EWHODAS: DEVELOPMENT OF A MOBILE APP FOR CLINICAL ASSESSMENT OF FUNCTIONING

EWHODAS: DESENVOLVIMENTO DE UMA APLICAÇÃO MÓVEL PARA AVALIAÇÃO CLÍNICA DA FUNCIONALIDADE

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Resumo. O objetivo deste trabalho é descrever o processo de criação e desenvolvimento de um aplicativo móvel que facilite a utilização do Cronograma de Avaliação de Incapacidade da Organização Mundial da Saúde (WHODAS) para avaliar sua funcionalidade na prática clínica de saúde. Após obtenção da autorização da Organização Mundial da Saúde, os autores executaram a ideia do projeto segundo as seguintes fases: concepção do storyboard, seleção de uma plataforma de desenvolvimento gratuita e fácil de usar, teste piloto, criação das versões em português e em inglês, e, disponibilização gratuita para uso. A primeira versão do aplicativo foi desenvolvida com base nas etapas descritas acima. Essa versão foi testada em campo na fase piloto por 16 profissionais e obteve boa pontuação de usabilidade de 80,93 na escala de usabilidade do sistema (SUS). A versão final do eWHODAS já está disponível a custo zero nas lojas online em inglês e português.

Palavras-chave: Whodas; clínica de saúde; aplicativo móvel; desenvolvimento.

Abstract. The purpose of this work is to describe the process of creating and developing a mobile application that facilitates the utilization of the World Health Organization Disability Assessment Schedule (WHODAS) for assessing its functioning in clinical health practice. After obtaining authorization from the World Health Organization, the authors executed the project idea according to the following phases: storyboard design, selection of a free and user-friendly development platform, pilot testing, creation of the Portuguese version, and free availability for use. The first version of the application was developed based on the steps described above. This version was field-tested in the pilot phase by 16 professionals and achieved a good usability score of 80.93 on the system usability scale (SUS). The final version of eWHODAS is now available at zero cost in online stores in English and Portuguese.

Keywords: Whodas;clinical health; mobile application; development.

1. INTRODUCTION

The World Health Organization (WHO) defines functioning as “an umbrella term for body function, structure, activity, and participation. It denotes the positive aspects of the interaction between an individual (with a health condition) and their contextual factors (environmental and personal factors)”[1]. By allowing an approach to health based on a biopsychosocial perspective, the assessment of functioning provides an opportunity for more adequate healthcare, going beyond the treatment of changes in body function and structure as the main health intervention. Owing to its ability to affect people's lives in association with health conditions, functioning has been suggested as a third health indicator, alongside mortality and morbidity[2].

To incorporate a functioning assessment into clinical practice, the WHO launched tools such as core sets [3] and the World Health Organization Disability Assessment Schedule (WHODAS) [4]. The latter is a questionnaire with 36 questions divided into six domains (cognition, mobility, self-care, getting along, life activities, and participation), each of which generates a score ranging from 0 to 100 (worst functioning).

WHODAS innovates by allowing the numerical measurement of people's functioning profiles according to their domains [4], and its use has grown considerably over time [5]. However, the application time (estimated at approximately 20 minutes) [4] and the complex calculation process of the scores can be considered barriers to its adoption by health professionals in clinical practice.

The transformation of mechanical or manual processes into digital processes has been gradually implemented through mobile applications [6]. Recently, the growing use of mobile apps has been proven to deliver ample benefits, including decision-making with lower error rates, improved quality, easy accessibility of information, and convenience of use, resulting in the reduction of adverse health events and length of hospital stay [7].

Given these operational challenges, digitizing WHODAS represents a promising strategy to increase its applicability in real-world settings. The development and availability of a cost-free and user-friendly application that accelerates the WHODAS application process can reduce the time required for an individual's assessment while ensuring effective storage, reading, and interpretation of information.

This paper describes the process of creating and developing an eco-friendly, easy-to-use, and free mobile application to facilitate the application of the WHODAS, designed to accelerate the clinical assessment of functioning from the perspective of a biopsychosocial model, in line with WHO recommendations.

2. MATERIAL AND METHODS

First, official authorization from the WHO was requested for the use of WHODAS in this project (granted in February 2021 under number 317992). The following steps were performed to complete the project: storyboard design, selection of a free and user-friendly development platform, pilot testing, creation of an English version, and free availability for use.

3. STORYBOARD DESIGN

After defining the application production platform, storyboards for the application screens were designed. These assays were performed on the Figma platform [9]. The team comprises professionals in the fields of information technology, physical therapy, and computer engineering. Considering that the purpose of this project was to provide a digitized version of an existing instrument by adding functionality, the layout of the app needed to maintain the original structure of WHODAS. Therefore, the project team worked on user-friendly screens that were more suitable for clinical environments.

4. DEVELOPMENT PLATFORM SELECTION

A wide variety of development platforms are used in building applications. Some of the most commonly used applications are Appy Pie®, Appery®, Felgo®, Mobincube®, and Bizness Apps®. Considering the requirements, the application development platform adopted in this project was Flutter®, which is a code-compatible version of the open-source user interface software development kit that uses HTML, CSS, JavaScript, and Dart to generate the user interface [10]. Flutter® was selected as the preferred application creation platform owing to its free availability, user-friendly nature, and capability to develop applications for different platforms (iOS and Android) [11] that are supported and maintained by Google. Firebase, a

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database management system that implements a nonrelational database known as the NoSQL database, is also maintained by Google. Firebase was chosen to manage the data in this application because of its simplicity and compatibility with Flutter® [12].

For the development and testing, a computer with an Intel i5 processor, 8 GB of RAM, 1 TB of HD, and an SM-J410G smartphone were used. Visual Studio Code was used as the development environment. The backup and versioning of the source code were managed using GitHub [13]. All materials and methods used during the software development and testing are shown in Figures 1a and 1b. It is important to emphasize that the score calculations were programmed as recommended by the WHODAS Manual [4].

For the security of patient and clinical data, the Firebase platform was used as an access and cloud database manager and met the main security requirements in accordance with international standards (https://firebase.google.com/support/privacy). No personal health data were stored beyond anonymized identifiers during testing, in compliance with ethical standards. Regarding password security, the app encourages users to use strong passwords and two-step validation, among other features.

The architecture of the application was implemented using cloud computing techniques, incorporating both a backend and a front end. The backend was implemented using the Firebase platform, which facilitated the storage of patient and clinical data as well as access controls. For the front end, which consists of interfaces that communicate with the backend through the Internet and run on a mobile device, Android, iOS, or a browser, the Flutter platform was utilized. The architecture preview of the app can be found in Figure 2.

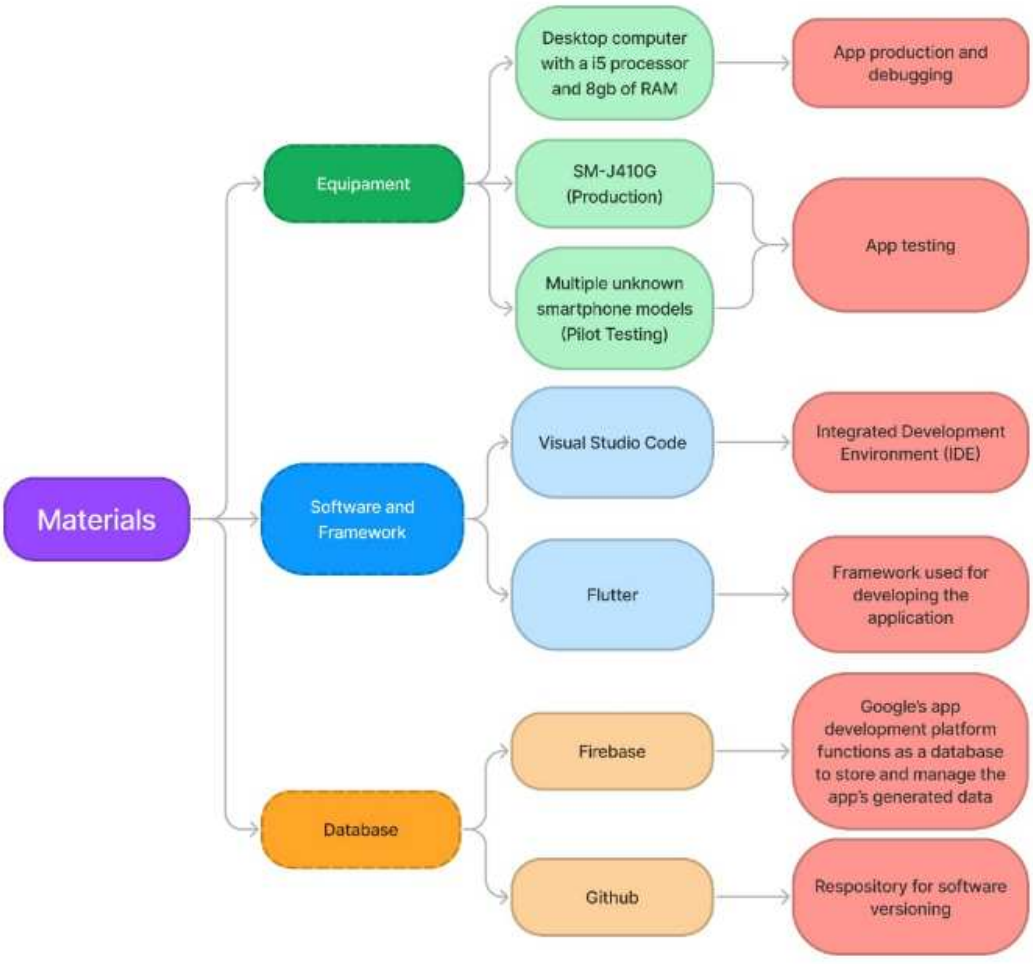

Figure 1a. Presentation of the materials used in the application development. Source: Author (2023)

5. PILOT TEST

The application underwent a testing phase in which a group of health professionals utilized it in clinical settings. This group comprised nurses, physiotherapists, occupational therapists, and physical educators who took a free 40-hour training course on the paper and pen version of the WHODAS application and used the questionnaire in their clinical practice. After a four-week period, the selected users were consulted regarding the usability, design, and layout of the application. In addition, the suggestions and criticisms offered by users were collected. The system usability scale (SUS) questionnaire was also employed at this stage to assess the learning ability and usability of the application. The SUS questionnaire consists of ten questions with five response options, ranging from 1 (strongly disagree) to 5 (strongly agree) [14]. The result of this testing phase indicated that only minimal adjustments were required, which did not necessitate a new testing phase for the application prior to its release for Internet use.

6. CREATION OF THE ENGLISH VERSION

The entire project team comprised Brazilians; however, we sought alignment with the WHO proposals. Therefore, we intend to make this application available in all the languages used by the WHO. The first step was to make the application available in English. Other languages are intended for this application, depending on the availability of financial and human resources for the execution of this process within the project.

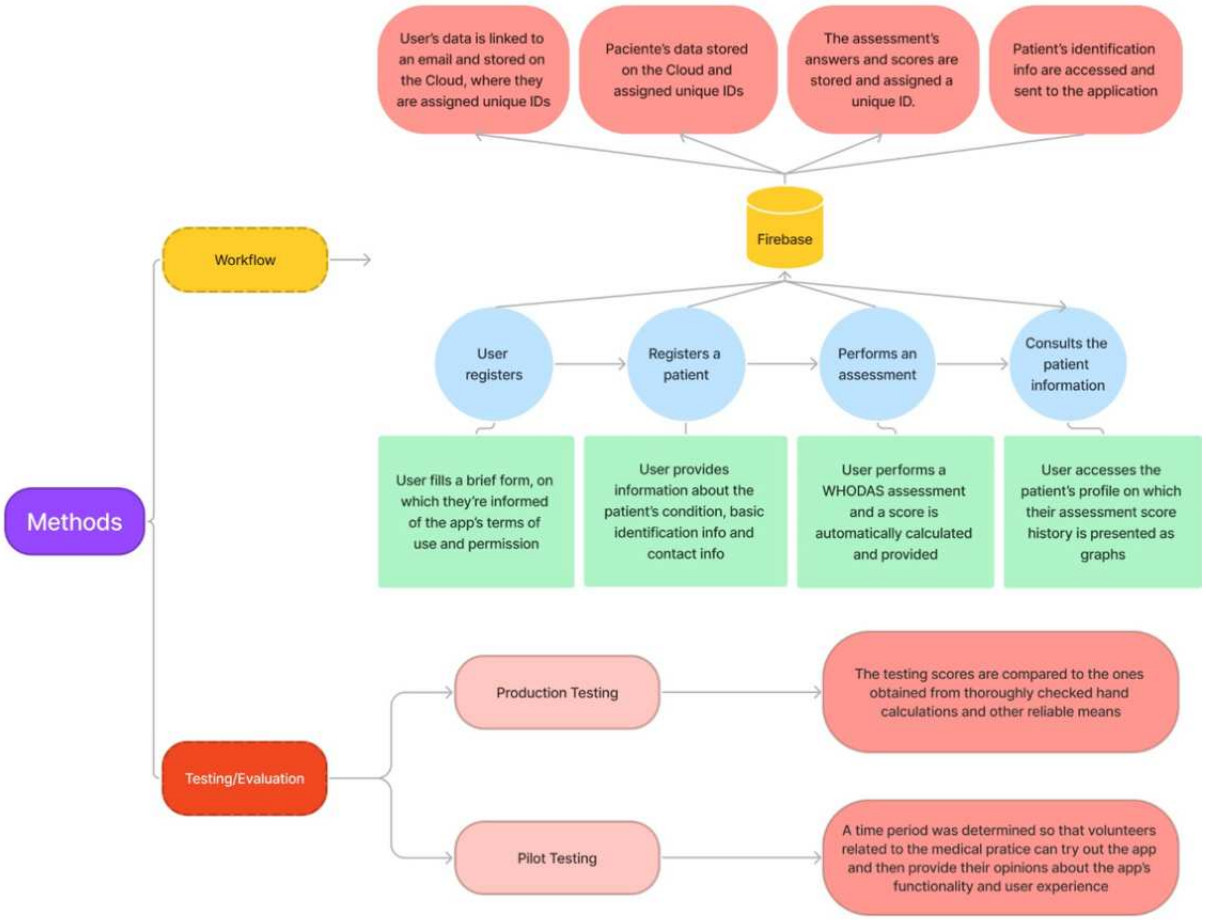

Figure 1b. Presentation of the methods used in the application development. Source: Author (2023)

7. FREE AVAILABILITY FOR USE

The iOS version will be released soon and made available for use. The Android version of the app is now available in the app store. A link to the application can be provided upon request from the authors of this paper.

8. RESULTS

The app creation process sought to maintain the integrity of the existing structure of the WHODAS as much as possible. Consequently, all sections present in the 36-question version of this tool were incorporated into the eWHODAS structure. These sections included the face sheet, demographic and background information, preamble, domain reviews, and their respective questions (domain 1: cognition, domain 2: mobility, domain 3: self-care, domain 4: getting along with people, domain 5: life activities, and domain 6: participation). Additionally, Flashcards 1 and 2 were included. The screens of these sections are shown in Figure 3.

In addition, the project provided an opportunity for the insertion of other screens and fields into the application so that the user could have a better experience. Some noteworthy screen features included user registration, a welcome screen, patient registration, patient search, ICF for consultation, and results screens with the scores of the WHODAS domains of each assessment performed with graphic and numerical presentations. Figure show some examples of these screens. In addition, the application had designed functionality such that a report with all patient data regarding the scores of the assessments could be shared.

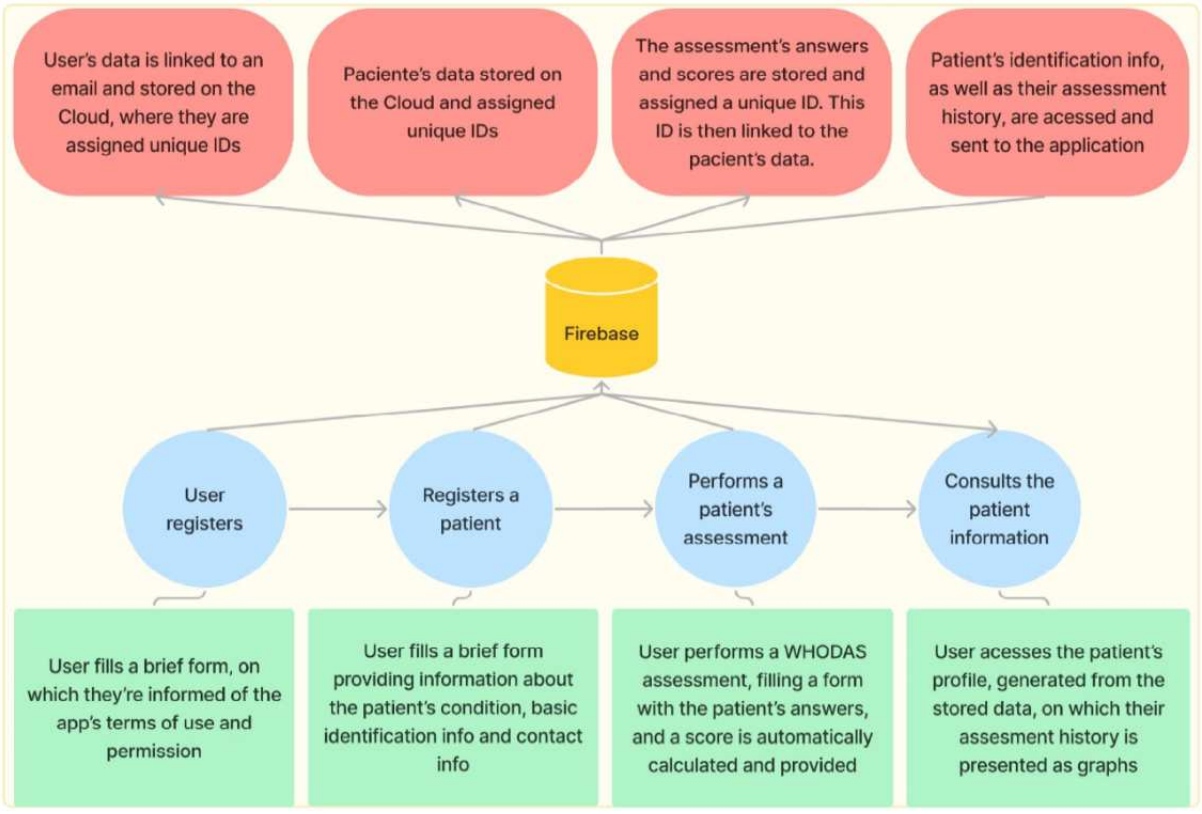

Figure 2. Architecture preview of the eWHODAS app.Source: Author (2023)

The usability of the app was verified through field tests conducted by 16 users from different fields of healthcare (physiotherapy, nursing, physical education, occupational therapy, and speech therapy) who volunteered to test the app after open invitations on social networks. At this stage, the SUS questionnaire was administered two weeks after using the

eWHODAS. The analysis of the app's usability through the SUS showed a score of 80.93 (SD 17.26), which surpasses the cutoff point of 68 [15], indicating good usability.

Some features of the app should be highlighted, so that its applicability becomes evident: 1) registration and quick search of patients; 2) online consultation of the WHODAS manual and the International Classification of Functioning, Disability, and Health-ICF; 3) automatic scrolling of the screens, thus speeding up navigation within the application; 4) automatic calculation of weighted WHODAS domain scores; 5) presentation of bars partially filled with colors showing the level of functioning by domains; 6) production of graphs with the scores of the evaluation domains over the treatment period; 7) availability of a history of scores per consultation, allowing access to individualized responses in each measurement; 8) possibility of sharing scores and graphs in a PDF file via email or a quick communication platform.

This stage of eWHODAS development has been completed, and the latest version of the application is available in virtual stores for users with Android devices. New features within the app can be implemented depending on user suggestions and are subject to the availability of human, physical, and financial resources. This project provided a process for digitizing the WHODAS application and scoring. The developed application is easy to use, eco-friendly, cost-free, and available in two languages (English and Portuguese). Thus, this project is expected to contribute positively to the assessment of functioning in healthcare settings.

It is important to highlight the unavailability of any other app with the same functionality and utilize WHODAS in electronic stores. Therefore, comparison with other mobile applications is a complex process. A literature review article on applications used in the field of rehabilitation verified 11 tools available for patient assessment, covering the following items: joint angle, joint angular movement, 2- and 6-minute walk tests, time, balance and gait changes, functional movements, transfer from sitting to standing, and variation in spinal movement. However, none of these applications refer to the measurement of functioning, highlighting the innovative and unprecedented characteristics of eWHODAS [16].

9. CONCLUSION

In this work, a mobile application to facilitate the application of the WHODAS, designed to accelerate the clinical assessment of functioning from the perspective of a biopsychosocial model, in line with WHO recommendations, was proposed and developed. Based on the information and discussions regarding eWHODAS, it is perceived that its use offers greater availability, ease of storage, and accessibility to patient information by health professionals and provides faster application by eliminating paper and pen and producing the results of scores automatically with visual quantification resources. In addition, the eWHODAS is free and user-friendly, providing mobility and independence to health professionals when assessing patients at no cost.

The final Android version is now publicly available. Based on the SUS score of 80.93, eWHODAS demonstrated good usability and potential to enhance efficiency in clinical practice. The eWHODAS is now available in its Android version to be used in different scenarios in which functional assessment may be required (primary, secondary, and tertiary care; social services; education; work; and others). A possible limitation of eWHODAS is the need for an internet connection for perfect functioning. Future studies that compare the administration process of the printed version with its applications are warranted. However, it is assumed that the application requires a shorter application time and faster processing, storage, and analysis of clinical information regarding the functioning of the assessed patient.

Therefore, the eWHODAS app simplifies and accelerates the clinical application of WHODAS 2.0, providing reliable, paperless, and accessible assessments of functioning. Its usability and free availability support broader adoption of biopsychosocial health models.

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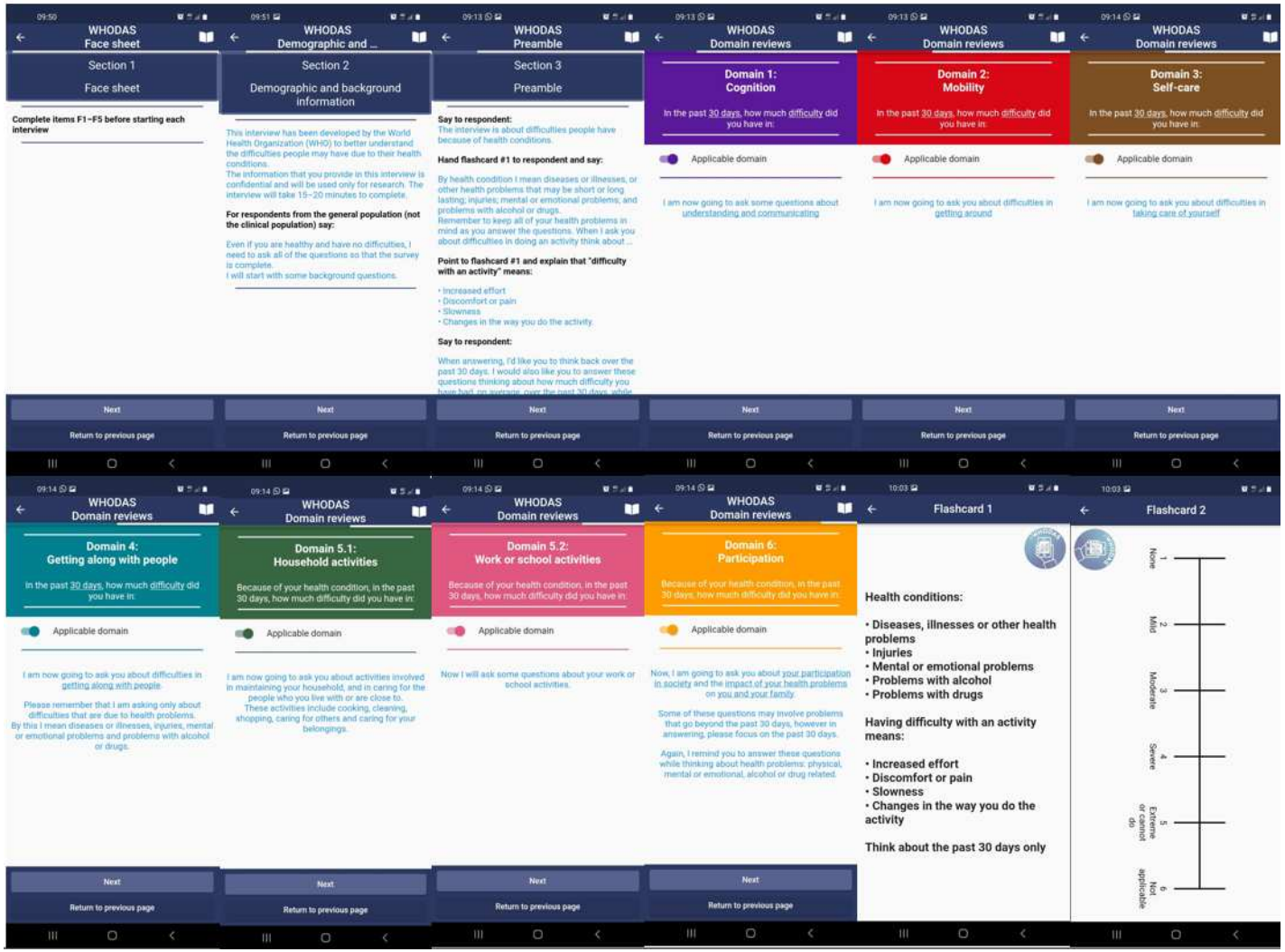

Figure 3.a. eWHODAS app screens overview. Source: Author (2023).

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Figure 3.b. eWHODAS reports screens overview. Source: Author (2023).

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