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Review

The landscape of research on smartphone medical apps: Coherent taxonomy, motivations, open challenges and recommendations

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ABSTRACT

Objective: To survey researchers' efforts in response to the new and disruptive technology of smartphone medical apps, mapping the research landscape form the literature into a coherent taxonomy, and finding out basic characteristics of this emerging field represented on: motivation of using smartphone apps in medicine and healthcare, open challenges that hinder the utility, and the recommendations to improve the acceptance and use of medical apps in the literature.

Methods: We performed a focused search for every article on (1) smartphone (2) medical or health-related (3) app, in four major databases: MEDLINE, Web of Science, ScienceDirect, and IEEE Xplore. Those databases are deemed broad enough to cover both medical and technical literature.

Results: The final set included 133 articles. Most articles (68/133) are reviews and surveys that refer to actual apps or the literature to describe medical apps for a specific specialty, disease, or purpose; or to provide a general overview of the technology. Another group (43/133) carried various studies, from evaluation of apps to exploration of desired features when developing them. Few researchers (17/133) presented actual attempts to develop medical apps, or shared their experiences in doing so. The smallest portion (5/133) proposed general frameworks addressing the production or operation of apps.

Discussion: Since 2010, researchers followed the trend of medical apps in several ways, though leaving areas or aspect for further attention. Regardless of their category, articles focus on the challenges that hinder the full utility of medical apps and do recommend mitigations to them.

Conclusions: Research on smartphone medical apps is active and various. We hope that this survey contribute to the understanding of the available options and gaps for other researchers to join this line of research.

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1. Introduction

Adoption of smartphones in the arsenal of healthcare is coming as no surprise. People have always used available facilities to enhance their most important activities and protect their most valuable assets; and no asset is more valuable than their own health. The utilization of information and communication technology in the practice of healthcare introduced the notion of eHealth [1,2], where telecommunications is enabling telemedicine, computers are processing health data, and the Internet is providing the infrastructure to exchange all sorts of medical information and services. When mobility became possible, telecommunications occurred through mobile phones, and computers moved along with people in the form of portable laptops and then handheld devices. The eHealth stretched to include mobile health (mHealth) [3]; but still, the phone was a phone and the computer was a computer; until both converged into a single unit known as a "smartphone".

Smartphones are mobile devices that are *smarter* than earlier generations of cellular phones, usually known as feature-phones [4]. This extra smartness is gained by virtue of closer resemblance to personal computers (PCs). Smartphones possess greater computing power, more connectivity options, sophisticated operating systems, full Internet access, and most importantly the ability to install and run third-party applications, often dubbed as "apps". This last feature extended the smartphone's versatility into new functions unthought-of before, even by its designers. However,

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