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Smartphone Applications in the Support of Weight Reduction and Goal Maintenance

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Abstract

The use of smartphones gets promoted in healthcare self-intervention setups. Its benefits include convenience, cost effectiveness and accessible weight management features among others. The aim of this study is to gather real-world smartphone application user data in order to analyse the efficiency of smartphone application features. This aim encloses applications for the reduction or maintenance of weight. Relevant members of online health communities were invited to participate in an online survey. The survey lasted for 6 weeks and received a total of 51 valid respondents. The analysis was divided into 2 groups, one group (n=29) had experience using a smartphone application in their weight management goal while another group did not use applications before (n=22). Among the application users, a significant BMI improvement was found (9.1%). We conclude that in our sample, the use of automatic weight control applications leads to a more healthy living style.

Keywords: Applications, goal maintenance, health, weight control, smartphone, online survey

1. How to use the template

The World Health Organization (WHO) defines overweight as abnormal or excessive fat accumulation that presents a risk to health (WHO, 2012). In 2008, it was stated that 1.4 billion people worldwide were overweight. Out of those, half a billion were considered obese. At least 2.8 million of these people die as a direct consequence of this issue. On a global scale, 44% of diabetes, 23% of ischemic heart disease and 7 - 41% of certain cancers are attributable to overweight and obesity (Okechukwu et al., 2014; WHO, 2012). The growing use of smartphone is increasingly being promoted and adopted in healthcare self-intervention. Its benefits include convenience, cost effectiveness and accessible weight management features. It is estimated that 1 out of 5 people or nearly over 1 billion people in the world use a smartphone (Pitt et al., 2011). Additionally, not only many people have their own smartphones, they also tend to spend their time under an increasing trend with these devices. Fig. 1 shows how dramatic the number of smartphone users is growing. It can be obtained that in 2006 only 1% of the world population were using smartphones, whereas in 2013 the number increased to 22%. As in many other subjects, companies and private online applications, developers quickly recognized the increasing demand of health monitoring applications over the past decade (Olla and Patel, 2002). Whether the design of these applications is based on clinical studies or preference surveys (Aday and Cornelius, 2011; Evans et al., 2005; Siemiatycki, 1979) unknown, but studies tend to agree to the efficiency of using web-based applications for reducing weight (Sobush et al., 2009; Pellegrini et al., 2012; Azar et al., 2013; Wing et al., 2006). We prepared a survey on the health condition using applications. Health surveys represent a critical resource to measure the status of a population and to assess the level of quality of the health improvement provided. To ensure the utility and integrity, it is important that these user surveys are designed according to efficient statistical and methodological practicies as well as optimal sample design. Therefore, we reviewed various guides for related topics on survey writing (Aday and Cornelius, 2011; Siemiatycki, 1979; Warner et al., 2011; Kuczmarski et al., 2001; Harvey-Berino et al., 2011).

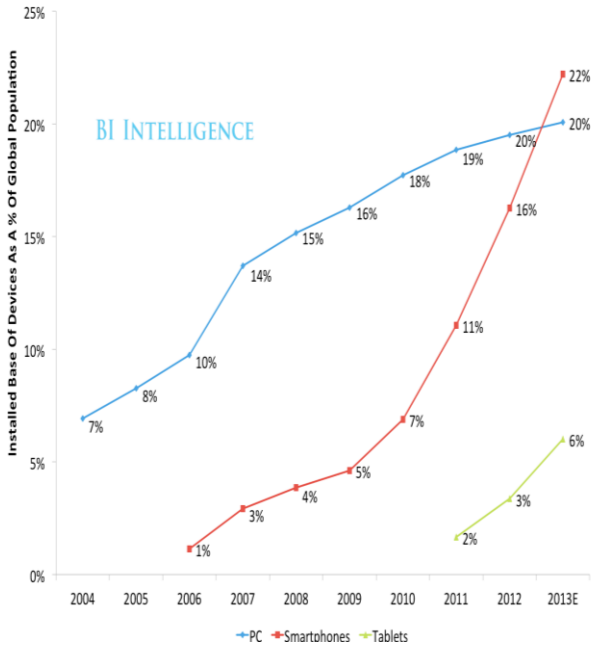

Fig. 1. Growing smartphone ownership. One of five persons worldwide own a smartphone (World bank, 2013).

In our systematic reviews concerning mobile phone interventions, it was reported how these devices can help to increase physical activity, reduce weight and decrease the impact of heart diseases. Breton et al. reports that the most frequent outcome of the studies was the change in the weight among the participants (Breton et al., 2011). The aim of this study is to gather real-world smartphone application users' data to gain knowledge about the efficiency of smartphone application features for reducing or maintaining weight as well as finding out the obstacles of using those applications. By the means of an online survey, both existing and potential weight loss application users underwent questions with the intent to answer the following key questions:

i. Is there a real-world evidence of the efficiency of smartphone use in weight reduction/maintenance?
ii. Which specific features of a weight loss application do individual users or potential users find most effective in meeting or keeping their weight goal?
iii. What are the reasons for current and potential users to not want to use a weight loss/maintenance applications?

The remainder of this paper is as follows. Section 2 describes the proposed approach. Subsequently, Section 3 provides results obtained from this research. Finally, Section 4 presents discussion and conclusion.

2. Proposed Research

Relevant members of online health communities in Google+, who accepted the authors in their circle, were invited to participate in the online survey. The survey lasted for 6 weeks and received a total of 51 valid respondents. The analyses was divided into 2 groups, one group (n=29) had experience using a smartphone application in their weight management goal while another group had not used such a smartphone before (n=22). The application feature effectiveness was judged according to the sum of scores for every feature, 100% for very effective and 50% for effective.

2.1 Recruitment

Members of Google+ online communities were requested to participate in this study by filling up an anonymous 12-question survey. Particularly targeted to participate were those who signed up for health and fitness and weight reduction related communities. Members invited, were randomly selected without regard to gender, age (18~65) or nationality. A total of 147 individuals were invited.

2.2 Procedure

A popular survey tool run by esurv.org and used by academicians was utilized for the creation of the online questionnaires. These questionnaires were developed adhering to the survey fundamentals: Guides to designing and implementing surveys (Aday and Cornelius, 2011; Yin, 2014; Wouters et al., 2014). Here, the questions were limited to 12 questions and were made to open anonymous questionnaire to encourage participation. Target participants in Google+ communities were searched for the keywords health, fitness and obesity. The search was limited to English-language based communities. From these communities, random members were requested to accept the authors in their circle. Those who responded received the survey link and were invited to fill up a roughly 3-minute survey under consideration of self-reported data accuracy (Kuczmarski et al., 2001; Harvey-Berino et al., 2011; Barr, 2014). Invitations were also sent to peers as well to those, who may or may not have used a health related web-based application. This survey lasted from March 24 to April 30, 2014. To validate unique responses, the IP addresses were cross-referenced for uniqueness and country of origin.

2.3 Statistical Analysis

The measurement of the effectiveness of the application features was based on normalized sum scores. Since the study was not statistically powered, 2 respondent groups, users and non-users were not statistically compared.

2.4 Data Exclusion

For this study, a total of 58 respondents were gathered, 7 were excluded from the analysis since their computed BMIs were below normal and did not meet the requirement of this study. The response rate was calculated as 31.5% (51/162).

Table 1
Baseline Characteristics.

		Users	Non-Users
Age		38.6	33.7
Weight (kg)		90.0	79.2
BMI (kg/m)		31.5	28.1
Gender, n (%)	Male	11 (37.9)	7 (33.3)
	Female	18 (62.1)	15 (66.7)
	Total, n/N (%)	29 (56.9)	22 (43.1)

a smartphone application (56.9%) and those that have not used a smartphone before (43.1%). Out of 51 adults who participated, 67% (34/51) were female and 33% (17/51) were male. The mean age of participants was 36.5 years. The mean participant BMI for users prior to use of smartphone application was 31.5 kg/m2 (SD 7.8). Here, about half of the participants (51.7%, 15/29) were classified as obese (BMI≥30 kg/m2). On the other hand, the mean BMI for non-user participants was 28.1 kg/m2 (SD 6.5). Out of the 51 participants, 20 came from the United States (39.2%), 19 from Asia (37.2%), 6 from Europe (11.8%) and another 6 from South America, Australia and Island countries.

3.2 BMI Improvement

Out of 29 participants who have used an application, 22 filled up a survey that showed an average reduction in BMI of 3.3 or an improvement of 9.1%. The average use of the application was 7.4 months. Most of participants (68%) have used an application for 7 months and below. From Fig. 2 it can be obtained that most of the participants were from the United States. South America was represented with some other Latin American countries, among these Brazil. Only a few European countries participated. France represented the highest rate of participation in this area.

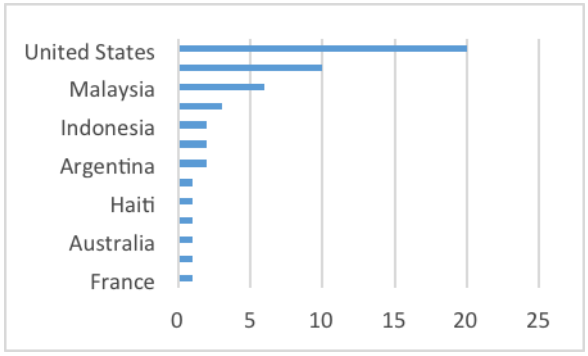

Fig. 2. Nationalities of participants.

3. Results

3.1 Baseline Characteristics

Table 1 shows the baseline characteristics of the pilot survey study separated into 2 groups – those who have used

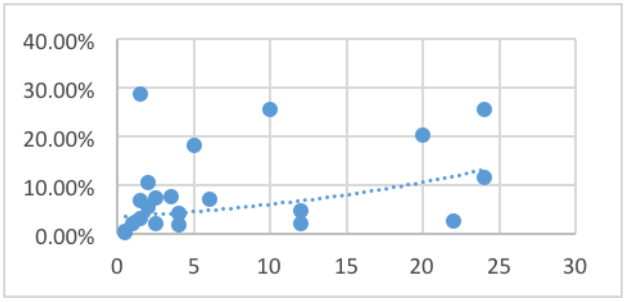

Fig. 3. BMI improvement (%) as a function of time (months).

From Fig. 3 it can be obtained that the average BMI improvement for users below 7 months was 7.7% while for those with a use of more than 7 months, it was 13.2%. The highest recorded BMI improvement was at 28% and lowest at 0.4%. Fig. 4 shows that the highest BMI improvement occurs in those who updated or checked their application daily. The improvement rate of the BMI was 14.3%. Although, the accuracy for web-based self-reported BMI values is not very high, it can still be considered as an orientation value (Lassale et al., 2013; Pursey et al., 2014). This trend is followed by those who checked the application 2-3 times weekly (4.5%), monthly or less (4.1%) and weekly (1.9%).

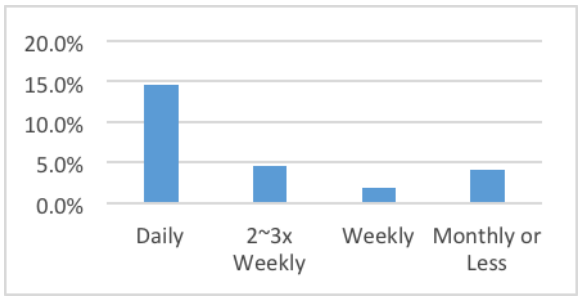

Fig. 4. BMI improvement (%) as function of application update frequency.

3.3 Feature Effectiveness Score

Fig. 5 shows the normalized score of feature effectiveness as judged by user groups and non-user groups. It also shows the combined weighted score for these 2 groups. A score of 50% is considered effective. For current users of health applications, weight, activity and food tracker are considered most important feature with a score 76%. This is followed by goal setting (64%), food tips (55%) and personal journal (54%). For the non-users, only event reminder with a score of 50% was perceived effective. Combined, 2 features meet minimum score - weight, food, activity tracker at 58% and goal setting at 51%.

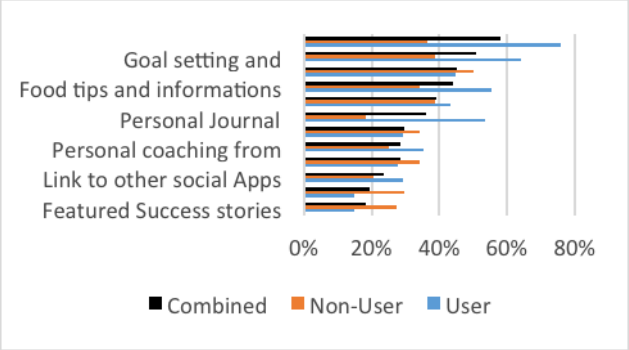

Fig. 5. Feature Effectiveness Score..

3.4 Reasons for interrupting the use of an application

From data shown in Fig. 6, it can be obtained that a majority of current users (20/29, 69%) continued to use an application for their weight reduction or maintenance goal. On the other hand, only 3 out of 22 (13.6%) of current non-users expressed the intention to start using an application. The top reasons given for both users (6/29, 20.7%) and non-user (10/22, 45.4%) were related to discipline issues.

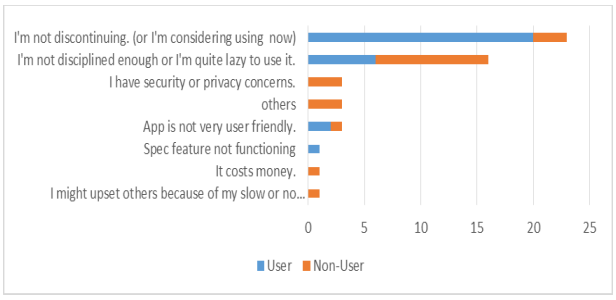

Fig. 6. Reasons provided for not using an weight reduction application.

4. Discussion and Conclusions

The authors' objective was to gather information on real-world effects of Smartphone use on weight reduction or goal maintenance to complement or compare with controlled trials, where most of the time, specific application or treatment were given. The authors believe that self-intervention efficancy are influenced by the choice of an application or treatment that suits best to their individual needs, commitment and preferences. There are a number of benefits on internet based research. One of these key advantages is global reach. Since overweight and obesity are a global issue, it is important to understand the effects of smartphone applications, which in almost all cases target global users rather than local ones. Another advantage of online surveys is that it allows people to be less likely conform with socially desirable standards and more likely to provide honest answers to questions on threatening, anxiety-arousing, or otherwise sensitive questions. Normally, accuracy of self-reported surveys in analysing data may be a concern. However, pertaining to BMI data, there had been several studies to support that while there may be under-reporting of weight and over-reporting of height, the overall data follows the same pattern as when done in face-to-face interviews or when data has been validated in person. Hence, web-based self-reported data showed to be useful.

4.1 Recruitment and Strategy

The recruitment strategy adopted in this study was using anonymous survey targeting relevant online communities. Although anonymous, the online survey had a way of verifying uniqueness of responses as well as country of origin. Duplicate responses were checked via IP address, automatically disregarded and excluded from the database. Nationalities registered in the responses were also validated using the IP address location search in the internet. Except for 4 Filipinos (IP location: Los Angeles-3 and San Diego-1) and 1 Haitian (IP location: Florida) who participated, all registered nationalities were consistent with the performed IP location check.

4.2 Principal Findings

The survey provided insights about the real-world effect of smartphone applications in order to reduce or maintain weight among health application users. It is suggested that the baseline figure for meaningful BMI improvement is 5%. The average BMI improvement in this survey was 9.1%. The average use of the application at the time of survey was 7.4 months. Data in Fig. 2 generally suggests that the longer the use of applicationlications was, the higher the BMI index got improved – 13.2% for those, who used applications for 7 months or more as compared to those who have used applications for less than 7 months (7.7%). One male, 36 years old, and participant from the UK reported an increasing (28%) BMI improvement over a period of just 6 weeks. On the other hand, one 25 years old woman from France reported a mere 2.65% BMI improvement over a period of 22 months of application use. These last 2 data do not represent the trend of the overall data. Other parameters entered, are keys to analyze the underlying reasons. The case of the participant from France, for example, considers interrupting the application use due to lack in user friendliness. Commitment appears to be the main factor for greater achievings in high BMI

improvement. Those, who updated or used their application daily had 14.5% BMI improvement - at least 10% better than those who checked weekly or less.

Among the users, 69% registered commitment to continue. The main reason to interrupt the application use was discipline (67%) followed by security and unsatisfying application experience (33%). These reasons were the most important factors among non-users (45%). It can be deducted that it is for this reason that among non-users, event reminder can be consindered as the only effective feature that can improve the effectiveness of application use in weight reduction or maintenance goal.

There are 4 application features, which users regard as effective (score >50%) - health applications, weight, activity and food tracker (76%), goal setting (64%), food tips (55%) and personal journal (54%). It appears that a straightforward tracking and monitoring are most important features for users. Low scores were obtained in the use of games (15%), links to social media (15%) and forums/chats (34%).

4.3 Limitations

This study serves as an initial pilot survey to obtain an insight of the efficiancy of the smartphone use among application users as well as to obtain findings, to which application features were most effective in helping users to achieve their weight reduction or maintenance goal. The relatively small number (users, n1=29; non-users, n2=22) of participants may not be statistically powered to compare results among groups and describe the best accurate representation of the population. However, initial results provided can be considered as supportive observations in order to warrant further surveys on a larger scale.

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