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Mobile Health Apps in Sweden: What do Physicians Recommend?

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Background: Currently over 50, 000 mobile health apps are available worldwide. In general, they are considered as innovations potentially delivering benefits to patients. Physicians are considered as potential channels to disseminate these innovations to patients. However, physicians' behavior in this regard has not been studied.
Objectives: To capture physicians' attitudes towards recommending health apps to patients and to describe factors influencing physicians' behavior, taking the specifics of an early adopter country, Sweden, into account.
Methods: Diffusion of Innovation theory, the Health App Maturity Model and the Six Hurdles Model were used to construct a web-based survey that was answered by 44 Swedish physicians. Survey results were followed up with 2 individual interviews. Descriptive statistics were used for quantitative data analysis and recursive abstraction for qualitative data analysis.
Results: Only a small group of physicians currently recommend mobile health apps to their patients. However, most physicians have a positive attitude and perceive improvement of patients' self-management ability as main benefit of health apps. Main perceived weaknesses include the lack of evidence-based content and lack of multi-language support. Regulation of health apps under the Medical Device Directive is asked for to assure quality and patient safety.
Conclusion: Innovators and early adopters play an important role in the diffusion of mobile health apps. Interpersonal communication is seen as the most effective way for physicians gaining information and also motivates them to recommend mobile health apps to their patients. Physicians' knowledge about certified websites to ensure quality is however low.

Keywords: Diffusion of Innovation, Mobile health app, Physician, Self Care, Sweden

Introduction

Mobile health applications, also known as "health apps", are application software programs providing mobile solutions for healthcare and prevention, which can be downloaded to run on smartphones, tablet computers and other mobile communication devices. Health apps include rich medical knowledge and references about health promotion, fitness, nutrition, and commonly have scheduling functions and medical calculators. Sensors as accessories can be paired with some apps to detect, collect, and analyze users' health conditions at any time anywhere in order to improve their self-management abilities. Physicians can even receive those data and perform interactions

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with their patients remotely. Currently over 50,000 health apps are available worldwide [1] compared to the number 17,000 in 2010 [2], meanwhile, there are increased concerns about the quality of health apps. For instance, a certain amount of health apps are released without clinical trials and lack evidence-based content [3, 4], mechanisms for protection of patients' health data, and regulations [5-7].

Previous research on the dissemination of health apps has shown that physicians are considered as a potential channel for introducing health apps to patients [8]. These studies have, however, not investigated physicians' knowledge about health apps and attitudes in depth. Thus we have little knowledge about how physicians think about health apps and how they act in reality. Do physicians really recommend health apps to patients and what are their reasons for doing so or not?Most studies so far have been performed in the United States and study results might not easily be transferred to other countries with different preconditions regarding health systems [9], e-Health literacy [8] and smartphone penetration [7].

Sweden has a higher smartphone penetration rate than the United States, citizens have a high level of health awareness in general and a high IT literacy exists even in the older population. However, studies to investigate physicians' attitudes towards recommending health apps to patients have not been performed.

Hence, the objectives of this study are to capture physicians' attitudes towards recommending health apps to patients and to describe factors that influence physicians' behavior in this regard, taking the specifics of an early adopter country, Sweden, into account.

1. Methods

Diffusion of Innovation (DoI) theory [9], the Health App Maturity Model and the Six Hurdles Model [8] were used to construct a web-based survey that was answered by 44 Swedish physicians. Survey results were followed up by individual interviews with 2 of the respondents. The survey consisted of four sections including *recommendation decisions*, *benefits*, *barriers*, and *quality factors*. Quantitative data from the survey was analyzed with descriptive statistics using SPSS. Qualitative data from the follow-up interviews was analyzed through recursive abstraction. The data collection period was three month between 25th April and 25th July, 2014. Possible respondents were approached through (1) the IT interest group of the Swedish Association of Family Medicine (SFAM); (2) an article named "*Läkares attityd till hälsoappar undersöks*" about the research project published in Dagens Medicin on 7th of May, 2014 [10]; and (3) adopting snowball sampling through sending emails, embedded with survey links to several physicians. They further spread the link to their acquaintances (physicians) in order to reach a larger population. By answering a survey question about their attitudes towards new IT innovation in healthcare, respondents were categorized into different adopter groups according to their definitions in the DoI theory. Characteristics of the 44 respondents are shown in table 1.

Table 1. Participant characteristics

Age range (mean)	Gender	Workplace	Work experience (mean)	Specialty	DoI Adopter group
37-48 years	Female (n=20)	Hospital (17%)	>10 years	GP (n=38)	Innovator (20.5%)
	Male (n=24)	Polyclinic (22.6%)		Cardiology (n=2)	Early adopter (56.8%)
		Primary Care (56.6%)			
		Disease Research Centre (3.8%)		Diabetes (n=2)	Early Majority (13.6%)
				Chiropractics (n=1)	Late majority (9.1%)
				Pediatrics (n=1)	Laggard(0%)

2. Results

The results show that 95.5% of the respondents know what health apps are and 81% of them use them themselves. More than half of the respondents (59.1%) were asked by patients about health apps. 36.7% of the respondents do currently recommend health apps to their patients and 56.8% consider to recommend them in the future (table 2). Only 6.8% of the respondents claim that they will never recommend health apps to their patients. Table 3 shows the main channels for respondents to gain information about health apps. Moreover, respondents who "recommend" or "will recommend" gave their answers about the types of health apps they recommend/will recommend. They also pointed out which patient groups should use health apps and the motivation factors influencing their recommendation decisions.

Table 2. Three recommendation decisions associated to different adopter groups (number of respondents)

Recommendation Decisions	Innovators	Early Adopters	Early majority	Late majority	Laggards	Total
Recommends	6	9	1	0	0	16
Will Recommend	3	15	4	3	0	25
Never Recommends	0	1	1	1	0	3
Total	9	25	6	4	0	44

Table 3. Information channels, health apps categories, target patients, and motivation factors

Top 3 information channels	Top3 health app categories	Top 3 target patients groups	Top 3 motivation factors
Digital app stores	Physical training	Chronic conditions	Patients' interests [a]
Patients	Health lifestyle	Unhealthy lifestyles	Personal interests [b]
Colleagues	Cognitive training	Cognitive problems	Colleagues 'interests [c]

[a] Refers to the survey answer option: Patients recommend health apps to me; [b] Refers to the survey answer option: I use health apps myself; [c] Refers to the survey answer option: Colleagues recommend health apps to me

Apart from defining different adopter groups, the DoI theory also suggests five different characteristics influencing physicians' decision making and thereby having an impact on the spread of innovations among individuals. The data summarized in table 4 present the contributing factors that influence physicians' decision making about recommending health apps to their patients in relation to these DoI characteristics.

Presented results are based on the survey data as well as the data from the follow-up interviews.

Table 4. Major perceived benefits, barriers, and quality factors rated by respondents

DoI	Benefits	Barriers	Quality Factors
Observability	Efficient patient encounter; Improve treatment plan;	Lack of integration with clinical data	Awareness of Clinical trial; Need trustable Peer-review & User feedback
Trialability	Good Trialability, (self-test, patients test, colleagues test)	Cannot find specific one; Unaware of existing apps Lack of multi-language;	Relative low awareness of existing aggregator websites; Require timely Updates
Simplicity	Good mobility; Easy to run; Easy to download; Replace paper lists	Unclear instructions; Lack of personalized design;	Require good customer services/technical support;
Compatibility	Personal judgments; Good user experiences from self-use, colleagues, patients;	Lack of surveillance by government/regulators	Awareness of FDA, ISO; High awareness of Protecting patients' health data; Require to treat health apps as medical devices
Relative advantage	Improve patients' self-management abilities	Lack of evidence-based content Lack of integration with clinical data	High awareness of Clinical proven (passed clinical trial)

By analyzing the interview results, we understand that physicians have observed some remarkable changes when their patients use recommended apps, which might improve the efficiency of patient encounters, and further improve treatment plans.

> *"Younger patients get greater freedom as they can use apps for carbohydrate counting ....They also get trained in knowing the carbohydrate content in common food... I think the apps sometimes are the reason some patients start using carbohydrate counting."* (Early adopter , Child diabetes)

Nevertheless physicians also see a need for integration with clinical data.

> *"We can of course not totally trust self-reported data anyhow – not today and not in the future…. We need integration with EMRs, I would like to validate data as close to measurement as possible!"* (Innovator, pediatrician)

Also the need for incentives and clear regulations was highlighted in the interviews.

> *"It must also be incentivized like other medical activities…apps have to be regulated like other medical devices, if not the innovator dares to take the responsibility , why should a patient or a physician dare?"* (Innovator, pediatrician)

3. Discussion

This study confirmed the existence of diffusion of health apps between physicians and patients in the real world. 60% of the respondents classify themselves as early adopters and the results also reveal a high recognition of adoption of health apps among them. However, more than half of the physicians keep a "wait-and-see" attitude in that they consider recommending health apps to their patients but have not done so yet. Early adopters usually perform as "opinion leaders" according to the DoI theory and their decisions will definitely influence others. This is also emphasized by the fact that "patients" and "colleagues" are mentioned as major information channels for physicians getting information about health apps and that many physicians use health apps themselves. However, in the current situation, physicians are still facing many challenges, whereof *lack of surveillance by governments and regulators* and *lack of*

integration with clinical data seem to be the pre-dominant ones. A suggestion given by one interviewee is to regulate health apps as medical devices. A rigorous standard as the "medical device directive" may hinder the progress of innovations, but the standardization of health apps may encourage full integration between health apps and clinical systems and also contribute to quality control. Also, *randomized controlled trials* (RCT) of health apps are suggested to ensure the quality of health apps. From the survey results, it can be stated that certified websites approving health apps such as e.g. [5, 6] are not considered as main information channels. On one hand, physicians may need to increase their awareness and knowledge about certified websites and relevant regulations; on the other hand, as app stores are the main channel for searching health apps, certified websites might collaborate with app stores to provide quality assured health apps.

Methodologically this survey was constructed based on existing theories. This theoretical background helped to build a data requirements table where each question in the survey is related to the respective theory and indicators to be measured. Also follow-up interviews were performed as a mean to collect more in-depth qualitative data as a complement to the quantitative measurements.

The limitations of this study are the very limited sample size (n=44), the recruitment process leading to a high percentage of primary care physicians and a high rate of early adopters, and the use of two volunteers for the follow up interviews who happened to be physicians who recommend apps. These restrictions severely hamper the representativeness of the data and its generalizability.

Nevertheless this study confirms the existence of Swedish physicians' recommendation behavior regarding health apps and highlights several contributing factors that influence their decision making. Future research will be based on a larger sample size, include other professional groups as well as patients, and also broaden the use of qualitative methods for data collection.

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