The Evolution of Clinicians' Preparedness for mHealth Use (2013-2017) and Current Barriers

Meghan Bradway[a,b], Lis Ribu[c], Gunnar Hartvigsen[d], Eirik Årsand[a,b]

[a]Norwegian Centre for E-health Research, University Hospital of North Norway (UNN),Tromsø, Norway
[b]Department of Clinical Medicine, UiT The Arctic University of Norway, Tromsø, Norwa,
[d]Department of Nursing and Health Promotion, Oslo Metropolitan University, Oslo, Norway
[c]Department of Computer Science, UiT The Arctic University of Norway, Tromsø, Norway

Abstract

Clinicians now insist that health authorities and researchers provide practical evidence and strategies for reacting to and handling patient-gathered data (PGD) and mobile health (mHealth) devices. With diabetes as a use-case, we present a summary of our own studies and a narrative scientific literature review to exemplify the progress of clinicians' perceptions of mHealth. We then compare these results to a narrative review of official clinical practice guidelines related to mHealth use (2013-2017) to demonstrate similarities and differences between what clinicians perceive as opportunities for mHealth and what health authorities are providing. Review of mHealth studies revealed that clinicians have become more willing to accept mHealth technologies and use patient-generated data over time. However, review of clinical practice guidelines revealed several barriers to using mHealth in clinical practice. Results of this comparison indicate 1) the need for a balance of clinician and patient participation and feedback during mHealth studies, and 2) health authorities' lack of sufficient guidance to clinicians for practically using mHealth in their daily practice.

Keywords:

Clinicians, Diabetes, Mobile Health, mHealth, mDiabetes, Consultation.

Introduction

Traditionally, medical devices for diabetes self-management and treatment were validated by health authorities. As such, clinicians were provided with structured guidelines and protocols for how to instruct their patients to use such technologies and relate to the subsequent gathered data. More and more commonly patient-operated mobile health (mHealth) tools enable patients to become more knowledgeable of their own health challenges and more in control of treatment priorities by providing them the means to better understand their own disease. As such, the novelties of mHealth throw a completely different spin on the priorities of patient care; clinicians are now expected to adapt not only to patients' new capacity to self-manage but also analyze larger patient-generated data sets.

Considering the lack of validation and testing within clinical settings, it is understandable that many medical personnel are concerned with various factors surrounding the clinical integration of e.g. mHealth apps [1]. Furthermore, because most often apps are designed for use by patients only, and not clinicians [2], initial evaluation studies within the medical realm focused upon answering questions relevant to individual patient users and not medical practice [3, 4]. Only until more recently was the concept of medical integration and evaluation considered [5]. Thus, medical personnel are now reacting to changes within two different environments: 1) the rapid increase of patient-centered mHealth, for example mobile diabetes (mDiabetes) tools, within the commercial sector as well as 2) pressures from patients to integrate such technologies within the medical sector.

The purpose of this paper is to identify the change in clinicians' perceptions related to mHealth between 2013 and 2017. By comparing this progress to the guidelines provided by regional and national health authorities, e.g. government agencies and those who create medical standards, we identify and emphasize the lack of necessary support for clinicians as well as the importance of including them in the planning and implementation of mHealth within clinical practices. This is especially important in primary health care, where research activities and partnerships with general practitioners' (GPs') offices are not as common as they are amongst health care personnel at hospitals.

Methods

Three narrative reviews were conducted. The first two were of health research literature, published between 2013 and 2017, that described mHealth interventions in which patient-gathered data were shared with clinicians. These were then compared to the third, which was a review of best practice recommendations produced by healthcare authorities, during the same period, regarding how clinicians should use patient-gathered mHealth data.

The first review was of mHealth interventions completed at our own University Hospital of North Norway's (UNN) Norwegian

Centre for E-health Research (NSE). These activities began with the REgioNs of Europe WorkINg together for HEALTH (RENEWING HEALTH) Norwegian Pilot study (2013) [6, 7] in which individuals with Type 2 Diabetes were encouraged to discuss their use of an mHealth app for diabetes self-management, called the Few Touch Application (FTA), during consultations. During the 2014 annual Diabetes Research Conference in Oslo, Norway, we surveyed clinicians about their perceptions of a "clinician interface" of the patient-operated Diabetes Diary smartphone app. The next study that was conducted, concerning clinicians' use and relation to mHealth, was the Norwegian diabetes pilot of the international FI-STAR study [8]. Two GP's and a specialist participated in a clinician workshop in October 2016 to reflect upon what is needed to share patient-gathered mHealth data during consultations. In 2017 we invited patients and clinicians to participate in a co-design workshop, in both peer and joint sessions, to design their ideal mHealth data-sharing system, and indicate their preparedness for relating to mHealth. Workshops were audio-recorded, transcribed and translated into English.

To contextualize our own reports, we conducted a second narrative review of literature describing clinicians' perceptions of mHealth and patient-gathered data reported from similar studies within Europe and America. PubMed and Google Scholar were used to search scientific literature produced between 2013 and 2017. The following search strategy was used for PubMed: *clinician, practitioner, provider, or nurse AND barriers, concern, motivations, perspective, opinion, viewpoint or outlooks AND apps, mHealth, mobile health, wearables, or sensors*. The following search strategy was used for Google Scholar: *combinations of clinician, practitioner, provider, or nurse AND apps, mHealth, mobile health, wearables, or sensors*. Resulting articles were exported to the Systematic Reviews web app, Rayyan [9], for sorting and selection. Analysis included screening for reports of clinicians' firsthand experience with mHealth data presented by patients during clinical interventions. Author MB collected and reviewed the full-text of the publications, where data extraction included clinicians' perceptions of using mHealth in clinical practice, which were categorized as either perceived benefits or barriers. Benefits can be seen as clinicians' willingness to use mHealth, while concerns and needs represent the uncertainty toward using mHealth that needs to be resolved. Inclusion criteria were that literature must i) be published between 2013-2017 in English, ii) describe patient-operated mobile apps as part of the intervention, iii) describe studies included inquiry and reported responses of health care providers within America or Europe. Publications were excluded if i) they did not survey health care providers as part of the study, if ii) no abstract was found to support initial review processes, if iii) it only included "medical devices" [10], if iv) the intervention primarily provided basic mobile phone functions, e.g. SMS, from health providers for patient self-management.

- The third review was of official recommendations produced by health authorities related to how healthcare practitioners should react to, or use patients' own-gathered mHealth data or tools during consultations. Guidelines were searched for in European, Norwegian and American health authorities' websites including The World Health Organization (WHO), the European Commission (EU), Health Care Information and Management Systems Society (HIMSS), and the Norwegian Health Directorate, using versions of the following terms: *"clinical practice guidelines",*

recommendations AND Europe, Norway, America AND mHealth, mobile health, apps. Analysis included screening for any recommendations related to how clinicians themselves should react to and\or use patient-gathered data and mobile health technologies in daily clinical practice. This did not include recommendations for health facility managers or security systems. Data extraction included recommendations for how clinicians could relate to mHealth during consultations. These recommendations were then compared to the clinicians' needs to relate to, as presented in the previous two narrative reviews. Inclusion criteria were as follows: must mention daily medical activities performed by health professionals related to patient-operated mHealth technologies or their self-gathered data. Guidelines must also be published open-access between 2013-2017 within governmental, health authorities' and/or organizational reports. In focusing on publically available documents, we stress the importance of ease of access and use of these clinical practice guidelines for health care personnel themselves. Documents were disregarded if they i) provided no recommendations directly to health care practitioners for mHealth-use, ii) Only described design and/or evaluation guidelines for mHealth interventions studies, iii) Merely commented on issues related to mHealth-use during clinical practice, without direct input from clinicians themselves, iv) Only described appropriate use of clinicians' own mobile device during working hours.

Results

First, we summarized the clinician-related responses to mHealth interventions for our research activities, annually between 2013 and 2017. Table 1 summarizes the results related to clinicians' perceptions of the mHealth tools that were presented to them, both from previously published and unpublished (UP) reports from our studies.

Table 1- Own research: clinicians' perceptions related to use of mHealth tools and patient-gathered data (PGD)

Ref.	Benefits	Concerns and needs
2013		
UP	• PGD would be useful (n=17/23) • Would give recommendations based on PGD (n=17/23)	• Unclear financing (n=12/23) • Would require re-organizing services (n=11/23) • Training/supporting patients (n=11/23)
2014		
UP	• Better preparations of consultations (n=15/15) • Better able to help patients (n=13/15) • More effective communication with colleagues (n=9/15)	• More knowledge required about "patient compliance" (n=12/15) and "Integration into EHRs" (n=12/15) • Clinicians would need more "direct experience" (n=13/15) and training via "seminars" (n=13/15)
2015		
[11]	• Comfort with the system increase over time • Increase understanding of the patient situation • Graphical displays of data improved understanding of patient situation	• Not all patients present data, which is needed for clinicians to provide guidance

2016		
[12]	• Easier to present PGD • Eager to discuss app data as graphs and trends • Patients reflect on data • Patients can and should take initiative during consults	• Must operate with existing medical technology • Data can be "noisy" • Patients need intensive training about how to collect data for medical purposes • Not all patients present data
2017		
[13]	• Can base discussion and advice on personalized data • Result in more concrete discussions • Patients can become more engaged in their health • Specific information will save time	• Patients don't always present their data • Must be easy to collect data • Chance of data overload • Could be too time consuming • Clinicians still need to learn more about mHealth tools

Second, we summarize results of both narrative literature reviews of mHealth intervention studies and official clinical practice guidelines in order to contextualize our own findings and gain a greater understanding of the overall needs expressed by clinicians within the evolving field of mHealth.

The keyword searches in PubMed and Google Scholar results in 71 and 64 results, respectively. Initial review of titles and abstracts was based upon the inclusion criteria as described in the Methods section. 129 publications were excluded because medical practitioners were not directly surveyed and/or because the intervention did not involve patient-operated mHealth tools, leaving only 6 publications for full-text review (see Figure 1). Responses were then separated into benefits and barriers for relating to mHealth tools during clinical practice (see Table 2).
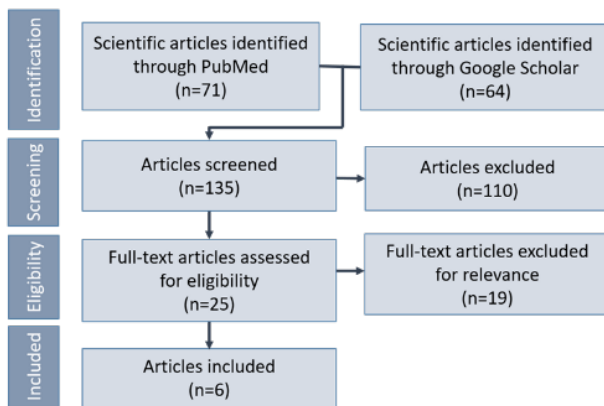

Figure 1- PRISMA flow diagram describing selection of scientific literature for review

Three of the reviewed publications reported clinicians' perspectives on the potential use of mHealth in general, while the remaining three papers reported clinicians' perspectives of a presented or tested mHealth system. The paper by Bonilla et al. [14] reported percentages of respondents' perceptions for each question, which allowed the authors of this paper to highlight how clinicians' perceptions differed between certain benefits and barriers. Table 2 summarizes the overall results of these six publications, ordered by publication year.

Table 2- Scientific literature search results: clinicians' perceptions related to use of mHealth tools and patient-gathered data (PGD).

Ref.	Benefits	Concerns and needs
2013		
[15]	• Simple to use • Positive for patient care process • Monitoring patient progress • React to problems in real time	• Rapid technology progress • Unclear impacts of technology • Content/data overload • Too time consuming • May increase clinical workload • No operational support/guidelines
2015		
[14]	• Tailored patient care • Supplementary patient support • Improved data accuracy • Increased amount of valuable data	• Cost • Time consuming to operate • Validity of applications • Reliability of patient-provided data • Risk of misinterpretation • Safety/privacy
[16]	• Tailor patient care • Improve communication • Fosters trust • Monitoring patient progress • Reinforce motivation and autonomy • Increase legitimacy of own clinical practice • Improve clinical workload/workflow	• Lack of direct view of patient data • Limited data flow and interoperability • Limited functionalities for follow-up • Technology limited to specific device • Competition with traditional care
2016		
[17]	• More possibilities for teaching patients • Increase admin efficiency • Increase consultation efficiency • Supplementary patient support	• No operational support/guidelines • Limited data flow interop. • Time consuming • Tech. integration would compete with other priorities • No guidelines for handling sensitive information
[18]	• Would recommend apps • Comfortable exchanging info via technology • Monitoring patient progress • Improve communication • Must be endorsed by experts	• Discomfort using electronic communication with patient • Lack of sufficient evidence
2017		
[19]	• Understand patient situations • Records symptoms • Medical adherence tracking & alerts	• No operational support/guidelines

Results from review of clinical practice recommendations

Ref.	Recommendations
2015	
[20]	Proposes Continua as the standard for welfare technology
[21]	**Guidelines for recommending apps to patients:** • Tailor app recommendations to patients and discuss consent regarding use of data and limits to consent • Discuss effective apps with colleagues • "Adhere to legislation and regulation (if existing) and/or professional obligations" • If the app is used for monitoring, the physician should instruct the patient how to respond to the information provided • Clinicians should look for the following characteristics before choosing an app: • Endorsement by professional or reputable health organization • Usability and evidence of impact - clinicians may also test the app themselves before recommending it • Reliability of information: inquire about how the patient intends to use the app to determine if the information provided is appropriate • Privacy/security: inform patients of added security risk of using apps, and even recommend apps with additional levels of authentication vs. apps without • Avoids conflicts of interest and fragmentation of health information
[22]	• Do not use medical apps that do not have a CE Mark, or if they do not "meet the requirements of the medical device directives and regulations" • "Exercise professional judgment before relying on information from an app"
[23]	• Clinicians should differentiate medical and non-medical mobile apps – differentiating characteristics are provided
2016	
[24]	• Clinicians should tailor recommendations to the disease and the mHealth apps/PGD presented by patients – example scenarios provided
2017	
	• None found

N=16 documents were identified from the search of clinical practice guidelines for mHealth. We excluded one document because it was not in English, and two documents because they were behind a pay-wall, leaving 13 for full-text review. We excluded 8 recommendations that do not offer practical solutions for clinicians in their every-day practice (see Figure 2).
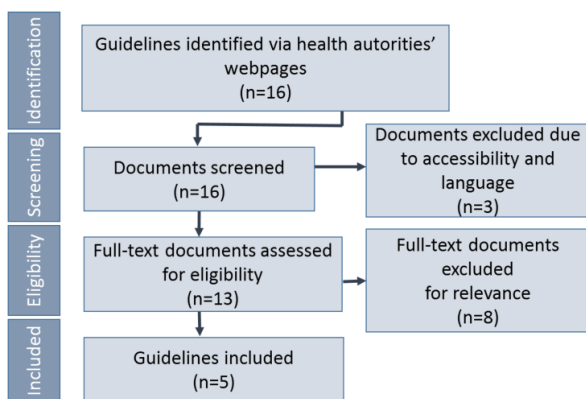

Figure 2 – PRISMA flow diagram describing selection of clinical practice guidelines for review.

Table 3 summarizes the recommendations provided by health authorities for how clinicians should relate to mHealth and patient-gathered data (PGD). This enabled us to compare if such recommendations meet clinicians' needs, as presented by the concerns and needs reported in Tables 1 and 2.

Table 3 – Health authorities' clinical practice recommendations for clinicians' use of mHealth and PGD.

Discussion

Clinicians have traditionally relied upon health authorities and management to provide guidance regarding clinical practice. As demonstrated, with the introduction of mobile health technologies to the options of patient self-management aids, clinicians have been and continue to be at a loss for answers. Despite these initial limitations, clinicians are acknowledging the benefits of these technologies more and more over recent years, especially since patients require more frequent support than the medical system is able to provide. Given the diversity of mHealth-generated data, health authorities and facility managers must provide support and suggestions for how care providers should relate to such technologies within differing clinical specialties in order for integration of mHealth to be successful.

The results of this paper also suggest an answer to the looming question; are the recommendations provided by regulatory bodies evolving quickly enough to meet the needs to clinicians in the rapidly changing environment of mHealth? Comparison of clinicians' perceptions of mHealth over time and guidance produced by regulatory bodies demonstrate that health and care authorities are beginning to propose the type of specific suggestions for relating to mHealth that clinicians need. However, the majority of the official activities under-way involve preparation for secure technological integration on the back-end. There have been few guidelines or recommendations for how clinicians can use data gathered by mHealth tools such as apps and sensors in daily practice. Questions remain regarding how patient-gathered lifestyle and health data should be weighted and considered along-side clinically generated information, e.g. lab results, to inform and generate actionable health recommendations. In addition, it is unclear which data is appropriate for providers to register and store within their own EHR systems. Health providers are responsible for judging which information is medically necessary and relevant for clinical decisions versus which information is sensitive to the individual and, therefore, should not be shared with the rest of the coordinated care team. This task is made exponentially more difficult with the added volume and detail of patient-gathered data, and our current research project *Full Flow of Health Data Between Patients and Health Care Systems* will address this in the coming clinical study of a mHealth system during clinical practice in Norway.

Conclusion

We have seen a development in mHealth where mobile technology, such as apps for mobile phones, smartwatches, and patient-operated sensors, have led to a situation in which patients are bringing new and more data into the clinical settings. mHealth is a rapidly developing field and clinicians need sufficient guidance to respond to the frequent changes and challenges that this new environment calls for. As this paper demonstrates, while official guidelines published by health authorities reference standards for back-end requirements for technological communication between EHRs and mHealth devices, they do not provide sufficient support for clinicians' in

their daily struggle to relate to mHealth. Therefore, the authors advocate for a greater voice and active involvement of health professionals in the development of any new processes, protocols or official standards, regardless of their specialty, to relate to mHealth successfully on a daily basis. It is time to integrate mHealth learning into medical and continued-education for practicing clinicians.

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Address for correspondence

Meghan Bradway
Norwegian Centre for E-health Research
Postboks 35
9038 Tromsø
Email: meghan.bradway@ehealthresearch.no