Mobile Health Apps: Adoption, Adherence, and Abandonment

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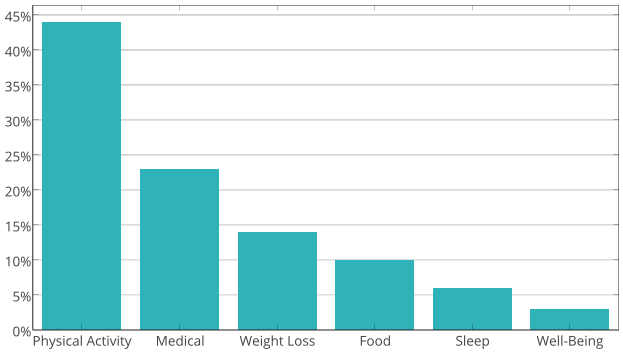

Figure 1: Most popular types of health apps according to download rates on Google Play

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Abstract
A myriad of mobile technologies purport to help individuals change or maintain health-related behaviors, for instance by increasing motivation or self-awareness. We provide a fine-grained categorization of popular mobile health applications and also examine the perceived efficacy of apps along with reasons underlying both app adoption and abandonment. Our findings bear implications for future tools designed to support health management.

Author Keywords
Health; Fitness; mHealth; Mobile Apps; Android

ACM Classification Keywords
H.5 [Information interfaces and presentation (e.g., HCI)]

Introduction
Health and well-being are major concerns on both societal and personal levels. Chronic diseases account for 7 of the top 10 causes of death, and approximately half of U.S. adults have at least 1 chronic health condition, with 1 in 4 adults suffering from 2 or more [1]. At the same time, opportunities for ubiquitous, technology-based health management continue to blossom as adoption rates and usage levels grow — 90% of U.S. adults own a cell phone (64% smartphones) [5], and 19% of those smartphone users have one or more health-related apps [2]. However,

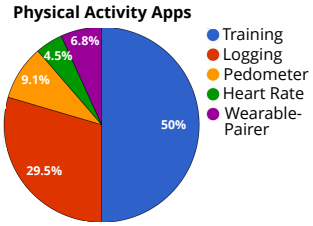

Figure 2: Breakdown of most popular type of Health and Fitness app (Physical Activity)

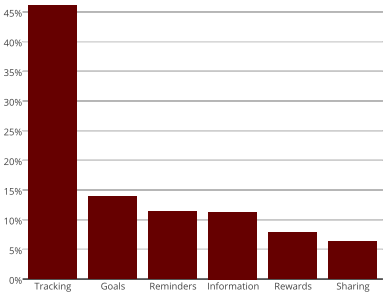

Figure 3: Most important health app features for respondents

while outlets such as App Annie[1] and PEW Research provide coarse summaries and statistics about apps and their usage, no fine-grained categorization exists nor has a more qualitative probe been taken into why and how people are actually using (or abandoning) these technologies.

Method

Over 3 months from June through August 2014, we used the Google Consumer Survey (GCS) service[2] to deploy nationwide surveys about usage and perceived effectiveness of health-related mobile apps. Specifically, surveys items covered:

- *Functionality*: types of health apps used and preferred features
- *Adoption*: how individuals learn about and come to download health apps
- *Adherence*: motives for using health apps, frequency of usage, and perceived effectiveness
- *Abandonment*: whether and why a health app was installed but its usage discontinued

The surveys targeted users of the Android Play Store[3] application market. According to a PEW Research report, Android is the most popular smartphone platform and has the most balanced userbase across racial, educational, and income groups [5]. Due to the nature of GCS, each survey was administered as a microsurvey to separate sets of representative respondents. Comparison shows no significant differences in inferred demographics (gender, age, income, urbanity) across survey samples. Overall, respondents were 56% male and 44% female, ranged in age from 18 to 65+ years, had a median income between $25,000-$49,999, and predominantly (87%) lived in urban or suburban locations. A mean of 1839 responses per question were collected.

[1] http://appannie.com
[2] https://www.google.com/insights/consumersurveys/home
[3] http://play.google.com/store

Characterizing Popular Health Apps

As of July 2014, tens of thousands of apps labeled as "Health" or "Health and Fitness" could be found in the Play Store. Focusing on the Play Store's 100 most popular (based on download rates listed on the site), we devised the multi-level categorization scheme in Table 1 to describe apps designed to support healthy behavior.

As seen in Figures 1 and 2, Physical Activity apps are the most prevalent type and comprise mostly Training and Logging apps. Similarly, when choosing from features based on a taxonomy of behavior change techniques [3], respondents report tracking as the most important feature (see Figure 3), followed by setting customized goals, notifications and reminders, and access to informational health materials. Respondents identify game-like reward elements and social sharing as the least important features, which aligns with prior work that finds rewards and sharing to be less motivating (despite their prevalence in systems) than goal-setting and reminders [4].

Adoption, Adherence, and Abandonment

We next explore how people come to download health apps in the first place, what motivates continued usage, and what prompts app abandonment. We find respondents most often learn of health apps from family members or friends (see Figure 4) and significantly less from health or fitness professionals, who may actually be more likely to have the knowledge of health topics and personal health needs necessary to appropriately recommend apps.

Category	Description	Example Apps	%
Physical Activity			44
Training	Workout guides, information, videos, coaching	Fitness Buddy, Daily Leg Workout, Cardio Trainer	22
Logging	Recording workout routines or routes	Map My Walk, Endomondo, Runtastic	13
Logging: Pedometer	Apps that use phone sensors (GPS, accelerometer) for step-counting. (Separate from apps that are a companion for a pedometer device, which are Wearable-Apps)	Noom Walk Pedometer, Walkroid	4
Logging: Heart rate	Apps that use phone sensors (built-in camera) to calculate heart rate. (Separate from apps that are a companion for a heart rate device, which are Wearable-Apps)	Instant Heart Rate, Cardiograph	2
Wearable-App	App by wearable manufacturer (e.g., FitBit, JawboneUP, Polar Monitor) made for use with that device	Fitbit Mobile, UP It Pro, Polar Bear	3
Medical			23
General	Symptom checkers and any app designed for patients, related to specific medical condition(s), or offered by a healthcare provider	iTriage Health, WebMD	7
Women's Health	Menstrual cycle, pregnancy	My Days, I'm Expecting	16
Healthy Behavior and Well-Being			17
Lifestyle Coach	Apps with functionality encompassing multiple aspects of health behavior management (e.g, tracking food plus planning workouts plus emotional encouragement, etc)	Map My Fitness, Workout Trainer	1
Weight Loss Companion	Health behavior management explicitly aimed at supporting weight loss goals	My Fitness Pal, Spark Coach, Noom Weight Loss Coach	14
Psychological Support	Mood trackers, personality tests, horoscopes	Know Yourself	2
Food			10
Logging	Calorie counters, food tracking	Calorie Count, Weight Watchers, Points Calculator	7
Recipes	Recipe catalogs, forums for sharing recipes	Favorite Recipes	2
Water	Hydration logging, reminders to drink water	Water Your Body	1
Sleep			6
Sensing & Logging	Sleep monitoring, recording, and assessment	Sleep Bot, ShutEye	1
Relaxation & Sounds	Ambient noise, white noise, and melodies to aid sleep or relaxation	Music Therapy, Sound Sleep	5

Table 1: Descriptions, examples, and proportions of the types of health-related applications most popularly downloaded

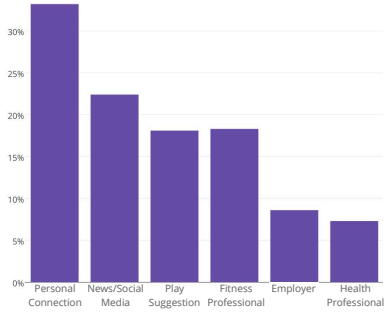

Figure 4: How respondents learned of downloaded health apps

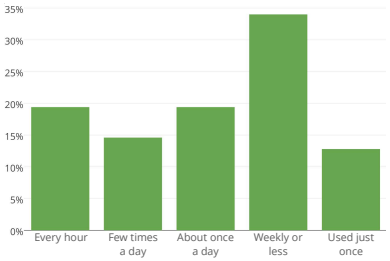

Figure 5: Reported health app usage frequency

The top reported reasons for maintaining use of a health app are to improve physical fitness and to lose weight (41.8% and 40.2%, respectively over all respondents), though fitness motivates men significantly more so than women, who are significantly more motivated by weight loss goals. Most (53.4%) respondents who use a health app do so about once a day or more (see Figure 5).

Responses about the efficacy of apps reveal common themes including that tracking provides personal accountability, the ability to reflect on improvements as well as lack of progress over time, and a concrete checklist of goals. Respondents also mention that being able to set customized goals and the corresponding enhanced sense of individuality help sustain motivation. Respondents who appreciate reward features (particularly self-identified gamer types) report gamification such as points and badges boosts motivation and keeps workouts fun. Further looking into adherent users' perceptions about app effectiveness, we find nearly half (49.1%) of respondents agree or strongly agree that health apps help them feel more healthy and full of energy, while only 9.8% and 9.5% disagree or strongly disagree, respectively — though frequency of use matters, as 69% of people who use a health app a few times a day or more strongly agree. Similarly, more frequent users report health apps actually cause them to walk more and help improve their stress levels significantly more than less frequent users.

Turning to abandonment, respondents who downloaded but later uninstalled a health app note reasons related to app functionality and personal circumstances. App and externally oriented issues include battery drain or phone incompatibility (mentioned by 13.4%), mistrust of the app's developer (6.1%), lack of desired features (e.g., tracking, notifications) (25.5%), and inability to use an app in a particular living environment (e.g., communities with low walkability) (6.1%). More personally-oriented reasons for non-use include no longer needing the app after achieving a health goal (10.3%) or, in contrast, abandoning a health goal and the app along with it (35.1%). Regrettably, we find the latter case is the most commonly reported reason underlying abandonment, and further it is the primary reason for over 3 times as many people than goal achievement. Overcoming this challenge likely presents greater difficulty than addressing technical shortcomings — motivating the need to pursue development of more effective technology-based solutions for promoting and sustaining healthy behavior.

Conclusion

In this paper, we provided a characterization of available health and fitness apps and explored how and why those apps are downloaded, used, and sometimes abandoned. We hope that this knowledge will have relevance for researchers across domains from HCI to public health.

Acknowledgements

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