Evaluation of digital health solutions from two large dermatology epidemiological studies

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Patel R, Daniel S, Baik R, Lapthorn J, Anastassopoulos K
Fortrea, Durham, North Carolina, United States of America

Introduction

- Over the past decade, there has been increased demand for patient-centric solutions in studies, such as digital health technologies.
- These technologies can be used to remotely capture primary data from patients participating in research studies, alleviating burden on sites and patients, and obviating the need for sites.
- They also have the potential to reduce time and costs, especially when conducting large epidemiology studies compared to traditional, site-based research studies.

Objective

The objective was to evaluate the use of two teledermatology solutions used for data collection in two epidemiological studies on the following:

- Participant photograph submission consent rate
- Participant photograph submission rate
- Photograph quality
- Clinician agreement of disease status

Methods

- We conducted two large (>40,000 adult participants each), cross-sectional, survey studies in the United States, each on the prevalence of a different dermatological condition.
- At the end of respective surveys, adult participants who consented were asked to submit photographs of their condition to a secure server for clinician evaluation.
- **For Condition 1**, participants used a 3rd-party dermatological application downloaded onto their mobile device (3rd-party app) to take and submit photographs.
  - A 3rd-party vendor developed and hosted the app. We provided design input and conducted user acceptance testing prior to release.
  - Prior to use in the study, the app was tested by >50 volunteers selected at random from the general population to 1) determine if they were able to download the app and upload photographs, and 2) identify difficulties while using the app.
  - The 3rd-party app was made publically available for download from the Apple store (for iPhone) and Google Play store (for Android). A unique ID was required to log into the app.
- **For Condition 2**, participants used a digital camera or camera on their mobile device (personal device) to take photographs.
  - Participants uploaded photographs using the same web-based solution used to complete their survey.
  - Photographs were saved to a secure Dropbox™ site.
- Three clinicians participated in each study to independently adjudicate the photographs. Clinicians did not have access to other adjudicators' responses and were provided with a username and password to access the photographs.
- The majority decision determined the disease classification. In instances of disagreement by all 3 clinicians, participants were classified as indeterminate. The level of agreement between the clinicians for disease classification was assessed using Fleiss' kappa coefficient (k).[1]
- The research studies were approved by central institutional review boards.

Presented at ISPOR Boston, MA, USA 2023

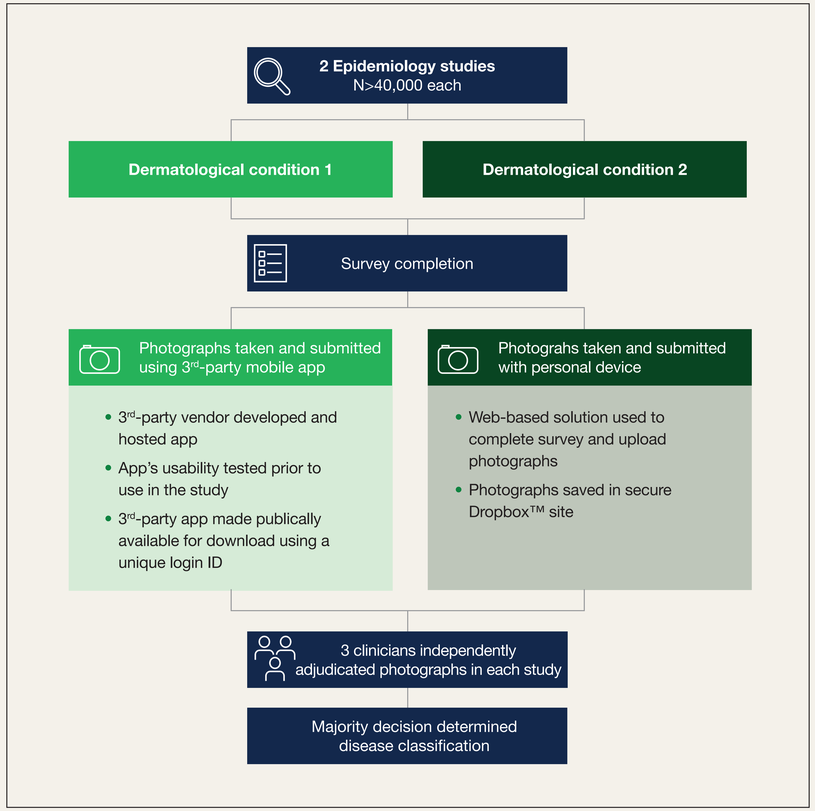

Figure 1. Cross-sectional survey and clinician evaluation flow

Results

- A higher percentage of participants **consented** to submit photographs with the 3rd-party app compared to the personal device (42.1% vs. 33.8%; P=0.005).
- Among those who consented, the photograph **submission rate** was significantly lower with the 3rd-party app compared to the personal device (47.7% vs. 61.5%; P=0.015), which resulted in a similar "realized" consent rate (3rd-party app: 20.1%, personal device: 20.8%; P=0.778).
- Clinicians reported a higher percentage of **quality** photographs from the 3rd-party app compared to the personal device (95.6% vs. 79.8%; P<0.001).
- However, both teldermatology solutions yielded similar moderate **clinician agreement** (3rd-party app: Fleiss k= 0.52, personal device; Fleiss k=0.49).

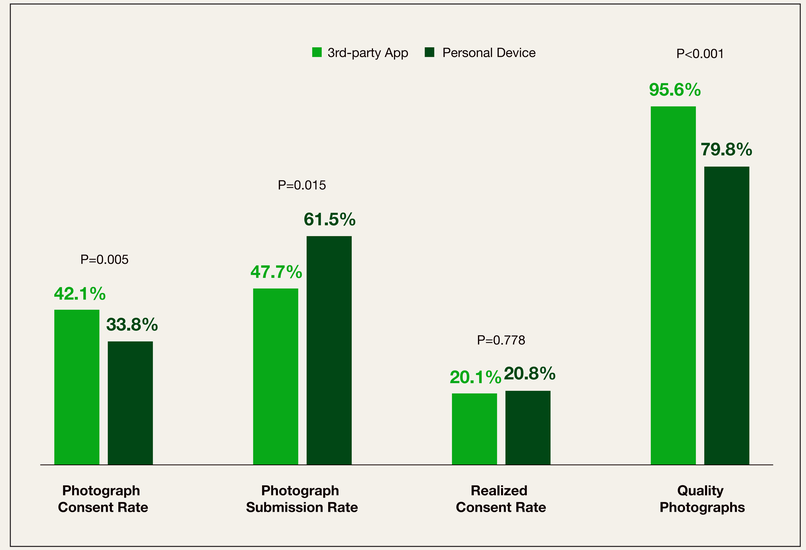

Figure 2. Observed differences in percent of patients use of two digital teledermatology solutions

Conclusions

- These results support the use of these digital technologies in large, observational studies.
- Both solutions resulted in a low realized photograph submission consent rate (1 in 5 participants) and similar clinician agreement. Low rates of submission may be attributable to the study designs (i.e., cross-sectional survey); results should not be extrapolated to site-based clinical studies.
- The 3rd-party app resulted in better photograph quality, which may be attributable to the 3rd-party app's ability to flag blurry photographs and prompt the user to retake the photograph. In contrast, the use of a digital or mobile camera to capture photographs was not subject to any quality control except the user's acceptance of the photograph as adequate.
- Differences may also be attributable to personal anatomical sensitivity of each condition, which were different between the two studies and respective dermatological conditions may confound the interpretation of these findings.
- Further research will help further understand participants' sensitivities, interest, preferences, and ability to use digital health technologies.

References

1. JL Fleiss. 1971. Measuring nominal scale agreement among many raters. *Psychological Bulletin.* 1971; 76:378-382.

Fortrea