A User Centred Approach in the Implementation of Mobile Marketing in Health Applications

Tiago Filipe Bravo Fernandes and André Vasconcelos[a]

INESC-ID, Instituto Superior Técnico, Universidade de Lisboa, Lisboa, Portugal

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Abstract: Medical appointments booking applications allow an easy way of accessing information about a healthcare provider like the possibility to see the CV of a medical health professional, an easy acquisition of a healthcare service or being able to see other patients reviews of the service. This paper describes the development of a mobile application, having mobile marketing as the main feature of it. This mobile application is an extension of a web based medical care appointment booking service. This research explores the various possibilities of mobile marketing by applying and reviewing User Interface (UI) and User Experience (UX) guidelines in order to provide the best user experience. The mobile marketing side of the application is used to offer patients suggestions for booking an appointment based on the location, medical history and recent searches on the application. Regarding the User Experience, several guidelines are assessed including the simplification of the medical appointment booking process, the presentation of an onboard screen for easier user interaction and all services before asking for a login. Through various test scenarios, using a focus group approach, the application presents satisfying user experience results, above the market average comparable applications.

1 INTRODUCTION

Medical services applications have arrived to allow an easy way of accessing information about a healthcare provider like the possibility to see the CV of a medical health professional or the portfolio of medical services provided. Additionally, healthcare applications also present an opportunity for faster and easier search and acquisition for health care services, considering other patients' reviews. These applications also allow features that overcome problems like patient's transportation, large waiting lists to perform a medical appointment and provide the user the power to search for the service easily and anywhere.

There are already some medical booking applications on the market, however, most only provide appointments in their own healthcare provider and few take advantage of the technologies available in mobile devices nowadays, like the location sensor and the ability to start the interaction with the user. With this in mind, this research is applied on the development of a mobile application for MedClick (https://medclick.pt/) having mobile marketing as a main feature of it. This mobile application is an extension of the MedClick online platform which is a medical care appointment booking service.

1.1 Objectives

MedClick provides to the users a fast and user-friendly way to find a health professional across multiple medical service providers. The patients are able to book the appointment based on the date, location, price, insurance providers or customer reviews (Berman, 2016); the goal is for the service to be available online and on smartphones and tablets.

The mobile marketing on the application is used to offer the patient suggestions for booking an appointment based on his or her location, medical history or recent searches in the application.

Together with mobile marketing, this application follows User Interface (UI) guidelines. It also gathers feedback from test users in order to enrich the User Experience (UX) and make the experience of booking an appointment easier and faster.

[a] https://orcid.org/0000-0003-0038-7199

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1.2 Document Outline

This paper has a structure composed of 6 main sections and is organized as follows. Section 2 includes an overview of the background investigated. Section 3 describes the requirements of the solution. Section 4 presents the implementation of the solution. Section 5 provides an overview of the evaluation performed and the results reached. Section 6 presents the conclusions and research future work.

2 BACKGROUND

This section is composed of the subsections that show the research and analysis performed for gaining knowledge to reach the solution definition. In subsection 2.1 it is reviewed the available frameworks to develop the solution. In subsection 2.2 it is presented the basis of mobile marketing. In subsection 2.3, a set of guidelines to develop the interface and experience are stablished. In subsection 2.4 it is analysed and compared current medical appointment booking applications.

2.1 Mobile Development Frameworks

The goal for the MedClick mobile application is to be available in the two most popular mobile operating systems in the world, iOS and Android (StatCounter 2018). One way to make this possible would be to code natively for both operating systems. However, this would be very time consuming because it is the same as creating two different applications in two different programming languages and with two different frameworks (e.g., XCode for iOS and Android Studio for Android), for the same purpose. Another way to develop the solution is to use a cross-platform development framework.

Cross-platform mobile application development frameworks have emerged with the goal of simplify the development of cross-platform mobile applications, reduce the development, maintenance costs and the time-to-market of the applications (Martinez and Lecomte, 2017). With these frameworks, the developer is able to share the code between the platforms, achieving the principle of "code once, deploy everywhere".

2.2 Mobile Marketing

"Mobile marketing refers to the two or multi-way communication and promotion of an offer between a firm and its customers using a mobile medium, de-vice, or technology" (Leppaniemi, 2008). This is a different way of communicating with the customers, not just waiting for the customer to interact with the company mobile application for example, but giving incentives to use it. Mobile marketing can provide customers with time, location sensitive (Gana, Thomas, and Kashif, 2017) and personalized information that promotes goods, services and ideas (Shankar and Balasubramanian 2009).

2.3 User Interface (UI) and User Experience (UX)

When developing a mobile application, one of the most important aspects of it is the user interface and user experience. What the user sees and feels when using the application can determine the success of it. The application might do what a user needs but if it does it in a very unintuitive way, slowly or confusingly, users will stop using it. (Dirin, and Laine 2018).

2.3.1 User Testing

User testing should be performed on every project because even the best product designer cannot predict every possible action and interaction of the user. The best way to ensure a good User Experience is to have insights from the users themselves. It allows the designers to identify resistance and flaws in the user experience they are designing. This way, that design flaw can be addressed before entering in production or being deployed (Aranyi, and Schaik, 2016).

Besides metrics like the time users spend on each screen of the application, users can also give their opinion about the experience using the application. Usually, the sooner the user testing starts, the better it is to find problems with the solution proposed and solve them with less work required.

2.3.2 Mobile Applications User Experience Design

There is no single definition of a good user experience. A good user experience is one that meets a particular user's needs in the specific context of using the product. However, there are some overall principles to ensure that a mobile application has a good experience.

First of all, when designing native platforms, the designer should respect the platform and consistently refer to the native operating system design guidelines. Popular mobile operating systems are now providing usability guidelines which focus mainly on

maintaining coherent interaction and presentation through applications over the whole platform. For iOS there are Apple's Human Interface Guidelines (Apple, 2019) and for Android there are Google's Material Design Guidelines (Google, 2019).

But only following the design guidelines won't result automatically in a good user experience. Other good principle to keep in mind is to always design for the customer benefit. This means that in every use case the designer should focus on how it will benefit the customer (Hubert et al., 2017). Considering this, the designer should prioritize features because adding as many features as possible will rarely result in a better experience. It is better for the application to be simple with a refined experience around its core objectives and not clutter the user interface with too much information. "Perfection is achieved, not when there is nothing more to add, but when there is nothing left to take away" (Saint-Exupéry, Galantière, and Gilbert, 1943).

2.4 Analysis of Medical Appointments Booking Applications

There are some applications already available to the patients that can schedule Medical Appointments. However, they have different features and characteristics. The analysis next presented is focus on the strong and weak points of each one, highlighting them in order to improve the solution proposed.

Table 1: Mobile medical appointments booking applications comparative analysis summary.

	Service			
Functionalities	My CUF	Zocdoc	Knok	Joaquim Chaves Saúde
Medical Appointment Type	In provider	Multiple provider	At home/video	In provider
Health professional CV	Yes	Yes	No	Yes[1]
Rating	No	Yes	Yes	No
Insurance	Yes	Yes	Yes	Yes
Patient History	Yes	Yes	Yes[2]	Yes
Platforms	Web, iOS, Android	Web, iOS, Android	iOS, Android	Web, iOS, Android
Recommendation to users	Yes[3]	Yes	No	No

[1] Not working in the majority of health professionals

[2] There seems to be a section for it but it shows just a blank page

[3] Not user specific, just general health articles

From the information presented in Table 1 it is possible to conclude that the service that reaches more people is Zocdoc (Zocdoc 2019) because it is not restricted to a single medical provider, it has all the features mentioned and it is available in every platform. All services have agreements with insurance and keep track of the patient appointment history. Both My CUF (Saude CUF, 2019) and Joaquim Chaves Saúde (Saude JC, 2019), the two services that only offer appointments in their own

medical facilities, have the same main functionalities; the only difference is the recommendations made to its patients and the design of the applications and web portal.

3 REQUIREMENTS

The objective of this paper is to create a mobile application for mobile marketing. This mobile application is an extension of the MedClick online platform, a medical appointment booking service.
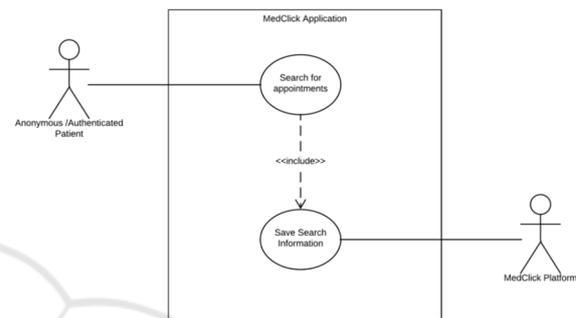

Figure 1: Searching for Appointment Use Case.

MedClick is a web platform in which users schedule medical appointments based on the date, location, price, insurance providers and customer reviews. The mobile application is expected to integrate all the functionality of the web platform and enhance it with mobile marketing techniques. This adds value to the whole MedClick platform, that in this way can reach more users and in different devices, giving the user the ability to do same task regardless of the device used. The approach proposed also takes advantage of the location sensors of mobile devices to facilitate in the medical appointment search process and in providing the user with useful push notifications.

The MedClick mobile application is expected to ensure the following major features:

- Searching for a medical appointment - The user, authenticated or not, can search for a medical appointment by specialty, location, date, health professional, price, insurance providers or customer reviews (see Figure 1). It is not required authentication for this feature, to allow for a wider user base and for a better user experience, not having to login or sign up before exploring anything on the application.

- Booking a medical appointment – After reviewing all the previous point parameters, location, date, health professional, price, insurance providers and

reviews, and selecting an available time slot for the appointment, the user is required to login or sign up in order to book the appointment (see Figure 2).

- History of the medical appointments – The authenticated user can review all the previously attended appointments. This feature also includes the preview of the future appointments so that the user can keep track and cancel them if needed.
- Alerts for future appointments – The application should send a push notification to the user when the appointment date is close to make sure the user doesn't forget about it (Figure 3).
- Mobile Marketing – Depending on the mobile marketing campaign available in the MedClick platform, the application sends a push notification to the user (Figure 3).
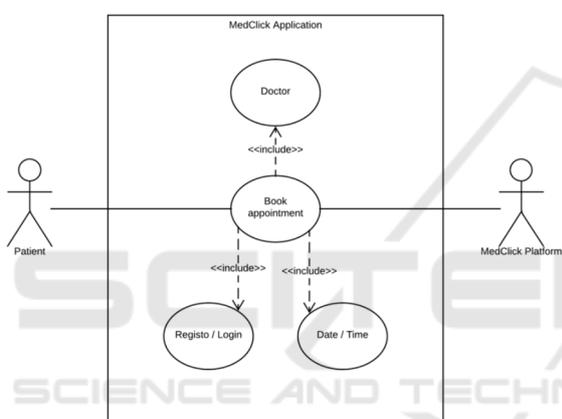

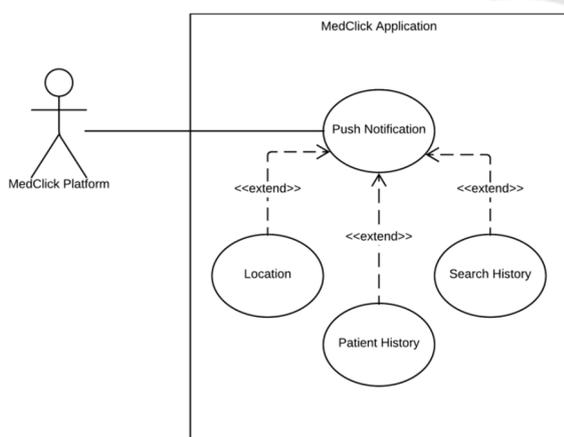Figure 2: Booking Medical Appointment Use Case.

Figure 3: Push Notification Use Case.

4 IMPLEMENTATION

Based on the research made about cross platform mobile application frameworks, the framework chosen was the React Native with Expo toolchain[1]. With Native React it is possible to build a mobile application that is indistinguishable from a native mobile application built using Swift or Java because it uses the same building blocks as regular iOS and Android applications. It will provide a superior user experience than hybrid applications. Additionally, from a development viewpoint, that is possible using just JavaScript code without the need to learn swift or C#. Features like hot reloading and simpler application deployment also support this decision.

After deciding the development framework, the approach was to wireframe the application and all the functionalities before implementing them. Using these wireframes, it is important to check if the usability guidelines are being followed.
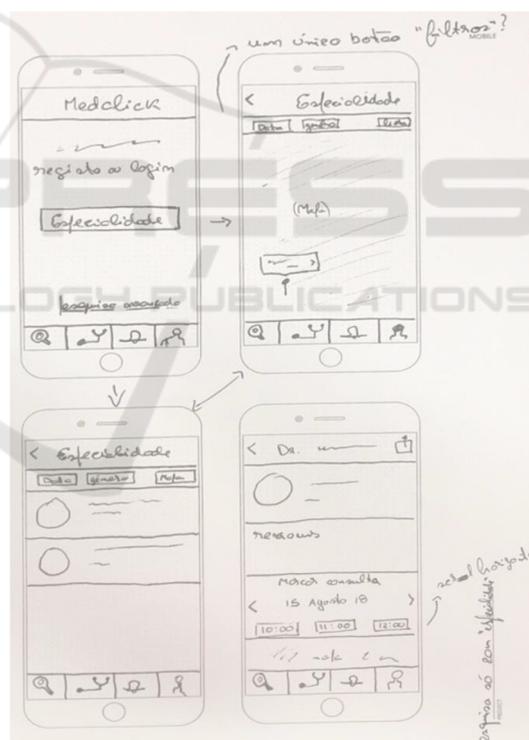

Figure 4: Application wireframe example.

The next step was to start developing the application. The expo toolchain makes the initialization of the project a straightforward process. The command "expo init" gives several options to start the project. It was chosen a template with several

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[1] https://expo.io/

example screens and tabs that were very similar to the design in the wireframes. After that it was a matter of developing screen by screen and feature by feature, testing them when implemented. These features include having an onboarding screen to introduce the user to the application, prioritizing most of the interaction with the application before login and sending push notifications to engage with the user.

4.1 Booking a Medical Appointment

The medical appointment process starts in the main screen of the application, as presented in Figure 5. This screen provides users the suggestion to book a medical appointment.
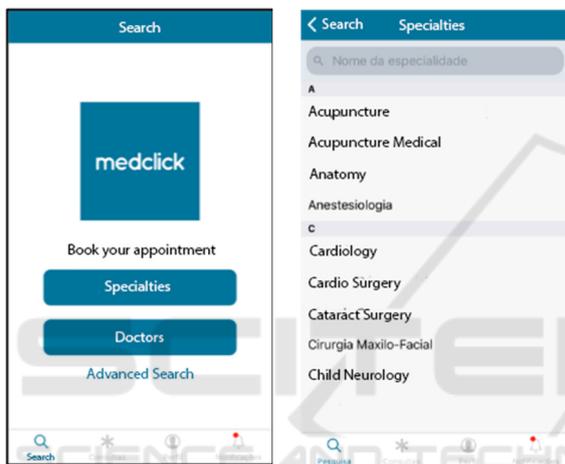

Figure 5: Main Search Screen (on the left) and Screen with List of Specialties (on the right).

Users have 3 options in this screen: choosing a specialty, choosing a health professional or selecting the advanced search option. If the specialty option is selected, users navigate to the screen presented in the same figure (in the right), a section list of the specialties divided by letter and sorted alphabetically. Users can also use the search bar to quickly find the wanted specialty.

The next screen presents a map that includes the locations of the healthcare providers that have medical services of the selected specialty (Figure 6). In this screen users can tap on any map pin to select a healthcare provider or skip this step and choose the health professional by name.

In the main screen (Figure 5), if users pressed the health Providers instead of the specialties, they would skip the list specialties screen and the map screen and navigate directly to the screen where they can choose the preferred health professional (Figure 6).
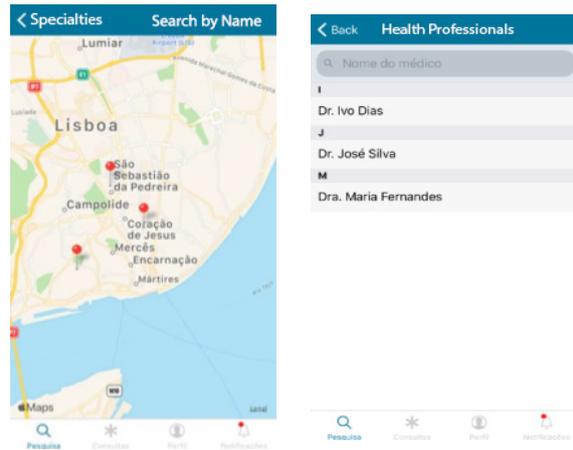

Figure 6: Map Screen (on the left) and Screen with List of Health Professionals (on the right).

After choosing the specialty, the health provider and the health professional, it is presented with a screen containing all the information about the health professional. In this screen, users can view the name of the health provider, contact, location, availabilities, map with providers, rating and curriculum (Figure 7).
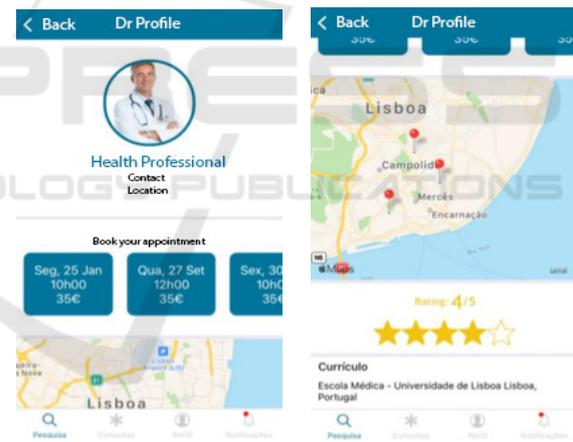

Figure 7: Health Professional Information Screens.

When users select the desired date of the medical appointment, an alert appears on the screen to confirm all the choices made by the user (Figure 8).

The next screen depends if the users are already logged in or not. If they are not logged in, a login screen will be presented.

If the users are already logged in, they will be redirected to the Appointments tab, where they can review all the past and future medical appointments booked through MedClick. An alert is shown letting the user know that the appointment is booked.
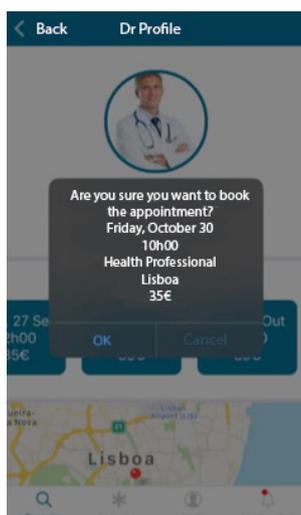
Figure 8: Appointment Confirmation Alert.

4.2 Onboarding

Having an Onboarding screen is a very important aspect of the user experience of a mobile application. It gives users a quick and simple introduction in the first time they open the application, explaining its basic functionality. For this solution it was chosen a simple swipeable card interface with four cards in total, showing just one at a time. The four cards chosen represent the four tabs of the application: Search, Appointments, Profile and Notifications. In each card, the name of the tab is a small description of that section, and contains information regarding what the users will find and can do in that section – see Figure 9 and Figure 10.
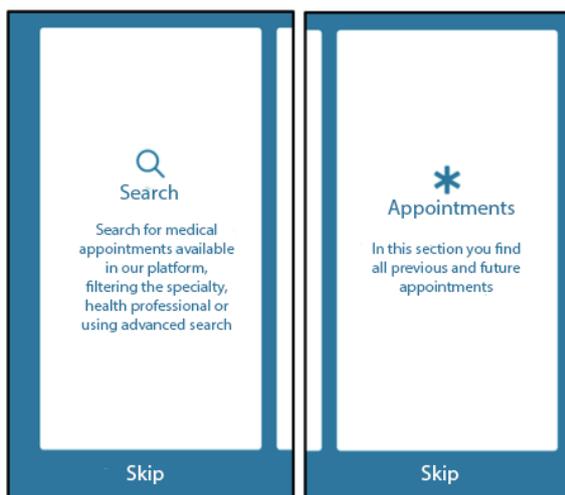

Figure 9: Onboarding Screens (1/2).

This way, even before interacting with the application, the users already know what to expect and where to find the functionality they are looking for. Only one card appears in the screen at a time, however it is possible to see part of the next card, giving users the idea that there are more cards to see and interact.

Figure 10: Onboarding Screens (2/2).

Below the cards there is an always visible button to skip this introduction screen. This gives users the chance to see all the cards or just ignore the tutorial all together, not making them lose time with something they are not interested in.

4.3 Prioritize Search before Login

All medical booking applications tested (see section 2), with the exception of Zocdoc, request the user to login or register before even starting to use the application. This is a major obstacle to the users because when they are expecting to start to interact with the application, they have to go through a tedious login or register process. MedClick mobile app has the goal of providing freedom to the user to search and use all the functionalities without the need to login or registration. This includes searching for an appointment, either by specialty or by health professional, searching the available healthcare providers and even receiving notifications based on the search history. This is achieved by creating a session linked to the device token, which can give the platform the ability to analyse the patients search history and notify them of a discounted appointment.

In the appointment tab and in the profile tab, when the user is not logged in, it is presented a simple

button in the middle of the screen asking the user to login to access that information.

4.4 Notifications

One important aspect of the solution is the notifications functionality. There are several scenarios where a notification should be deployed to the application:

- When users enter a predetermined area, established by the MedClick platform, where it is available a mobile marketing campaign or some suggestion to the users of a certain location.
- All the search history of the users is saved on the MedClick platform, where it can then be analysed to send suggestions of appointments and schedules based on that user's history. When this happens, a notification is sent to the user.
- To remind users of upcoming medical appointments. The application sends a push notification to the user when the appointment date is close to make sure the user did not forget about it.

For this to happen, when the user logs in the application, it sends to the server the token that identifies the device when receiving notifications, the ExpoPushToken. This token is then associated to the logged user. This way, anytime a notification is triggered to a specific user, the server knows what device to send the notification.
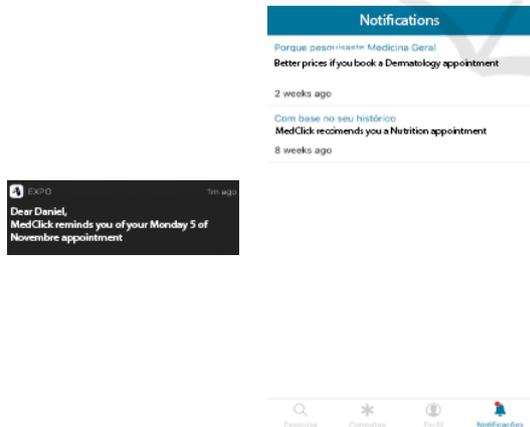

Figure 11: Notification Screens.

4.5 Weblogging of User Information

All the requests made by the application to the platform are saved in order keep track of the users' habits inside the application. This way it is possible for the users to receive notifications based on their

search history, with suggestions for appointments or even discounted appointments.

5 EVALUATION

In this section it is described the iterative testing methodology and its contribution to the final solution. Then it is described all the Focus Group Test Scenarios and its results. Lastly it is discussed the limitations of the tests.

5.1 Iterative Testing Methodology

The approach developed aim at having real users testing each iteration of the application. When testing, users will always have access to a feedback tab on the application where they can give feedback about the current screen. After concluding the testing process, it is presented a small questionnaire to the users with questions about their age, gender, profession and education. All this information is sent to the MedClick servers, as well as the users' location and information about the time spent on each screen of the application.

The test methodology was planned in order to receive real users' feedback and to improve the application in iterative steps. The first functionality tested was the book appointment process. The application was sent to several users. Some flaws were discovered very quickly. In the logs it was visible that some users were not completing the full testing process. Additionally, others were stuck on the same screen for a long period of time. There were also duplicated logs of users that reloaded the application and interacted again.

In total, in this short first iteration test, it was gathered data from 11 trustworthy tests, 8 male test users and 3 female test users, with an average age of 29,4 years. It was concluded that with these errors leading to such a small amount of data gathered, the testing approach should change and rely on focus group testing.

5.2 Focus Group Test Scenarios

After the first small iterative testing, it was decided to change the approach to a focus group testing, using a small group of people to test the application (in person), in this case, 18 people. Each person was given three test scenarios where he or she had to perform certain tasks in both the MedClick mobile application and in two other medical booking applications reviewed in section 2, namely "My

CUF" and "Joaquim Chaves Saúde" applications. These applications were chosen because they were the most similar ones to the proposed solution, in the Portuguese market.

To measure the impact of not having a login screen as the first interaction of the user with the application, users had to start each test without a logged session or any other preference in the application. Another reason for this was that neither My CUF nor Joaquim Chaves Saúde retain the user login after exiting the application. So, to make testing similar across all applications, login was needed in all scenarios.

5.2.1 Scenario 1 - Appointment Booking for a Health Professional

The first scenario given to the test users was to book an appointment for a specific health professional. This scenario assesses the impact of having a quick option to select the desired health professional and test the premise that if a patient wants to have a medical appointment with a specific health professional, all other parameters are not that relevant.

Table 2: Scenario 1 results.

Application	Average Time to Complete Scenario	Standard Deviation of Average Times
My CUF (Health Professional Maria de Vasconcelos)	≈1m25s	≈18s
Joaquim Chaves Saúde (Health Professional Maria de Fátima Miguel)	≈1m43s	≈25s
MedClick Mobile Application (Health Professional Maria Fernandes)	≈53s	≈11s

Most users had no problems in quickly identifying the search by health professional on the MedClick mobile application. This translated in Table 2 results, where users were in average more than 30 seconds quicker to complete the task comparing to the other two applications.

Another reason for these results were some bugs with the My CUF application that sometimes just loads blank screens and the user has to go back and try to submit the request again for the process to continue.

Also, on the Joaquim Chaves Saúde application, even when choosing a specific health professional,

the application requires users to select the type of appointment. This translated in an extra step users had to go through, most of times to select the only option present, making this action completely unnecessary.

Lastly, one feedback received multiple times was to change the alert presented to after the login screen when login is needed. That way the last step before booking the appointment was actually confirming it.

5.2.2 Scenario 2 - Appointment Booking by Specialty

The second test scenario was to give users the task of booking another medical appointment but this time with the specialty as a main focus. All other parameters such as location, health professionals, date or others were completely optional and up to the user. This test assesses the impact of having the specialty parameter in the first step when trying to book a medical appointment.

Table 3: Scenario 2 results.

Application	Average Time to Complete Scenario	Standard Deviation of Average Times
My CUF (Dermatology)	≈1m08s	≈15s
Joaquim Chaves Saúde (Dermatology)	≈1m11s	≈18s
MedClick Mobile Application (Dermatology)	≈1m04s	≈14s

In this test scenario, results were very similar across all applications, mainly because users had to go through every step when booking the appointment. This confirms the importance of having an option for the user to search directly for health professionals.

5.2.3 Scenario 3 – Past and Future Appointments

The third test scenario is simpler than scenario 1 and 2. It was given to the user the simple task of checking their past and future appointments. This scenario tests the utility of having a quick access to the patient's past and future appointments, accessing it via a main tab in the main screen of the application.

The times referring My CUF and MedClick mobile application are mainly the time users spent logging in because both applications have the appointments tab quickly accessible and in an intuitive manner. The MedClick mobile application has a label below the icon on that tab, however numerous users pointed the lack of contrast making it

difficult to read and quickly identify it. Several users were completely lost in the Joaquim Chaves Saúde application, because this tab does not have an intuitive name and many were looking in the appointments search section, confirming that having an option to search inside the tab with the past and future appointments is a good idea.

Table 4: Scenario 3 results.

Application	Average Time to Complete Scenario	Standard Deviation of Average Times
My CUF	≈44s	≈9s
Joaquim Chaves Saúde	≈1m08s	≈15s
MedClick Mobile Application	≈38s	≈8s

5.2.4 Scenario 4 – User Profile Information

The fourth and last test scenario is very similar to the third one. It is simply asked for users to review their profile information in the application.

Table 5: Scenario 4 results.

Application	Average Time to Complete Scenario	Standard Deviation of Average Times
My CUF	≈42s	≈13s
Joaquim Chaves Saúde	≈46s	≈14s
MedClick Mobile Application	≈37s	≈13s

Once again, most of the time spent in this scenario was due to login, and in here the majority of users had no problems finding the profile tab and completing the task. It should be noted that in a real-world scenario, MedClick mobile application saves the user login when closing the application, dramatically improving these times.

5.3 Limitations

In the Iterative Testing Methodology, as described in section 5.1, user created errors resulting in false results; that made it hard to understand when the average time spent in each screen was due to a bad user experience or simply due to user disinterest.

After the failure of the first methodology, a focus group test approach was adopted with various test scenarios. This approach also has the limitation of not testing a broad enough audience.

The authors expect that with the platform fully functional and deployed to a wide range of users and patients it will be possible to enlarge the significance of the results. Namely with a broader audience the authors expect to verify if users use more the web platform or the mobile application, if the mobile application brings new users to the platform and if they engage more with the platform because of the marketing efforts, mainly the mobile push notifications about the location and the history.

6 CONCLUSIONS

A large percentage of customers in most industries are demanding frictionless booking. Having the ability to book a medical appointment in any device is a must have for patients nowadays.

This research develops four major contributions: i) a comparative analysis of mobile medical appointments booking applications; ii) the use case and requirement definition for the health care mobile marketing process; iii) the Implementation a health care mobile marketing application; iv) the assessment of the user experience for mobile marketing.

Regarding the first contribution, this paper presents a comparative analysis of the functionalities of 4 mobile medical appointments booking applications.

This paper proposes a set of use cases and requirements in order to make available four major functionalities (booking a medical appointment, history of medical appointments, alerts for future appointments, and mobile marketing).

The third contribution of this research is the development of the mobile application, including the mobile marketing side (having various notifications deployed to the user engagement of the user). In the development of the application, the user experience was a major concern, using onboarding screens and the prioritizing use before login. Introducing this application together with the platform will not only give more options to the users but will also provide more features like relevant notifications to the user.

Regarding user testing, through various scenarios, the application gave satisfying user experience results, even when not taking advantage of features like retaining the user login. This supports that the application would be well received by real world users.

As a suggestion for future work, besides the metrics presented in the focus group test scenario in section 5.2, the application could be tested using a questionnaire regarding usability, like the System

Usability Scale (SUS) questionnaire. Another thing to be considered when deployed to real patients is the GDPR compliance, not researched in this work.

During the development of this paper, some difficulties and limitations were found. One of the major limitations of this research is that there are features whose impact can only be measured once the MedClick application is deployed and used by a large number of patients. Considering the results presented in this paper the authors expect the mobile application marketing functionalities have significant impact in the healthcare industry.

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REFERENCES

Apple, 2019. Apple Developer Human Interface Guidelines, available at https://developer.apple.com/design/human-interface-guidelines/ - Accessed on 05/10/2019.

Aranyi, G. and van, Schaik, P., 2016. Testing a model of user-experience with news websites. J Assn Inf Sci Tec, 67: 1555-1575. doi:10.1002/asi.23462

Berman, B., 2016. Referral marketing: Harnessing the power of your customers, Business Horizons, 59, 1, pp. 19-28.

Dirin, A., and Laine, T., 2018. User Experience in Mobile Augmented Reality: Emotions, Challenges, Opportunities and Best Practices, Special Issue Advances in Mobile Augmented Reality, Computers 2018, 7(2), 33, https://doi.org/10.3390/computers7020033

Gana,M., Thomas, T., and Kashif, H., 2017. Consumers' Value Assessment on Location Based Service Application as a Mobile Marketing Tool, International Journal of Business and Applied Social Science Vol.2, No.3.

Google, 2019. Material Design updates and guidance, available at https://material.io/design/ - Accessed on 05/10/2019.

Hubert, M., Blut, M., Brock, C., Backhaus, C., and Eberhardt, T., 2017. Acceptance of smartphone-based mobile shopping: Mobile benefits, customer characteristics, perceived risks, and the impact of application context. Psychology & Marketing, 34(2), 175-194.

Leppaniemi,M., 2008. Mobile Marketing Communications in Consumer Markets, University of Oulu.

Martinez, M., and Lecomte, S., 2017.Towards the Quality Improvement of Cross Platform Mobile Applications, IEEE/ACM 4th International Conference on Mobile Soft ware Engineering and Systems (MOBILESoft), Buenos Aires, 2017, pp. 184 188.

Saint-Exupéry, A., Galantière, L., Gilbert S., 1943. Airman's Odyssey, New York, Reynal & Hitchcock.

Saude, CUF, 2019. Grupo Cuf homepage, https://www.saudecuf.pt/ - Accessed on 05/10/2019.

Saude, JC., 2019. Joaquim Chaves Saude homepage, https://www.jcs.pt/pt/home - Accessed on 05/10/2019.

Shankar, V., Balasubramanian, S., 2009. Mobile Marketing: A Synthesis and Prognosis, Journal of Interactive Marketing, 23, 2, pp. 118–29.

StatCounter 2018. GlobalStats statcounter: Mobile Operating System Market Share Worldwide, available at http://gs.statcounter.com/os-market-share/mobile/worldwide - Accessed on 05/10/2019.

Zocdoc 2019, Zocdoc Homepage. https://www.zocdoc.com - Accessed on 05/10/2019.