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Hype or hope for diabetes mobile health applications?☆



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Mobile health applications (apps) created to help improve type 1 diabetes or type 2 diabetes care are perceived by their visionaries and programmers as game-changing tools which assist in the rigorous demands of diabetes self-management. People living with diabetes who have access to mobile technology are learning how to utilise technology for better blood glucose control and support, often in conjunction with their healthcare teams.

Despite all the technological progress and success, diabetes health apps also raise concerns about important issues such as regulation and approval, privacy, accuracy and safety. In a shortened review, Joyce Lee, Associate Professor of Pediatrics at the University of Michigan and Co-Director of the Mott Mobile Technology Program for Enhancing Child Health assesses the types of endocrinology and diabetes apps available today and examines current challenges that so often come with new technologies.

Mobile device growth

Mobile phones have become ubiquitous. According to the 2012 Pew Research Center's Internet and American Life Project, the majority of US adults (91%) own a mobile phone, and more than half now carry smartphones, phones with a mobile computing platform, such as iPhone and Android [1–3].

Fig. 1 shows that smartphone ownership is a generational thing; younger individuals have greater adoption, but use is increasing across all age groups, and most importantly differences in smartphone ownership are narrowing, across

race and ethnicity (Fig. 2) and income (Fig. 3), particularly for younger generations. Because mobile phones are now widely available, there is great interest in the development of mobile technology for improving health.

According to industry estimates provided by the US Food and Drug Administration (FDA) website, 500 million smartphone users worldwide will be using a healthcare application by 2015, and by 2018, 50% of the more than 3.4 billion smartphone and tablet users will have downloaded mobile health applications. These users include healthcare professionals, consumers, and patients.

What is mHealth?

Mobile health is referred to as mHealth, and is defined as “mobile computing, medical sensor and communications technologies” used for health promotion, including chronic disease management and wellness. mHealth includes medical applications that may run on a cell phone, sensors that track vital signs and health activities, and cloud-based computing systems for collecting health data [4,5].

There has been an explosion in mHealth over the last five years, with more than 13,000 apps on healthcare topics alone available to Apple iPhone users [6] and over 6,000 medical apps available to Android users [7]. Apps focused on diabetes are proliferating in the marketplace, but how many and what kind of apps are available? We recently published a review of endocrinology and diabetes applications to examine the types of apps available as well as review current challenges for the diabetes mobile application ecosystem [8].

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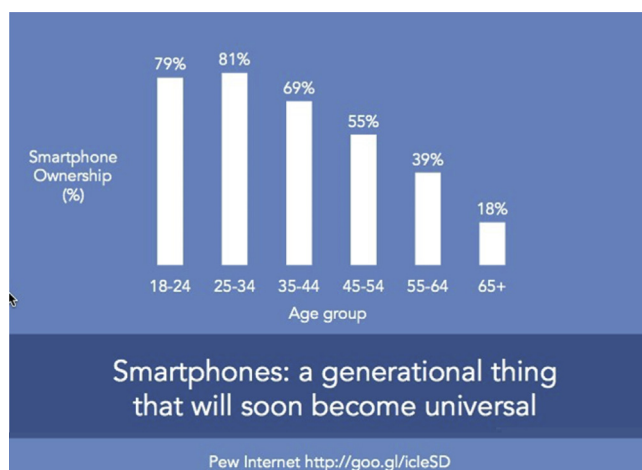


Fig. 1 – Smartphone ownership on the rise across all generations

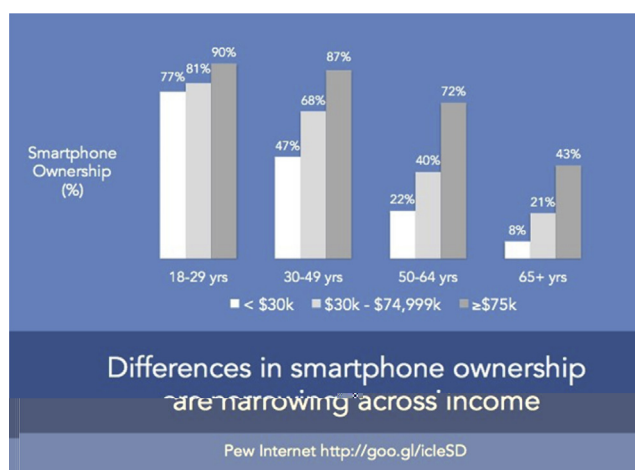


Fig. 3 – Smartphone ownership across income levels is narrowing

Growing number of diabetes apps

When we searched for “diabetes” on January 27, 2013, we found 600 apps on the Apple iTunes store, of which 85% were relevant, and 480 apps on the Android marketplace, of which 50% were relevant.

Important takeaway messages:

- Options vary depending on what type of phone you have.
- Our review was done in 2013 but a more recent search (July 3, 2014) found 969 results in the iTunes store, which demonstrates how quickly the number of available apps is accelerating.

The Android search algorithm challenged our review; it would only allow us to view the first 400+ apps and the searches in Android yielded a low percentage of relevant results. We concluded it would be best to focus our review on

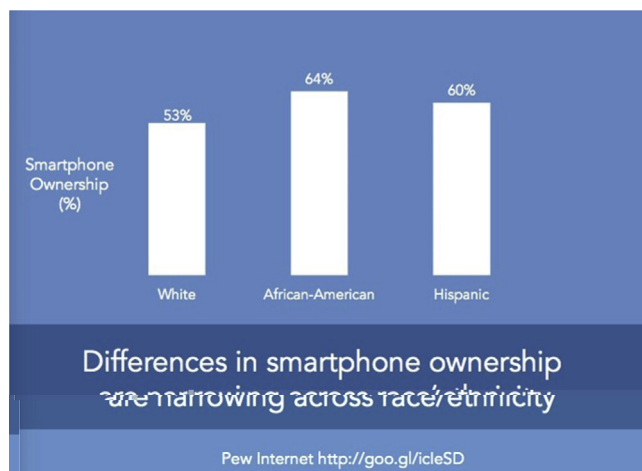


Fig. 2 – Smartphone ownership nearly even across race/ethnicity

the apps that we found through the iTunes store for use on iOS systems.

App categories

1. *Medical management of diabetes:* The Welldoc Diabetes Manager, “Bluestar” is the only app to receive clearance from the FDA for medical management of type 2 diabetes in adults [9,10]. The Welldoc system allows patients to track and record their blood glucose levels and identifies trends in blood glucose patterns providing real-time, clinically based feedback and coaching for people living with diabetes. In addition, the app can share diabetes data directly with the healthcare team. Bluestar can be obtained only by a prescription from your doctor.
2. *Apps for tracking and displaying health information:* The largest proportion of diabetes apps (33%) was focused on health tracking. These apps allowed users to track blood glucose, insulin doses, carbohydrates, weight, and physical activity and review their data in a variety of ways including raw numbers, graphs or summary values such as averages. The majority of tracking apps required the user to manually enter their health data into the app. Just a few apps could directly upload glucose levels to a mobile phone, such as the Glooko system, the iBGStar meter, or the Telcare meter. mySugr is a diary and monitoring app that leverages gamification style to keep users engaged and motivated. Each of these apps has been given FDA approval [11].
3. *Apps for teaching and/or training:* Approximately 22% of apps were focused on teaching and/or training. For example, some apps taught the principles of carbohydrate counting through interactive graphics and games. Other apps were insulin dose calculators that provided a suggested dose of insulin based on a target blood glucose value, correction factor, carbohydrate ratio, current blood glucose and estimated carbohydrate before a given meal. Tracking apps also provided training for users in medication administration such as glucagon or assistance with device use.

4. *Food reference databases*: Approximately 8% of the apps were food reference databases for carbohydrate counting. Another 5% had recipes for users with diabetes. Some apps combined carbohydrate counting guides with tracking tools.
5. *Social forums/blogs*: Approximately 5% of the apps were social networks, social forums, or blogs meant to connect people with diabetes to each other so that they might share information and experiences.
6. *Physician directed apps*: Although most apps were developed for people with diabetes, approximately 8% were intended for the healthcare provider as a tool for providing medical information. Other apps were designed for diabetes journals which provided electronic access to articles.

Current challenges in the mHealth app landscape

1. The majority of mHealth diabetes apps have not been tested or evaluated for improving health outcomes.
2. Most diabetes apps were consumer facing, and although users could elect to send health information to their provider, they could only share the information using methods of communication like email that are not compliant with the US Health Insurance Portability and Accountability Act (HIPAA). The purpose of HIPAA is to prevent inappropriate use and disclosure of individual health information. In addition, there was no way for the data from the apps to be integrated into the health provider electronic medical record.
3. There are potential safety concerns. The FDA defines an app as a medically regulated device if it provides a patient-specific result, diagnosis, or treatment recommendation that is used for making clinical decisions [11]. We found a number of insulin dose calculator apps which technically meet criteria for being a medically regulated mobile application, but did not find evidence for FDA approval despite their availability to consumers [12,13].
4. In both the iPhone and Android stores, many of the diabetes apps were categorised as “medical” in their descriptions, but this designation was provided by the app maker, and not by any particular review body or medical expert. Individuals may be unaware of this distinction and may incorrectly assume that the “medical” label implies an endorsement for medical effectiveness.
5. There are possible threats to privacy and security of information transmitted through mobile apps [14]. There is growing concern about the privacy of data entered into mHealth apps, what companies actually do with the data, and whether they notify users of how they use the data.
6. There are difficulties with finding relevant apps. Again, given the different results we found with the iPhone and Android searches, an individuals’ access to diabetes apps was wholly dependent on whether they had an Android phone or an iPhone. The search capabilities for both app stores were relatively rudimentary, without the ability to perform more advanced searches. Apps did carry user reviews, which were few in volume and with uncertain

reliability. Finally, app search algorithms are not transparent and it has been speculated that the iPhone app store is continually changing the search algorithms which could affect patient access and choice depending on when they access the app store.

Regardless of these challenges, mHealth has great potential for improving outcomes in diabetes, communication between patients and providers, and increasing the efficiency of care delivery in health systems. However, further work is needed to: (1) prove the effectiveness of these apps; (2) integrate the use of apps with healthcare providers into the healthcare delivery system; and (3) provide consumers with systematic and reliable information about the safety and medical utility of mobile health applications. There’s a little bit of hype right now, but my bet is on the hope.

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