Context Sensitive Health Informatics: Sustainability in Dynamic Ecosystems
R. Marcilly et al. (Eds.)

doi:10.3233/SHTI190137

Exploring mHealths Fit to Workflow in Homecare – A Case Study in Sweden

Sofia ROSBORG [a, c], Malin LINDBERG [a], Margaret RAMUKUMBA [b], Lovisa JÄDERLUND HAGSTEDT [a] and Maria HÄGGLUND [a, c, 1]
[a] *Health Informatics Centre, Karolinska Institutet, Sweden*
[b] *Department of Health Studies, University of South Africa*
[c] *Department of Women's and Children's Health, Uppsala University and Uppsala University Hospital*

Abstract. With an ageing population and limited resources in healthcare, many high-income countries such as Sweden see an increase in homecare and mobile work for healthcare professionals. In this case study, we explore how mHealth services can support the everyday work for healthcare professionals when delivering home care in rural areas in Sweden. The studied mHealth application had failed to be adopted among district nurses, despite a great expressed need for mobile tools. The results indicate that the mHealth solution did not live up the healthcare professionals' expectations in terms of providing the same functions as the regular electronic health record systems, and with poor integration into the existing eco-system of eHealth applications. In conclusion, in order for a mHealth application to be successfully implemented in a context where many digital services are already in use, it is not enough to support important activities in the current workflow. The mHealth application will need to be carefully integrated into the existing eco-system of healthcare applications to increase the chances of adoption.

Keywords. mHealth, Socio-Technical Systems, Evaluation, Homecare, Workflow

1. Introduction

Globally, healthcare systems are facing similar challenges and a great pressure to perform alongside limited budgets and shortage of staff. eHealth has an enormous potential to facilitate the work for healthcare professionals. The increased use of tablets and smartphones improve opportunities for mobile technologies, also in healthcare. Despite all these opportunities, the everyday life of healthcare professionals in Sweden is filled with outdated systems that are more frustrating than supportive [1]. New mobile technologies are developed and implemented to support clinicians in their daily workflow, yet the failure rate is still high.

To improve design and implementation of mHealth to support homecare in rural areas in the future, we need an in-depth understanding of the factors that impact the success or failure of mHealth interventions. Today, there is a lack of empirical evidence of effectiveness when implementing mHealth services in rural homecare [2]. Often, the focus of evaluation of mHealth is on technical aspects of the systems. As mHealth

[1] Corresponding Author: Maria Hägglund, E-mail: maria.hagglund@kbh.uu.se

interventions can be classified as complex socio-technical systems [3], it is important to consider also other aspects when evaluating mHealth.

Healthcare is to a large extent computerized in Sweden today, and information and communication technology, such as medical records, is used in everyday care. Most of the county councils and regions use one medical record system throughout hospitals, primary care and psychiatric care, which means the patient records are available in the entire county council. Private healthcare providers may use different systems which means the information access is limited, even though many county councils have an agreement with private actors, which allows information exchange [4]. The use of smartphones and tablets in healthcare is increasing and has the potential to improve workflow and access to information. Currently, seven (out of 20) county councils have strategies for the use of tablets, and they also use tablets in care-providing activities (e.g. to provide mobile access to medical records). The extent of implementation of mHealth solutions in homecare within these seven regions is however not known. Five county councils have strategies for the use of smartphones [4]. The use of mobile devices in homecare has increased in the municipalities as well. In 17 % of the municipalities, the health care staff have the possibility to read and write information using mobile device, compared to 5 % in 2015 and 11 % in 2016 [5].

This study aims to explore how mHealth services can support the everyday work for healthcare professionals when delivering home care in rural areas in Sweden. This study is part of the research project MobEval, a collaboration between Karolinska Institutet and Uppsala University, Sweden, and University of South Africa in Pretoria. The purpose of the project is to study different mHealth tools used in both countries, and try to exchange experiences, possible challenges and lessons from each other, to evaluate and possibly improve mHealth tools, and how they contribute to health care delivery.

2. Methods

A case study was performed, focusing on the implementation of a specific mHealth service intended to support district nurses in Sweden when delivering home care for patients in rural areas. The focus was on mapping their current workflow and investigate where and when healthcare professionals can be supported by mHealth services, and how well the implemented solution provided this support.

2.1. Setting and participants

"Hälsa På Plats" (HäPP) is a mobile application for tablets and is not tied to a specific medical record or supplier, but is built on established standards for information management within healthcare in Sweden [6]. The application is based on the "national service platform for information exchange", which is an online, virtual service and allows for information exchange between different systems used in health care [7]. The purpose of the service is interoperability, and for different systems to communicate with each other, regardless of which developer or technical solution they have [7]. The application was developed for clinicians working in primary care and homecare. Today, the mobile application HäPP is implemented in a municipality north of Stockholm. The area is partly located in the archipelago and countryside, which means the Internet/4G/5G network connection cannot be trusted. The functions of HäPP include access to the patients' medical records, which means reading and documenting in the records. The

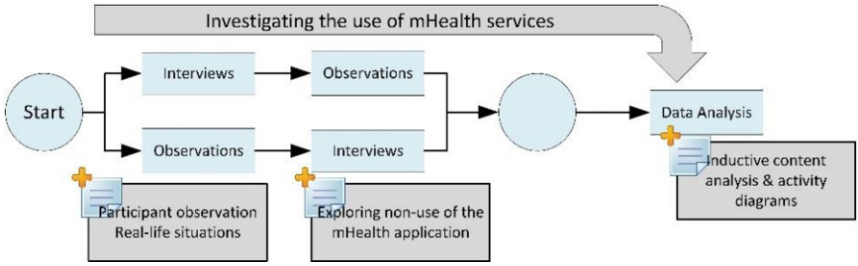

Figure 1. Study design.

patients' list of diagnoses is available, as well as certain lab results. The user can also create their own lists of patients, including the patient name unique identifier. There is a map function where the user can see where they and their co-workers are.

Participants in the case study were recruited using a convenience sampling strategy [8]. A total of seven healthcare professionals participated in the study. Five healthcare professionals were both observed and interviewed. To keep the anonymity, age, gender and workplace are not disclosed. More information about the participants can be found in Table 1.

Table 1. Overview over all participants.

Participant	Observation	Interview
1 district nurse	3 accommodations	One
2 district nurses, 1 physician	3 home visits	One
2 district nurses	-	One with both
1 district nurse	2 accommodations	One

2.2. Data collection and analysis

Two different qualitative data collection methods were used; observations and interviews. The participants were observed in their natural working environment. The aim of the observations was to obtain a clear understanding of the workflow. Interviews were also held with all participants in Sweden, in connection with the observations (Figure 1). The aim was to get in-depth knowledge of why the mobile service is not used. Ideally, interviews were to be held after the observations but for practical reasons the interview was sometimes held before the observation. The interview questions were developed by a team of researchers with both medical and technical background. The interviews were held face-to-face with the participants.

Activity diagrams were used for visualizing the healthcare professionals' workflow (Figure 2). Based on the analysis of observations and interviews, activities that could be supported through mHealth were identified, and a mapping with the functionality of HäPP was performed to further understand how well it supported the current workflow.

Qualitative content analysis was used for analyzing the interviews [9]. The first step of qualitative content analysis is to divide the text into meaning units; words, sentences or paragraphs that relate through their content and context. The meaning units are categorized into groups of common content. In this study, we took our starting point in the socio-technical framework proposed by Sittig & Singh [10] focusing on two of the eight dimensions they propose; workflow and clinical content.

The study has an ethical approval in Sweden by the Stockholm Ethical Review Board (2015/1457-31/5).

3. Results

The analysis of the case study is presented in the form of an activity diagram (Figure 2) with accompanying descriptions of activities that could be supported through mHealth. In the diagrams, a green star indicates that the studied mHealth solution provides support for this activity, whereas a red circle indicates that it does not. Further descriptions of the marked activities are presented in Table 2.

Table 2. Description of workflow with potential for mHealth support.

	Description of the activity	Possible mHealth support
A2	Print a to-do list of all patient visits during the day from ordinary medical record system	The list of patient visit does not necessarily need to be printed. The list can be provided in an electronic format through a mHealth service.
A4	A daily activity is to make calls to different persons to co-ordinate work and activities.	An asynchronous chat function provided in the mHealth service could make the communication more efficient. However, the purpose is not to replace phone calls
A6	If a physician is participating during the home visit, the district nurse will print the patient's measurement values for the physician, since the measurements are in the district nurse's system	This is an interoperability problem, because the district nurse's and physician's systems are not integrated. The measurements do not necessarily need to be printed, but could be accessible in a mHealth service
A7	All printed materials are put in a folder. The rest of the materials are put in a nurse bag	The printed materials could be supported by a mHealth service
A8	The patient is notified in advanced that the healthcare professionals are coming	It is possible that this activity can be supported by a mHealth service, although it must be integrated to a mHealth service for the patient.
A10	A GPS can be used to navigate.	The GPS is provided in the mHealth device
A11	The healthcare professional registers their visit by scanning through the IntraPhone	This is already supported by a mHealth service called IntraPhone, which is however not integrated with HäPP
A13	If it is a sheltered housing, the district nurse enters all apartments to check the signatures made when medications are administered, to ensure adherence to the treatments	The list of signatures could be provided in electronic format
A14	Notes are made on the papers that were printed at the hospital	The medical records could be accessed through a mHealth service
A17	All patient visits must be documented in the medical record system. The administrative work is scheduled to take approximately one hour	Function is provided in HäPP, but due to technical issues it has not been used. A mHealth service could make it possible to document on-site.

A district nurse working with the sheltered housing/nursing home for special needs patients makes approximately 1-4 visits a day. These visits are usually routine, and the same tasks are carried out. A district nurse usually works from 8 am to 5pm.

3.1. Qualitative analysis related to workflow and clinical content

During the observations, it was noted that the Swedish health care workers did not use the HäPP application. During the interviews, they were asked if they had used the HäPP application or not. All of them said that they had tested it, but that they do not use it. When they were asked about the reason why, they said that the application is not adapted

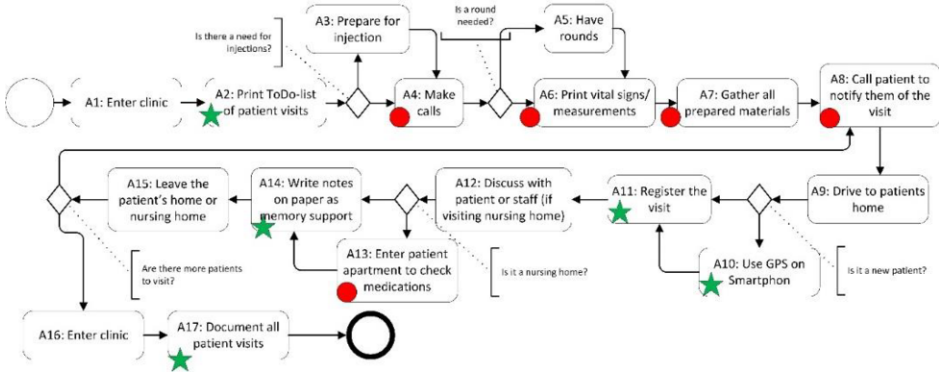

Figure 2. Workflow of healthcare professionals in rural homecare.

to their workflow. All participants mentioned this as the major reason. In table 3 below, findings from the interviews regarding the clinical content are presented.

Table 3. Findings related to clinical content of HäPP.

Category	Description	Quote
User satisfaction	The participants are not satisfied with the application.	*"Isn't adapted to the way we work"*
Interface	The participants are positive towards the application, and think it is easy to use.	*"Easy to use and simplified compared to the medical record system".*
Missing functions	The application lacks main functions from the ordinary medical record system that the health care workers need.	*"The most important functions are not there"*
Usability	The participants mentioned that the application is not adapted to their workflow.	*"Very few things were usable to us, unfortunately".*

4. Discussion and Conclusion

Without a mHealth service, paper and pen were used as the most common tool. The healthcare professionals find it insufficient; much of the work is spent on paperwork related tasks, it can be lost, missing or destroyed. The information stays local and takes longer to transfer. Despite a well-developed infrastructure, Sweden faces challenges of bad network connection in rural areas such as in the case study presented here. The healthcare professionals were handed the mHealth services with limited user-involvement or plan that reached further than the pilot-phase. The mHealth solution failed to support the most important activities in the homecare workflow, which was described as one of the most important reasons for the low adoption among the healthcare professionals. An improved communication tool was also described as important. As a district nurse within home care in Sweden, one is quite alone and in need of communication with other healthcare providers. Also, because of the healthcare system's structure in Sweden, several healthcare providers need to share information about a patient, for example change of medication [11]. This is an interoperability issue that is well-known in healthcare. When introducing a new mHealth service in a context such as the Swedish, where many digital tools, such as medical record systems, are already in use, it is essential that the application is integrated with the systems currently in use. Therefore, the national health information exchange platform was used, however in this

case not all relevant systems were able to share information. In such a context, the new application risks being yet another system – increasing the risk for non-adoption.

In conclusion, for a mHealth application to be successfully implemented in a context where many digital services are already in use, it is not enough to support important activities in the current workflow. The mHealth application will need to be carefully integrated into the existing eco-system of healthcare applications to increase the chances of adoption.

Acknowledgement

The study was funded through the MobEVAL project (2016-00623) supported by FORTE – the Swedish Research Council for Health, Working Life and Welfare and SAMRC – the South Africa Medical Research Council. This research was also supported by Uppsala MedTech Science & Innovation (www.medtech.uu.se), a joint strategic initiative between Uppsala University and Uppsala University Hospital.

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