

**Mobile Communication Between Patients and Providers: An Examination of Impact  
of Health Applications on Patients and Patient's Willingness to Exchange Health  
Information Using Mobile Devices**

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## **INTRODUCTION:**

Mobile technology has slowly and surely made its way into the world of Healthcare. Both patients and doctors find themselves using mobiles for some form of health intervention. The study results here aim to understand the factors and the extent to which they influence this health intervention decision amongst providers and patients. Firstly, we aim to understand the present impact of mobile apps on patients. Secondly, we study the willingness amongst patients to exchange health related information with Providers and the study the factors which hinder this decision to better streamline this process. Finally, we explore the various modes of communication, and identify various behavior and sociodemographic variables that influence this decision.

For the purposes of the study, the data was filtered on respondents who own a smartphone, tablet, or both. The data analysis was carried out using STAT 14.0 software. All of our analyses were carried out with weighted data to account for the complex survey design of HINTS. The linear precursor of Bootstrap sampling, Jack knife re sampling with 50 iterations was used for this purpose. List wise deletion was used to take care of missing information.

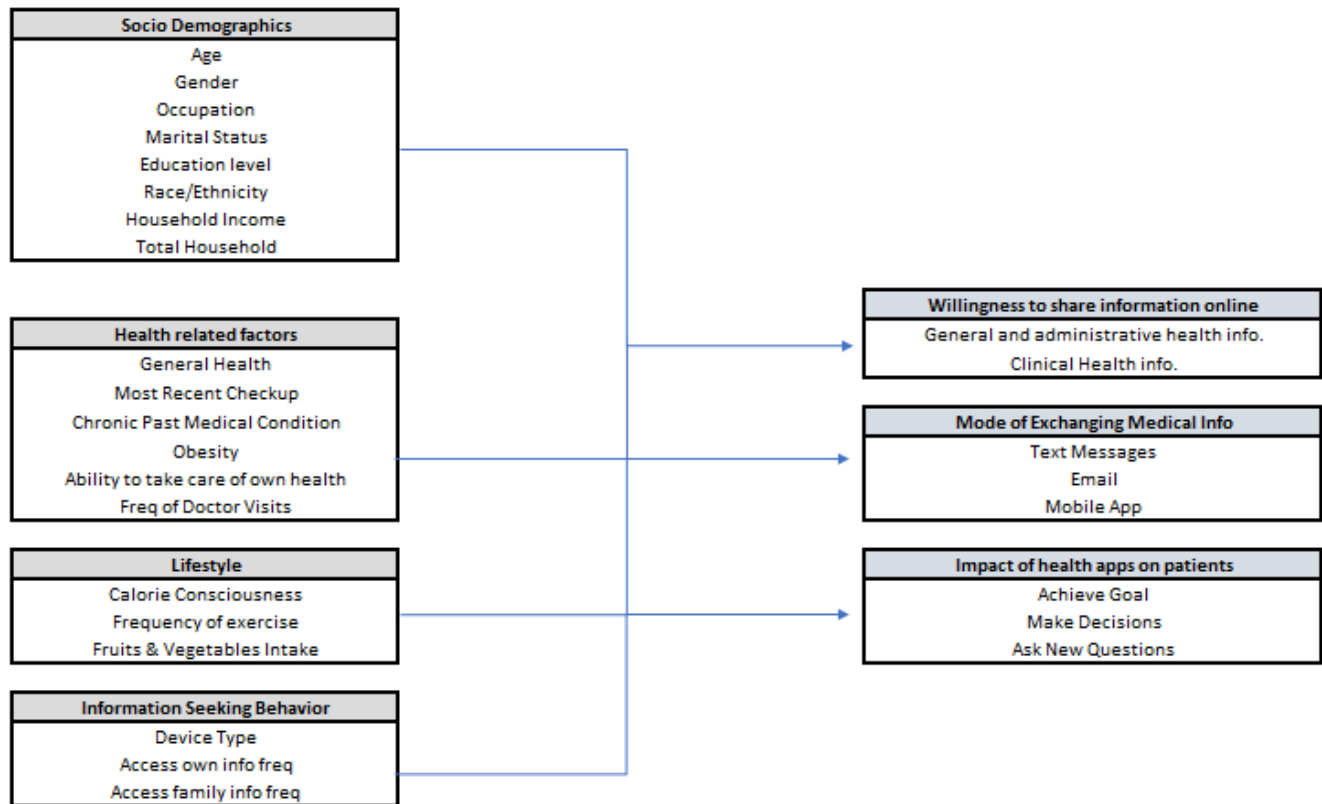
### **Objective**

We sought to examine the patients' willingness, mode of exchange to use mobile devices (smart phones and tablets) to communicate with providers. We further wanted to examine the impact of health apps on smartphones and tablets.

Our research goals are as follows:

- (i) examine patients' willingness to exchange health related information with a provider using mobile phone or tablet which varies by their socio demographic characteristics, health factors and health information seeking behavior
- (ii) assess if patients' using smartphones have health apps and find their impact
- (iii) examine if the mode of exchanging health information using mobile device was associated with any of the socio demographic and other behavior variables

## Key Factors



## EXAMINATION OF THE EXTENT OF IMPACT MOBILE APPS HAVE ON PATIENTS

### **MATERIALS AND METHODS**

#### **Sample**

We used the data from 2014 Health Information National Trends Survey (HINTS), a cross-sectional survey conducted by National Cancer Institute to record how US adults use different communication channels to access and process health information. Consistent with our research goals, we selected only those respondents who owned either a smart phone or a tablet or both and had a health app installed on it. Our analytic sample included only those respondents with complete data for all the other measures used (n=819).

## **Measures**

The impact of health app on patients was examined using the question “Have the apps on your smartphone or tablet related to health done any of the following?” and sought responses which were Yes/No indicators.

- a) Helped you achieve a health-related goal such as quitting smoking, losing weight, or increasing physical activity – Yes/No
- b) Helped you make a decision about how to treat an illness or condition – Yes/No
- c) Led you to ask a doctor new questions, or to get a second opinion from another doctor – Yes/No

The sociodemographic factors that we included were age group, gender, occupation status, total size of household, education and ethnicity. General Online Health information seeking behavior, self-reported health status factors such as general health, confidence in ability to take care of self, obesity and most recent checkup were included. To check if chronicity plays a part in extent of app impact 2 variables, frequency of visiting provider and presence of chronic past medical condition were included. Lifestyle factors which influences mobile app behavior such as exercise frequency, calorie consciousness, and fruit and vegetables intake were also included in the Logistic Regression Models.

## **RESULTS**

### **Participant Characteristics**

Table 1 presents the characteristics of the participants included in the study. The number of patients who use the health app to achieve goals (58%) is higher than for apps that lead patients to ask new questions (40%) followed by apps that enable patients to make decisions (39%).

In general, more females (66%) tend to have health apps on their device compared to males (34%). About 59% of people who have health apps have a college graduate degree or more. 61% of patients have a chronic past medical condition.

## Crosstab of Dependent against Categorical Independent Variables

		Achieve Goal		Make Decision		New Questions	
Age		No	Yes	No	Yes	No	Yes
	18-34	7.3%	16.6%	15.2%	8.6%	15.3%	8.5%
	35-49	10.4%	19.9%	18.3%	12.0%	20.2%	10.0%
	50-64	15.0%	16.3%	17.8%	13.6%	17.8%	13.6%
	65-74	5.3%	3.0%	5.1%	3.3%	3.5%	4.9%
	75 and above	1.9%	0.2%	1.9%	0.2%	1.0%	1.1%
	Missing	1.9%	2.2%	2.5%	1.6%	2.1%	2.0%
Gender							
	Male	17.5%	16.3%	21.0%	12.8%	19.3%	14.6%
	Female	23.8%	41.6%	39.1%	26.2%	40.0%	25.3%
	Missing	0.5%	0.4%	0.5%	0.4%	0.6%	0.2%
Occupation Status							
	Employed	24.4%	41.6%	40.6%	25.4%	42.7%	23.3%
	Unemployed	2.0%	2.1%	2.2%	1.9%	2.3%	1.7%
	Homemaker	2.0%	3.7%	3.3%	2.3%	4.1%	1.6%
	Student	1.4%	2.4%	2.2%	1.5%	2.0%	1.7%
	Retired	7.2%	3.7%	7.5%	3.3%	4.8%	6.0%
	Disabled	2.8%	2.0%	1.9%	3.0%	1.7%	3.1%
	Other	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%
	Missing	1.9%	2.7%	2.7%	1.9%	2.1%	2.5%
Education							
	Less than High School	0.9%	1.2%	0.5%	1.6%	0.7%	1.4%
	High School Graduate	5.1%	4.7%	6.2%	3.6%	4.8%	4.9%
	Some College	12.1%	15.6%	14.8%	12.8%	13.8%	13.8%
	College Graduate or more	22.2%	35.0%	37.3%	20.0%	38.9%	18.4%
	Missing	1.5%	1.7%	1.9%	1.4%	1.6%	1.6%
Race/Ethnicity							
	White	24.1%	30.8%	37.4%	17.5%	36.8%	18.1%
	Black	7.1%	11.1%	7.3%	10.9%	7.7%	10.5%
	Hispanic	4.5%	7.4%	6.4%	5.4%	6.2%	5.7%
	Asian	1.6%	3.1%	3.5%	1.4%	3.5%	1.4%
	Other	1.9%	2.4%	2.3%	1.9%	2.8%	1.4%
	Missing	2.6%	3.5%	3.7%	2.3%	3.0%	3.1%
Chronic Past Medical Condition							
	No	14.1%	24.4%	24.9%	13.6%	26.2%	12.3%
	Yes	26.2%	32.7%	33.8%	25.1%	32.6%	26.3%
	Missing	1.4%	1.2%	1.9%	0.7%	1.1%	1.5%

Ability to take care of own health							
	No	38.0%	55.8%	56.0%	37.8%	56.8%	37.0%
	Yes	2.4%	1.6%	2.7%	1.2%	2.1%	1.9%
	Missing	1.4%	0.9%	1.9%	0.4%	1.0%	1.2%
Obese							
	No	27.2%	37.3%	41.2%	23.3%	40.7%	23.8%
	Yes	12.0%	19.6%	16.7%	14.8%	17.3%	14.2%
	Missing	2.5%	1.5%	2.7%	1.2%	1.9%	2.1%

## Key Factors Associated with Impact of Health App on Patients

Model 1 – Passive impact of health app in achieving goals such as weight loss and quitting smoking

The significant factors in order of importance (based on p-value) are listed below:

- A person lifestyle choice in calorie consciousness is 1.6 times more likely to use the app for health goals that a person who is not (OR 1.6)
- A person who spends an extra day exercising in the week is more likely to use the app (OR 1.18)
- Respondents in the 50-64 age group are less likely to use the health app to achieve goals compared to 18- 34 age group (OR 0.39)
- Retired respondents are less likely to use the health app for goals compared to Employed patients (OR 0.32)

Model 2 – Active impact of health app in treating an illness/condition.

The significant factors in order of importance (based on p-value) are listed below:

- People who exercise more are less likely to use the app to treat illness (OR 0.75)
- Black people are 3 times more likely to use health app to treat a condition than White. (OR 3.11)
- People who do not have confidence in their ability to take care of health use the app to treat illnesses. (OR 0.09)
- Unemployed and Students are more likely than Employed respondents to use the health app to treat a condition (OR 1.46 and 1.75), possibly because of poor access to health insurance
- Respondents in age categories 36 - 49 and 65 – 74 are 2 times and 4 times more likely than respondents in 18-34 category to use the health app to treat a condition, respectively (OR 1.87 and 3.38)

### Model 3 – Extreme impact of health app in driving patients to seek second opinion and ask the doctor new questions

The significant factors in order of importance (based on p-value) are listed below:

- Black people are 5 times more likely than white people to use information from the app to ask a doctor new questions (OR 4.90)
- A person who exercises more every week is less likely to use the app to ask new questions. (OR 0.80)
- Students are 4 times more likely than employed respondents to seek a second opinion and ask new questions (OR 4.16)
- As the size of the household increases by 1, the respondent is 1.26) times more likely to seek second opinion (OR 1.26)
- Calorie Conscious folks are 1.3 times more likely to seek second opinions (OR 1.31)
- Obese people are 1.8 times more likely than non-obese patients to seek second opinions based on information in mobile app (OR 1.79)

## IMPACT of Health Apps on Patients – Odds Ratio Table

	N=819		Achieve Goal OR	Make Decisions OR	New Questions OR
			n= 808	n=810	n=810
Demographic Factors	Age	n=785	(58% = 1, 42% = 0)	(39% = 1, 61% =0)	(40% =1, 60% =0)
	18-34	25%	ref	ref	ref
	35-49	31%	0.73 [0.35,1.53]	1.89* [0.94,3.78]	1.01 [0.47,2.16]
	50-64	33%	0.41** [0.18,0.95]	1.66 [0.78,3.54]	1.49 [0.66,3.34]
	65-74	9%	0.61 [0.16,2.37]	3.80** [1.01,14.27]	2.07 [0.42,10.30]
	75 and above	2%	0.18 [0.01,3.05]	1.97 [0.13,29.37]	8.20 [0.16,409.49]
	Gender	n=812			
	Male	34%	ref	ref	ref
	Female	66%	1.45 [0.68,3.08]	0.72 [0.31,1.68]	0.88 [0.45,1.73]
	Occupation Status	n=782			
	Employed	69%	ref	ref	ref
	Unemployed	4%	2.53 [0.54,11.89]	1.64 [0.31,8.61]	0.68 [0.18,2.48]
	Homemaker	6%	1.05 [0.36,3.03]	0.65 [0.19,2.18]	0.36 [0.08,1.55]
	Student	4%	0.57 [0.14,2.34]	1.78 [0.33,9.69]	4.08** [1.05,15.85]
	Retired	12%	0.32* [0.09,1.14]	0.49 [0.13,1.85]	1.86 [0.33,10.47]
	Disabled	5%	0.61 [0.13,2.85]	3.30 [0.33,32.68]	3.10 [0.22,43.31]
	Education	n=793			
	Less than High School	2%	ref	ref	ref
	High School Graduate	10%	0.74 [0.07,7.94]	0.15* [0.02,1.09]	0.70 [0.10,4.86]
	Some College	29%	0.74 [0.06,9.19]	0.24 [0.04,1.49]	0.59 [0.11,3.14]
	College Graduate or more	59%	0.72 [0.06,8.07]	0.12** [0.02,0.72]	0.29 [0.05,1.56]
	Total Household	n=788			
		2.64 (SD 1.46)	1.17 [0.94,1.45]	1.09 [0.89,1.33]	1.22* [0.99,1.51]
	Race/Ethnicity	n=769			
	White	59%	ref	ref	ref
	Black	19%	1.24 [0.44,3.49]	3.02** [1.18,7.70]	4.79*** [2.29,10.04]
	Hispanic	12%	0.91 [0.33,2.45]	1.53 [0.63,3.71]	1.26 [0.60,2.62]
	Asian	5%	1.65 [0.38,7.20]	1.52 [0.20,11.67]	0.84 [0.22,3.23]
	Other	4%	0.75 [0.17,3.38]	2.94 [0.52,16.82]	2.15 [0.38,12.11]
Chronicity	Online Info Seeking Behavior	n=811			
		1.20 (SD 1.72)	0.93 [0.78,1.12]	1.07 [0.87,1.32]	0.95 [0.79,1.13]
	Frequency of visiting Provider	n=809			
		2.78 (SD 1.84)	0.93 [0.76,1.15]	0.89 [0.71,1.12]	0.99 [0.86,1.14]
	Chronic Past Medical Condition	n=797			



	No	39%	<i>ref</i>	<i>ref</i>	<i>ref</i>
	Yes	61%	1.59 [0.86,2.96]	1.25 [0.59,2.64]	1.39 [0.69,2.80]
Self-Reported Health Status	General Health	n=799			
		3.54 (SD 0.91)	0.81 [0.55,1.18]	0.83 [0.51,1.35]	0.88 [0.56,1.36]
	Ability to take care of own health	n=801			
	No	96%	<i>ref</i>	<i>ref</i>	<i>ref</i>
	Yes	4%	0.33 [0.06,1.86]	0.13** [0.02,0.79]	0.58 [0.11,3.08]
	Obese	n=787			
	No	67%	<i>ref</i>	<i>ref</i>	<i>ref</i>
	Yes	33%	1.25 [0.64,2.41]	1.13 [0.58,2.19]	1.78* [0.93,3.40]
	Most Recent Checkup	n=819			
		5.55 (SD 0.90)	1.07 [0.69,1.66]	0.82 [0.46,1.47]	1.26 [0.91,1.74]
Lifestyle	Frequency of exercise	n=813			
		3.05 (SD 2.06)	1.20** [1.02,1.41]	0.75*** [0.61,0.93]	0.79*** [0.67,0.93]
	Calorie Consciousness	n=815			
		3.03 (SD 1.22)	1.57*** [1.20,2.06]	1.11 [0.78,1.58]	1.32* [0.98,1.78]
	Fruits and Vegetables Intake	n=808			
		5.74 (SD 2.46)	1.07 [0.95,1.19]	1.11 [0.95,1.29]	1.09 [0.95,1.26]
	Constant		0.25 [0.01,8.98]	9.07 [0.30,270.52]	0.08* [0.01,1.40]
	F-Value		<b>3.79***</b>	<b>1.93*</b>	<b>2.17**</b>
*** p < .01, **p < .05, * p<0.10					

## Discussion:

A lifestyle factor that continues to emerge as significant across all 3 models is Frequency of exercise per week. While that positively impacted the impact of mobile app in achieving goals, a healthy person who exercises more is less likely to rely on an app for advanced measures such as treatment for illnesses and seeking second opinions. They appear to be minimal risk takers. Another lifestyle factor is calorie consciousness. The more calorie conscious a person is the more likely he/she is to rely on an app for achieving goals and seeking second opinions/ask new questions.

The ethnicity sociodemographic factor, particularly the black population is a high indicator of using the app for treating illnesses and seeking second opinions/asking new questions. Students tend to ask new questions based on the app, whereas the retired community is using it actively to achieve goals.

## EXAMINATION OF WILLINGNESS TO EXCHANGE HEALTH INFORMATION

### Sample

Our analytic sample included only those respondents with complete data for all the other measures used (n = 2063)

### MATERIALS AND METHODS

Patient's willingness to exchange health related information with providers was examined using the question "*How willing would you be able to exchange the following types of medical information with a health care provider electronically through your mobile phone or tablet?*" that sought responses on the following scale: (1) *not at all*, (2) *a little*, (3) *somewhat*, (4) *very*. This measure was reverse coded so that higher score indicated a greater willingness. We have also taken the other factors influencing the use of mobile communication such as are they calorie consciousness, lifestyle behavior, incomes range etc.

### Analysis:

Principal component analysis with varimax rotation of the responses revealed two underlying latent variables –

- willingness to exchange *general and administrative information* such as appointment reminders, health tips, lifestyle, and medication reminders
- willingness to exchange *clinical information* - diagnostic data, vital signs, digital images/videos, symptoms

The mean scores for each of these variables were 2.86 (Administrative) and 2.81 (Clinical) which meant the respondents are inclined to use mobile communication for administrative purposes more or almost equal as clinical purposes.

	WILLINGNESS VARIABLES	DESCRIPTIVE STATS	ADMINISTRATIVE MODEL		CLINICAL MODEL	
			Coeff	adj R square	Coeff	adj R Square
			F-value :	6.28 *** (0.001)	4.9*** (0.0007)	
				<b>13.1</b>		<b>11.68</b>
Age						
	18-34	19.80%	<i>ref</i>		<i>ref</i>	
	35-49	27.84%	0.0426349		0.0346632	
	50-64	33.65%	-0.0533811		-0.0861548	*
	65-74	13.89%	0.0457619		-0.0472805	
	75 and above	4.72%	-0.0026072		-0.1958945	**
Gender						
	Male	41.06%	<i>ref</i>		<i>ref</i>	
	Female	58.94%	0.060703		-0.0102082	
Employed (Yes/No)						
	Not Employed	34.41%	<i>ref</i>		<i>ref</i>	
	Employed	656.59%	-0.0053669		-0.0264737	

Education					
	Less than 8 years	1.13%	<i>ref</i>		<i>ref</i>
	8 - 11 years	2.57%	-0.1877729		0.3997849
	12 yr - high school	13.50%	-0.2968706		0.1946934
	Post high School	7.13%	-0.1729193		0.224322
	Some College	22.88%	-0.2096488		0.3618764
	College Graduate	31.40%	-0.3059469		0.3162945
	Post Graduate	20.79%	-0.2740497		0.3444264
Total Household					
		n = 2041	-0.0001579		-0.004319
Race/ Ethnicity					
	Non Hispanic White	63.79%	<i>ref</i>		<i>ref</i>
	Non Hispanic Black	14.66%	0.2256082	***	0.0385878
	Hispanic	13.65%	0.2208075	***	0.0542833
	Non Hispanic Asian	4%	0.2516452	***	0.1240616
	Non Hispanic Other	3.75%	0.1153325		0.0434029
Income Ranges					
	0 - \$9999	3.88%	<i>ref</i>		<i>ref</i>
	\$10,000 - \$14,999	3.49%	0.0210179		0.0411909
	\$15,000 - \$19,999	3.73%	0.0720855		0.0114531
	\$20,000 - \$34,999	10.03%	0.1127353		-0.0095564
	\$35,000 - \$49,999	13.52%	0.052283		0.0029143
	\$50,000 - \$74,999	18.42%	0.1775738	*	0.1015996
	\$75,000 - \$99999	14.25%	0.1948795	*	0.0574967
	\$100k - \$ 199,999	18.37%	0.2177082	**	0.1365541
	\$200k & more	6.83%	0.2086991	*	0.1104201
General Health					
		n = 2027	-0.0184256		-0.0299792
Most Recent Check-up					
		n = 2058	-0.0071723		-0.0236743
Access Information both family and self					
		n = 2038	0.0446726	***	0.049193
Chronic Past Medical Condition					
	No	42.00%	<i>ref</i>		<i>ref</i>
	Yes	58.00%	0.0235097		0.0353953
Visits to Health professional (not emergency)					
		n = 2042	-0.000038		0.0075948
Calorie Conscious					
		n = 2053	0.0488433	***	0.0259527
Frequency of Exercise					
		n = 2056	0.0137096		0.0167977

## **Results and Discussions:**

The respondents considered for this analysis are segmented based on their smartphone. 34% of the respondents own smartphones, 14% own tablets and 53% own multiple devices.

The multivariate regression results revealed that socio-demographic variable Age are having a statistically significant association with willingness to exchange clinical health information. Though negative, statistically insignificant association was observed between age and willingness signaling that with increasing age, individuals might have lesser tendency to share clinical health information through mobile device. Our analysis indicated senior citizens to exhibit lesser willingness to share clinical information via mobile device than the younger population.

Second demographic variable that showed positive significance with the administrative health information. The race groups such as Non-Hispanic African-American and Asians, Hispanic communities are more willing to transfer administrative information.

We also noticed that people who are calorie conscious and follow a regular exercise routine are positively associated with sending both administrative and clinical health information.

The most significant variable we found was the Access Information Online, where the respondent access both self-information and family-information. This variable has the highest significance in determining the willingness to exchange both administrative and clinical information.

## **EXAMINATION OF MODE OF HEALTH INFORMATION EXCHANGE**

### **MATERIALS AND METHODS**

To study the mode of information exchange, we selected only those respondents who owned either a smart-phone or a tablet or both. And we used the question “In the past 12 months, have you used any of the following to exchange medical information with a health care professional?” Users indicated their mode amongst email, text messages, apps, video conferencing, social media, and fax. Out of these, we analyzed:

- Email
- Text messages
- Mobile Health Apps

as the top 3 frequent modes amongst the respondents. For the socio-demographic factors we used age, gender, employment status, marital status, education level, race/ethnicity, and income range. Lifestyle factors such as exercise frequency per week, fruits & vegetables intake per day, and calorie consciousness were taken into consideration. To check if participant's health plays a part, 3 variables were included: (a) General health: participant's self-reported health status, 1 being “excellent” and 5 being “poor” (b) frequency of provider visit within last year (c) chronicity: past chronic disease history were included. General online health information seeking behavior defined by frequency of accessing own and family's health information online and type of device were also considered for the analyses.

### **Analyses**

We used multivariate logistic regression to study the relationship between the mode of communication and the independent variables. Analyses were based on the weighted data to account the complex survey design. Based on different key factors like demographics, health related, online info seeking behavior, and lifestyle, predictions were made for the preferred mode of communication.

### **Results**

#### **Participant Characteristics:**

More than 50 percent of the owned both a tablet and a smartphone, 34 percent had only smartphones, and 15 percent used only tablet devices. Around 55 percent of the population in the study are aged 50 years or more with the overall female percentage as 61 percent. 3/5<sup>th</sup> of the respondents are employed, 50 percent of the respondents have a college graduate degree or higher, and 2/5<sup>th</sup> of the respondents reported their salary greater than \$75000. Most the respondents (80%) were married with an average number of people in the household as 2.6. 2/3<sup>rd</sup> of the respondents identified their race as non-Hispanic white. Every 3<sup>rd</sup> person out of 5 were observed to be calorie conscious with average frequency of exercise per week as 3 and average fruits and vegetable intake per day as 5. Most of the respondents (88%) reported their health status as “Excellent”, “Very Good” or “Good” and 3/4<sup>th</sup> of respondents visited their doctor in past 1 year. Out of the respondents, 29 percent used email, 9 percent used text messages, and 6 percent used Mobile apps to communicate with the provider.

## **Key factors associated with mode of mobile communication with providers**

The regression results revealed only Online info-seeking behavior: Frequency of accessing own health info online as having a statistically significant association with all the three modes. The ORs from the logistic regression are summarized in table. Hispanics were 2-3 times more likely to use text messages and mobile apps as compared to non-Hispanic white respondents (OR: 2.62, 2.04). Respondents who frequented physicians 10 times or more in the previous year were three times as likely to email their providers as those who never visited a provider (OR: 3.16). Respondents who owned both a tablet and a smartphone were 2 and 3 times more likely to use email and text messages as compared to the respondents with just tablets. Amongst the lifestyle factors, calorie conscious people were found to be twice as likely to use mobile apps to communicate with provider (OR =1.97). Our results also indicate that online self-health seeking activity to be positively associated with communicating with the providers via text, email, or mobile Apps (OR: 2.14, 1.31, and 1.68 respectively). Respondents with income ranges: \$35,000 to \$49,999 and \$75,000 to \$99,999 were less likely to use a mobile app for communication with the provider (OR: 0.12, 0.20 respectively). The results also indicated that with more no. of people in the household they were more likely to use email and text as the mode of communication (OR:1.18 and 1.27 respectively). People in the age group 65-74 were less likely to use a mobile app as compared to the young people in the age group 18-35 (OR: 0.36).

## Determinants of Mobile Communication Modes: Results from Logistic Regression Analysis

			E-mail OR	Text OR	Mobile Apps OR
N= 2316			(29% = 1, 71% = 0)	(9% = 1, 91% = 0)	(6% = 1, 94% = 0)
Demographic Factors	Age	n=2235			
	18-34	18%	ref	ref	ref
	35-49	27%	0.78	1.06	0.95
	50-64	36%	1.21	1.08	0.84
	65-74	14%	1.60	1.32	0.36*
	75 and above	5%	1.53	2.20	1.00
	Gender	n=2290			
	Male	39%	ref	ref	ref
	Female	61%	0.99	0.94	1.21
	Occupation Status	n=2225			
	Unemployed	38%	ref	ref	ref
	Employed	62%	0.82	1.74*	1.78
	Education	n=2254			
	Less than High School	5%	ref	ref	ref
	High School Graduate	14%	1.22	1.04	0.63
	Some College	31%	2.30	1.00	1.06
	College Graduate or more	50%	3.02	0.91	0.91
	Married	n=2245			
	No	18%	ref	ref	ref
	Yes	82%	0.61	0.54	1.16
	Total Household	n=2243(2.61,1.46)	1.18**	1.27*	1.16
	Race/Ethnicity	n=2160			
	White	60%	ref	ref	ref
	Black	16%	0.85	1.66	1.36
	Hispanic	15%	1.11	2.60**	2.04*
	Asian	4%	1.06	0.69	1.29
	Other	4%	2.80	3.01	11.52
	Income Ranges	n=2294			
	\$0 to \$9999	5%	ref	ref	ref
	\$10000 to \$14999	5%	0.27	0.21	0.05
	\$15000 to \$19999	5%	1.71	0.28	0.21
	\$20000 to \$34999	11%	0.68	0.64	0.28
	\$35000 to \$49999	14%	0.60	0.43	0.12**
	\$50000 to \$74999	19%	0.94	0.73	0.19
	\$75000 to \$99999	15%	1.16	1.07	0.20**
	\$100000 to \$199999	19%	2.22	0.94	0.26
	\$200000 and above	7%	2.06	1.04	0.41
Lifestyle	Frequency of Exercise	n=2301(2.87,2.14)	1.08	1.04	1.07
	Calorie Consciousness				
	No	41%	ref	ref	ref
	Yes	59%	1.54	1.34	1.97**
	Fruits and Vegetables Intake	n=2283(5.36,0.92)	1.05	1.14*	1.00
	General Health	n=2268			
	Excellent	13%	ref	ref	ref
	Very good	38%	1.07	2.03	0.82
	Good	37%	1.30	1.72	1.63
	Fair	10%	1.10	1.74	2.66

Health Related Factors	Poor	2%	1.78	2.37	0.74
	Chronicity	n=2316			
	No	40%	ref	ref	ref
	Yes	60%	0.81	0.97	0.96
	Frequency of Visiting Provider	n=2287			
	None	14%	ref	ref	ref
	1 time	14%	1.39	0.92	1.01
	2 times	21%	1.34	1.13	0.49
	3 times	16%	1.30	1.57	0.99
	4 times	12%	1.89	1.19	1.23
	5-9 times	13%	2.28	2.04	1.02
	10 or more times	9%	3.16***	1.70	1.20
	Most Recent Checkup	n=2316			
	Within past 1 year	74%	ref	ref	ref
	Within past 2 years	14%	1.35	1.90	1.41
Info. Seeking Behaviour	Within past 5 years	7%	0.72	0.73	0.56
	5 or more years ago	5%	0.49	0.44	0.11**
	Access own health info. Online	n=2285(0.63,1.08)	2.14***	1.31**	1.68***
	Access family health info. Online	n=2284(0.25,0.72)	0.99	0.88	1.01
	Device Type	n=2316			
	Tablets	15%	ref	ref	ref
	Smart Phone	34%	1.80**	2.03	0.77
	Both	51%	1.85**	3.08***	0.65
Constant			0.01	0.00	0.04
F-Value			4.81***	1.49**	3.44***
*** p<0.01 ** p<0.05 *p<0.1					

## Discussion

From the study, one of the noteworthy observations was related to respondent's online self-health seeking behavior. Respondents with higher access frequency tend to use smart phones more than the other population in study. Another noteworthy observation was found related to lifestyle. Calorie conscious respondents are more likely to switch to health apps for communication and should be a target for any mobile apps. Use of email was found to be the dominant mode whereas text messaging and mobile apps still seem to be in the early stage. Smartphone devices can offer a lot in healthcare if planned and implemented properly in the workflows. The advancement in mobile technologies such as wearable health devices are already embraced in the healthcare industry and can play an important factor to fully realize the benefits of mobile technologies.



## **CONCLUSION**

Mobile apps play a significant part in managing patient health. While usage and the extent of impact differs among different communities, the significant patterns emerging from the Logistic Regression results can be used to effectively target various health apps on different sectors of the market. While an app such as WebMD which helps in treating conditions can be targeted at the African American population, a fitness app would do well amongst the Retired community. As more patients embrace health apps in managing their health, health care practices can streamline the way information reaches targeted segments of population.

To understand the willingness for exchange of information, we need to identify those customers who are calorie conscious, access information and belong to the higher income range. For mode of information exchange, it will be useful to target patients who frequently visit doctors and those who already have significant online health activities.

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