

Mobile App Rating Scale (User Version) for the Assessment Community Health Worker Mobile Medical Application: a Qualitative Study

Jan Noel Molon

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Jan Noel Molon¹ MD, MSci

¹ University of the Philippines, College of Medicine Metro Manila PH

Corresponding Author:

Jan Noel Molon MD, MSci

University of the Philippines, College of Medicine
College of Medicine, Pedro Gil Street, Taft Ave, Ermita, Manila,
Metro Manila
PH

Abstract

Background: Noncommunicable diseases (NCDs) pose a significant burden in the Philippines, with cardiovascular and cerebrovascular diseases among the leading causes of mortality. The Department of Health implemented the Philippine Package of Essential Non-Communicable Disease Interventions (Phil PEN) to address this issue. However, healthcare professionals faced challenges in implementing the program due to the cumbersome nature of the multiple forms required for patient risk assessment. To address this, a mobile medical app, the PhilPEN Risk Stratification app, was developed for community health workers (CHWs) using the extreme prototyping framework.

Objective: This study aimed to assess the usability of the PhilPEN Risk Stratification app using the (User Version) Mobile App Rating Scale (uMARS) and to determine the utility of uMARS in app development. The secondary objective was to achieve an acceptable (>3 rating) score for the app in uMARS, highlighting the significance of quality monitoring through validated metrics in improving the adoption and continuous iterative development of medical mobile apps.

Methods: The study employed a qualitative research methodology, including key informant interviews, linguistic validation, and cognitive debriefing. The extreme prototyping framework was used for app development, involving iterative refinement through progressively functional prototypes. CHWs from a designated health center participated in the app development and evaluation process – providing feedback, using the app to collect data from patients, and rating it through uMARS.

Results: The uMARS scores for the PhilPEN Risk Stratification app were above average, with an Objective Quality rating of 4.05 and a Personal Opinion/Subjective Quality rating of 3.25. The mobile app also garnered a 3.88-star rating. Under Objective Quality, the app scored well in Functionality (4.19), Aesthetics (4.08), and Information (4.41), indicating its accuracy, ease of use, and provision of high-quality information. The Engagement score (3.53) was lower due to the app's primary focus on healthcare rather than entertainment.

Conclusions: The study demonstrated the effectiveness of the extreme prototyping framework in developing a medical mobile app and the utility of uMARS not only as a metric, but also as a guide for authoring high-quality mobile health apps. The uMARS metrics were beneficial in setting developer expectations, identifying strengths and weaknesses, and guiding the iterative improvement of the app. Further assessment with more CHWs and patients is recommended. Clinical Trial: N/A

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ABSTRACT

Noncommunicable diseases (NCDs) pose a significant burden in the Philippines, with cardiovascular and cerebrovascular diseases among the leading causes of mortality. The Department of Health implemented the Philippine Package of Essential Non-Communicable Disease Interventions (PhilPEN) to address this issue. However, healthcare professionals faced challenges in implementing the program due to the cumbersome nature of the multiple forms required for patient risk assessment. To address this, a mobile medical app, the PhilPEN Risk Stratification app, was developed for community health workers (CHWs) using the extreme prototyping framework.

OBJECTIVES

This study aimed to assess the usability of the PhilPEN Risk Stratification app using the (User Version) Mobile App Rating Scale (uMARS) and to determine the utility of uMARS in app development. The secondary objective was to achieve an acceptable (>3 rating) score for the app in uMARS, highlighting the significance of quality monitoring through validated metrics in improving the adoption and continuous iterative development of medical mobile apps.

METHODS

The study employed a qualitative research methodology, including key informant interviews, linguistic validation, and cognitive debriefing. The extreme prototyping framework was used for app development, involving iterative refinement through progressively functional prototypes. CHWs from a designated health center participated in the app development and evaluation process – providing feedback, using the app to collect data from patients, and rating it through uMARS.

RESULTS

The uMARS scores for the PhilPEN Risk Stratification app were above average, with an Objective Quality rating of 4.05 and a Personal Opinion/Subjective Quality rating of 3.25. The mobile app also garnered a 3.88-star rating. Under Objective Quality, the app scored well in Functionality (4.19), Aesthetics (4.08), and Information (4.41), indicating its accuracy, ease of use, and provision of high-quality information. The Engagement score (3.53) was lower due to the app's primary focus on healthcare rather than entertainment.

CONCLUSIONS

The study demonstrated the effectiveness of the extreme prototyping framework in developing a

medical mobile app and the utility of uMARS not only as a metric, but also as a guide for authoring high-quality mobile health apps. The uMARS metrics were beneficial in setting developer expectations, identifying strengths and weaknesses, and guiding the iterative improvement of the app. Further assessment with more CHWs and patients is recommended.

Keywords: Noncommunicable Diseases, Medical Informatics Applications, Community Health Workers, Proof of Concept Prototype, Philippines, uMARS

INTRODUCTION

Noncommunicable diseases (NCDs) pose a significant global health burden, accounting for two-thirds of all deaths worldwide, with a disproportionate impact on low- and middle-income countries (LMICs) [1]. In the Philippines, cardiovascular and cerebrovascular diseases are among the leading causes of mortality, reflecting a concerning trend observed across the Western Pacific Region. The economic burden of NCDs is substantial, comprising 4.8% of the gross domestic product in 2017. To address this pressing issue, the Department of Health implemented the Philippine Package of Essential Non-Communicable Disease Interventions (Phil PEN), an adaptation of the World Health Organization (WHO) guidelines for managing NCDs in low-resource settings [1-3].

Despite these efforts, healthcare professionals have faced challenges in implementing the Phil PEN program, citing the cumbersome nature of the multiple forms required for patient risk assessment and the time-consuming process, especially in high-volume settings [4]. To address this challenge, Molon [5] developed the PhilPEN Risk Stratification app, a mobile medical app for community health workers based on the Phil PEN Noncommunicable Disease Risk Assessment Form, using the extreme prototyping framework (Figures 1 and 2). However, a reliable method for assessing the quality of health software generated through this framework was lacking.

To address this need, Stoyanov et al. [6-7] developed the (User Version) Mobile App Rating Scale (uMARS), a simple, objective, and reliable tool for classifying and assessing the quality of mobile health apps. It provides a 20-item measure that includes four Objective quality subscales - Engagement, Functionality, Aesthetics, and Information Quality - and one Subjective quality subscale [Appendices A and B]. Scores of individual items are averaged to obtain a mean quality score for each dimension; in turn, the scores on the four Objective quality dimensions are averaged to yield a uMARS total score. All mean quality scores are on a 1 (poor) to 5 (excellent) scale [6-7]. The uMARS can also serve as a checklist for the design and development of new high-quality health apps.

This study aimed to assess the usability of the PhilPEN Risk Stratification app using the uMARS, while continuing the extreme prototyping cycle of development. The secondary objectives were (1) to achieve an acceptable (>3 rating) score for the app in uMARS, highlighting the significance of quality monitoring through validated metrics in improving the adoption and continuous iterative development of medical mobile apps, and (2) to determine the utility of uMARS in app development.

METHODS

The study employed a qualitative research methodology, including key informant interviews, linguistic validation, and cognitive debriefing. The extreme prototyping framework, consisting of three phases – static prototype, dynamic prototype, and service implementation – was used for app development [5]. This iterative approach allowed for the gradual refinement of the app through progressively functional prototypes (Figure 3).

All 19 CHWs of the designated health center were involved in the continued development and evaluation of the mobile app (Figure 4). The CHWs had the following characteristics and were identified as representative end-users of the app:

- has undergone a training program under any accredited government and/or non-government organization
- has completed the DOH training for NCD intervention
- has used the NCD Risk Assessment Form
- has used a smartphone and its web-browser
- has given written consent

In the static prototype phase, the initial design and functionality of the app were conceptualized based on the Phil PEN Noncommunicable Disease Risk Assessment Form and the WHO guidelines for NCD management in low-resource settings [3, 8]. Key informant interviews were conducted with healthcare professionals and stakeholders to gather insights and requirements for the app's design and features. During the dynamic prototype phase, a working version of the app was developed using HTML5, CSS3, JavaScript, and Apache Cordova [5, 9-12]. This phase involved linguistic validation, where the app's content and terminology were evaluated for clarity and accuracy by healthcare professionals and language experts. Cognitive debriefing was also conducted, where potential end-users tested the app and provided feedback on its usability, navigation, and overall user experience. Based on the feedback and insights gathered from the previous phases, iterative refinements and improvements were made to the app's design, functionality, and user interface. The service implementation phase involved the finalization of the app and its deployment for wider usage and testing among community health workers and healthcare professionals [5, 13-14].

The CHWs underwent a one-day general orientation and training on the PhilPEN Risk Stratification

mobile medical app. The app was installed on entry-level smartphones provided by the author, and the CHWs practiced using the app through demonstrations, return demonstrations, and simulations.

The CHWs then used the app to interview adult patients from the health center during its Out-Patient Clinic, with the intention of collecting data from 100 patients. The researcher confirmed proper use and interpretation of the app during this process.

The prototype cycle of feedback/requirement definition, system design, coding/testing (back to feedback/requirement definition) was intended to continue until an acceptable dynamic prototype with a uMARS rating of at least 3.0 was developed. If it was below 3.0, the revisions and/or feedback provided would have been reprogrammed, and the subsequent versions tested by the CHWs, collecting data from another set of patients. The CHWs would again use the uMARS to rate the overall quality of the app, and the average final mobile app rating would be recorded.

RESULTS

The participants had an average age of 48 years (range 37-62) with an average of 70 months (range 33-79) in the field as a CHW. All owned a smartphone and had experience using a mobile web-browser for more than 12 months (Table 1). Only 18 of the 19 CHWs were able to undergo the one-day general orientation and training on the mobile medical app. All 18 health workers were familiar with the NCD Risk Assessment Form, having populated the form and its previous iteration with patient data along with physical examination findings since 2017. However, due to COVID restrictions, only 8 out of these 18 CHWs were able to participate and use the app, collecting data from 36 patients.

Five more prototype mini-cycles of feedback/requirement definition, system design, coding/testing then back to feedback/requirement definition were performed during the course of the study. Code refactoring and bug fixes caught internally were excluded in these results. An example is Version 3.02.05, which saw the implementation of data security features, a requirement definition mandated by the ethics board for compliance with the Data Privacy Act of 2012. Another (Version 3.02.07) was brought about by a comment from one of the older CHWs, who experienced difficulty in reading the text on the mobile app, "*Maganda sana kung pwedeng lakihan yung mga letra*" (It would be nice if the letters could be enlarged). This requirement definition led to the addition of "+" and "-" buttons to allow for changing of the font size.

The CHWs gave the PhilPEN Risk Stratification mobile medical app an average of 3.53 for "Engagement; i.e. Fun, interesting, customizable, interactive, has prompts (e.g. sends alerts, messages, reminders, feedback, enables sharing)." This was quite unexpected since the primary focus of the app was healthcare and any entertainment value was put low on the priority list.

The app averaged 4.19 in terms of Functionality. The Performance metric rated highly among users indicating that the app features, such as the automatic computation of Age, BMI, WH Ratio and the Risk Stratification performed accurately and as intended. Ease of Use was also high, suggesting that the app was seen as easy to learn or, at least, had clear instructions with a logical flow.

The CHWs gave an average of 4.08 for "Aesthetics, Graphic design, overall visual appeal, color scheme, and stylistic consistency". This was better than anticipated since the developer went for a simple layout and used a basic unassuming color palette.

The users gave the mobile medical app an average of 4.41 for "Information, Contains high quality information (e.g. text, feedback, measures, references) from a credible source". From the outset, the Information section and its corresponding metric components were given the most importance, even if the final rating would knowingly be based on all four Objective Quality ratings having equal weight. As such, no effort was spared to ensure accuracy of the data for the app and its faithfulness to the WHO algorithm, which included testing all 640 possible risk stratification outcomes and their corresponding health advice for the patient.

This resulted in an Objective Quality rating of 4.05.

The CHWs gave an average of 3.25 for Personal Opinion, which is also equivalent to the Subjective Quality rating. Highest scores were given for item E17 "Would you recommend this app to people who might benefit from it?", garnering a favorable 4.13, indicating "4, There are many people I would recommend this app to". The app received the lowest scores for E19 "Would you pay for this app?", averaging 1.75, which corresponds to "2 No". For E20 "What is your overall (star) rating of the app?" the health workers gave the app an above average 3.88-star rating.

As a final measure, Stoyanov and associates [6-7] stated that there should be a high correlation between the MARS quality total score and its overall star rating. While the study is lacking in statistical power, it can be said that both the 4.05 Objective Quality rating and 3.88-star rating gravitate towards 4.0 and provide a further indication that the perceived overall quality of the app was captured.

DISCUSSION

The (User Version) Mobile Application Rating Scale (uMARS) was chosen as the evaluation tool for the medical mobile app developed in this study, as it is the only scientifically documented and statistically tested app rating scale available, designed with the user in mind [6-7, 15-16]. The uMARS proved to be applicable for gathering both objective and subjective feedback on the developed app, translating it into understandable metrics.

The above-average scores obtained for Engagement (3.53), Functionality (4.19), Aesthetics (4.08), Information (4.41), and the combined Objective Quality rating (4.05), as well as the Personal Opinion/Subjective Quality rating (3.25), are testament to the effectiveness of the extreme prototyping framework employed in developing this medical mobile app. Stoyanov et al. [6] suggested that MARS could provide guidance for authoring high-quality mobile health apps by using it as a checklist of criteria during the design process, an approach explored in this study.

The uMARS objective metrics were beneficial in setting and managing developer expectations by identifying the potential strengths and weaknesses of the proposed health app. Initially, it was apparent that the app would have little entertainment value, reflecting a low Engagement score, and the use of simpler graphics for entry-level smartphones would impact the Aesthetics score. However, the app's ability to deliver quality information in a timely manner and perform accurately could merit above-average ratings for Information and Functionality.

While "low priority" did not equate to "no priority," certain concessions had to be made to achieve an acceptable uMARS rating (>3). The uMARS sub-questions within each category provided a guide for critiquing and improving the app during the system design and coding/testing phases. For instance, while Engagement was initially a low priority, the sub-questions highlighted areas like customization, interactivity, and target group that could be improved. Similarly, the Information sub-questions helped present the necessary information concisely without overwhelming the user.

Overall, the study demonstrated that a deliberate awareness of the uMARS metrics can serve as an excellent guide for developing high-quality mobile medical apps. While the checklist points may seem obvious, experience has shown that critical areas can be overshadowed during the development cycle, and uMARS proved to be an appropriate guide to avoid pitfalls in app creation [14, 17].

This study sought to continue applying design theory to the development of a mobile app intended as an adjunct to healthcare delivery and to assess the quality of this app through a validated metric, i.e. to develop a mobile medical app for CHWs based on the Phil PEN Noncommunicable Disease Risk Assessment Form using extreme prototyping for development and uMARS for assessment. Analysis of the limited data set seems to indicate that the extreme prototyping framework is applicable not only to mobile app development in general, but to medical mobile apps as well, substantially bridging the gap between health science and information technology. The results also support that the uMARS is a useful guide to aid in medical mobile app development – the first in literature to document this alternative use.

The next step would be to have more CHWs utilize the app on patients to further assess its usability in their work setting and improve it through additional prototype iterations.

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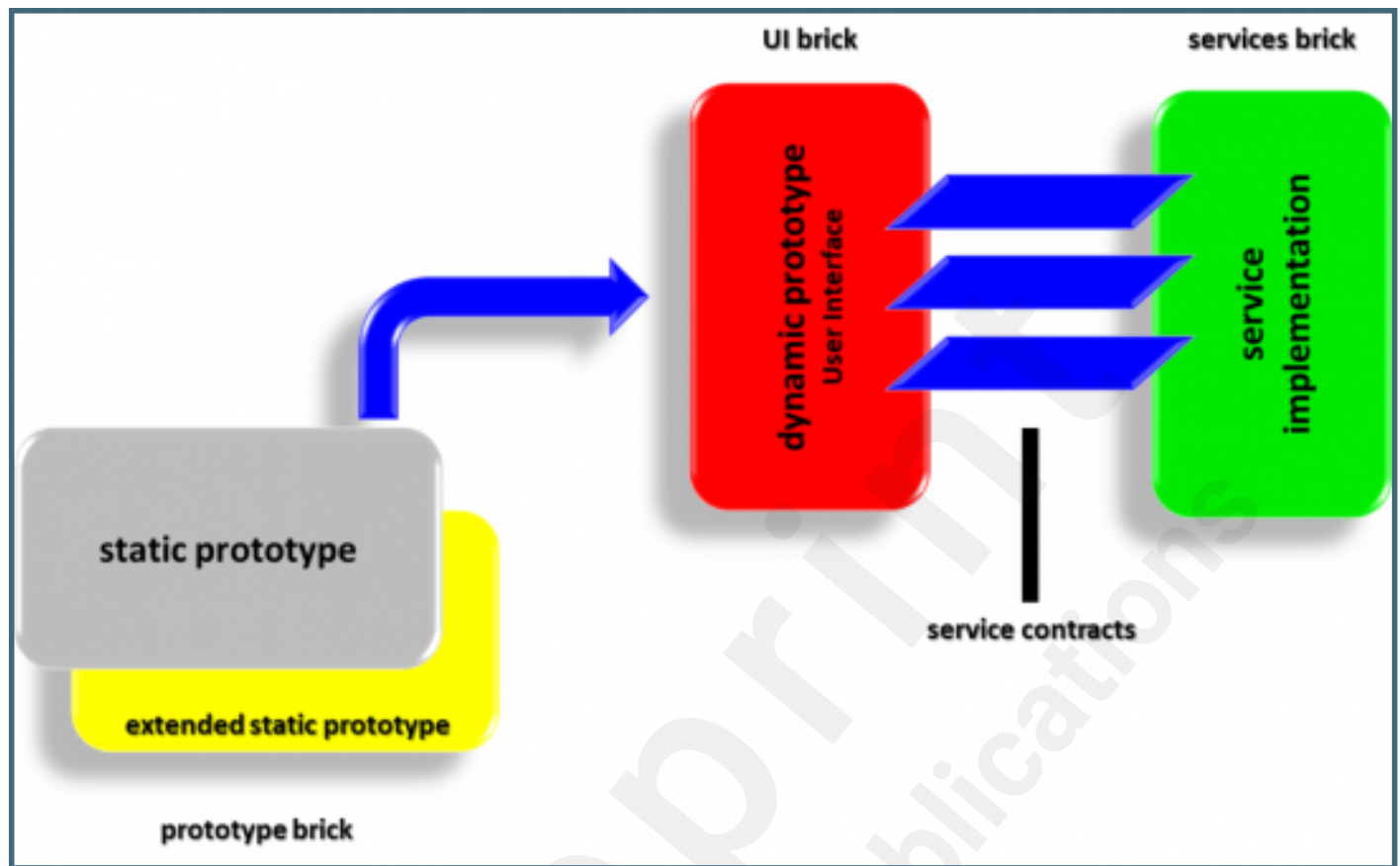
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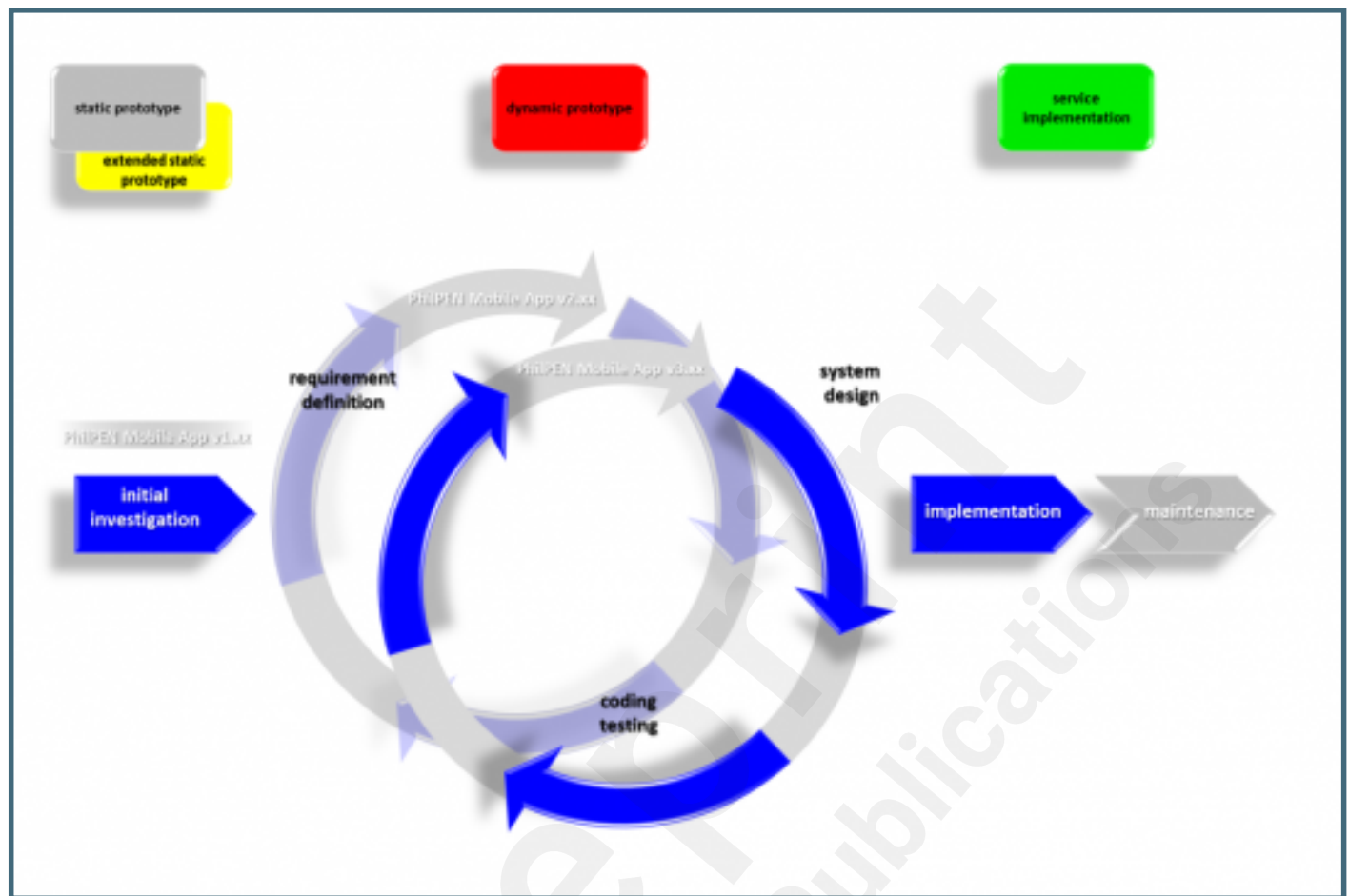
Supplementary Files

Figures

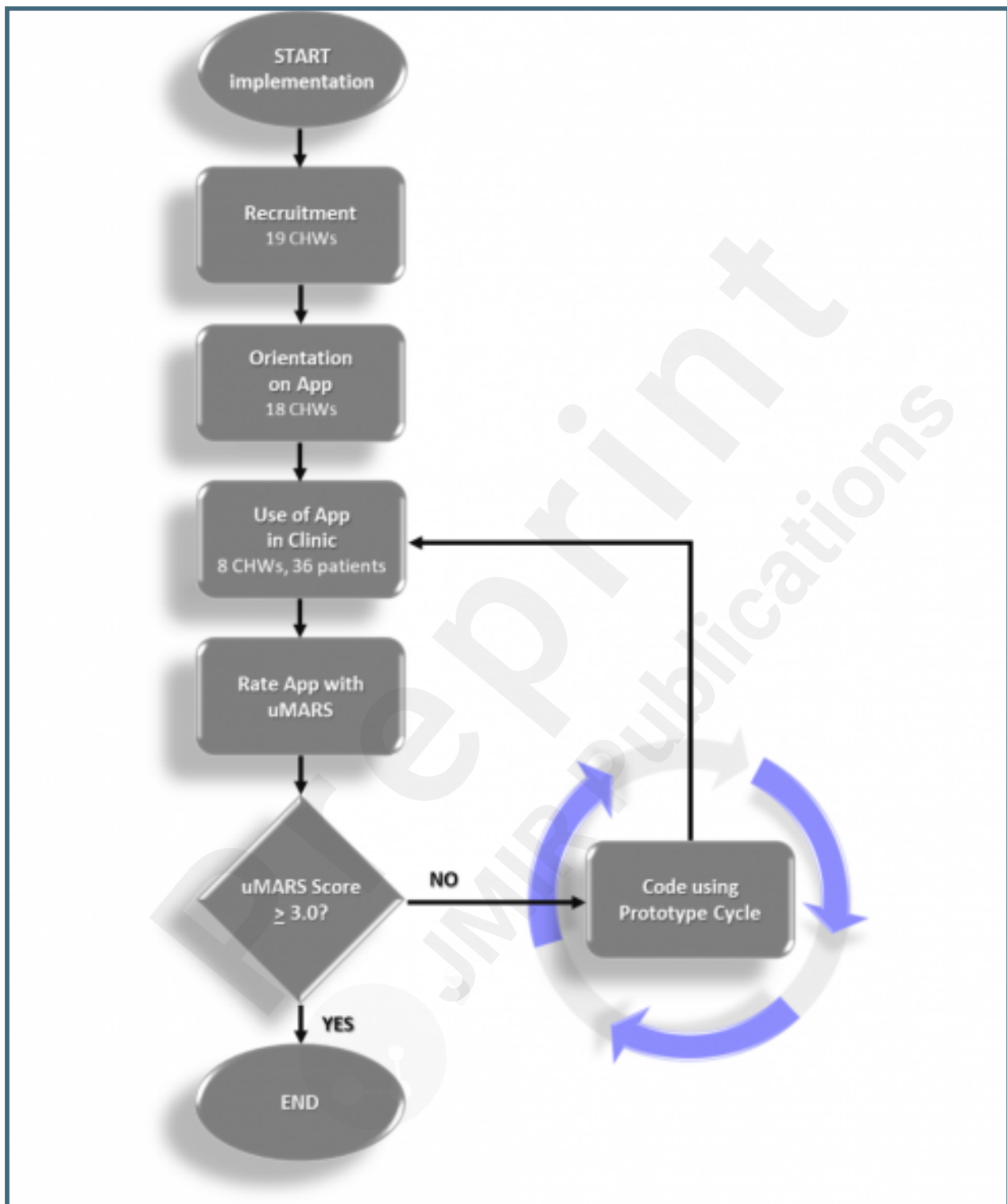
The extreme prototyping framework.



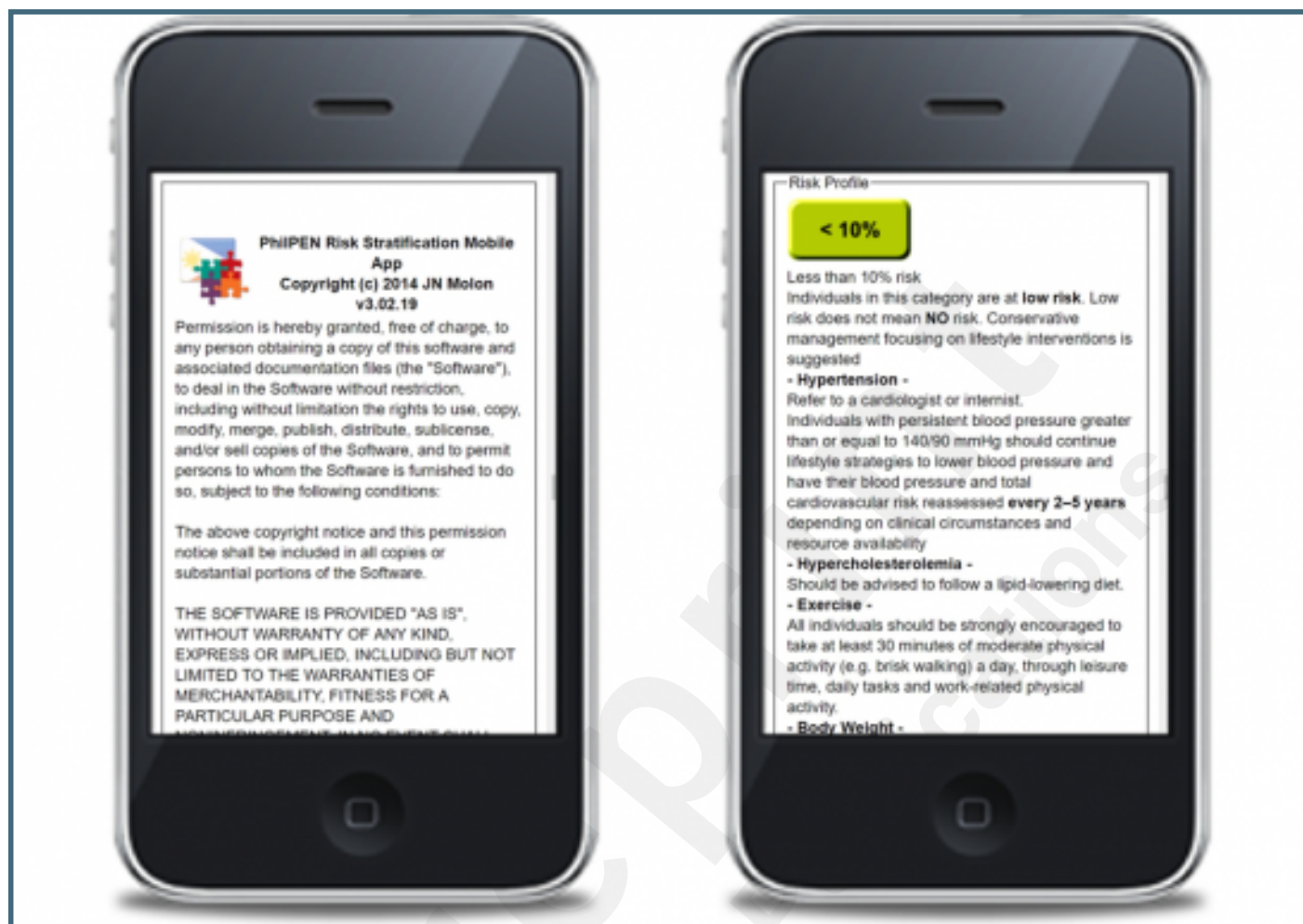
The extreme prototyping framework in development of the mobile medical app.



Iterative approach to development of progressively functional prototypes.



Screenshots of the mobile medical app.



Multimedia Appendixes

Original English version of the users Mobile Application Rating Scale (uMARS).

URL: <http://asset.jmir.pub/assets/d99aa2e4a18d19709fc9dc5e69bd5f16.pdf>

Filipino version of the users Mobile Application Rating Scale (uMARS).

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Tables of uMARS Assessment results.

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