Universitat de Girona
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Protocol and pilot test to assess the quality of performance of the Skin NTDs app: a diagnosing tool developed by the World Health Organisation for Neglected Tropical Diseases that primarily affect the skin.

A cross-sectional study.

Final Degree Project

January 2021

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First of all, I would like to thank my tutors Carme Carrión, José Antonio Ruiz Postigo and Rafel Ramos for helping me with my final degree project.

Then, I would like to express my gratitude to my friends, who've become my family while I was away from home.

Last but certainly not least, I would like to thank my family for being the main pillar in my life. To my parents for always believing in me and loving me no matter what. To my sister for always taking care of me. And finally, to my aunts and my cousins for always bringing joy to my life.

Thank you all!

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ABBREVIATIONS

APA: American Psychiatric Association

AQUEL: Tool for Nutrition App Quality Evaluation

CHW: Community Health Worker

CM: Case management

DALYs: Disability adjusted life years

eHealth: Electronic health

EU: European Union

FHW: Frontline Health Worker

HIV/AIDS: Human immunodeficiency virus/ acquired immunodeficiency syndrome

ICT: Information and Communication Technologies

IDM: Intensified Disease Management

IMART: Interactive Mobile App Review Toolkit

iOS: iPhone Operating System

ITU: International Telecommunications Union

LMIC: low-and middle-income country

MARS: Mobile app rating scale

MAST: Model for Assessment of Telemedicine

MDA: Mass Drug Administration

MDG: Millennium Development Goals

mERA: mHealth Evidence Reporting and Assessment

mHealth: Mobile health

NGO: Non-Governmental Organisation

NRL: Netherland Leprosy Relief

NTDs: Neglected Tropical Diseases

PC: Preventive Chemotherapy

PCT: Preventive chemotherapy and transmission

PDA: Personal Digital Assistant

RDS: Respondent-driven sampling

SDG: Sustainable Development Goal

sNTDs: Skin Neglected Tropical Diseases

TB: Tuberculosis

UN: United Nations

UOC: Universitat Oberta de Catalunya

WHO: World Health Organisation

WMA: World Medical Association

YLD: Years lost to disability

YLL: Years of life lost

ABSTRACT

Background: Neglected Tropical Diseases (NTDs) are a major health problem that cause more than 18.79 million disability adjusted life years (DALYs) worldwide. They affect mainly the poorest populations of tropical and subtropical regions. To counter them many interventions are being conducted, notably mobile health (mHealth) interventions, such as the one launched by the World Health Organisation against skin NTDs (sNTDs), where a mobile application, *Skin NTDs app*, was created to act as a decision supporting tool for Frontline Health Workers (FHW).

Objectives: The main objective of this *protocol* is to assess the quality of WHO's *Skin NTDs app* as a decision supporting tool. The main objective of the *pilot test* is to assess the feasibility of the protocol.

Design and methods: This study will be cross-sectional. The sample of the study will be obtained using respondent-driven sampling (RDS). The quantitative data will be obtained by conducting an online survey based on an existing app assessment tool named MARS, and the qualitative data, from semi-structured interviews. Then they will be analysed accordingly.

Results: The *pilot test* revealed that the protocol was easy to follow and reproduce. The results of the survey showed that *Skin NTDs app*'s quality is right above average, with a total mean score of 3.74 in the objective categories, and 3.09 in the subjective quality section.

Conclusions: As the protocol was found to be easy to reproduce, and given its importance for the development of *Skin NTDs app*, a long-term study will be performed based on it

Key words: Neglected Tropical Diseases, mHealth, Skin NTDs app, mobile application, quality, decision supporting tool, MARS tool

1. INTRODUCTION

1.1. BACKGROUND

1.1.1. Neglected Tropical Diseases

Neglected tropical diseases (NTDs) are a diverse group of diseases and conditions that mostly prevail, although not exclusively, in tropical and subtropical regions, affecting mainly the most impoverished populations. Such communities live in conditions of poor sanitation, are often in contact with infectious vectors and livestock, and have very limited access to adequate healthcare. (1–3) Thus, the issue of poverty is key to the nature of NTDs, as not only these diseases have been off the radar in terms of research, funding and policy due to the type of populations they affect, but have also contributed to the further impoverishment of said populations, through their socioeconomic impacts (4).

Therefore, the term NTDs has been created as an attempt to raise awareness and funding to this group of diseases, that are of biologically dissimilar characteristics, and have been historically discarded from attention in comparison to the "big three" i.e., HIV/AIDS, malaria, and tuberculosis (TB) (5).

In the early 2000s the World Health Organisation (WHO), counted 17 communicable diseases under the scope of NTDs, that were caused either by bacteria, helminths, protozoa or viruses. In 2017, on the occasion of the *10th meeting of the Strategic and Technical Advisory Group for Neglected Tropical Diseases*, the list was expanded with three more diseases, and for the first time, the now 20 NTDs include a non-communicable disease (5,6). (See Table 1).

Table 7. *Neglected tropical diseases: Overview of the WHO NTD list, their main reservoir and mode of transmission. Adapted from (5,7,8).*

	Main RESERVOIR			**Mode of TRANSMISSION**		
	Human	Zoonotic	Other[a]	Oral/food-borne	Vector-borne	Other[d]
VIRAL DISEASES						
Dengue and Chikungunya fevers	X				X	
Rabies		X				X[e]
BACTERIAL DISEASES						
Buruli ulcer		X	X[b]			X[e]
Leprosy (Hansen´s disease)	X					X[e]
Trachoma	X					X[e]
Treponematoses (Yaws, Endemic syphilis, Pinta)	X					X[e]

HELMINTHIC DISEASES					
Dracunculiasis (Guinea-worm disease)	X		X		
Echinococcosis		X	X		
Food-borne trematodiases		X	X		
Lymphatic filariasis (LF) (Elephantiasis)	X			X	
Onchocerciasis (river blindness)	X			X	
Schistosomiasis (snail fever)	X	X			X[e]
Soil-transmitted helminthiases (Ascariasis, Hookworm disease, Trichuriasis, Strongyloidiasis)	X		X		X[e]
Taenia solium: (Neuro) Cysticercosis/Taeniasis		X (only taeniasis)	X		
PROTOZOAN DISEASES					
Chagas disease		X		X	X[f]
Human African trypanosomiasis (HAT) (sleeping sickness)	X	X		X	
Leishmaniasis	X	X		X	X[f]
ECTOPARASITIC DISEASES					
Scabies	X			X	
FUNGAL DISEASES					
Mycetoma, chromoblastomycosis and other deep mycoses		X[c]			X[e]
NON-COMMUNICABLE DISEASES					
Snakebite envenoming		X[b]			X[e]

Note: a) Environment[b], unknown but it's believed to be the soil[c] d) direct contact[e], fetomaternal[f]

Another reason why NTDs have never been in the spotlight is that individually, none of them represents a global priority in terms of numbers of people affected or disability adjusted life years (DALYs) lost. Moreover, global attention tends to focus on mortal diseases, and NTDs cause disabilities and disfiguration more than they kill. DALYs caused by NTDs are constituted for 56% by years lost due to disability (YLD) and for 44% by years of life lost (YLL). If we compare these numbers to those of malaria, for example, we find that the latter causes 7% of YLD and 93% of YLL, which explains why it is a disease that is difficult to disregard.

However, by bringing the different NTDs together in one unique entity, the burden of disease resulting grows considerably, and ends up weighting as much as HIV/AIDS, TB or malaria (6). According to the *Expanded Special Project for Elimination of Neglected Tropical Diseases*, the number of people affected by NTDs worldwide accounts to more than 1.5 billion

people. It is also estimated that between 350 000 and 500 000 people die from them every year (1,5,9).

According to the *Global Burden of Disease Study* in 2016, 18.79 million (26.06 million in 2010) DALYs were attributed to NTDs (5). Women and children are disproportionately affected by many of these conditions (2), and since they cause more disabilities than deaths, there are numerous indirect consequences to NTDs, including stigma, discrimination, social exclusion, impaired intellectual and cognitive development, impaired pregnancy results, blindness, disfigurement, keeping children out of schools and adults out of work, and burdening households with considerable costs to seek healthcare. This high-morbidity/low-mortality rate prevents people from leading productive lives and traps communities in an endless cycle of poverty, hindering their social and economic development, and explaining why many consider them to be a "chronic pandemic" (2,6,10).

These disproportionately affected communities are collectively known as the "bottom billion", which in turn refers to the approximately 1.4 billion people who live below the World Bank poverty figure of US$1.25 per day; the majority of which reside in remote rural areas and poor urban settings of low-and middle-income countries (LMICs), i.e., Sub-Saharan Africa, Asia, Latin America and the Caribbean (11). However, due to poverty, migration and climate change, high income countries such as the United States of America and some southern European countries are also experiencing a raise in prevalence of NTDs (5).

Global Response and new challenges for NTDs

After being overlooked in the *Millennium Development Goals* (MDGs) where they were categorised as "other diseases" (11), the fight for a global response to combat NTDs finally started in 2005. On that year the WHO established a strategy to combat NTDs as a group of diseases, based on a combination of five public health interventions: innovative and intensified disease management, large scale preventive treatment, integrated vector management, veterinary public health, and access to water, sanitation and hygiene (Figure 1). The first two interventions are purely medical, aiming to the curation, ease or prevention of the diseases. The other three are cross-sectoral actions aimed to stop the root causes of NTDs (5,6).

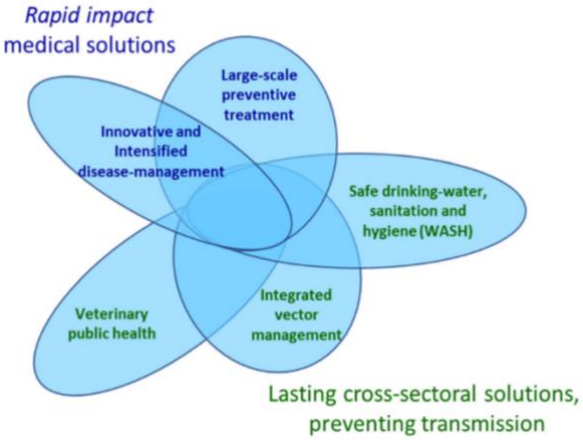


***Figure 3**. The five public interventions recommended by WHO to overcome the impact of NTDs (6)*

The intention behind focusing the attention on NTDs as a group rather than establishing disease-specific interventions, was for endemic countries to be able to afford their economic cost (6). Even if this strategy attracted an unprecedented support from the pharmaceutical sector in the form of large-scale drug donations, the implementation of the interventions ended up being very slow. Because of this, on the 30th January of 2012, the WHO released an NTD roadmap with bold targets to boost prevention, control, elimination and eradication of NTDs towards 2020. On that same day, a conference, with the name of *"Uniting to combat NTDs: ending the Neglect and Reaching the 2020 Goals",* was held in London to show support to the WHO's initiative and endorse a declaration in support of the roadmap, the London *Declaration on Neglected Tropical Diseases* (6). The Declaration ended up being widely disseminated and succeeded in placing NTDs firmly on the international global health agenda (4).

The combination of the WHO NTD roadmap and the London Declaration, together with enhanced commitment from endemic countries made a breakthrough in the management of NTDs for the first time. In 2012, 700 million people were reached with NTD treatments, representing the 37% of the 1.9 billion at risk. By 2016 the number of people reached increased to one billion which was maintained until it went up to 1.12 billion people in 2018, representing nearly 65% of people at risk. As a result, 31 countries have eliminated at least one NTD since 2012, as compared to only 13 before the London Declaration (6,10). The Declaration also instigated progress in the research and development for NTD control and management, and increased the engagement with the pharmaceutical companies (4).

NTDs have now been acknowledged as a barrier to development and listed in the United Nations Agenda for Sustainable Development, in goal 3.3 that states: "By 2030, end the epidemics of AIDS, tuberculosis, malaria and neglected tropical diseases and combat hepatitis, water-borne diseases and other communicable diseases" (2).

In 2018, the WHO began drafting a new roadmap for NTDs intended to take place from 2021 to 2030, to attain the 2030 Sustainable Development Goal (SDG) stated above. The roadmap set its targets to prevent, control, eliminate and eradicate NTDs by shifting away from single-disease vertical programs to more integrated approaches, aimed to promote coordination and collaboration. Such approaches derive from the five-pillar disease strategy outlined by WHO back in 2005 (Figure 1).

The 2030 roadmap targets are divided in two groups, the first of which reunites its overarching global targets, stating that by 2030 the aim is to:

- Reduce by 90% the number of people requiring treatment for NTDs
- Eliminate at least one NTD in 100 countries
- Eradicate two diseases (dracunculiasis and yaws)
- Reduce by 75% the DALYs related to NTDs

The second group outlines various cross-cutting targets aligned with WHO's Thirteenth General Programme of Work 2019-2023 and the SDGs (12). All the targets can be consulted in Figure 2.

***Figure 4**. Overarching global targets and cross-cutting targets of WHO's 2030 Roadmap against NTDs (12).*

Lastly it should be noted that the roadmap was drafted before the COVID-19 outbreak. The pandemic is expected to alter the outcomes for the targets previously stated. However, more research is needed in order to assess the impact that the pandemic is having on the interventions against NTDs.

Strategies to control and manage NTDs: the role of Frontline Health Workers

The term Frontline Health Worker (FHW) refers to any health worker that directly provides services to the community they assist. They include medical doctors, nurses, community health workers (CHWs), midwives and pharmacists that work in a local context to connect families and communities to the health system (13). Therefore, their role is primordial for those who don't have access to health care, especially in remote rural areas (14).

FHWs are generally based in the communities they serve and are often the first and only link between the people and the health system. Half of the global population is estimated to

live in rural areas, where they are served by less than 38% of the total nursing workforce, and by less than 25% of the desired number of physicians (13). Meanwhile, in urban settings, the populations tend to come from diverse backgrounds and ethnicities, each with its own language and set of customs (15). Therefore, by being from the communities, FHWs have the potential to deliver the lack of healthcare in rural areas, and counter the cultural differences in urban ones, making them essential to any healthcare delivery intervention, especially in LMICs, where the quality of healthcare lacks the most.

According to the WHO, NTDs can be classified in two groups: preventive chemotherapy and transmission control (PCT) NTDs and innovative and intensified disease management (IDM) NTDs (10). The first group reunites the diseases that are potentially preventable by conducting large-scale preventive chemotherapy (PC) interventions using mass drug administration (MDA), and the second can only be addressed through individual case management (CM) (5).

The role of FHWs is essential to the success, sustainability and quality of any MDA campaign, as they are the ones in charge of teaching the other participants that are not trained in healthcare delivery how to perform the drug administration, apart from administrating the drugs themselves. They are also responsible for managing and reporting adverse drug reactions (16), as well as guaranteeing community engagement.

However, FHWs face many challenges in the field. Their voices are often missing or ignored in the planning of the interventions, they often lack enough medical knowledge to perform their tasks and they usually have little access to training. They also lack the appropriate means to collect data or reach other peers or supervisors to handle situations that are beyond their skills (13). This is why many studies state that it is necessary to adopt measures to support FHWs, by giving them proper training, tending to their needs, and taking their feedback into consideration before, during and after the interventions (17).

The second group (the IDM NTDs), on the other hand, reunites the diseases that aren´t preventable. The only way to manage them is through early diagnosis and treatment, which not only requires an individual approach, but also skilled personnel (1).

Skin Neglected Tropical Diseases (sNTDs)

To talk about sNTDs, we need to go back to the WHO classification of NTDs in PCM and IDM. As it was stated before, NTDs that can beneficiate from PC have more chances of being managed at community level. IDM-NTDs on the other hand need to be managed individually through case management (CM) approaches, as they don't beneficiate from any preventive measure available. Instead, they rely on early diagnosis and treatment of every patient identified, which in turn, requires considerable resources, including trained personnel and financial support. What's more is that even if these requirements are met, the measures do not produce an immediate impact, which results in less investment in research and development to control this group of diseases (1). Despite the *66th World Health Assembly*'s call for Member

States to intensify and integrate measures against NTDs, not much progress has been achieved concerning CM-NTDs (18). Patients still require long hospital stays and high costs to get treatment (3).

A common feature found among CM-NTDs is their frequent expression though the skin, in the form of nodules, patches, oedema and ulcerations (1). Among NTDs, these cause the most stigmatization, physical impairment and disfigurement as well as psychological distress, since the manifestations are visible to the eye (3). These complications can happen even after successfully treating the underlying cause (18). All of this, paired with the lack of preventive measures available for most of them, has led the WHO to regroup these diseases under the scope of one entity i.e., skin Neglected Tropical Diseases (sNTDs).

The term sNTDs, therefore, refers to NTDs that manifest primarily as lesions on the skin. The WHO lists the following NTDs under the sNTD label: Buruli ulcer, cutaneous leishmaniasis, post-kala-azar dermal leishmaniasis, leprosy, lymphatic filariasis (lymphoedema and hydrocele), mycetoma, onchocerciasis, fungal infections, scabies and yaws (8). In this group, only lymphatic filariasis and onchocerciasis can be controlled by MDAs; the rest depend on individual CM (1).

Just like how the concept of NTDs was created to attract attention to a group of neglected diseases, the further categorisation of NTDs in sNTDs aims to obtain the same effect. By grouping them, it will be easier to fully understand the burden of disease resulting from the chronic complications of sNTDs, which will also make it easier to create a strong argument for funding research and control activities. Like this, the interventions can combine activities to counter more than one disease at a time. This is especially interesting because sNTDs are frequently co-endemic in low-resource settings, and many of the available treatments and can result beneficial for more than one condition (18).

Apart from the treatment, other strategies can also benefit from the integration of sNTDs, like the mapping of the diseases, as data collection and surveillance become more manageable. The diagnosing process can also become more efficient as the healthcare providers can detect multiple conditions in one encounter. The only condition to this statement is the need for an adequate training for health workers, not only to identify the diseases, but also to distinguish them from other non-NTD skin conditions that are much more frequent than sNTDs (10% of all consultations at peripheral healthcare level are related to common skin diseases).

In conclusion, even though there is still much to be done to achieve a decent control of these diseases, the integrated approach to sNTDs offers a great potential to reinforce health systems in resource-poor settings, and to improve skin health for millions of the world's most disadvantaged people (18).

1.1.2. Mobile Health (mHealth)

The WHO defines mobile health (mHealth) as "an area of electronic health (eHealth) dedicated to the provision of health services and information using mobile and wireless technologies such as mobile phones, tablets and Personal Digital Assistants (PDAs)" (19). With this definition we can deduce that the scope of mHealth goes beyond the offline use of mobile devices, as it also counts on mobile software and applications that may require internet connection.

Nowadays, the medical sector is starting to incorporate mobile technology into its strategies to improve the quality of healthcare delivery (20), after it has proved to bring effective, cost-effective, safe and scalable interventions. Among these new strategies, mHealth has been used to promote healthy behaviours (e.g., smoking cessation, healthy eating or monitoring one´s alcohol consumption), improve outcomes in people with long term conditions such as diabetes or cardiovascular disease, and provide remote access to effective treatment like computerised cognitive behavioural therapy for mental health and somatic problems (21).

To enhance the clinical management and epidemiological surveillance of infectious skin diseases, among other dermatology issues, we can also find various strategies based on mobile applications, where epidemiological data can be collected, access to training can be achieved and decision supporting tools can be developed to enhance health workers' capability in diagnosing (13,22,23). Another important mHealth strategy worth mentioning is teledermatology, where telecommunication technologies are used to exchange information regarding skin conditions over distances that a patient would otherwise have to travel. (22).

With all the potential mHealth has proven to have, it is no surprise to notice that its use has grown exponentially in recent years (24). Even the WHO, in its release in April 2019 recognises that mHealth is now a significant component to healthcare delivery worldwide (25). However, to focus the information to the topic of this study, in the following sections we're mainly going to focus on mobile applications when referring to mHealth, unless expressed otherwise.

mHealth limitations

Unfortunately, mHealth does not only come with advantages, in fact there are many limitations to the usage of strategies based on mobile technology.

Among the current limitations found with the usage of mobile apps for healthcare delivery is the **lack of quality standards** that guide both the creation and implementation processes of said interventions. Nowadays, more literature is emerging on the subject (21), bringing the light on the defects found in the apps considered. From these studies some conclusions can already be made, like the fact that what initially seems like the best app available on the market may turn out to be a deception after using it (26).

This last statement comes from the fact that the target users, whether they are clinicians or patients, usually only consider an app based on the data retrieved from the store outlets. This information is often limited to a short description, user reviews, and popularity statistics expressed using a star rating system (24), all of which are mostly subjective opinions and yield little or no reliable basis for bringing an app to clinical use. As a result, poor quality apps still raise to the top of the list in various app repositories (26,27). In this study, for example, 47 smoking cessation apps were taken from Apple and Android app stores in order to compare their rankings to the underlying scientific evidence found on them. The results reveal a negative correlation of quality between what the scientific evidence and the app repositories say, confirming just how little the latter can be trusted in guiding users to finding a good healthcare application (Figure 3).

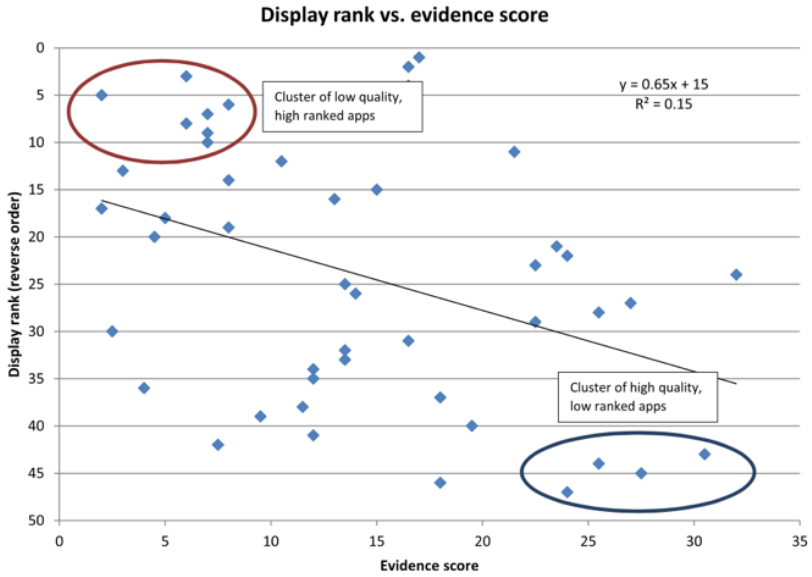


Figure 5. *Comparison of Apple iTunes App Store or Google Play store rank (vertical axis, inverse scale) with the quality of the underlying evidence on which 47 cessation apps are based. Extracted from (27).*

The fact that the apps are being developed and distributed through an unregulated free market raises other important issues that need to be tackled. Since there is no credible process for certifying apps, the **contents** provided may not necessarily be grounded in scientific evidence, which can result in being of poor quality at best, and dangerous to its users, at worst (27). Another important issue has to do with **safety**, since there are many apps that tamper with their privacy policies, either by not listing them in the app story listing page, requiring installation of the app and release of personal information before revealing it; or directly by not providing any privacy policy at all. Moreover, many policies do not protect privacy, as they fail to disclose that they share clinical information with outside parties (26).

Naturally, all of these issues raised concerns among healthcare professionals, and as a result more research is being made to indelicate how best to regulate digital healthcare. However, many of these studies face methodological limitations, which leaves very little rigorous and high-quality evidence on the efficacy and effectiveness of mHealth applications (23,28).

Fortunately, healthcare apps are now considered as medical devices, and as such they will be subjected to a new legislative, the *Regulation (EU) 2017/745 on Medical Devices*,

which will help with overcoming the limitations stated above (29). This new legislation will replace the existing one that dates back to the 1990s. It has been adopted back in May 2017, and it will be applicable within the European Union (EU) starting 26 May 2021. However, to allow manufacturers and authorities to adapt, avoiding thus any market disruption, the new rules will only start applying after a transition period of three years.

These new rules aim to modernise the current system and provide a series of standards that will force the manufacturers (in this case the app developers) to improve the quality, safety and reliability of their medical devices. The new legislation will also strengthen the transparency of information for consumers and enhance vigilance and market surveillance (30).

mHealth assessment tools

Apart from the legal measures that are being taken to counter the many limitations that healthcare apps are currently facing, the scientific community is also starting to take action. Like it was stated before, now more than ever, studies are constantly emerging on the topic, and many approaches to assess mHealth are being tested. Among these approaches we can find assessment tools made to evaluate different healthcare apps on their quality and performance.

These tools are especially important to mHealth because they offer a quick way of obtaining evidence on the different apps, as opposed to traditional research based on clinical trials. Without any doubt, clinical trials offer the highest level of evidence, but they also require considerable resources, and they take long periods of time to implement and publish. The field of mHealth cannot afford the amount of time that a clinical trial requires, as the technology aspect inherent to it is in constant evolution, and often outpaces the ability to generate and disseminate quality evidence produced by the clinical trials (28).

For example, imagine an iPhone app promoting physical activity. If its development started in 2008, the results of a randomised controlled trial on it would be published after two or three years, and by that time the iPhone operating system (iOS) would have undergone substantial changes in functionality, design and overall use. This would make the results of the evaluation feel out-of-date at best, and obsolete or non-functional at worst (21).

As a result, many authors started developing different instruments to overcome the major obstacles that are preventing mobile healthcare apps from being part of routine clinical practice. This section is meant to act as a short introduction to the most important mHealth assessment tools available to this day.

A) Mobile App Rating Scale (MARS)

The Mobile App Rating Scale (MARS) is a tool developed by a group of researchers of the *Queensland University of Technology* and *The Young and Well Cooperative Research Centre* in Australia. It was created after conducting an exhaustive literature search to identify app quality rating criteria that would then be used as the basis for the tool.

After the research was done, the investigation team concluded that their tool was going to be based on five broad categories of criteria, four of which are of objective nature: *engagement*, *functionality*, *aesthetics*, and *information quality*; and the remaining one a *subjective quality* scale. These categories were then converted into 23 scalable items that go from 1, "inadequate" to 5, "excellent". The tool also offers a section specific for the app evaluated, allowing some flexibility in the assessment so that all heath apps can be analysed in a universal yet partially personalised manner.

The aim of this tool, therefore, is to provide an objective and systematic method of rating the quality of mobile health applications, as well as acting as a checklist to the development of new ones (24).

So far, the MARS tool has proved to have high levels of internal consistency (Cronbach alpha= .90) and interrater reliability (Interclass correlation coefficient = .79, 95% CI 0.75-0.83) when applied to the independent rating of 50 mental health and well-being apps, making it a highly competent rating tool that has been praised and used by many, to a point where it is currently being translated and validated in other languages (31–33).

B) mHealth Evidence Reporting and Assessment (mERA) checklist

To improve the reporting of mHealth interventions, the *WHO mHealth Technical Evidence Review Group* developed a checklist on mHealth Evidence Reporting and Assessment (mERA). This checklist consists of 16 items that gather information on the content (what it is about), the context (where it was implemented) and the technical features (how it was implemented) of mHealth interventions.

Therefore, the main objective of the mERA checklist is to standardize the reporting on mHealth interventions by assisting authors and policymakers in synthetising high-quality interventions, and guiding journal editors in critically assessing mHealth studies. This means that it is not a tool made for evaluating the quality of the intervention in itself but rather the quality of the reporting of the intervention. With this checklist, the evidence found on mHealth is expected to be delivered in a more transparent and complete way, which will also allow better comparisons between studies, and the knowledge gaps in the field of mHealth will become easier to identify (28).

C) American Psychiatric Association (APA)'s app evaluation tool

The American Psychiatric Association (APA)'s *Smartphone Evaluation Work Group* developed an app assessment tool designed to check whether or not a healthcare app should be used or not. The basis of this tool is the non-maleficence principle, and its objective is to provide an idea of the risk-benefice balance of the app considered.

Even though it was originally designed for apps related to mental health, the authors of the tool recognised its usefulness in assessing other types of health applications.

To assess a health application, this tool considers four items: *security*, *evidence*, *ease of use* and *interoperability*. These items are ordered in a hierarchical way, which means that if an app for example, is not safe enough, there is no need to consider the rest of the items, as according to this tool it should not be used. The authors do not say, however, how many of the items should be passed in order to consider an app "good" or "useful" (34).

D) Other mHealth assessment tools

There are numerous other app assessment tools, some of which are **still in development**, like the *Interactive Mobile App Review Toolkit (IMART),* an ambitious project that aims to create a Digital Health Review Library where anyone can search for app reviews and consult them before deciding whether to download the app or not. These reviews can be made either by the user, after registering to the Library's platform, for personal use; or by qualified experts, in which case the reviews would be accessible to the public.

Other assessment tools are made to evaluate **specific type of apps**, like the *Tool for Nutrition App Quality Evaluation* (AQUEL), made specifically for food and nutrition apps; or are **outdated** compared to more recent ones, like the *Model for Assessment of Telemedicine (MAST),* created in 2009 as opposed to the MARS tool, for example, which was first established in 2015 (34).

What is sure is that **there is no ideal app assessment tool**, or one that should be used above the others. Until a gold standard is established, it is up to the evaluators to choose which tool is more pertinent for the app they want to assess.

1.1.3. mHealth and LMIC

Having read about both mHealth and the burden of NTDs- and especially sNTDs- in LMIC, it is necessary to understand the bridge that links them both to one another. On one hand, it is important to address the issue of whether or not it makes sense to implement mHealth interventions in LMIC, by evaluating whether or not the countries in question have the basic Information and Communication Technologies (ICT) and infrastructural means for it. On the other hand, it is essential to assess whether or not the LMIC, represented by their respective community of FHW, are more likely to accept and adopt such interventions.

1.1.3.1. Mobile connectivity in LMIC

With now over 3.8 billion mobile internet users worldwide, the mobile industry connects over 49% of the global population, which accounts to a raise of over 13% in less than five years, and an increase of 250 million people in just one year (Figure 4). According to the GSMA State of Mobile Internet Connectivity Report of 2020 (35), the other 51% of non-connected people around the world fall in either one of the following two categories:

- The uncovered: referring to the people who do not have access to mobile broadband network coverage. In other words, those who are subjected to a **coverage gap**.
- The covered but not connected: these are the people who live within the reach of a mobile broadband network but do not make use of mobile internet services. This situation is referred to as **usage gap**.

It is important to distinguish between these two types of gaps and understand the realities they stem from in order to understand why their percentages vary across the different regions of the planet.

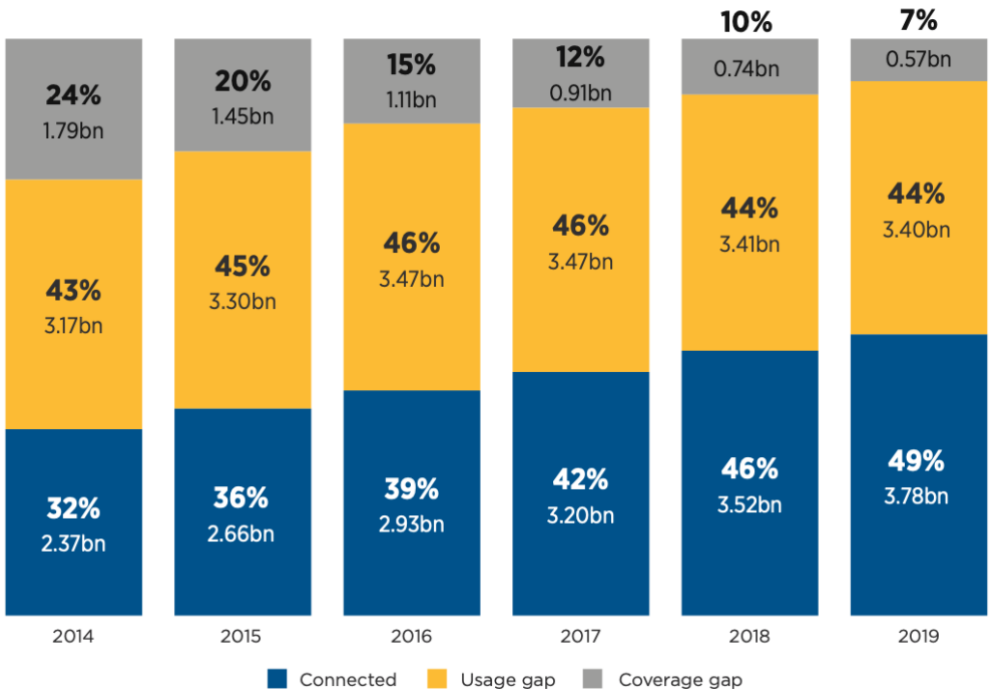


***Figure 6**. Evolution of global mobile internet connectivity, 2014–2019 (36).*

Coverage Gap

The individuals living in remote and sparsely populated areas are more susceptible to fall under the coverage gap due to the lack of implementation of mobile broadband infrastructure. This explains why the gap is significantly higher in rural areas compared to the urban ones. In 2018 across LMIC, about a quarter of the rural population was not covered by mobile broadband network, and when considering only low-income countries, the numbers climb up to half of the rural population (36).

However, in 2019 the coverage gap fell from 10% to 7%, meaning that more than 150 million people who weren't in reach of a 3G or 4G network in 2018 now are. This reduction in the coverage gap has been consistent ever since 2017 due to the advances achieved in mobile broadband deployment and adoption in rural and remote areas. More specifically, the most recent expansion in coverage is mostly owed to South Asia and Sub-Saharan Africa where we find 67% of the world´s uncovered population instead of the 75% there was in 2018 (35).

Usage Gap

While the numbers are optimistic regarding the process of coverage betterment, there is still a considerable usage gap (35). Before addressing the statistics concerning this matter, it's important to know what determines whether or not a person living in a network covered area uses mobile broadband network or not. These indicators are also referred to as usability enablers, according to the Mobile Connectivity Index (37).

The first one on the list is the *affordability* enabler, meant to assess the availability of mobile services and devices according to the level of income across the national population in each country. Then, it's important to evaluate the *consumer readiness* enabler by addressing the gender gap, the rural-urban gap, and the lack of basic skills and awareness across the population. Lastly, the *content and services* provided have to guarantee online security and relevance to the population (36).

Nowadays 3.4 billion people are living in areas covered by mobile broadband but do not use mobile internet. This usage gap is estimated to be six times larger than the coverage gap (Figure 4).

As data has become more affordable in some countries, the reality is that the majority of LMIC have still not achieved the United Nation (UN) affordability target set to make entry-level data services less than 2% of monthly income per capita by 2025 (35,38). For instance, Sub-Saharan Africa still has the highest monthly cost of 1GB as a proportion of income, and only 28% of countries within the region currently meet the UN affordability threshold. Only in South Asia, Europe and Central Asia do the majority of countries meet said 2% threshold.

Still concerning the affordability enabler, the cost of a mobile device remains a substantial problem for many of the unconnected, especially for those with the lowest income. Even though the average cost of an internet enabled device fell from 44% of monthly income in 2018 to 34% in 2019, it is still the main barrier to mobile ownership. For example, in Sub-Saharan Africa the median cost of an entry-level internet enabled headset represents more than 120% of monthly income for the 20% of the poorest population. However, new financing models such as granting loans or payment instalment plans have helped in increasing the affordability and thus, the smartphone adoption rates across the globe have also increased.

Nevertheless, the COVID-19 outbreak has the potential to reverse the recent improvements in affordability after the subsequent economic impact on the GDP, which is expected to fall by 4.9% in 2020. As a consequence, people may allocate less budget to connecting to the internet as they see their income shrink.

Under the category of consumer readiness, the first matter to tackle is whether consumers know about the benefits of mobile internet. In LMIC almost a quarter of adults were not aware of mobile internet, especially among women and rural populations. However, both

the gender gap and the rural-urban gap are showing significant improvement after going down from 17% to 8% and from 25% to 12% respectively over the course of the past three years.

Nonetheless, being aware of the technology and actually using it are two different things. Lack of literacy and digital skills has been and still is the main barrier to mobile internet adoption among people aware of mobile internet across all regions. However, this is even more accentuated in rural populations and by women, the latter reflecting how gender inequity in education hinders the development of many nations, especially across Africa.

Lastly, people who are aware of internet mobile might not think of it as relevant. Nowadays this is becoming less of a problem as more people see internet mobile as relevant to their lives. In the last years the mobile internet usage has becoming more diverse as consumers engage in a wider array of activities in their phones. For instance, the health information sought from mobile internet has doubled in the last three years according to the GSMA Intelligence Consumers in Focus Surveys of 2017, 2018 and 2019.

Nowadays, **mobile internet is the primary means of internet access in LMIC,** where in 2019, it took over 87% of all types of broadband connections, according to the International Telecommunications Union (ITU).

Lastly in this section, it is important to mention that although in this study we are evaluating a mobile app, the scope of mHealth goes beyond internet-based interventions, like telemedicine or SMS text messaging. These "internet-less" interventions can be achieved as long as the person has access to a mobile-cellular subscription.

These subscriptions are more affordable and available than broadband subscriptions, and they also require less learning experience from the users. All of this, combined with the fact that connectivity is a priority everywhere in the world, explains why there were over 8.3 billion mobile-cellular subscriptions in 2019 (exceeding the number of people living in the world) (39), and why the differences between developed and developing countries are relatively small compared to broadband connectivity (36).

However, for the first time in history, the number of subscriptions is declining, from 108 mobile-cellular subscription per 100 inhabitants in 2019 to an estimated 105 in 2020. This is probably due to the COVID-19 pandemic, although further research is needed to confirm this statement (38).

1.1.3.2. Frontline Health Workers on mHealth

The importance of FHWs in the task of providing healthcare services to the developing world is undeniable, as they are often the first and only point of contact for people who seek medical aid. These workers face many challenges daily, from the maintenance of skills and knowledge to the complexity of tasks performed in the field. Nowadays these issues have the potential to be more manageable due to the advances in ICT (40,41).

In 2013, the majority of studies from LMIC only used "internet-less" interventions, as smartphones were yet to be widely used, and only a small number of articles described the potential of smartphones in resource poor environments (23,41). In 2015 it was revealed that the number of reported mHealth projects focused on FHWs had nearly doubled in one year (40). On top of that, the release in April 2019 of the WHO guideline on digital interventions for health system strengthening, attests that mHealth is now a significant component in the delivery and support of healthcare services.

This shows that the scientific community is increasingly setting its focus on mHealth, as ICT continues to develop (see section 3.1.3.1). However, this potential, as big as it may be, needs to be corroborated by scientific evidence. That is why the aim of this section is to provide evidence on FHWs' perceptions and experiences using mHealth devices to provide healthcare services. The following findings are all extracted from a Systematic Review made by the Cochrane Library on the subject (25).

Finding 1: Most health workers perceived mHealth as more valuable than paper-based systems. Some of the advantages include convenience (40,42–44), reducing and easier correction of recording mistakes (45,46), ease of information transmission and sharing (42,43,47–49), not having to carry heavy paper stationery (45,46) and quicker access to summaries and reported data (40,42,46,50). However, there are studies that concluded that some workers preferred paper-based systems, as they perceive these as safer to store information, more flexible, and had concerns about malfunctioning technology (43,46,51,52).

Finding 2: Some health workers reported that mHealth devices raised their social statuses, made them feel more professional compared to when they used a paper-based system and increased the trust and respect they received from patients (52,53). This was in part due to the connotations, such as prestige, innovation, and trustworthiness, attached to the devices (54).

Finding 3: Health workers appreciate the fact that mobile devices allow them to connect with other health workers (42,43,45,46,49,55–61), and across various healthcare services (48,49,56,62), especially in emergency situations and when reporting disease outbreaks. Studies found real-time communication improved coordination between health workers, which resulted in better screening, diagnosing and prioritising of patients (42,43,46,49,55).

Finding 4: Apart from facilitating contact between same-level health workers, less experienced health workers value being able to receive advice and support from their seniors using mobile devices (43,47–49,55,56,59,60,62–66). These workers perceived this as improving the quality of their care and health outcomes.

Finding 5: Health workers appreciated the efficiency of mobile devices as they allowed them to provide healthcare in rural and geographically challenging contexts, saving them from having to travel there (47,48,55,56,58,60,63,65). Some workers found that they could spend more time with their patients by reducing the travel time, regardless of the geographical context (52).

Finding 6: Through mHealth, health workers were able to use treatment and screening algorithms that were loaded onto their devices (42,43,50,54,55,57,67,68). Most of them found the algorithms easy to integrate into their work routine (54,55,69). However, the perceptions reported varied from those who found the algorithms easy and useful, as they guided them through their clinical tasks and helped them improve their knowledge on medicine (42,43,54,55,67,68,70,71), to those who viewed them as too prescriptive, and were concerned that they would lose their clinical competencies by blindly following them (50,71).

Finding 7: Studies found it was important for health workers that the software and applications they had to handle were easy to use, as the training required would be simpler (42,54,55,62,72,73). Health workers also pointed out the importance of these devices in improving the quality of their care (54,62). On the contrary, if the applications were not user-friendly, they felt frustrated and reluctant to use the mobile devices (42,46,57,72).

A total of 32 studies were conducted in order to obtain the findings stated above, and all the information gathered is labelled under "moderate to high confidence in the evidence". Most of the studies were from LMIC, which is where the weight of FHWs is the heaviest.

Having gone through all of this information, it is evident that mHealth, although not exempt from having its flaws (23,43,46,57,72), has the potential to become an important asset to healthcare delivery, especially in resource poor settings (28,49,71,74).

Lastly, as essential as it is to know how FHWs react to mHealth interventions, it is also primordial they take part in the developing process and implementation of the new apps. Many studies recognise that the success of mHealth relies on knowing whether people want to and are able to use the apps offered (19,40).

There are many ways to involve app users methodologically in the design and development process of digital technology. These methods include working with users directly, through the evaluation of prototypes, or through user evaluation and testing of the finished product. An additional benefit from this is that studies found that people who were involved in the development process of an mHealth tool were more likely to experience more engagement and empowerment from using it (19).

1.1.4. WHO's "skin NTDs app"

One of the initiatives taken by the Department of Control of Neglected Tropical Diseases of the WHO, in response to the 2030 roadmap against NTDs was to draft a training guide entitled *Recognizing Neglected Tropical Diseases through changes on the skin*. This document is targeted to FHW, to help them identify the signs and symptoms of sNTDs through the cutaneous lesions they produce, as well as giving them other useful information on how to diagnose and manage common skin problems that they may encounter (75).

With the raise in connectivity experienced throughout the last decade, the WHO started exploring the potential of mHealth to widen the scope of its interventions regarding global public health issues. As a result, the Department of Control of NTDs adapted the training guide previously mentioned into an interactive mobile application named *Skin NTDs app* (76).

This application has the same purpose as the training guide it stemmed from, which is to be used as a decision supporting tool to help FHW diagnose patients with sNTDs. It is meant to be installed in the health-worker's mobile device and used during their daily clinical practise.

Apart from the information obtained from the training guide, the app offers multiple useful features like a collection of more than 100 photos, so the professionals can compare them to the lesions on their patients, epidemiological data obtained directly form the WHO database, a chat box that allows rapid exchange of information in case the professional needs a quick answer to a question, as well as the link to download the training guide in case the health worker wants to read more on the subject. The last two features require internet connection, while the rest of the app can be consulted offline.

To use it, the user mainly disposes of two methods to come to the diagnosis. The first one is to search directly for the disease they suspect in the *Skin NTDs* section of the app (Figure 5) and compare the results obtained to the signs and symptoms of the patient. The second one is meant for when the health-worker is only able to identify the lesions on the patient. In that case the user needs to go to the *Diagnosis* section of the app (Figure 5), where the four major skin signs are displayed, and for each one selected a diagnostic flow-chart unfolds to guide the user towards the likely diagnosis for their patient.

The app is currently in its second version, upgraded from the previous one on December 2020. In this new version more pictures were added, and the epidemiological data has also been upgraded. The app also offers now of a new section titled *Global Index* (Figure 5) where the user can select any country and see what sNTDs are endemic in it.

This version is currently available in English, Spanish, French and Portuguese, for mobile devices with iOS operating systems through the Apple App Store respectively, free of charge. For Android devices this new version is expected to launch in early 2021 (76).

Figure 7*. Welcome page of WHO's Skin NTDs app version 2.0*

Although this update seems promising, the developers of the app are constantly working on it to make it better so it can serve its purpose to lessen the burden of sNTDs as much as it possibly can. In order to do that, for its upcoming third version, it is agreed that *Skin NTDs app* will merge with another mobile application named *SkinApp*, developed by Netherland Leprosy Relief (NRL), an international Non-Governmental Organisation (NGO).

While *Skin NTDs app*'s strong point is its focus on sNTDs, *SkinApp* offers a wider array of diseases to select from. Apart from tackling sNTDs it also acts as a diagnosing tool for other skin problems, including common skin diseases like acne, less common diseases like leprosy, skin diseases that may lead to mortality like HIV/AIDS related skin diseases.

Both apps act the same way: they offer an interactive algorithm to support the process of diagnosis. However, *Skin NTDs app* also offers epidemiological data, and *SkinApp* contains information on how to treat the diseases. By merging these two apps together, the aim is to obtain a third app that combines all of the strengths of its two predecessors, so that the users of the new app can be equipped to face almost any dermatology patient they encounter (19).

Another future target of *Skin NTDs app* is to include a feature for data collection and surveillance, since gathering information in peripheral areas of LMIC is still very tricky.

In conclusion, this mobile app offers an opportunity to address the mismatch between the burden of skin diseases and the lack of trained personnel, especially for those who don´t have enough training in the area of dermatology or those living in peripheral areas, where the resources are scarce.

1.2. JUSTIFICATION

In response to the elevated burden of NTDs in LMIC, the WHO developed its 2030 roadmap targets (12), and in order to achieve them, many interventions are being conducted. Among these interventions, thanks to the raise in mobile and wireless connectivity in LMIC, strategies including mHealth are also being explored and taken into consideration, as they have proved to have the potential to impact even the most remote of populations (47,48,56).

With these premises in mind, the WHO' Department of Control of NTDs decided to develop a mobile app called *Skin NTDs app* as a way of fighting sNTDs by countering the lack of training that many FHWs face (13,17), hindering, thus, the proper clinical management that patients attained with these diseases should receive. This then, contributes to the burden of disease that could otherwise be lower.

However, as pertinent as *Skin NTDs app* may be, it is still a new app, launched to the market in March 2020. So far it is only in its second version, and although the app developers have ambitious plans for its future, it is clear that in order to obtain the best results, it is necessary to involve the app users into its developing process. Nowadays, this is becoming standard practise, as many authors highlight the importance of adding user's feedback to the development of any health intervention. (17,21)

Being an official mobile application of the WHO, the main concerns of this app are neither its contents nor its privacy policy, since both come from an authentic source (75). Its main limitation, as it was stated before, is the fact that the app developers know very little about how their app is being perceived, which is why the focus of this study is centred in assessing the quality of the app by obtaining the user's feedback. Given the time frame that was given to us, the practical part of this study will not be an exhaustive evaluation of the app, but rather a pilot test intended to give information to the app developers about how to perform the assessment of their app, as well as giving preliminary results about how it is performing in the field so far.

The last issue that we needed to tackle in order to perform this study, was to choose which assessment tool would evaluate best the application. Even though there are many tools to choose from, indicating just how much importance digital health evaluation is becoming (21,27,28), we ended up deciding on the MARS tool. The following points gather the reasons that justify our decision:

- The MARS is a simple app evaluating tool that focuses on reporting on the quality of the apps it evaluates, which is precisely the type of information that we are seeking to obtain in this study (24).
- It is a validated tool that numerous studies have used, and it is even being translated to other languages to further disseminate its use around the world. (33,77)
- Compared to other app rating tools it is meant for all types of health apps, and it was developed recently making it very pertinent to the evaluation of *Skin NTDs app*.

- Although it has a set of fixed categories that are impermeable to any modification, the MARS tool also offers a section specific to the app that is being assessed, so that the evaluation can be tailored even to the most specific of its features.

2. MOTIVATION AND STUDY DEVELOPMENT

In this study we will present the protocol we developed on how to assess the quality of WHO's *Skin NTDs app*, as well as the results of the pilot test we conducted by applying the protocol to a small number of participants. In order to avoid any confusion to the reader, we felt the need to clarify certain aspects about our motivation and how we developed the study.

First of all, we want to emphasize on the fact that this is **mainly a protocol** made for future replication in a long-term study. However, as the opportunity to collaborate with Dr. José Postigo, the Medical Officer from WHO's Department of Neglected Tropical Diseases in charge of the development of the application, was presented to us, we took it as a chance to take the protocol to the next level by also conducting a small pilot test to see how it performs in the field. This pilot test exercise was especially interesting, and highly appreciated by the developers of the app, because they intend to reproduce our protocol later in a long-term study. This means that the preliminary results we will be presenting are going to be useful to them in their future task.

Another reason why we decided to conduct the pilot test was due to personal motivation, as it gave us the opportunity to get introduced to the more practical side of a study, such as passing an *Ethics Committee* or having to do the statistical analysis, for example; which was something we didn't get the opportunity to do before.

Lastly, we want to clarify that as our study will be divided in two parts, an interview and a survey, due to lack of time the pilot test was only performed to the latter.

3. HYPOTHESIS

WHO's *Skin NTDs app* is a high-quality app, that serves its purpose of being a diagnosing tool to frontline health workers who need guidance in assessing patients with sNTDs. Therefore, it is expected to receive positive feedback from its users and perform well in the field.

4. OBJECTIVES

The *main objective* of this study is to assess the quality of WHO's *Skin NTDs app* as a decision supporting tool for FHW that deal with patients who suffer from sNTDs. To do so, this study aims to:

- Conduct a **survey** based on the MARS tool and an **interview** to target users of the app in order to gather their feedback
- Analyse the results of both interventions and give conclusions regarding the quality of the app and its performance on the field

As a *secondary objective*, this study also aims to give recommendations to the developers of the app on how they could ameliorate it, according to the suggestions made by its users in the survey and the interview.

THE PILOT TEST

The *main objective* of the pilot test is to take this protocol to the field to see how it performs before it could be applied in a long-term study.

As a *secondary objective*, the results of the pilot test also intend to give a vague idea on the quality of the app, although it is expected that they will be heavily biased due to the small size of the sample.

5. MATERIALS AND METHODS

5.1. STUDY DESIGN

This study will be divided in two different types of designs, as the information we seek to obtain is of two different natures, and thus, requires two different approaches in order to collect it:

- The first part will be in the form of a **cross-sectional** study, where we will conduct a survey to users of the *Skin NTDs app*, in order to obtain information about its quality as a medical digital device. Therefore, the information we want to obtain with this design is of *quantitative* nature.
- The second part will consist in conducting **semi-structured interviews** with the users of the app**,** that will allow us to collect focused, *qualitative* data.

5.2. POPULATION

The study population includes all the potential app users of *Skin NTDs app*, that either already have it or might be susceptible to download it. The term "potential app users" refers to the people for whom Skin NTDs app is targeted, meaning that they must be frontline health workers who deal with patients who suffer from skin NTDs in their daily practise.

Since the objectives of this study are the same for both parts, our target population will be the same for both study designs, meaning that a person who answers the survey can also participate in the interview.

5.3. INCLUSION AND EXCLUSION CRITERIA

INCLUSION CRITERIA

Participants of this study must:

- be frontline health workers: healthcare professionals who are in direct contact with patients.
- deal with patients who suffer from skin NTDs on a routinely basis.
- be in charge of diagnosing their patients.
- own a smartphone device (either Apple or Android).
- have downloaded the *Skin NTDs* app, and used it for at least one day, or until they feel familiar enough with its features to be able to answer questions about it.
- be informed (Annex 1) and have signed the consent from (Annex 2) in order to participate to the interview. To participate in the survey however, this criterion will not be taken into account as there will be no need for a signed consent since it will be completely anonymized.

EXCLUSION CRITERIA

Participants of this study were be excluded if:

- they download the app but do not use it for at least one day.

5.4. SAMPLE

5.4.1. STUDY SETTING

This study is designed as a complementary intervention to the Department of Control of Neglected Tropical Diseases (NTDs) of the World Health Organisation (WHO)'s initiative to create a mobile app meant for frontline health workers who deal with skin NTDs. Because these diseases are more prevalent in LMICs, this study focuses more on covering them, as they are the countries in which the app is meant to be more useful.

5.4.2. SAMPLE SELECTION

The population of this study will be selected using a respondent-driven sampling (RDS) method. Although it is a non-random sampling method, we choose RDS because it is ideal to reach less accessible or very specific groups of people, which is precisely the case for our target population. This method consists in contacting people, who will then do the same until we get the desired sample size. The sample we get by using this method will be the one charged with answering the survey.

The sample for the interviews will come from the one we obtain for the survey using RDS. This is because in its last section, the participants will be asked if they are interested in conducting an interview, and those who give a positive answer will become the sample for the interviews.

THE PILOT TEST

To obtain our sample, the chain of contacts started with Dr. José Postigo setting out word to his colleagues who work in the NTD departments of WHO's regional and field offices. He also contacted other colleagues who don't work for the WHO but are experts in NTDs. All of these people, then, contacted frontline health workers in their region/country and invited them to participate in our study if they met the inclusion and exclusion criteria. The people who accepted were then sent the survey to answer.

5.4.3. SAMPLE SIZE

In order to calculate our sample size, we used the GRANMO Calculator, Version 7.12. Since we do not have similar studies to base our sample size from, we had to calculate it from scratch. To do so, we chose to focus on getting the sample for the survey, as the participants of the interview will already be included in the first group.

Since our study population is very large and heterogeneous, it cannot be estimated easily, so we calculated our sample size as if its number was infinite. Then, we chose the variable "number of people who are going to review the app as average (3 stars) or more" to estimate the population percentage, which we expected it to be 85%, with a 95% confidence and a precision of +/- 10% units. Lastly, as the data collection was carried out online, we have supposed a dropout rate of 50%. All of this left us with a final sample size of 98 subjects.

THE PILOT TEST

By using this sampling method in the pilot test, we were able to obtain a total of 11 participants.

5.5. VARIABLES AND METHODS OF MEASUREMENT

Since this study combines two different study designs, we will get two different types of data that will have to be treated accordingly. First, the survey will give us quantitative data, which means that we will be able to identify variables to study. The interviews, on the other hand, are meant to be semi-structured, and because their analysis will be qualitative, there will be no variables to identify. Instead, the information obtained will be in the form of quotations supporting the main dimensions that will be talked about.

Although they are not variables, the following list explores the main questions that will be asked during the interviews:

- What features do you think are essential to the app? The features that you wouldn't change in the app. Why?
- What features do you think are the least useful? The features you wouldn't mind taking off the app. Why?
- What features must the app have necessarily in order for you to use it or recommend it to someone?
- Do you see the app being incorporated as a standard medical device in your workplace? Why?
- Do you use other healthcare apps in your daily practise? What about your colleagues?
- Would you like to add something else, or talk about another aspect that you feel is relevant to the app?

VARIABLES OF THE SURVEY

The survey that will be given to the participants of this study is an adaptation of the MARS questionnaire, a tool developed by Stoyanov Et Al. (24) in 2015 to assess the quality of healthcare mobile applications. This tool evaluates 23 items, grouped in five different categories: *engagement, functionality, aesthetics, information quality,* and *subjective quality*. Each MARS item is rated using a 5-point scale (1-Inadequate, 2-Poor, 3-Acceptable, 4-Good,

5-Excellent), and in the cases where an item may not be applicable to all apps, it also offers a "Not applicable" option.

Besides, each category offers a separate item, where the evaluators are asked to rate from 1 to 10 the importance of the category to their experience with the app. This last item was added by us for descriptive purposes and will not be taken into account in the MARS score.

The MARS is scored by calculating the mean scores of each of the first four categories, as well as the overall mean app quality total score. That way it is possible to compare apps on a specific category or set of categories instead of having to compare only the total score. The fact that the results are given by the mean score and not by the addition of scores is because of the "Not applicable" items that would otherwise alter the calculations. The *subjective quality* items are scored separately as a mean *subjective quality* score.

The MARS tool also offers a separate section named *App-specific*, where other questions that are specific to the app evaluated can be added, allowing, thus, a certain amount of flexibility that guarantees the coverage of all features of the app.

Lastly, we also added an initial section called *General information* intended to describe the profile of the different app evaluators.

In this section we will only specify the variables from the *General information* and the *App-specific* categories, as they are the only ones that were made and adapted by us, respectively. The categories that are inherent to the MARS, and were therefore kept the same, will only be explained briefly. For more details on them, see Annex 3.

GENERAL INFORMATION

- **Age**. Assessed by asking the evaluators to choose one of the following clusters: <25, 25-35, 36-45, 46-65 and >65, according to their age on the day they answer the survey.
- **Gender**. Male or female.
- **Type of health worker**. Three main options are considered for this item: medical doctor, nurse and community health worker, as well as a fourth option labelled "other", where the evaluator can add a different answer if their occupation doesn´t fall under any of the ones available.
- **Frequency in which they come across patients with skin NTDs**. Four options are given: Rarely (<1 case per month), occasionally (1-3 case per month), frequently (4-6 case per month), usually (>6 case per month).
- **Working experience in Dermatology**. Evaluators are given three choices according to their impressions on how much training and experience in Dermatology they have. The options are: trained and experienced; not trained, but have some experience with Dermatology patients; and not trained and inexperienced.
- **Work environment**. Rural or urban.
- Evaluators are also asked if they **work for an NGO**. The options given are yes/no.
- **Knowledge on mobile technology** Three options are given: high, medium or low.
- **Internet connectivity**. Evaluators are asked how often they have internet connection in their phone. The answers available are: all the time; most of the time; sometimes, when I need it; and never.
- **Country of residence**. Evaluator are asked to type down the answer.

- **Languages**. Evaluators are asked to type down the languages they speak.

APP-SPECIFIC

- **App discovery**. Evaluators are asked about where they first heard about the app. Three options are given: the email about the survey, surfing in the app store, or from a colleague; as well as a fourth option, labelled "other", for those who come across *Skin NTDs app* somewhere else.
- **Time using the app**. Evaluators are asked how long they had the app**.** Five options are given to answer the question: days (<7 days), weeks (<4 weeks), 1-2 months, 3-4 months or more.
- **Usage frequency**. Evaluators are asked how often the used the app since downloading it. Four options are given: rarely (once or twice), occasionally (less than five times), frequently (every other day), or usually (almost every time they visit a patient with skin conditions).
- **New features requiring internet connection**. Evaluators are asked how they would perceive it if new features that require internet connection are added to the app. Five possible answers are given: I mind it a lot, I hardly never have internet connection on my phone; I mind it, most of the time I don´t have internet connection on my phone; I don´t care, sometimes I have internet connection on my phone; I'm up for it, most of the time I have internet connection on my phone; and I think it would be great, I always have internet connection on my phone.
- **Increase of knowledge using the app**. Evaluators are asked if the app is likely to increase their knowledge on skin NTDs. To answer this question, they have to choose a number from one to five, where 1 is *strongly disagree* and 5 is *strongly agree*.
- **Usefulness**. Evaluators of the app are asked if the app is likely to help them come up faster and more efficiently with a diagnosis on skin NTDs. To answer this question, they have to choose a number from one to five, where 1 is *strongly disagree* and 5 is *strongly agree*.
- **Translation feature**. Evaluators are asked if they want the app to be translated to other languages. The options given are yes/no.
- **Translation languages**. If the answer to the previous question is "yes", the evaluators are asked to specify which languages they want the app to be translated into.
- **sNTDs surveillance feature**. Evaluators are asked if they want the app to be equipped with a skin NTDs surveillance feature. The options given are yes/no.
- **Patient record feature**. Evaluators are asked if they want the app to offer a section where they can save data and keep record of the patients entered. The options given are yes/no.
- **Desktop version.** Evaluators are asked if they are interested in a desktop version of the app. The options given are yes/no.

CATEGORIES INHERENT TO THE MARS

- **Engagement**. Contains a total of 5 items that evaluate the entertainment, interest, customisation, interactivity and target group of the app.

- **Functionality**. Contains a total of 4 items that evaluate performance, ease of use, navigation and gestural design.
- **Aesthetics**. Contains a total of 3 items that evaluate the layout, graphics, and visual appeal of the app.
- **Information**. Contains a total of 7 items that evaluate the accuracy of the app description, the goals, the quality of information, the quantity of information, the visual information, the credibility and the evidence base of the app.
- **Subjective quality**. Contains a total of 4 items that evaluate how recommendable the app is, how many times the evaluators would use it in the next 12 months, if they would pay for it and its overall star-rating.

SUGGESTIONS

At the end of the survey, the evaluators are asked to leave suggestions about the app, if they had any.

"BEFORE YOU LEAVE" SECTION

This last section is added to inform the evaluators that we have the intention of conducting interviews to obtain more information on the quality of the app. We ask them if they are interested in participating in it. The options given are yes/no.

We also ask them if they want to see the results of the survey once we have them. The options given to this item are also yes/no.

If the evaluator answers yes to one of the previous questions, they are asked to leave a way of contacting them.

THE PILOT TEST

In the pilot test, we used the adapted MARS tool as we explain it in this section. However, we also had to translate the questionnaire to Portuguese, as there were participants who had difficulties understanding English. Even though it was not ideal, the translation was made using the "google translate" tool. Since it is not a validated translation, we consider this a limitation to the pilot test (See section 10.3).

5.6. DATA COLLECTION AND STUDY CIRCUIT

In order to obtain the data necessary to achieve the objectives of this study, we will have to follow a specific circuit, which is explained below:

1) First, the protocol will have to be submitted and approved by an *Ethics Committee* before the start of the study.
2) Then, the survey will have to be drafted and ready to be sent to the participants, whether it is digitally or on paper.

3) Then, the sample selection can begin (see Section .4.2), until the required sample size is obtained.

4) As soon as a participant enters the study, the survey will be sent to them as well as the details about the procedures. This information includes: the links to download the app, a recommended time of usage of the app before answering the survey, and the information about the interviews. It is also important to specify to the participants that it is in the last section of the survey that they will have to answer if they wish to participate in the interviews or no.

5) Then a separate email will be sent to those who wish to participate in the interviews in order to set the time and place for it. That email will also have to contain the information sheet (Annex 1) and the consent form (Annex 2) which the participants will have to read and sign, respectively, before entering this phase of the study.

6) During the data collection phase of the study, the investigators will be able to send as many reminders to the participants as they see fit.

THE PILOT TEST

The circuit we used for the pilot test is the following:

- *27/11/20*: We presented the protocol of the pilot test to the *Ethics Committee* of the Universitat Oberta de Catalunya (UOC).
- *9/12/20*: We obtained the approval from the *Ethics Committee* (Annex 4).
- *9/12/20 to 22/12/20*: We started drafting the survey, taking the MARS tool and adapting it to the *Skin NTDs app* by adding the *general information* and *app-specific* sections. Then, we created a Google Forms survey with all the items obtained. During that time, we also began the sampling process (see Section .4.2) in order to recruit participants who were willing to download the app, use it and review it. The survey can be consulted in Annex 3, or using the link *https://forms.gle/vPiWEnX6UQTahtbX7*.
- *23/12/20 to 11/1/21*: During this period, the sampling process continued, but we also started receiving answers from volunteers who were willing to participate in the study. Since all of them met the inclusion and exclusion criteria, we contacted them back with the following information:
    - The links to download the app from the Apple Store and Play Store.
    - The link to the survey.
    - We gave them a deadline to answer the survey, which was 17/1/21.
    - We asked them to use the app for a few days before answering the survey (we recommended at least one week of use, if the deadline allowed it).
    - We also informed them about the interviews, indicating that in the end of the survey they would be asked if they were willing to participate in it or not. If their answer was positive, they were asked to leave a way of contacting them.
- *13/1/21*: Translation of the adapted MARS tool to Portuguese.
- *12/1/21*: We sent an email titled “Gentle reminder” to remind the participants about the survey and increase the response rate.

- *17/1/21*: Day of the deadline. We had successfully contacted 37 potential participants and gotten 11 replies, after which we proceeded with the statistical analysis before concluding the pilot test.

5.7. STATISTICAL ANALYSIS

QUANITITATIVE ANALYSIS

A quantitative analysis will be performed to the information obtained from the surveys.

In the **univariate analysis**, the quantitative variables will be described using central tendency measures. These measures are the mean +/- standard deviation, if the variables follow a normal distribution, and the median (interquartile range Q3-Q1) if they do not follow it. For the qualitative or categorical variables, the results will be expressed in percentages.

In the **bivariate analysis**, to compare categorical variables a chi-square test (χ^2) will be used. The quantitative variables will be compared using a Student's t-test.

For the **multivariate analysis,** a logistic regression analysis will be performed in order to add the covariates that could skew the main association we want to analyze. We will assume a confidence interval of 95% and P value <0.05 to consider that there is a significance difference.

THE PILOT TEST

Since the sample size of the pilot test was small (n=11), the variables did not follow a normal distribution. This is why in the univariate analysis we also used the median, instead of just the mean, and in the bivariate analysis, a Mann-Whitney U test and a Median test instead of a Student's t-test ($p<0.05$ for both tests). For the categorical variables, the analysis remained the same.

The pilot test did not have a multivariate analysis, as we did not think it would be useful considering the size of its sample and the limitation that come with it.

QUALITATIVE ANALYSIS

A qualitative analysis will be performed to the information obtained from the interviews.

The interviews will be online and have a duration of 25 to 40 minutes. They will be audio recorded, with the participants' permission, and professionally transcribed. Then, selected quotes will be sent back to the participants for their approval. After that, a software, Atlas.Ti Version 7, will be used in order to code the information obtained according to the different dimensions explored during the interventions, with each inquiry corresponding to at least one code. Codes will be then clustered in categories and developed further to capture the text's meaning.

6. ETHICAL CONSIDERATIONS

This study will be conducted according to the ethical principles established by the World Medical Association (WMA) in the *Declaration of Helsinki of Ethical Principles for Medical Research Involving Human Subjects*. The research protocol will be presented and approved by an *Ethics Committee* before the study begins.

Following the "*Ley Orgánica 15/1999 de Protección de Datos de Carácter Personal"* and the *Regulation (EU) 2016/679 of the European Parliament and of the Council of 27 April 2016 on the protection of natural persons with regard of the processing of personal data and on the free movement of such data*, any identifiable information that will be collected about the participants in connection with this study will remain confidential, and all the data will be analysed anonymously.

All participants will be presented with an information sheet (Annex 1) and a consent form (Annex 2) that they have to sign before partaking in the interview. Since the survey is anonymous and does not require sharing of personal information, there will be no need for an information sheet or a consent form. The researchers will also inform the interviewees personally about their rights before the start of the interviews.

THE PILOT TEST

The research protocol has been presented and approved by the *Ethics Committee* of the UOC before the beginning of the study. No conflicts of interest were declared.

7. RESULTS

Description of the population

The population of our pilot study is described in Table 2.

Table 8. *Demographical data of the study population.*

		N (11)	Percent %
Age	25-35	6	54,5
	36-45	2	18,2
	46-65	2	18,2
	> 65	1	9,1
Gender	Male	8	72,7
	Female	3	27,3
Healthcare Professional profile	Medical doctor	8	72,7
	Nurse	1	9,1
	Other	2	18,2
Frequency in which you come across patients with sNTDs	Rarely	1	9,1
	Occasionally	2	18,2
	Frequently	4	36,4
	Usually	4	36,4
Working Experience in Dermatology	Trained and experienced	8	72,7
	Not trained but experienced	3	27,3
Work Environment	Rural	4	36,4
	Urban	7	63,6
Work for an NGO	Yes	2	18,2
	No	9	81,8
Knowledge on Mobile Technology	High	7	63,6
	Medium	3	27,3
	Low	1	9,1
Internet Connectivity	All the time	4	36,4
	Most of the time	4	36,4
	Sometimes	3	27,3

The main profile of our population are male individuals, aged between 25-35 years. Most of the participants (72,7%) are physicians, have received training and are experienced in the area of Dermatology.

Results of the sections intrinsic to the MARS tool

To obtain the results of the sections of the MARS tool, we calculated the mean +/- standard deviation, median and percentiles (p25, p50 and p 75), all of which are detailed in Table 3.

Table 9. *Results of the sections inherent to the MARS tool.*

		Engagement	Functionality	Aesthetics	Information	Subjective quality
Mean		3,20	3,97	3,90	3,87	3,09
Median		3,20	4,00	3,66	3,83	3,25
Std. Deviation		,55	,57	,53	,59	,70
Minimum		2,20	2,75	3,33	3,00	2,00
Maximum		4,20	5,00	5,00	5,00	4,00
Percentiles	25	2,80	3,75	3,66	3,50	2,75
	50	3,20	4,00	3,66	3,83	3,25
	75	3,60	4,50	4,33	4,33	3,75

The total score of the MARS tool is calculated using the total mean score of every section except the *Subjective quality* section, which is usually specified apart. This makes the score of the overall quality of *Skin NTDs app* a total of 3.74 in the objective categories (*engagement*, *functionality*, *aesthetics* and *information*) and 3.09 in the *subjective quality* section. Out of all the categories, *Skin NTDs app* received the best score in the *functionality* section.

The median was also used to describe the results since they were not expected to follow a normal distribution.

The following box and whisker plots represent the mean of every individual category of the MARS (Figures 6 to 10).

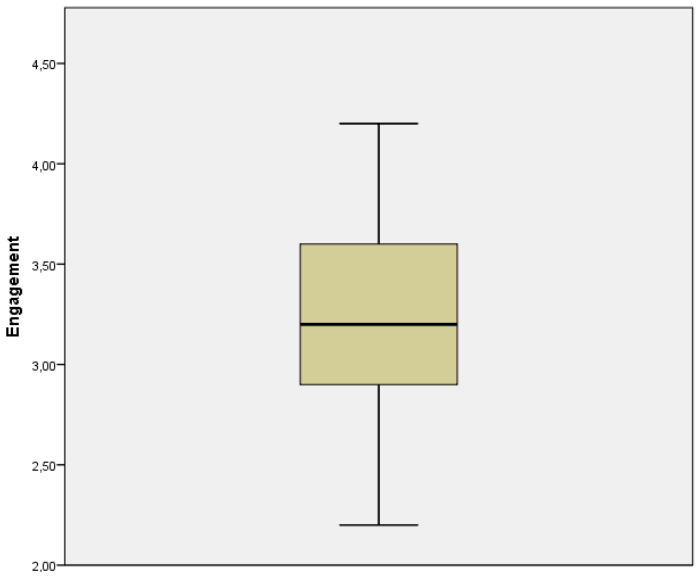


Figure 8. *Box and whisker plot for the engagement mean result for Skin NTDs app.*

Figure 9. *Box and whisker plot for the functionality mean result for Skin NTDs app.*

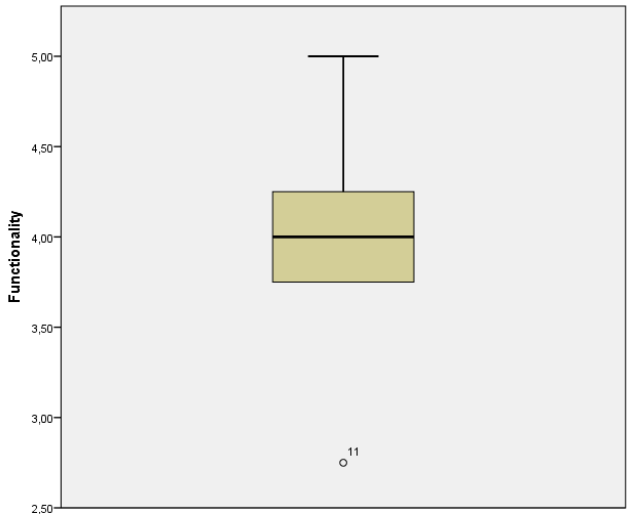


Figure 10. *Box and whisker plot for the aesthetics mean result for Skin NTDs app.*

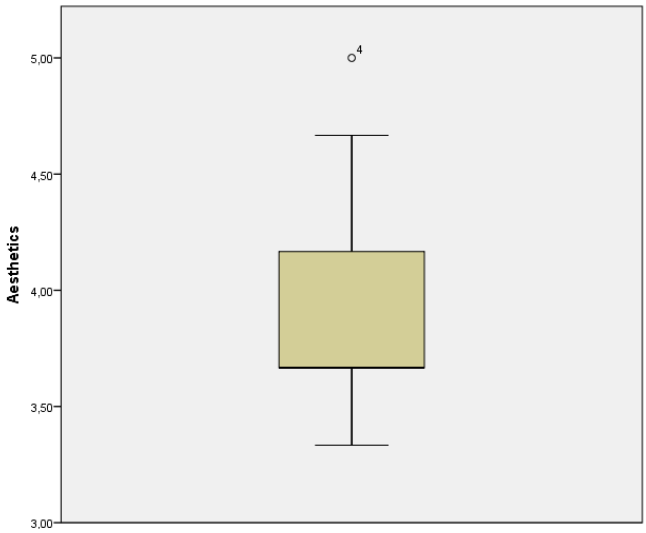


Figure 11. *Box and whisker plot for the information mean result for Skin NTDs app.*

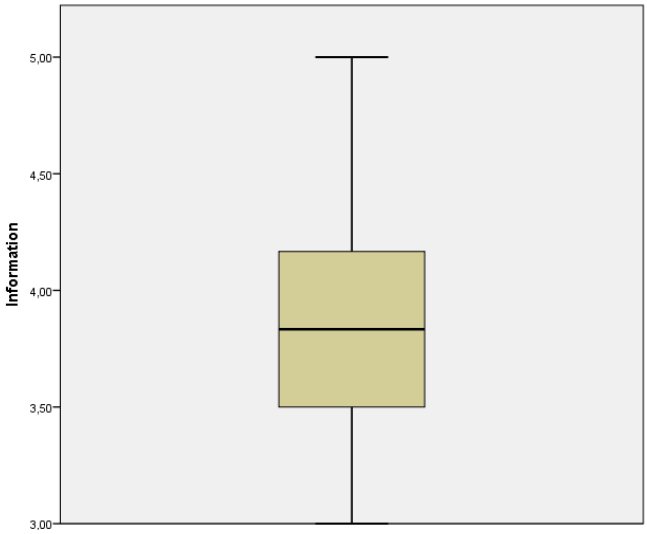
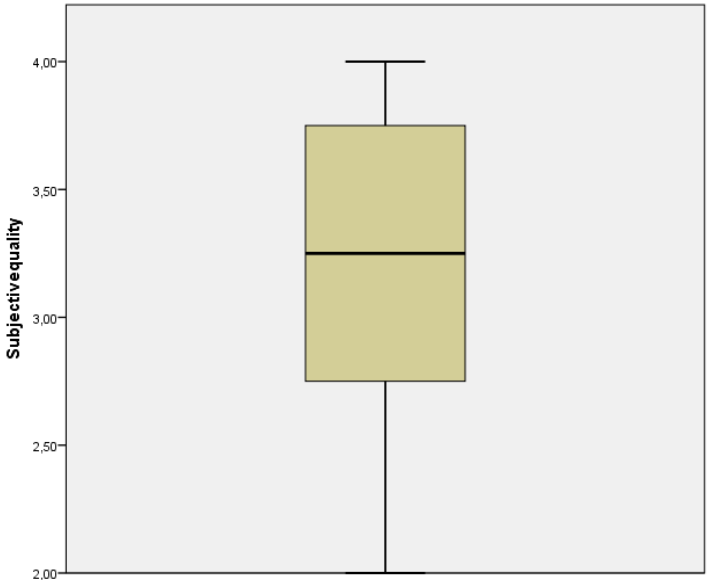


Figure 12. *Box and whisker plot for the subjective quality mean result for Skin NTDs app.*



Results of the subgroup analysis according to the gender

In Table 4 we find the data stratified in genders. The results were compared using a Mann-Whitney U test and a Median test, but no significant differences were found, as the p value for all the variables compared was >0.05.

Table 10. *Stratified results by genders.*

GENDER		Engagement	Functionality	Aesthetics	Information	Subjective quality
Male	Mean	3,22	4,03	3,91	3,83	3,06
	Median	3,30	4,00	3,66	3,83	3,00
	Std. Deviation	,62	,31	,52	,52	,63
Female	Mean	3,13	3,83	3,88	4,00	3,16
	Median	3,00	3,75	3,66	3,50	3,75
	Std. Deviation	,41	1,12	,69	,86	1,01

Results of the subgroup analysis according to the level of experience and training in Dermatology

In Table 5 we find the data stratified according to the level of experience and training that the participants had in the area of Dermatology. The results were compared using a Mann-Whitney U test and a Median test, but no significant differences were found, as the p value for all the variables compared was >0.05.

Table 11. *Stratified results according to the working experience in Dermatology.*

Working experiennce in Dermatology		Engagement	Functionality	Aesthetics	Information	Subjective quality
Trained and experienced	Mean	3,17	4,15	4,00	3,85	2,90
	Median	3,20	4,00	3,83	3,75	2,75

	Std. Deviation	,64	,46	,61	,66	,73
Not trained but experienced	Mean	3,26	3,50	3,66	3,94	3,58
	Median	3,20	3,75	3,66	4,00	3,75
	Std. Deviation	,30	,66	,00	,41	,28

Results concerning the new features of the app

In the survey, the evaluators were asked their opinion on adding new features to the app. In Table 6 we find the details of the answers to those items of the survey, all of which were extracted from the *app specific* section.

Table 12. *Results on the new features of the app.*

		N (11)	Percent %
Translation Feature	Yes	9	81,8
	No	2	18,2
sNTDs Surveillance Feature	Yes	11	100
	No	0	0
Patient Record Feature	Yes	9	81,8
	No	2	18,2
Desktop Version	Yes	9	81,8
	No	2	18,2

The main languages that were asked for the app to be translated in were Amharic (n=2; 18,2%) and Nepali (n=2; 18,2%).

8. DISCUSSION

The main objective of this pilot test was to determine the feasibility of our protocol regarding the assessment of the quality of WHO's *Skin NTDs app*. In this section we are going to discuss the main findings we gathered form performing it, putting special emphasis on the limitations we faced in order to counter them in future replications of the protocol.

8.1. Feasibility of the protocol

The first finding we want to discuss is the lack of difficulties we had to follow the steps of the protocol, as its circuit was relatively simple and easy to understand. The protocol also had the strong point of not requiring many resources for its execution. One or two investigators were enough to be in charge of the whole project and, as it can be done online, no material costs were needed in order to reproduce it.

The pilot test we're presenting has successfully responded to the objectives of the protocol. By following it, we obtained a sample so tailored to the needs of the study that there were no participants we had to let go of, because they didn't meet the inclusion or exclusion criteria.

The survey adapted from the MARS tool was easily understood by those who had a basic level of English. The results we obtained from it effectively reported on the quality of *Skin NTDs app*. Any limitations that have to do with the quality of the results did not come from the protocol itself, but rather from the challenges we faced during the implementation of the pilot test (see section 10.3).

However, it is important to note that the number of participants, and thus, the quality of the results obtained are directly proportional to the efforts made by the investigation team. This, in turn has a heavy influence on the time required to obtain the results. All of this is due to the low response rate associated with the types of studies that depend on the results of a survey, especially if it is performed online. In the case of our pilot test, with the first email we sent, we had contacted a total of 37 potential participants, but after sending them the details about the survey, we ended up getting only 2 responses, making the response rate a small 5,4%. Nonetheless, after sending a reminder to the participants recruited, we obtained 9 more replies, which made the response rate climb up to 29,7%, with a total of 11 final replies, obtained during the period of time from 9/12/2020 to 17/1/21.

This means that investigators have to pay attention to the response rate constantly and send as many reminders as they see fit in order to obtain a steady flux of replies. If the investigators do not maintain close contact with the people contacted, the duration of the sampling will last longer than if they do otherwise. This finding should therefore be taken in consideration when planning the study. However, we do not think it alters the feasibility of the protocol, since this one does not specify a required amount of time for each step of its circuit, leaving it up to the investigators to decide.

Lastly, although the pilot test only covers the survey part of the protocol, this one also calls for a second part consisting of semi-structured interviews conducted to the same population as the first, so that both study designs can complement each other in their task of evaluating *Skin NTDs app*. However, in this section we cannot discuss the feasibility of the second part as we did not have enough time to conduct any semi-structured interview. The only thing we can argument is the expected sample for the interviews, since it is something we were able to assess. As we previously explained, in the last section of the survey we asked the participants if they were interested in conducting an interview. Out of the 11 survey responses we got, 5 participants gave a positive answer to the question, which accounted for the 45,5%.

8.2. Results of the adapted MARS tool

Since the main objective of our pilot test was to discuss the feasibility of the protocol, the results of the survey imported very little, as the size of our sample was not big enough to be representative of the population we wanted to study (n= 11, whereas the optimal sample size according to the protocol, section 7.4.3, was 98). However, for the sake of completing the exercise, and giving an initial idea on the quality of the app (the pilot test's *secondary objective*), in Section 9 we presented what we considered to be the most important results obtained from the survey.

In future reproductions of this study, when the sample size acquired becomes significative, it must be noted that the items of the *adapted MARS questionnaire* should be analysed more thoroughly in order to obtain pertinent conclusions about the quality of the app.

Since we did not intend on presenting such conclusions, our analysis only consisted in determining the total score of Skin NTDs app according to the MARS tool, as well as making comparisons between the groups that we thought would be more interesting to comment i.e., *gender* and *experience in Dermatology*. In the end, the total mean score of the overall quality of *Skin NTDs app* was 3.74 in the objective categories (*engagement*, *functionality*, *aesthetics* and *information*) and 3.09 in the *subjective quality* category. This score, although not excellent, was still above average, and if we considered it as being representative, it would mean that the app is ok, but can still become better. This result was already expected as *Skin NTDs app* is still in its development phase, which, on the other hand explains why a future study based on our protocol is so essential in order to obtain the feedback necessary for making the right improvements in the iteration process to develop the app.

Lastly, we also performed a descriptive analysis that can be consulted in the Annex 5, where the reader can find the details about all the separate items of the adapted MARS questionnaire that were not included in section 9.

8.3. Limitations of the pilot test

This pilot test presents many limitations that need to be discussed. The first one is intrinsic to the protocol, as it has to do with the sampling method it requires, RDS. This method, as it was previously mentioned in section 7.4.2, allows investigators to obtain a sample from

groups of people that are very specific or hard to reach, both of which are present in our population. Besides, as it is a non-random method, it generates a considerable *selection bias* that alters the representativity of the population intended to be analysed.

In the pilot test, we ended up getting several inequitably distributed groups, especially in the *gender* and *dermatology experience* categories, which are essential to the analysis of this study. As a result, some of its conclusions may be altered or even false. Nonetheless, the protocol still asked for this method, as it was the only possible way to reach our population. However, with a big enough sample, this bias should be controlled.

The other limitations we will be discussing have to do with the implementation of the pilot test, rather than the protocol itself. The first one is due to the lack of time we had for the execution of the protocol, as our pilot test only covered its first part, the survey. This limits the extent in which we could review the feasibility of the protocol.

The second limitation has to do with the non-official translation to Portuguese we did to the *adapted MARS questionnaire* in order to recruit more participants. Since it was not validated, the survey in Portuguese generated an *information bias*. This is because the questions in Portuguese may not have had the same meaning than the ones in the original, which might have led to confusing the participants and causing errors in the final results. Instead, the translation should have been validated using a standardized methodology especially designed for the certification of questionnaires.

Nonetheless, this translation was necessary as there was a group of people from Mozambique who did not understand enough English to answer the original survey. In the end, the number of answers we received from the Portuguese survey was 2.

Lastly in this section is probably the biggest limitation that this pilot study comes with i.e., the sample size. Like we previously mentioned in section 6, the objectives of the pilot test were established taking in consideration the limited amount of time we had to accomplish them. As a result, our sample size turned out to be relatively small (n=11, whereas the ideal sample size calculated in the protocol is 98). However, by considering the assessment of the app a secondary objective, this limitation loses some of its weight, as the results obtained from the survey are only used to give a vague idea on the quality of the app, and are not to be taken in consideration when seriously describing it. Instead, we chose to focus on the applicability of the protocol, which we were able to assess comfortably with the size of our sample.

9. CONCLUSIONS

The pilot test was deemed successful in proving the feasibility of the protocol. Although it had many limitations, the results obtained were considered crucial for the betterment of *Skin NTDs app* by its developers. This is why it was decided that the study will keep on going, this time on a larger scale, by expanding the sample size and performing the qualitative part as well. The investigation team will be kept the same, in collaboration with Dr. José Postigo again.

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ANNEXES

ANNEX 1

INFORMATION SHEET FOR THE INTERVIEWEE

Pilot test to assess the quality of performance of the Skin NTDs app: a diagnosing tool developed by the WHO for Neglected Tropical Diseases that primarily affect the skin.

1. General information

You are being invited to participate in the second part of our pilot test, where you will be asked several questions about your experience with the Skin NTDs app, in the form of a semi-structured interview.

The study is being conducted by Asmae Frej, last year medical student from the University of Gerona, in collaboration with Dra. Carme Carrión, principal investigator of eHealth lab Research Group of the Universitat Oberta de Catalonia (UOC) and Dr. José Postigo, medical officer of the department of Control of Neglected Tropical Diseases (NTD) of the World Health Organisation (WHO). This study has been approved by the Ethics Committee of the Universitat Oberta de Catalunya.

Please take time to read the following information carefully and discuss it with others if you wish. Feel free to ask us if there is anything that is not clear, or if you would like to receive more information (you will find our contact details at the end of the text). Take time to decide whether or not you wish to participate.

2. "What is the purpose of this study?"

The aim of this study is to conduct a pilot test to assess the quality of the recently launched mobile application Skin NTDs app. This app is being developed by the WHO, with the purpose of aiding frontline health workers (especially those located in resource poor settings) to come up with diagnoses when dealing with patients who suffer from Neglected Tropical Diseases that primarily affect the skin.

With this study we want to obtain information about how the app performs in the field, whether or not it is helpful to its users, if it needs changes, and what those changes could be. This information can only be obtained from the target users of the app, which is why your participation is precious to us.

The importance of this study resides in its capacity to provide feedback to the developers of the app, so that they can make better versions that would eventually allow it to achieve its goal of being a highly performant diagnosing tool.

3. "Why have I been invited to participate in this study?"

You are eligible to participate in this study because you have the profile required for using Skin NTDs app. As we previously mentioned, the target audience for this app are frontline health workers who deal with patients who suffer from Skin NTDs. In order to fill the survey (which was the first part of our study) you were required to download the app and use it for at least one week (if the deadline allowed it). Since you gave us your contact through the survey, we conclude that you are indeed familiar with our app, and that makes you the perfect candidate for our interview.

4. "What if I don't want to take part in this study, or if I want to withdraw later?"

Participation in this study is voluntary. It is completely up to you whether or not you want to take part in it. You can decide to withdraw any time without having to give a reason. If you do so, we will automatically discard all the information you have given us.

5. "How will my confidentiality be protected?"

Following the "*Ley Orgánica 15/1999"* and the *Regulation (EU) 2016/679 of the European Parliament and of the Council of 27 April 2016 on the protection of natural persons with regard of the processing of personal data and on the free movement of such data*, any identifiable information that is collected about you in connection with this study will remain confidential, and will be disclosed only with your permission, or except as required by law. Only the researchers named above, and the Ethics Committee can have access to your details.

6. "What does this study involve?"

If you agree to join us in this study, you will be asked to participate in a semi-structured interview, as mentioned above. The interview will consist in a short teleconference (with or without video, according to your preferences), where you will be asked to give your opinion on Skin NTDs app, by answering a series of questions that we have prepared. In order to collect the information thoroughly, the interview will be recorded. However, once the data is processed, all the recordings obtained in this study will be deleted.

7. "Will I benefit from the study?"

With the information we receive from all the feedback we get from this study, the developers of the Skin NTDs app will be more aware of the needs of its users. That means that the app will be able to serve better its purpose; and ultimately, if you keep on using it, it could help you in your diagnosing task, when dealing with patients that are affected by Skin NTDs.

10. "Will taking part in this study cost my anything, and will I be paid?"

Participation in this study will not cost you anything, nor it will retribute you for taking part in it.

9. "What happens with the results?"

The results of this study will be published only for research issues. Your opinion and feedback will be completely anonymized.

If you wish, the results of the study can be provided to you.

10. "Who should I contact if I have inquiries or if I have concerns about the conduct of this study?"

This study has been approved by the Ethics Committee of the Universitat Oberta de Catalunya. For any concern you may have, you can contact them at comite_etica@uoc.edu.

If you wish to take part in this study, please give us your permission by filling the consent form you will find in the next page. Thank you for considering this study!

If you have any inquiries or if you want additional information, please contact Asmae Frej at asmae.frej@gmail.com

ANNEX 2

CONSENT FORM

1. I confirm that I have read and understood the information about the project as provided in the INFORMATION SHEET.

2. I confirm that I have received enough information about the study.

3. I confirm that I have had the opportunity to ask questions, and the researcher has answered any questions about the study to my satisfaction.

4. I understand that my participation is voluntary and that I am free to withdraw from the project at any time, without having to give a reason and without consequences.

5. I understand that I can withdraw my data from the study at any time.

- Name and surname: _____
- Date: _____

According to the *Regulation (EU) 2016/679 of the European Parliament and of the Council of 27 April 2016 on the protection of natural persons with regard of the processing of personal data and on the free movement of such data*, I hereby declare to be informed of my rights, and agree to take part in the study mentioned in this document.

☐ Yes, I AGREE to take part in this study

☐ No, I REFUSE to take part in this study

Signature of the participant:

ANNEX 3

Skin NTDs App-ADAPTED MARS TOOL

Thank you for accepting to participate in this survey. All the information given will be treated according to the current legislation on data protection, preserving full anonymity and confidentiality; and used for the sole purpose of obtaining scientific evidence.

You will be presented with a series of questions that will help us gather as much information about your experience using our Skin NTDs App. Every question (except the "general information" and the "app-specific" sections) is scaled from "1. Inadequate" to "5. Excellent". We ask you to read the questions carefully and rate every item by marking the number that most accurately represents the quality of the app component you are evaluating, according to your user's experience with the app.

GENERAL INFORMATION:

Please state the following:

a) Age:
   - ☐ <25
   - ☐ 26-35
   - ☐ 36-45
   - ☐ 46-65
   - ☐ >65

b) Gender:
   - ☐ Male
   - ☐ Female

c) Type of Health Worker:
   - ☐ Medical doctor
   - ☐ Nurse
   - ☐ Clinical assistant
   - ☐ Other: _____

d) How often do you come across patients with skin NTDs (Neglected Tropical Diseases that have a cutaneous expression)?
   - ☐ Rarely. < 1 case per month
   - ☐ Occasionally. From 1- 3 cases per month
   - ☐ Frequently. From 4- 6 cases per month
   - ☐ Usually. > 6 cases per month

e) Do you work for an NGO?
   - ☐ Yes
   - ☐ No

f) Country of residence: _____

g) What languages you speak: _____

h) Do you have working experience in Dermatology
   - ☐ I am trained in Dermatology or have a lot of experience with Dermatology patients
   - ☐ I am not trained in Dermatology but I have had some experience with Dermatology patients
   - ☐ I am not trained in Dermatology and I have no experience with Dermatology patients

i) What type of environment do you work in?
   - ☐ I work in a RURAL environment
   - ☐ I work in an URBAN environment

j) How knowledgeable are you in mobile technology?
   - ☐ High knowledge: I am an expert using my phone. It is a big part of my daily life
   - ☐ Medium knowledge: I know how to use my phone. Sometimes I use it during the day
   - ☐ Low knowledge: I don't know how to use my phone. I hardly ever use it during the day

k) How often do you have internet connection in your phone?
   - ☐ All the time
   - ☐ Most of the time
   - ☐ Sometimes, when I need it
   - ☐ Never

APP QUALITY RATINGS:

SECTION A*:* ENGAGEMENT

1 Entertainment**. Is the app fun/ entertaining to use?**

1. Dull, not fun or entertaining at all
2. Mostly boring
3. Ok, fun enough to entertain for a brief time (less than 5 minutes)
4. Moderately fun and entertaining, would entertain user for some time (5 to 10 minutes)
5. Highly entertaining and fun, would stimulate repeat use

2 Interest. **Is the app interesting to use? Does it use any strategies to increase engagement by presenting its content in an interesting way?**

1. Not interesting at all
2. Mostly uninteresting

3. Ok, neither interesting nor uninteresting; would engage user for a brief time (less than 5 minutes)
4. Moderately interesting; would engage user for some time (5 to 10 minutes)
5. Very interesting, would engage user in repeat use

3 Customisation**. Does the app provide all necessary settings/ preferences for app features (e.g., sound, content, notifications, etc.)?**

1. Does not allow any customisation or requires setting to be input every time
2. Allows insufficient customisation
3. Allows basic customisation to function adequately
4. Allows numerus options for customisation
5. Allows complete tailoring to the individual's preferences, retains all settings

4 Interactivity. **Does it allow user input, provide feedback, contain prompts (reminders, sharing, options, notifications, etc.)?**

1. No interactive features
2. Insufficient interactivity
3. Basic interactive features to function adequately
4. Offers a variety of interactive features
5. Very high level of responsiveness through interactive features

5 Target group: **Is the app content (visual information, language, design) appropriate for you, as an audience?**

1. Completely inappropriate/unclear/confusing
2. Mostly inappropriate/unclear/confusing
3. Acceptable but I do not feel targeted by the app
4. Well-targeted, with negligible issues
5. Perfectly targeted, no issues found

A: If you have any **suggestions** regarding the engagement section of the app please add them here:
B: From a scale of 1 to 10, how important is this section to your experience with the app:
C: Engagement mean score = _____

SECTION B: FUNCTIONALITY

6 Performance. **How accurately/fast do the app features (functions) and components (buttons/menus) work?**

1. App is broken; no/insufficient/inaccurate response (e.g., crashes/bugs/broken features, etc.)
2. Some functions work, but lagging or contain major technical problems
3. App works overall. Some technical problems need fixing/ slow at times

4. Mostly functional with negligible problems
5. Perfect/timely response; no technical bugs

7 Ease of use. **How easy is it to learn how to use the app; how clear are the menu labels/ icons and instructions?**

1. Complicated to use; menu labels/icons are confusing
2. Usable after a lot of time and effort
3. Usable after some time and effort
4. Easy to learn how to use the app
5. Able to use app immediately; intuitive and simple

8 Navigation. **Is moving between screens logical/accurate/appropriate/uninterrupted; are all necessary screen links present?**

1. Different sections within the app seem logically disconnected and confusing; navigation is difficult
2. Usable after a lot of time and effort
3. Usable after some time and effort
4. Easy to use or missing a negligible link
5. Perfectly logical, easy, clear and intuitive screen flow throughout, or offers shortcuts

9 Gestural Design**. Are interactions (taps/swipes/scrolls) consistent and intuitive across all components/screens?**

1. Completely inconsistent/confusing
2. Often inconsistent/confusing
3. Ok, with some inconsistent/confusing elements
4. Mostly consistent/intuitive with negligible problems
5. Perfectly consistent and intuitive

A: If you have any suggestions regarding the functionality of the app please add them here:
B: From a scale of 1 to 10, how important is this section to your experience with the app:
C: Functionality mean score = _____

SECTION C: AESTHETICS

10 Layout. **Is arrangement and size of buttons/icons/menus/content on the screen appropriate?**

1. Very bad design. Some options impossible to select/locate/read; device display not optimised
2. Bad design. Random, unclear, some options difficult to select/locate/read
3. Satisfactory. Few problems with selecting/locating/reading items or with minor screen-size problems
4. Mostly clear, able to select/locate/read items

5. Professional, simple, clear, logically organised, device display optimised. Every design component has a purpose

11 Graphics. **How high is the quality/resolution of graphics used?**

1. Graphics appear amateur, very poor visual design- disproportionate, completely stylistically inconsistent
2. Low quality/resolution graphics, low quality visual design- disproportionate, stylistically inconsistent
3. Moderate quality graphics and visual design
4. High quality/resolution graphics and visual design- mostly proportionate, stylistically consistent
5. Very high quality/resolution graphics and visual design- proportionate, stylistically consistent throughout

12 Visual appeal. **How good does the app look?**

1. No visual appeal, unpleasant to look at, poorly designed, clashing/mismatched colours
2. Little visual appeal- poorly designed, bad use of colours, visually boring
3. Some visual appeal- average, neither pleasant, nor unpleasant
4. High level of visual appeal- professionally designed
5. As above + very attractive, memorable, stands out; use of colours enhances the app

A: If you have any suggestions regarding the aesthetics of the app please add them here:
B: From a scale of 1 to 10, how important is this section to your experience with the app:
C: Aesthetics mean score = _____

SECTION D: INFORMATION

13 Accuracy of app description (in app store). **Does the app contain what is described?**

1. Misleading. App does not contain the described components/functions; or has no descriptions
2. Inaccurate. App contains very few of the described components/functions
3. OK. App contains some of the described components/functions
4. Accurate. App contains most of the described components/features
5. Highly accurate description of the app components/features

14 Goals. **Does the app have a specific, achievable goal?**

1. The app has no chance of achieving its stated goal
2. The description lists some goals, but the app has very little chance of achieving them
3. OK. The app has clearly specified goals, which are achievable

4. The app has clearly specified goals, which are achievable
5. The app has specific goals, which are highly likely to be achieved

15 Quality of information. **Is the app content correct, well written and relevant to the purpose of the app?**

1. It's irrelevant, inappropriate, incoherent and/or incorrect
2. It's poor. Barely irrelevant, inappropriate, incoherent and/or incorrect
3. Moderately relevant, appropriate, coherent and appears correct
4. Relevant, appropriate, coherent and correct
5. Highly relevant, appropriate, coherent and correct

16 Quantity of information**. Is the extent of the coverage within the scope of the app, comprehensive enough and concise?**

1. Minimal or overwhelming information
2. Insufficient or possibly overwhelming
3. Ok, but not comprehensible
4. Offers a broad range of information, but has some gaps or unnecessary details; or has no links to more information and resources
5. Comprehensive and concise; contains links to more information and resources

17 Visual information. **Is visual explanation of concepts- through images/graphs/maps/charts, etc.- clear, logical, correct?**

1. Completely unclear, confusing, wrong or necessary but missing
2. Mostly unclear, confusing, wrong
3. Ok, but often unclear, confusing, wrong
4. Mostly clear, logical, correct, with negligible issues
5. Perfectly clear, logical, correct

18 Credibility. **Does the app come from a legitimate source (specified in the app store or within the app itself)?**

1. Source identified but not legitimate or untrustworthy
2. Appears to come from a legitimate source, but it cannot be verified
3. Developed by small NGO/institution (hospital, centre, etc.)/funding body
4. Developed by government, university or as above but larger in scale
5. Developed by an international organisation, nationally competitive government, or research funding.

A: If you have any suggestions regarding the information section of the app please add them here:
B: From a scale of 1 to 10, how important is this section to your experience with the app:

C: Information mean score = _____

SECTION E: APP SUBJECTIVE QUALITY

19 **Would you recommend this app to people who might benefit from it?**

1. Not at all
2. In between 1 and 3
3. Maybe
4. In between 3 and 5
5. Definitely

20 **How many times do you think you would use this app in the next 12 months?**

1. None
2. 1-2
3. 3-10
4. 10-50
5. > 50

21 **Would you pay for this app?**

1. No
2. Maybe
3. Yes

22 **What is your overall star rating of the app?**

1. * One of the worst apps I've used
2. **
3. *** Average
4. ****
5. ***** One of the best apps I've used

SECTION F: APP-SPECIFIC

23 **From where did you first hear about the app?**

- ☐ The email about the survey
- ☐ Surfing in the app store
- ☐ From a colleague
- ☐ Other

24 **For how long have you had the app?**

1. Days (< 7 days)
2. Weeks (< 4 weeks)
3. 1- 2 Months
4. 2-4 Months
5. More

25 **How often do you use the app since you downloaded it?**

1. Rarely (or once or twice since downloading it; you manage to diagnose your patients without its help)
2. Occasionally (less than five times since downloading it; sometimes you reach for it to come to a diagnosis)
3. Frequently (or every other day; you often reach for it to come to a diagnosis)
4. Usually (or you barely visit a patient with a skin condition without using it)

26 **This app is likely to increase my knowledge about skin NTDs:**

1. Strongly disagree
2. Disagree
3. Neutral
4. Agree
5. Strongly agree

27 **This app is likely to help me come up faster and more efficiently with a diagnosis on skin NTD:**

1. Strongly disagree
2. Disagree
3. Neutral
4. Agree
5. Strongly agree

28 **If we add features that require internet connection to function, how would you perceive it?**

1. I mind a lot. I hardly never have internet connection on my phone
2. I mind it. Most of the time I don't have access to the internet on my phone
3. I don't care. Sometimes I have internet on my phone
4. I'm up for it. Most of the time I have internet on my phone
5. I think it would be great. I always have internet on my phone

29 **Would you want the app to be translated to other languages?**

- Yes
- No

30 **If the answer to the last question was positive, please state the languages you wish the app to be translated into: _____**

31 **Would you want the app to be equipped with a feature for sNTDs surveillance?**

- Yes
- No

32 **Would you want the app to offer a section where you can save data, and keep record of all the patients entered? _____**

33 **Would you be interested in a desktop version of the app? _____**

Thank you very much for coming this far into the survey. All the data you've entered will be processed accordingly, and will be taking into account when developing the newer versions of the app. And because your opinion is precious to us, before you leave, we would like to invite you to participate in an interview where you can tell us more about your experience using our Skin NTDs app.

- ☐ I am interested in participating in the interview. Count me in!
- ☐ No, thank you. I'm not interested in doing an interview.

ANNEX 4

Evaluation by the Ethics Committee of the UOC

Dr. Marta Aymerich, president of the Ethics Committee of the Universitat Oberta de Catalunya

CERTIFIES

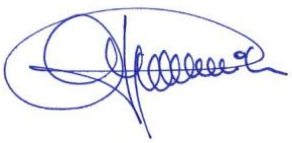
That the researcher Carme Carrión Ribas declares under his responsibility and for the appropriate legal purposes the following:

- The project entitles "Avaluació skin NTDs app" does not contain human participation or any processing of personal data.
- The research staff state that they are aware of current legislation on data protection.
- The capacity of the research staff involved in the research, the facilities and means available are adequate to carry out the referenced research.
- The necessary suitability requirements are met in relation to the objectives of the research itself and the non-evaluation by the Committee is justifies in accordance with the information provided in the self-assessment document submitted.

Having met on December 9th 2020, and under the responsibility of the research staff, this committee APPROVES the execution of the aforementioned project.

For the record, I sign this document in Barcelona, December 9th 2020.

Signed:



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ANNEX 5

Descriptive analysis of the individual items of the adapted MARS tool

		N (11)	Percent %
Age	25-35	6	54,5
	36-45	2	18,2
	46-65	2	18,2
	> 65	1	9,1
Gender	Male	8	72,7
	Female	3	27,3
Type of Health Worker	Medical doctor	8	72,7
	Nurse	1	9,1
	Other	2	18,2
Frequency in which you come across patients with sNTDs	Rarely	1	9,1
	Occasionally	2	18,2
	Frequently	4	36,4
	Usually	4	36,4
Working Experience in Dermatology	Trained and experienced	8	72,7
	Not trained but experienced	3	27,3
Work Environment	Rural	4	36,4
	Urban	7	63,6
Work for an NGO	Yes	2	18,2
	No	9	81,8
Knowledge on Mobile Technology	High	7	63,6
	Medium	3	27,3
	Low	1	9,1
Internet Connectivity	All the time	4	36,4
	Most of the time	4	36,4
	Sometimes	3	27,3
Country	Tunisia	1	9,1
	Ethiopia	2	18,2
	Nepal	3	27,3
	Mozambique	2	18,2
	Guyana	1	9,1
	USA	1	9,1
	Bolivia	1	9,1
App Discovery	E-Mail	4	36,4
	Colleague	7	63,6

		N (11)	Percent %
Time Using App	Days (<7)	5	45,5
	Weeks (<4)	4	36,4
	1-2 Months	1	9,1
	More	1	9,1
App Usage Frequency	Rarely	4	36,4
	Occasionally	5	45,5
	Frequently	1	9,1
	Usually	1	9,1
Features Requiring Internet	I mind it	2	18,2
	I don't care	1	9,1
	I'm up for it	6	54,5
	It would be great	2	18,2
Increase of Knowledge Using App	Strongly disagree	0	0
	Disagree	2	18,2
	Neutral	3	27,3
	Agree	2	18,2
	Strongly agree	4	36,4
Usefulness	Strongly disagree	0	0
	Disagree	2	18,2
	Neutral	4	36,4
	Agree	2	18,2
	Strongly agree	3	27,3
Translation Feature	Yes	9	81,8
	No	2	18,2
Translation Languages, N=10 (one evaluator answered 2 languages)	Arabic	1	10
	Amharic	2	20
	Swahili	1	10
	Nepali	2	20
	Portuguese	2	20
	Spanish	2	20
sNTDs Surveillance Feature	Yes	11	100
	No	0	0
Patient Record Feature	Yes	9	81,8
	No	2	18,2
Desktop Version	Yes	9	81,8
	No	2	18,2

Engagement		N (11)	Percent %
Entertainment	Ok, fun enough to entertain for a brief time (less than 5 minutes)	5	45,5
	Moderately fun and entertaining, would entertain user for some time (5 to 10 minutes)	5	45,5
	Highly entertaining and fun, would stimulate repeat use	1	9,1
Interest	Ok, neither interesting nor uninteresting; would engage user for a brief time (less than 5 minutes)	3	27,3
	Moderately interesting; would engage user for some time (5 to 10 minutes)	6	54,5
	Very interesting, would engage user in repeat use	2	18,2
Customisation	Dull, not fun or entertaining at all	3	27,3
	Allows basic customisation to function adequately	6	54,5
	Allows numerus options for customisation	2	18,2
Interactivity	No interactive features	2	18,2
	App store	2	18,2
	Basic interactive features to function adequately	6	54,5
	Offers a variety of interactive features	1	9,1
Target Group	Mostly inappropriate/unclear/confusing	1	9,1
	Acceptable but I do not feel targeted by the app	6	54,5
	Well-targeted, with negligible issues	4	36,4
Importance of the Section	1	0	0
	2	2	18,2

Engagement		N (11)	Percent %
	3	0	0
	4	1	9,1
	5	1	9,1
	6	1	9,1
	7	2	18,2
	8	2	18,2
	9	2	18,2
	10	0	0

Functionality

Performance	Some functions work, but lagging or contain major technical problems	1	9,1
	App works overall. Some technical problems need fixing/ slow at times	2	18,2
	Mostly functional with negligible problems	6	54,5
	Perfect/timely response; no technical bugs	2	18,2
Ease of Use	Usable after some time and effort	1	9,1
	Easy to learn how to use the app	7	63,6
	Able to use app immediately; intuitive and simple	3	27,3
Navigation	Usable after SOME time and effort	1	9,1
	Easy to use or missing a negligible link	8	72,7
	Perfectly logical, easy, clear and intuitive screen flow throughout, or offers shortcuts	2	18,2
Gestural Design	Ok, with some inconsistent/confusing elements	4	36,4
	Mostly consistent/intuitive with negligible problems	5	45,5

Engagement		N (11)	Percent %
	Perfectly consistent and intuitive	2	18,2
Importance of the Section	1	0	0
	2	0	0
	3	0	0
	4	0	0
	5	0	0
	6	2	18,2
	7	1	9,1
	8	5	45,5
	9	3	27,3
	10	0	0

Aesthetics			
Layout	Mostly clear, able to select/locate/read items	9	81,8
	Professional, simple, clear, logically organised, device display optimised. Every design component has a purpose	2	18,2
Graphics	Moderate quality graphics and visual design	4	36,4
	High quality/resolution graphics and visual design- mostly proportionate, stylistically consistent	5	45,5
	Very high quality/resolution graphics and visual design- proportionate, stylistically consistent throughout	2	18,2
Visual Appeal	Some visual appeal- average, neither pleasant, nor unpleasant	5	45,5
	High level of visual appeal- professionally designed	4	36,4
	As above + very attractive, memorable, stands out; use of colours enhances the app	2	18,2

Engagement

		N (11)	Percent %
Importance of the Section	1	0	0
	2	0	0
	3	0	0
	4	0	0
	5	0	0
	6	1	9,1
	7	2	18,2
	8	5	45,5
	9	3	27,3
	10	0	0

Information

Accuracy of App Description	Ok	5	45,5
	Accurate	4	36,4
	Highly accurate	2	18,2
Goals	Ok. The app has clearly specified goals, which are achievable	6	54,5
	The app has clearly specified goals, which are achievable	3	27,3
	The app has specific goals, which are highly likely to be achieved	2	18,2
Quality of Information	Moderately relevant, appropriate, coherent and appears correct	3	27,3
	Relevant, appropriate, coherent and correct	6	54,5
	Highly relevant, appropriate, coherent and correct	2	18,2
Quantity of Information	Insufficient or possibly overwhelming	2	18,2
	Ok, but not comprehensible	1	9,1
	Offers a broad range of information, but has some gaps or unnecessary details; or has no links to more information	5	45,5

Engagement

		N (11)	Percent %
	Comprehensive and concise; contains links to more information	3	27,3
Visual Information	Ok, but often unclear, confusing, wrong	2	18,2
	Mostly clear, logical, correct, with negligible issues	7	63,6
	Perfectly clear, logical, correct	2	18,2
Credibility	Appears to come from a legitimate source, but it cannot be verified	1	9,1
	Developed by small NGO/institution (hospital, centre, etc.)/funding body	1	9,1
	Developed by government, university or as above but larger in scale	4	36,4
	Developed by an international organisation, nationally competitive government, or research funding	5	45,5
Importance of the Section	1	0	0
	2	0	0
	3	0	0
	4	1	9,1
	5	1	9,1
	6	3	27,3
	7	0	0
	8	3	27,3
	9	3	27,3
	10	0	0

Subjective Quality

Recommendation	1 Not at all	0	0
	2	1	9,1
	3	2	18,2
	4	2	18,2
	5 Definitely	6	54,5
	None	1	9,1

Engagement		N (11)	Percent %
Future Use (in next 12 months)	1-2	2	18,2
	3-10	2	18,2
	10-50	2	18,2
	>50	4	36,4
Pay for it	No	8	72,7
	Maybe	3	27,3
Star Rating	1	0	0
	2	0	0
	3	7	63,6
	4	4	36,4
	5	0	0