated with the purchase of the freemium version.

4.2. Apps for Odontology

In May 2017, it had been 27 years since the first webpage exclusively for odontologist was created, and the career in the development of e-content for study has not stopped until the arrival of Apps.

In the field of odontology, many Apps that are useful for various specialties can be found. There are Apps that offer information about self-care for better dental health. Some constitute clinical Apps, while others, which offer the realisation of different treatments: watching videos, simulators, pictures, etc. Apps for clinical management allow the recording and analysis of data and the scheduling of medical Appointments are directed to patients, The Apps with therapeutically uses allow treatments via medical internet consultations and the diagnosis of several pathologies [27].

Periopixel Pro

This App provides a detailed guide for the techniques of surgery and oral health. It features 3D videos with texts that explain each surgical technique, which can be of great help to future dentists and oral surgeons who want to refresh their knowledge of advanced periodontal surgery. Only available on iTunes.

Lexi-Dental

Lexi-Dental is a premium App developed by Lexi comp. It is a database full of dental treatments. Information about treatments (pills and secondary effects, high-definition images, laboratory procedures, diagnosis, and emergencies). Lexi-Dental has a free trial of 30 days, after which it costs 285 dollars [28].

IRomexis

IRomexis is an App specially designed for the iPad, and its main use is to act as a screen for displaying pre-recorded 2D and 3D images. It is designed to display any kind of image created by an X-ray unit to teach students about odontology and for consultations between specialists [29].

Dental Patient Education

Dental Patient Education is an App that improves communication between specialists and patients. Through this App, the odontologist can show patients the condition of their teeth and what treatments to follow [30].

None of the three Applications mentioned above or Apps such as those shown in the report about Applications in odontology [31] are available on iTunes, Google Play, Windows, or Blackberry. However, the most important ones are booked to e-platform in ITunes. The Apps for odontologist are each time more frequent. Therefore, we will examine other Apps recommended by other web pages to determine whether they are available on other platforms. Smart Dental [32], which is available to professionals but not patients, is available on Google Play, Pricelist available for 0.99 dollars. Implant Treatment Guide [33] offers images of the different steps in dental implant therapy and information about various treatments. It is only available on iTunes. It helps odontologists explain treatment options to patients better than with intraoral photography.

DDS GP [34]: Written by a dentist, translated to more than 12 languages with a one-time cost of 399 dollars with lifetime updates. Available on iTunes and the Apple Store. Gordon Christensen's who won several prizes developed this App: 'awarded five Starts' by Dental Product Shopper reviewers. This was the first App that we found with this characteristic, made for experts and oral health professionals, and evaluated for odontologist. This has been an exception after reviewing hundreds of Apps. Furthermore, it was one of the few Applications that was available for at least two platforms, Android and Apple, as surprisingly Odontologist Apps seem to be marketed almost exclusively on iTunes.

To date, reasonable evidence exists for some Apps, overall, for those used to help manage chronic symptoms such as high blood pressure, diabetes, or Obstructive Pulmonary Chronic Disease. However, Apps for general use, as we have shown in this study, are made by publicity agents who are able to create several Applications without a medical group that provides support; in fact, there is a question of legality.

The maturation of the eHealth field towards effective clinical interventions requires developers, consumers, policymakers, and clinicians to recognise that Applications should be evaluated like any other clinical intervention.

Bringing the benefits of consumer mobile technology to the healthcare market requires the work of all stakeholders to evolve the field and integrate it with conventional research and clinical practice.

However, few microbiologists, endocrinologists, and odontologists, for example, are responsible for reports with good recommendations on the internet, or in good reports it seems that is and industry under commercial marketing prioritisation its quality, exceptionally two practitioners match about the best quality Apps. We have thought that it is so important theme to treat it in a report, overall to advise patients not to do the things by themselves because in most occasions there is the same digital marketing agency behind the Apps of several themes. Who will be able to answer the responsibility if someone uses this technology incorrectly?

5. Conclusions

In conclusion, the use of smartphones and mobile Applications is becoming increasingly popular in the field of microbiology [35-46] and other health fields and has great potential for further use but always under user patient or practitioner supervision [47].

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