Healthcare Transformation with Informatics and Artificial Intelligence
J. Mantas et al. (Eds.)
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doi:10.3233/SHTI230509

# Development of a Mobile Application with Health Guidelines for TB Patients Care

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Abstract. Health guidelines inform recommendations for different clinical practices or public health policies. They are a simple way to organize and retrieve relevant information that can impact patient care. Although these documents are easy to use, most are not user-friendly because they are difficult to access. Our work aims to present the developing approach for a decision-making tool based on health guidelines to assist health professionals in caring for patients with tuberculosis. This tool is being developed for use on mobile devices and as a webbased system, which will transform a passive and declarative health guideline document into an interactive tool that will provide data, information, and knowledge. User tests with functional prototypes developed for the Android platform show that this application has the potential to be applied in TB healthcare facilities in the future.

Keywords. Tuberculosis, health guidelines, mobile application

#### 1. Introduction

The Brazilian Health Ministry 2023 reported the incidence coefficient in 2022 was 36.3 cases per 100000 inhabitants. This value demonstrates an upward trend in the prevalence of the disease based on 208 million inhabitants (total) in Brazil [1]. Several factors elucidate Brazil's difficulty in controlling TB. Among these are the increased incidence rates of HIV contamination, the decline in the socioeconomic status of populations, and inadequate urban planning, among others [2].

Decision-making support tools are essential to guide care practices. With TB, it is no different. That is why we have noted technological advances to help resolve this issue, such as educational games for continuing the education of health professionals. [3], Manuals that gather health protocols for managing patients with TB [4], and more.

Looking deeper into these guidelines, one can observe that the formats in which they were made available to health services are incompatible with the day-to-day use of their key users. Although there are several challenges to overcome in a typical workday at a public health facility in Brazil, there is still the urge to have all the knowledge needed to treat the patients best. All the guidelines are currently in PDF format and are available on the official website of the Ministry of Health. In other words, it is difficult to access the target audience. Our work aims to present the developing approach for a

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decision-making tool based on health guidelines to assist health professionals in caring for patients with TB.

## 2. Material and Methods

### 2.1. The System Architecture

In this work, the system architecture was Microservices. This architecture consists of small and independent services that run and communicate with each other using APIs. The version of Ionic used in this project supports this kind of architecture, and it was the main reason for this choice. With the front-end in Ionic, the application makes requests to an API hosted on the server and the API communicates with the database.

### 2.2. The Guidelines and Development Tools

Three health guidelines were used in our study: A quick guide for mainly the control of tuberculosis [1]: an essential guide for prevention, treatment, and control of TB in patients living with HIV [4], and the basic guideline of combined prevention [5]. These guidelines were chosen because they are the most studied in Brazil.

The Ionic framework (https://ionicframework.com/) built native, hybrid platform applications. This framework works with TypeScript as the primary programming language and, beyond that, HTML and CSS for the front-end components.

### 2.3. Usability Validation and Satisfaction

A usability assessment measure effectiveness, efficiency, and satisfaction. It can detect difficulties in use and contribute to improving the user experience (UX), which is on the rise in the technology market. The CSUQ - Computer System Usability Questionnaire [6] was chosen to assess satisfaction with using the application. This instrument is intended for non-laboratory environments and has been used to evaluate other health information systems.

After coding the mobile app, the authors provided a tutorial video with the main features, available at: https://youtu.be/DZtRT8W-BmQ. Then, an invitation to answer the questionnaire was sent to 100 health professionals. We asked the participants questions that characterize them, like age and job title. We also inquired about the application's usability after they saw the video of the mobile application running. Respondents should answer how much they agree or disagree with the statement, being 1: "totally agree" and 7: "totally disagree.".

### 3. Results

In our previous work, we described a developed protocol for the application presented in this work which was carried out in different stages [7]. These are the initial structure assessment of the health guidelines, the literature review, requirements gathering, and the prototyping and coding process. Our work was developed and tested from a functional Ionic 5 technology prototype, presented in Figure 1. The screenshot shows how a professional can trackback TB in patients living with HIV. After using the application and seeing the video, 45 health professionals answered a modified CSUQ.



**Figure 1.** TB+ screenshot refers to the content on Screening for active TB in patients living with HIV [5]. In Table 1 we show some of the results.

Table 1. Results of the questions of the modified version of CSUQ.

Question id	Question statement	Amount of "totally agree" responses	Amount of "totally disagree" responses
1	Overall, I am satisfied with how easy this system is to use.	22	7
2	It was simple to use this system	26	5
3	I feel comfortable using this system	26	5
5	It was easy to learn to use this system	28	5
6	It is easy to find the information I needed	26	5
7	The information provided for the system is easy to understand	25	5
8	The organization of information on the system screens is clear	25	4
9	The interface of this system is pleasant	23	3
10	I like using the interface of this system	23	3
11	This system has all the functions and capabilities I expect it to have	24	4
12	Overall, I am satisfied with this system	25	3

# 4. Discussion

It was noticeable that most respondents had positive feelings about the application in all the questions. Despite that, we intend to go deeper in this analysis using CSUQ in future research with other application versions. It will soon be possible to carry out more tests to validate its effectiveness in helping care and not just its usability outside the daily context of health professionals. In addition, partnerships are also intended to make TB+ available on the official websites of TB treatment units.

Although TB is an ancient disease, it continues to cause significant morbidity and mortality worldwide. Information about national recommendations for TB screening, diagnostic testing, and treatment recommendations is vital for reducing TB cases and mortality. Providing a quick and accessible tool can significantly aid decision-making processes and help allow health professionals to obtain information when needed. The guides are a tool that can help mainly regions lacking information resources and continuing education incentives. We show it is possible to make the process viable, fast, and intuitive by simplifying official information access.

#### 5. Conclusion

The novelty of our work is the transformation of paper guidelines intended to support TB patients into interactive applications. It was developed for mobile devices and a web platform, using structured information and adding knowledge to the data provided by these guidelines. Through the development of this application, the end user will be able to carry out textual and dynamic tasks and searches to retrieve the desired information. We conclude the application has the potential to be applied in a health service that serves patients with conditions related to TB.

### 6. Acknowledgements

This work was supported by the São Paulo Research Foundation (FAPESP) - grant number 2020/01975-9, coordinated by author DA.

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