User acceptance of DeSkab mobile application for early detection of scabies in Indonesia

Sandra Widaty
Department of Dermatology and Venereology, Faculty of Medicine, Universitas Indonesia - Dr. Cipto Mangunkusumo Hospital, Jakarta, Indonesia

Dewi Friska
Department of Community Medicine, Faculty of Medicine, Universitas Indonesia, Jakarta, Indonesia

Kusmarinah Bramono
Department of Dermatology and Venereology, Faculty of Medicine, Universitas Indonesia - Dr. Cipto Mangunkusumo Hospital, Jakarta, Indonesia

See next page for additional authors

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Authors
- Sandra Widaty
  *Department of Dermatology and Venereology, Faculty of Medicine, Universitas Indonesia - Dr. Cipto Mangunkusumo Hospital, Jakarta, Indonesia*
- Dewi Friska
  *Department of Community Medicine, Faculty of Medicine, Universitas Indonesia, Jakarta, Indonesia*
- Kusmarinah Bramono
  *Department of Dermatology and Venereology, Faculty of Medicine, Universitas Indonesia - Dr. Cipto Mangunkusumo Hospital, Jakarta, Indonesia*
- Siti Maulidya Sari
  *Department of Community Medicine, Faculty of Medicine, Universitas Indonesia, Jakarta, Indonesia*
- Irene Darmawan
  *Department of Dermatology and Venereology, Faculty of Medicine, Universitas Indonesia - Dr. Cipto Mangunkusumo Hospital, Jakarta, Indonesia*
- Aria Kekalih
  *Department of Community Medicine, Faculty of Medicine, Universitas Indonesia, Jakarta, Indonesia*
User acceptance of DeSkab mobile application for early detection of scabies in Indonesia

Sandra Widaty¹, Dewi Friska², Kusmarinah Bramono¹, Siti Maulidya Sari², Irene Darmawan¹, Aria Kekalih²

1. Department of Dermatology and Venereology, Faculty of Medicine, Universitas Indonesia - Dr. Cipto Mangunkusumo Hospital, Jakarta, Indonesia
2. Department of Community Medicine, Faculty of Medicine, Universitas Indonesia, Jakarta, Indonesia

Email: Aria.kekalih@gmail.com

Abstract

Background: Individual case management strategy is not suitable for reducing scabies transmission, especially in high prevalence settings. A community-based approach has been proposed to control scabies. We developed a mobile application, called DeSkab, to empower non-medical personnel in crowded populations e.g., boarding schools, and to aid the identification of skin lesions suggesting scabies based on the cardinal signs of scabies. Early treatment and prevention of scabies transmission is expected to follow this approach. This was the initial development of the DeSkab mobile application which aims to assess user acceptance.

Methods: The DeSkab mobile application was designed using Java and XML, supported by Google's Android. The scabies detection and education features were the app's key distinctive aspects. An online survey was performed, aimed at potential users, including boarding school teachers and healthcare workers. The survey was divided into four sections: application design and user-friendliness, early detection data entry and interpretation, education features, and user recommendations.

Results: Overall, users' acceptance of this application was good. More than 70% of the users gave good feedback for the application. Using mobile health makes it easier for the users to find information about scabies and check whether their skin lesions are suggestive of scabies.

Conclusion: This application is expected to help expand scabies detection, especially in crowded communities. Improvements must be made to the interface, data entry, and educational material for the app's next iteration. Further study is needed to determine how mobile health application can improve scabies detection in communities.

Keywords: community, DeSkab, mobile application, scabies detection
and impairment in the quality of life. Scabies is associated with embarrassment, stigmatization, and activity restriction.\textsuperscript{6}

Chronic disfigurement caused by scabies adversely affects mental health.\textsuperscript{1} Scabies causes rash and itching, leading to sleep disturbances, difficulty in concentrating, as well as absences from school and work.\textsuperscript{7} The strategy for individual case management is not suitable for reducing scabies transmission, especially in high prevalence settings.\textsuperscript{6} One of the principles for scabies treatment is to treat all contacts and the patient; therefore, it is crucial to detect scabies in boarding schools where they started.\textsuperscript{5} It is also necessary to bridge the gap between the prevalence of scabies in a community, especially in boarding schools, and among healthcare workers in primary healthcare facilities. Therefore, a community-based approach has been suggested to control scabies.

Widaty, et al.\textsuperscript{8} developed an instrument called DeSkab to empower non-medical personnel to aid the identification of skin lesions suggesting scabies. The instrument consists of cardinal signs of scabies, including pruritus worsening at night, pruritic lesions on the predilection sites, and similar symptoms affecting a group of people. This community-based approach should be followed by establishing a referral flow so the suspected cases can be referred to primary healthcare facilities for appropriate treatment, followed by close contacts treatment and other means to stop scabies transmission. We developed the DeSkab mobile application, an Android mobile health application for early detection of scabies by non-medical personnel in Indonesia. In this digital era, using mobile applications can expand the distribution of the DeSkab instrument nationally. This is the pilot version of the mobile application. Since this was the initial step of the DeSkab mobile application development, it is necessary to assess users’ acceptance of this application.

Methods

*Deteksi skabies – DeSkab mobile application*

The *Deteksi skabies – DeSkab* mobile application (shortened as DeSkab application) was developed based on the DeSkab instrument. This application was designed using Java and XML, supported by Google’s Android. We chose a mobile-based application so that the users, either adults (teachers or parents) or adolescents (students), could use it easily. The users’ details are kept confidential. This application was developed for two types of logins: An individual login for personal users and a community login for community health leaders to monitor their community members’ conditions. This community login is still under development. The personal login has two features, including scabies detection and education features. The early detection feature was developed for self-examination and made based on an algorithm in the DeSkab instrument, validated in a previous study, using three cardinal signs of scabies.\textsuperscript{8} Two or more positive cardinal signs indicate suspected scabies. If the results were suspected scabies, the user is encouraged to visit a medical practitioner for confirmation and treatment. The education feature of this application mainly discusses general knowledge regarding scabies (etiology, transmission, signs and symptoms, treatment, and prevention).

During the development of the individual login, several dermatology experts and community medicine experts contributed to the content and imagery, and provided feedback. Scabies detection and education features are the signature features of this application. The scabies detection features allow the user to self-examine with the guidance of an algorithm called e-form that shows a list of dermatological symptoms. This can be done alone, or in groups of people living together. Explicit pictures of lesions in the predilection area were provided to aid users in identifying specific scabies manifestations on their skin. The education features explain the detection, prevention, and treatment of scabies in a language that can be understood by laypersons with an animated illustration to deliver a better perspective. The DeSkab mobile application is currently available on Google Play Store (Figure 1).

**Study Design**

This was a descriptive study using an online survey, aiming at potential users of the DeSkab application. This study was approved by the ethical committee of the Faculty of Medicine, Universitas Indonesia (ethical clearance Number KET-120/UN2.F1/ETIK/PPM.00.02/2020). Subjects were recruited using purposive sampling method, until a total number of 30 users in two Indonesian cities (Bogor and Jakarta) was achieved.

We included health cadres of Islamic boarding schools, members of the general communities as primary potential users, as well as medical practitioners and medical students as potential referral doctors. Before completing the survey, users were asked to download the DeSkab mobile application in the Android Play Store and to use all
the features in the application within the individual login domain. A Google form was used to obtain informed consent from subjects, and to administer the survey. We excluded users who did not complete the survey.

The survey was conducted for a month in March 2021. The inclusion criteria were subjects aged >12 years old who has a smartphone to download the application. The sample group was asked to download and to use the DeSkab app for at least 7 days before answering a web-based survey. The survey consists of four sections: application design and user-friendliness, early detection data entry and interpretation, education features, and user recommendations. Each question was measured using a Likert scale (1 = strongly agree; 2 = agree; 3 = neutral; 4 = disagree; 5 = strongly disagree). We subsequently simplified the answers into agree (strongly agree and agree) and disagree (neutral, disagree, and strongly disagree). Data were analyzed using statistical package for social sciences (SPSS) for Windows version 20.0. Categorical data are presented as percentages.

**Results**

Thirty users participated in the online survey for the DeSkab application in March 2021. Most of the users were 20-29 years old (60%) and female (63.3%). The characteristics of the users are shown in Table 1. The results of the survey are summarized in Table 2. Overall, users’ acceptance of the application was good. More than 70% of the users provided good feedback for the DeSkab mobile application. The survey also revealed several areas that require improvements, including data entry for physical examination (70% of users agree) and result interpretation (70% of users agree). As many as 70% of users would recommend this application to others. Other than the survey above, we also asked for direct feedback from the users. Most of the comments were suggestions to improve the design and layout, add more clinical pictures as references, and enrich the education content.

**Discussion**

The novelty of this study lies in the fact that it describes a comprehensive approach to develop a scabies early detection application that involves dermatology experts and non-medical personnel. Various methods have been used to enhance the surveillance and management of skin and infectious diseases worldwide, including technology such as telemedicine, artificial intelligence, and mobile health (mHealth). In the past five years, mHealth utilization by dermatologists have increased, especially for teledermatology and as a source for dermatology references.
### Table 1. Users' Sociodemographic Characteristics (N = 30)

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>n</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;20 years</td>
<td>9</td>
<td>30.0%</td>
</tr>
<tr>
<td>20-29 years</td>
<td>18</td>
<td>60.0%</td>
</tr>
<tr>
<td>≥30 years</td>
<td>3</td>
<td>10.0%</td>
</tr>
<tr>
<td>Gender</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>19</td>
<td>63.3%</td>
</tr>
<tr>
<td>Male</td>
<td>11</td>
<td>36.7%</td>
</tr>
<tr>
<td>Education</td>
<td></td>
<td></td>
</tr>
<tr>
<td>University level</td>
<td>17</td>
<td>56.7%</td>
</tr>
<tr>
<td>Senior high school level</td>
<td>12</td>
<td>40.0%</td>
</tr>
<tr>
<td>Junior high school level</td>
<td>1</td>
<td>3.3%</td>
</tr>
<tr>
<td>Work</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unemployed</td>
<td>12</td>
<td>40.0%</td>
</tr>
<tr>
<td>Teachers in Islamic boarding schools</td>
<td>6</td>
<td>20.0%</td>
</tr>
<tr>
<td>Others</td>
<td>12</td>
<td>40.0%</td>
</tr>
</tbody>
</table>

### Table 2. The DeSkab Application User Acceptance Survey Results (N = 30)

<table>
<thead>
<tr>
<th>Agree</th>
<th>n</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Design and user-friendliness</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>a. The application is easy to download</td>
<td>24</td>
<td>80.0%</td>
</tr>
<tr>
<td>b. The application is easy to understand</td>
<td>24</td>
<td>80.0%</td>
</tr>
<tr>
<td>c. The login options are easy to understand (individual login or community/healthcare workers login)</td>
<td>24</td>
<td>80.0%</td>
</tr>
<tr>
<td>d. In general, the application is easy to use</td>
<td>24</td>
<td>80.0%</td>
</tr>
<tr>
<td>e. The grammar is excellent and clear</td>
<td>23</td>
<td>76.7%</td>
</tr>
<tr>
<td>f. The content is appropriate</td>
<td>23</td>
<td>76.7%</td>
</tr>
<tr>
<td>g. The layout design is attractive</td>
<td>22</td>
<td>73.3%</td>
</tr>
<tr>
<td><strong>Scabies detection: Data entry and interpretation</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>a. Data entry for “Night-time itching” is clear and easy to understand</td>
<td>24</td>
<td>80.0%</td>
</tr>
<tr>
<td>b. Data interpretation for “Not scabies” or “Suggesting scabies” is clear and easy to understand</td>
<td>24</td>
<td>80.0%</td>
</tr>
<tr>
<td>c. Data entry for “Previous medication history” is clear and easy to understand</td>
<td>23</td>
<td>76.7%</td>
</tr>
<tr>
<td>d. The steps for early detection are easy to understand</td>
<td>23</td>
<td>76.7%</td>
</tr>
<tr>
<td>e. Data entry for &quot;Complaint of itching in other people around the subject&quot; is clear and easy to understand</td>
<td>22</td>
<td>73.3%</td>
</tr>
<tr>
<td>f. Data entry for &quot;History of similar disease&quot; is clear and easy to understand</td>
<td>22</td>
<td>73.3%</td>
</tr>
<tr>
<td>g. Data entry for &quot;Physical examination&quot; is clear and easy to understand</td>
<td>21</td>
<td>70.0%</td>
</tr>
<tr>
<td>h. The result of early detection based on the number of cardinal signs and the conclusion of &quot;Not scabies&quot; or “Suggesting scabies” are clear and easy to understand</td>
<td>21</td>
<td>70.0%</td>
</tr>
<tr>
<td><strong>Education Feature</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>a. The examples of scabies skin lesions are clear and easy to understand</td>
<td>24</td>
<td>80.0%</td>
</tr>
<tr>
<td>b. The education content on scabies is appropriate and clear</td>
<td>23</td>
<td>76.7%</td>
</tr>
<tr>
<td><strong>User Recommendations</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>a. As a user, this application is beneficial and easy to understand</td>
<td>23</td>
<td>76.7%</td>
</tr>
<tr>
<td>b. This application is needed in crowded areas</td>
<td>23</td>
<td>76.7%</td>
</tr>
<tr>
<td>c. The user will recommend this application to others</td>
<td>21</td>
<td>70.0%</td>
</tr>
</tbody>
</table>
mHealth implementation is expanding in dermatology. Given its visual nature, dermatology is suitable for medical mobile applications. mHealth can be used to collect data for training and decision support, emergency referrals, follow-up reminders, as well as improve communication and supervision between healthcare workers. Generally, mHealth can be classified into applications for healthcare providers, for patients or for the public. For healthcare providers, the applications can be used for educational resources or managing dermatology practices, while for patients, the applications are helpful for educational purposes, independent skin surveillance, and early detection of disease.

In 2017, more than 520 dermatology-related mobile phone applications were available in Google Play Store, mainly for teledermatology consultation, self-diagnosis aids, and to provide a general dermatology reference. Agarwal, et al. conducted a systematic review to find evidences on the feasibility and effectiveness of mobile-based services for frontline healthcare workers. They found that mHealth applications were potential tools to improve healthcare delivery. Frontline healthcare workers usually serve the local community to address primary healthcare needs in rural areas with different capacities, such as midwives, nurses, pharmacists, doctors, and community healthcare workers.

This study has developed a mobile application called Deteksi skabies – DeSkab for scabies detection. This application was made according to the DeSkab instrument previously developed by Widaty, et al. It is an instrument designed for scabies detection by non-medical personnel. This instrument has a wide range of sensitivity and specificity, ranging from 56–97% and 0–74%, respectively.

The history-taking part of DeSkab contains four main questions: The presence of nocturnal pruritus and its location, complaint of itch in other people around the subject, history of previous medications, and history of similar diseases.

The physical examination part contains questions regarding the lesions’ type (papules, pustules, or erosions/excoriations/ulcers) and location. The result interpretation was concluded based on a minimum of two of three cardinal signs, which are pruritus that worsens at night, pruritic lesions on predilection sites, and similar symptoms affecting a group of people.

This application was developed to expand and provide more access to the DeSkab instrument. It has several login options, namely individual, community, and primary healthcare workers logins. mHealth is expected to help users find information about scabies and check whether or not their skin lesions are suggesting scabies. It contains example photos of scabies lesions in different body parts. Based on the survey, ≧70% of the users gave a good feedback on the DeSkab application. However, several improvements were needed in the design, data entry, and result interpretation.

Another feature of this application is the education feature. This feature emphasizes several topics, such as the cause of scabies, its transmission, signs and symptoms, treatments, and prevention. The education content was presented as news articles. Overall, the user agreement for the DeSkab app features is quite promising (76.7%).

Expertise in data processing, data preparation, and other technical requirements is required to provide a user-friendly interface. Users’ perceived usefulness significantly influenced their intention-to-use. Wahab, et al. developed a mobile application for online learning, called Rumah Belajar, and conducted an acceptance survey. They indicated that performance expectancy, facilitating conditions, information quality, enjoyment, and playfulness significantly affected the users’ intention to use the application.

Control of institutional scabies relies on prompt recognition, outbreak management team, infection control practice, education, simultaneous treatment of all exposed individuals, and environmental disinfection. Mobile applications can serve as information sources and educational tools. Scabies infection control, prevention, and environmental management information can be delivered using the educational section in the DeSkab mobile application. Prolonged surveillance is essential in eradicating scabies. For the next step of this application development, in addition to individual uses, we also planned to integrate...
personal data originating the same community (as a community-based approach). The community leader or health management team will be allowed to monitor the number of suspected scabies in their community members. For example, this application can be applied in a crowded community, such as a boarding school. By signing in as a community user and registering the members of their community, previously trained non-medical personnel (health cadres) can monitor the number of suspected cases in their boarding school and plan a referral to the nearest primary healthcare facility. For neglected tropical diseases, the approach in which skin diseases can be detected early and diagnosed clinically by trained individuals or frontline healthcare worker is acceptable.  

A clear referral pathway is essential for an individual with positive findings of scabies. The referral is aimed at diagnosis confirmation and treatment, followed by close contacts treatment and other measures to stop scabies transmission. Cases that cannot be managed at a primary healthcare facility will be referred to hospitals.

The end goal of this arrangement is to eliminate scabies in crowded places, such as boarding schools. These practices will need the cooperation of several stakeholders, such as community leaders, to provide health cadres, encourage them to periodically conduct early detection, and submit referrals to primary healthcare facilities for confirmation and treatment. The important factor for successful adoption of mobile tools was the involvement of healthcare workers throughout the development and implementation process.

The limitation of this study lies in the fact that the participants might be healthy people and not the one with skin lesions. Further study is needed to evaluate user acceptance of this application among people with skin lesions in scabies endemic communities. Most of the Islamic boarding schools forbid the students to bring mobile phones; thus, the targeted users were the teachers or supervisors.

**Conclusion**

In conclusion, this pilot mobile health application was well-accepted by users. The DeSkab application usage in crowded areas is projected to grow due to the application's user-friendly interface and early detection function. Improvements must be made to the interface, data entry, and educational material for the applications' next iteration.

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**Author Contributions**

All authors act as the guarantor of the manuscript. SW, KB, AK, and DF participated in the conception. SW, KB, AK, DF, SMS, and ID participated in data acquisition, data interpretation, and writing of the manuscript. AK participated in study data analysis and statistical analysis.

**Conflict of Interest**

No conflict of interests.

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