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Mobile health apps and recovery after surgery: What are patients willing to do?

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ABSTRACT

Background: Mobile health technologies (mHealth) may improve post-operative care but it is unknown if patients are willing to use this technology.
Methods: We surveyed 800 NY State residents to determine their willingness to engage in mHealth after surgery and compared socioeconomic factors that may affect willingness to engage.
Results: A majority of respondents reported willingness to wear a tracker on their wrist (80.6%), fill out a survey (74.3%), send pictures of their wound to their surgeon (66.3%), and share updates with friends/family (59.1%). Older age was associated with lower likelihood of having a smartphone, but not associated with willingness to engage with other features. Hispanic ethnicity was associated with lower likelihood of wearing a tracker while Black race was associated with lower willingness to send pictures.
Conclusions: Overall, potential users of mHealth are interested and willing to use mHealth. Older respondents are as willing as younger respondents to engage with mHealth. Individuals with Hispanic ethnicity and Black race may be less willing to engage and therefore may require education regarding benefits of this technology.

1. Introduction

Smartphone access and use has increased dramatically over the past five years.[1] In parallel, development of mobile health apps has also increased, predominantly for the management of chronic diseases.[2,3] Recently, a few small pilot studies have demonstrated the opportunity for mobile health technology[4–7] and telehealth[8–10] to monitor post-operative recovery to improve outcomes and potentially reduce patient costs.

As part of the growing body of literature evaluating the utility of mobile health technology, several studies have evaluated the public's interest[11] and willingness to engage with mobile health applications[12–15] and health information exchange[16] to manage chronic medical disease. Only one other small, single center study evaluated patients' perceptions regarding mobile health app use in the acute post-operative setting.[17] As a result, there is a paucity of data regarding which patients would be willing to participate and what they would be willing to do in the perioperative period.

Our study objective was to ascertain the public's willingness to engage in mobile health technology in the post-operative setting, using a representative survey, and to identify patient-specific variables associated with a willingness to do so.

2. Materials and methods

2.1. Survey development and administration

The Cornell University Survey Research Institute is a member of the Association of Academic Survey Research Organization and is a well-established organization that has been conducting survey research since 1996.[18] They have been conducting the Empire State Poll, a telephone survey of adult residents ≥18 years of age in New York State, every year since 2003. Each year there is a core set of questions addressing themes of community, government, and the economy. In addition to the core questions, Cornell investigators may submit questions to be included in the annual survey. Submitted questions are reviewed by the Survey Research Institute and a preliminary pilot of 25 individuals is conducted. Investigators are

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then given feedback regarding any issues encountered by surveyors when administering these questions and the pilot data is analyzed and questions refined. Based on this feedback, investigators then modify their questions prior to conducting the survey. We submitted 5 closed-ended questions using a 5-point Likert scale addressing the public's access and willingness to use mobile health technologies in a hypothetical scenario assuming respondents had undergone surgery for any reason (Supplemental Table 1).

2.2. Sampling

The 2016 Empire State Poll was administered from February 9, 2016 to April 19, 2016. 3230 individuals were contacted, 1184 of whom were eligible. Of those eligible individuals contacted, 800 individuals completed the final survey (67.5% cooperation rate[19] comparable to other research organizations and considered acceptable[20]). The average interview length was 18 min. Cornell Survey Research Institute used a dual-frame random digit dial sampling of landlines and cell phones as previously described.[21] The state was divided into two regions, upstate and downstate, and sampling was conducted in proportion to population totals. The sample size of 800 produced a margin of error of 3.5% for questions with a 50/50 distribution and 95% confidence interval and is comparable with other research organizations.[22]

2.3. Analysis

The primary outcome of our study was willingness to use a mobile health app after surgery. The secondary outcome of our study was patient specific variables associated with willingness to use a mobile health app after surgery. Responses of 'Very Willing' and 'Willing' were categorized as "Willing" while responses of 'Not sure', 'Unwilling', and 'Very Unwilling' were categorized as "Not Willing". Independent variables tested included age, gender, education level, race (White, Black, or 'Other' which included Asian, ≥2 races, or 'other race'), ethnicity (Hispanic or Non-Hispanic), income, geographic location (according to Metropolitan Statistical Area), marital status (Married, Divorced/Separated/Widowed, or Single), social ideology, religion (Christian, Agnostic, or 'Other' which included Muslim, Jewish, and 'other religion'), perceived Internet trustworthiness, and whether participants owned a smart phone that allowed them to download mobile apps. Social ideology responses were captured on a scale of 1–7 with the following response options: 'Extremely Liberal', 'Liberal', 'Slightly Liberal', 'Moderate or middle of the road', 'Slightly Conservative', 'Conservative', 'Extremely Conservative'. These responses were then grouped into "Liberal", "Middle of the road" and "Conservative". Internet trustworthiness is a question including in every Empire State Poll and asks participants to rate on a scale of 1–10 how trustworthy they perceive the Internet to be, with 1 being "untrustworthy" and 10 being "trustworthy". Based on the distribution of responses and for ease of interpretation, responses were categorized as "untrustworthy" (if response was 1–5) and "trustworthy" (if response was 6–10).

61 of the 800 respondents had one or more missing responses or refused to answer one or more questions and were dropped from analysis. Mean age was treated as both a continuous variable and a categorical variable based on prior studies evaluating this topic.[13] When age was treated as a continuous variable, comparison was made using Wilcoxon Rank Sum Test; when age was treated as a categorical variable, comparison was made using chi-square test. Other categorical variables were tested with chi-squared tests. Variables were added to a multivariable logistic model based on statistical significance and clinical assumptions. Forward and backward stepwise regression was used to arrive at a final model. All data were analyzed with STATA v13.1.

3. Results

3.1. Description of cohort

A total of 739 NY state residents had complete survey data. The average age of respondents was 47 years old (±17) with an equal

Table 1
Participant characteristics and association with willingness to engage with wearing a wrist tracker.

Characteristic	Not willing (N = 142) n (%)	Willing (N = 497) n (%)	P value
Mean age, years (std)	49 (17)	46 (16)	0.13
Age-group, years			0.52
18–34	32 (22)	168 (28)	
35–49	40 (28)	161 (27)	
50–64	42 (30)	171 (29)	
≥65	28 (20)	97 (16)	
Gender			0.54
Male	68 (48)	303 (51)	
Female	74 (52)	294 (49)	
Race			<0.01
White	84 (59)	414 (69)	
Black	24 (17)	107 (18)	
Other[a]	34 (24)	76 (13)	
Ethnicity			<0.01
Hispanic/Latino	33 (23)	62 (10)	
Non Hispanic/Latino	109 (77)	535 (90)	
Metropolitan resident			0.02
Center city of MSA	62 (44)	224 (37)	
Outside center city of MSA	35 (25)	173 (29)	
Inside suburban county of MSA	21 (15)	56 (9)	
In MSA with no center city	9 (6)	87 (15)	
Not in MSA	15 (10)	57 (10)	
Marital status[e]			0.95
Married	69 (49)	283 (48)	
Divorced/Separated/Widow	22 (15)	88 (15)	
Single	51 (36)	221 (37)	
Education			<0.01
Less than High School Grad	23 (16)	39 (6)	
High School Grad	44 (31)	121 (20)	
Some post-college training	35 (25)	159 (27)	
College grad	20 (14)	159 (27)	
Post-grad	20 (14)	119 (20)	
Income group			0.02
<$30,000	26 (18)	81 (14)	
$30,000-$49,999	32 (23)	121 (20)	
$50,00-$74,999	44 (31)	133 (22)	
$75,000-$99,999	9 (6)	88 (15)	
$100,000-$149,999	19 (13)	101 (17)	
≥$150,000	12 (9)	73 (12)	
Internet trustworthiness			0.01
Untrustworthy[b]	114 (80)	412 (69)	
Trustworthy[c]	28 (20)	185 (31)	
Social Ideology			<0.01
Liberal	31 (22)	209 (35)	
Middle of the road	42 (30)	229 (38)	
Conservative	69 (48)	159 (27)	
Religion[f]			0.04
Christian	104 (74)	376 (63)	
Agnostic	26 (19)	147 (25)	
Other[d]	10 (7)	72 (12)	
Smartphone Use			<0.01
Does not have smartphone	48 (34)	98 (16)	
Has smartphone	94 (66)	499 (84)	

[a] Other races = Asian, ≥2 Races, Other.
[b] Below the 50th percentile of responses.
[c] Above the 50th percentile of responses.
[d] Other religion = Muslim, Jewish, other.
[e] Excludes 5 responses of "Other".
[f] Excludes 4 responses of "Refused to answer".