# I Am Not a Patient: Design Challenges in Self-Screening Medical Devices

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## Abstract

Personal health informatics refers to a type of medical systems and devices intended to be used by users without professional medical training. They play an important supporting role for healthy decision-making in non-clinical environments.  There are two important categories of personal health informatics: self-monitoring and self-screening.  Self-monitoring devices help users better manage illness and maintain wellness through surveillance of health parameters, which has been widely studied in recent years. However, self-screening medical devices, of which the users are unaware of their potential illness, are less understood. This paper presents the first results from an investigation into the difference between self-monitoring devices and self-screening devices. Based on a skin cancer self-screening mobile system, we conduct semi-structured interviews to explore the challenges regarding acceptance and adoption.  Future work that focuses on addressing the design challenges evolved are also introduced.

## Author Keywords

Personal health informatics; self-screening; acceptance and adoption; interviews;

## ACM Classification Keywords

H.5.m. Information interfaces and presentation (e.g., HCI): Miscellaneous.

## Introduction

As life expectancy rises, the prevalence of health problems is expected to increase [8]. With this, the cost of supporting the related healthcare ecosystems would become a serious social burden. Personal health informatics systems have the potential to help mitigate this financial and social tension [5]. Through presenting analytic interpretations of users' health data, such systems enable users to detect and interpret early disease symptoms, be aware of their health condition and support healthy behavior changes by linking to long-term health objectives.

While researchers have paid increasingly attention to both patients and doctors' needs [2] to identify the design requirements of personal health informatics system, one type of such systems are less studied so far- the systems that assist users to perform self-screening. The users of these systems are not identified as patients yet. This user category presents unique acceptance and adoption challenges compared with users of other personal health informatics devices. For instance, it is not clear how to incentivize usage, how to best present results, and how to sustain habit formation for periodic long-term use.
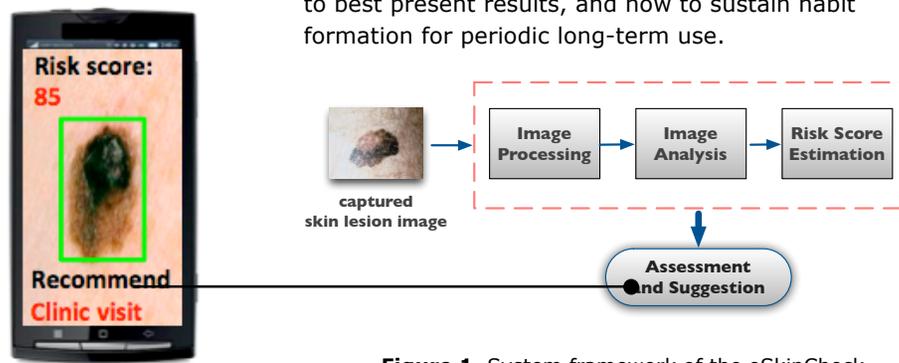


**Figure 1.** System framework of the eSkinCheck

## Self-monitoring Vs. Self-screening

Self-monitoring devices collect physiological parameters through wearable or non-wearable sensors or journaling forms [7]. The users defined in this context tend to have received professional medical diagnosis, being categorized as "patients" or at least are aware of the problem (e.g., obesity or diabetics). By providing this type of users own personal health information, researchers aim to empower them to take an active role in their health management [6]. In contrast, self-screening devices work as an accessible pre-screening method to help users to identify potential health problems in the early stages of the diseases. Before being formally diagnosed with a particular health problem, the users have different considerations and needs compared with "patients". In addition, although self-screening devices requires a routinely data acquisition like self-monitoring devices, a large number of them are usually designed without a long-term health objective which could encourage healthy behavior changes. Instead, these systems typically provide a yes-no suggestion or risk assessment of specific diseases. We argue that lacking long-term health objective may also cause difficulty to sustain usage of the devices. An example of self-screening device from our prior work is briefly introduced below.

## eSkinCheck System

Skin cancer is one of the most common cancers in Caucasians. Due to the lack of patients' awareness, the presence of disease is diagnosed by doctors only at a late stage, usually fatal by then [4]. Aiming to assist people to diagnose the risk of skin cancer in a low cost and timely, we develop eSkinCheck system [9], a mobile-based self-screening application for providing common users early detection of skin cancer.

To carry out the self-screening, users need to capture the skin lesion area using eSkinCheck. Then the system use image analysis to compute features that capture the morphological and chromatic characteristics of the skin mole. Based on these features, the system uses machine learning based algorithms to estimate the malignancy and to provide suggestion (Figure 1).

## Acceptance and Adoption Challenges

To explore the design issues of self-screening systems, we conducted semi-structure interviews with eight older users (over 65 years old) using the eSkinCheck system as an example. We illustrate the interview insights based on the acceptance and adoption of the technology.

### Acceptance

Users raised questions about potential harmfulness as a first concern –despite our system being implemented on a smartphone. Older adults may associate these systems with the hospital diagnostic machines and question about whether risky detection methods (e.g., "X-Ray") would be used, even among the older adults who had used smartphone for a long period.

The older adults also expressed high system acceptance if expertise of the diagnosis could be verified. Some interviewees expressed they may start to use the system only after receiving the recommendations from their peers.

A key viewpoint expressed by some interviewees is that they intend to keep happy without being aware of any potential disease, even if this would heavily threaten their health in the future. The designers of self-screening systems should investigate how to turn the sense of negative disease detection into the notion of positive health maintenance.

### Adoption

In order to detect the potential risk of disease timely, the self-screening device requires routinely usage. Thus, we also explore the long-term adoption of the device in the interviews. Apart from the easiness to use, older adults expect the results of the diagnosis to be easy to understand. The detailed analysis of personal health data was considered confusing and complex.

Without a specific long-term goal like self-monitoring device, the motivation of sustained usage is a key challenge. Most of the interviewees reported they would not continue to use after received negative results several times. However, they still expressed the need for regular formal medical check-ups. Thus, the reminder of self-screening may help routinely data acquisition, especially in the case that the reminder was from a professional, as some interviewees suggested.

It would be helpful to keep the data acquisition in a routine if the process is performed by family members or potential care givers. However, the older adults indicated that they only intend to "trouble" the family members if they have a good relationship.

## Future Work and Discussion

Our work suggests that a novel type of personal health informatics systems need further understanding of users' needs and perceptions. From our interviews, we identify three unique issues of self-screening devices: the importance of less "perceived harmfulness", the difficulty of sustaining usage without a long-term goal and the lacking of intention to learn negative personal

health information. We acknowledge that the culture difference may exist towards the system usage. However, we believe that the difference is more subtle than argued regarding the issues we have explored. Our future work will further design our current eSkinCheck system by embracing the end users' considerations and conducting field studies. More specifically, we will consider:

*Belief* - Previous research reports that acceptance of medical ICT devices is strongly motivated by perceived usefulness [3]. Moreover, in our context, we aim to design self-screening systems with low "perceived harmfulness" and high "perceived expertise".

*Beyond Yes or No* - Arnrich et al. suggest shifting the reflective disease management to a more pervasive and assistive focus [1]. Future work will investigate how to embed the pervasive information with a constructive health objective into the simple diagnosis information, thereby improving sustained motivation.

*Positive Perspective* - Users should not be "scared" by the perceived negative disease-diagnosing behavior. Future design will focus on how to present disease diagnosis process in a positive health maintenance way.

*Reminder from Doctors*- From our interviews, reminder helps keeping the motivation of sustained usage, especially if the reminder message is designed in the form of professional doctors' narratives.

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