

Can the Use of Internet Applications Increase the Participation of Men in Healthy Lifestyle Behavior?

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ABSTRACT

Mortality rates in the United States are higher for men than women as a result of chronic diseases such as heart disease, cancer, and diabetes. Although men suffer from chronic diseases at higher rates than women, few health interventions are targeted to men. Limited knowledge exists regarding the specific components needed to design Internet applications to appeal to men. The purpose of this quantitative study was to examine the relationship between Internet applications and the influence on participation of men in healthy lifestyle behaviors. A quasi-experimental design was used to analyze data collected from the Health Information National Trends Survey (HINTS) ($N = 990$). A group of men ($n = 323$) that used Internet applications was compared to a control group of men ($n = 667$) that did not use Internet applications. The study results are generalizable to men in the United States because of the use of data from HINTS. Results from the regression analysis indicated that Internet applications for self-management of health behavior had a significant effect upon participation in healthy lifestyle behavior $t(49) = -2.212, p < .05$. There was no significant effect upon men not using Internet applications $t(49) = 1.023, p > .05$. This study supports the United States federal government's Healthy People 2020 objective to increase the proportion of people who use Internet applications for health management.

Keywords: Internet, Men, Self-Management, Self-regulation, Nutrition, Physical Activity

INTRODUCTION

Background

Men in the United States commonly suffer from chronic and preventable diseases that are the result of their health behaviors (Danaei et al., 2010). Despite their high rates of chronic diseases, men are infrequently targeted for Internet applications (Duncan et al., 2012; George et al., 2012). Research that focuses specifically on Internet applications for men is also limited. Previous literature reviews on nutrition interventions (Taylor et al., 2013) and on physical activity (George et al., 2012) identified few chronic disease prevention programs designed to change the health behavior of men. Innovative Internet applications exclusively targeted to men are needed to improve health behavior to reduce chronic diseases endured by men (Vandelanotte et al., 2013).

Treatment of chronic diseases such as heart disease, cancer, and diabetes are projected to cost the U.S. healthcare system approximately \$4.2 trillion per year by 2023 (Anderko et al., 2012). This forecast is a significant increase from total healthcare expenditures in 2013 of \$2.9 trillion (Centers for Medicare & Medicaid Services, 2014). According to the Centers for Disease Control and Prevention (CDC; 2013b), heart disease, cancer, and diabetes are costly chronic preventable diseases. Although more men than women have been diagnosed with a higher

percentage of chronic diseases such as heart disease, cancer, and diabetes that are linked to poor nutrition and lack of physical activity (Duncan et al, 2012), health educators have not targeted or designed many health promotion interventions exclusively for men (George et al., 2012). In addition, health interventions used by women do not appeal to men (Duncan et al., 2012). Internet applications are more appealing to men than traditional health promotion interventions because self-tailored and self-paced activities allow self-management (Taylor et al., 2013).

Internet applications have produced significant health behavior changes (Davies, Spence, Vandelanotte, Caperchione, & Mummery, 2012). This suggests that creating effective Internet applications would benefit from studying specific content and theoretical designs to understand what factors affect participation in healthy lifestyle behavior. A systematic review of the literature conducted by Webb, Joseph, Yardley, and Mitchie (2010) found that the use of the theory of planned behavior increased the effectiveness of Internet applications.

Objective

The purpose of this study was to examine the relationship between Internet applications used for self-management of health behavior upon men in the United States, and the influence upon men's participation in healthy lifestyle behaviors. Internet applications can be used to manage healthcare appointments, communicate with healthcare providers, fill prescriptions, monitor nutrition, physical activity, weight management, and calculate body mass index (BMI). In the context of this study, participation in healthy lifestyle behavior included fruit consumption, vegetable consumption, and regular physical activity.

Chronic diseases such as heart disease, cancer, and diabetes are among the most widespread preventable health conditions in the United States; however, options to successfully manage these chronic diseases are limited (Chaney et al., 2013). Improving health outcomes associated with heart disease, cancer, and diabetes requires options that provide the opportunity for self-management (Chaney et al., 2013; Lorig et al., 2012; Miron-Shatz & Ratzan, 2011). Incorporating the self-management and self-efficacy components of the social cognitive theory into the design of diabetes Internet applications have successfully been used to significantly improve health behavior (Glasgow et al., 2012). Internet applications used for disease prevention, preventing disease complications, or managing existing chronic diseases such as heart disease, and cancer are less costly, more effective treatment for chronic diseases (Hyman, 2009). According to the CDC, chronic preventable diseases are responsible for 75% of U.S. healthcare spending (2013a).

Internet applications that increase male participation in healthy lifestyle behavior are predicted to produce better health outcomes that prevent or minimize the effects of heart disease, cancer, and diabetes, ultimately reducing healthcare expenses (Kennedy et al., 2012). This study was also designed to support the Healthy People 2020 objective to increase the proportion of people in the United States who use Internet Applications for health management (Healthy People 2020, 2013). Data from the U.S. National Cancer Institute's Health Information National Trends Survey (HINTS) was used to conduct this study.

Theoretical Framework

The theoretical framework for this study was based on social cognitive theory. Social cognitive theory was developed by Albert Bandura and is based upon modeling, self-regulation, and self-efficacy (Bandura, 2005). Utilizing self-efficacy and self-regulation skills have contributed to successful participation in positive health behavior changes that prevent disease (Bandura,

1997). Internet applications provides knowledge and encouragement to increase the participation of men in healthy lifestyle behavior. Internet applications assist with self-management of an individual's health behavior, thereby providing individuals the opportunity to employ self-regulation.

This study explores using interactive Internet applications to influence lifestyle habits. Lifestyle habits are a major factor in the participation of chronic disease prevention activities. Because individuals control their lifestyle habits, men can use these habits to have major input into their overall health (Bandura, 2005). Self-management provides individuals with the opportunity to realize the benefits of engaging in healthy lifestyle behavior. The benefits of positive self-management are effective in helping men live longer and healthier lives (Bandura, 2004). Interactive Internet applications offer methods of motivating individuals (Glasgow et al., 2012). If structured properly, interactive Internet applications have a strong potential to develop the motivation of individuals and provide the opportunity for self-management as they work through health behavior changes (Bandura, 2005). If Internet applications are not effectively designed to increase motivation and enhance self-management skills, the individuals that benefit most from these Internet Applications will not use them (Bandura, 2004).

METHODS

Data Source

Secondary data from the Health Information National Trends Survey (HINTS) 4 Cycle 1 survey was used to conduct this study. Data was collected by the National Cancer Institute from adult participants throughout the United States. HINTS is a national survey used to measure Internet use associated with healthcare, nutrition, physical activity, healthcare access, cancer risks, in relationship to individual's health (National Cancer Institute, 2014b).

First, a stratified sample of addresses was selected from a database of residential addresses in the United States. High-minority, low-minority, and Central Appalachian strata were created based on demographic data. Creation of the three strata was performed to increase the accuracy of the estimates for the high-minority and Central Appalachian subpopulation. Because of the low responses to previous HINTS surveys, the high-minority stratum and the Central Appalachia stratum were oversampled to increase the total responses for these subpopulations (Westat, 2012). The HINTS 4 Cycle 1 survey was mailed to 6,730 addresses in the high minority stratum, 5,475 surveys were mailed to addresses in the low minority stratum and 180 surveys were mailed to the addresses in the Central Appalachia stratum (Westat, 2012).

The second stage of the sample design consisted of selection of the adults living in the households that received the survey. Survey participants within the households were selected by either the "All Adult" method or the "Next Birthday" method. The "All Adult" method mailed two surveys that requested every adult in the household to respond. The "Next Birthday" method requested only the member of the household with the next upcoming birthday respond to the survey (Westat, 2012).

Participants

The survey response methods resulted in data being collected from 3,959 respondents, which included men and women (Westat, 2012). The final response rate for the high-minority strata was 27.97%, the low-minority strata response rate was 39.34%, and the Central Appalachia strata response rate was 32.62% (Westat, 2012). The overall response rate to the HINTS 4 Cycle 1 survey was 36.67% (Westat, 2012). Only the 1,552 responses from men were used for

analysis of this study.

The target population of this study consisted of men at least 18 years of age and older. The sample consisted of 1,552 men whose responses were collected between October 2011 and January 2012 for the HINTS 4 Cycle 1 survey. Inclusion in the HINTS 4 Cycle 1 survey required respondents to be at least 18 years of age, but had no upper age limit. This led to all men's responses collected by the survey being included in the sample. The sample of the HINTS 4 Cycle 1 survey is generalizable to approximately 111,372,696 men in the United States according to Westat (2012).

Measures

Demographics, which included age, education, and ethnicity were self-reported by the participants of the survey. Survey items in the HINTS 4 Cycle 1 survey were used to perform a secondary analysis of the variables in this study. Though the HINTS questionnaire provided measurement of numerous items, only some of the items measured are applicable to this study.

Internet applications, measured the use of the Internet to monitor nutrition and physical activity. The first questions used to measure this variable from the HINTS 4 Cycle 1 questionnaire is: "In the last 12 months, have you used the Internet for any of the following reasons" (National Cancer Institute, 2014b)? Used a website to help you with your diet, weight, or physical activity. Response options are measured on a categorical scale, possible responses were: 1. Yes or 2. No. The second question in the survey asked: "Have you used the Internet to keep track of personal health information such as care received, test results, or upcoming medical appointments" (National Cancer Institute, 2014b)? Response options are measured on a categorical scale, possible responses were: 1. Yes or 2. No.

Healthy lifestyle behavior, is participation in healthy lifestyle behavior that included, activities related to healthy nutrition and participation in regular physical activity. Fruit consumption, vegetable consumption, and physical activity were used to measure this variable. To measure fruit consumption participants were asked "About how many cups of fruit (including 100% pure fruit juice) do you eat or drink each day" (National Cancer Institute, 2014b)? The 7 responses were measured on an interval scale, which ranged from none to 4 or more cups per day. Vegetable consumption was measured by the question "About how many cups of vegetables (Including 100% pure vegetable juice) do you eat or drink each day" (National Cancer Institute, 2014b)? The 7 responses were measured on an interval scale, which ranged from none to 4 or more cups. The first question measuring physical activity is: "In a typical week, how many days do you do any physical activity of at least moderate intensity, such as brisk walking, bicycling at a regular pace, swimming at a regular pace, and heavy gardening" (National Cancer Institute, 2014b)? Response options were measured on an interval scale, possible responses are: none, 1 day a week, 2 days a week, 3 days a week, 4 days a week, 5 days a week, 6 days a week, 7 days a week. The second question measuring physical activity: "In a typical week, outside of your job or work around the house, how many days to you do leisure-time physical activities specifically designed to strengthen your muscles such as lifting weights or circuit training (do not use cardio exercise such as walking, biking, or swimming)" (National Cancer Institute, 2014b)? Response options were measured on an interval scale, possible responses are: none, 1 day a week, 2 days a week, 3 days a week, 4 days a week, 5 days a week, 6 days a week, 7 days a week.

Statistical Analysis Procedures

The Statistical Package for the Social Sciences (SPSS) version 21 was used to analyze the data sets available for public use containing information collected for the HINTS 4 Cycle 1 survey. The statistical program WesVar 5.1 was used in addition to SPSS version 21. Use of WesVar 5.1 is necessary to incorporate the jackknife replicate weights used in the HINTS database (National Cancer Institute, 2014a). Not including the jackknife replicate weights in the analysis of information in the HINTS 4 Cycle 1 data sets could increase the possibility of type I errors resulting from incorrect p-values (National Cancer Institute, 2014a). Results of the statistical test performed in SPSS were imported into WesVar 5.1 to complete the analysis of this study. Secondary data obtained from HINTS data sets were used to analyze information associated with the independent variable, Internet applications, and the dependent variable participation in healthy lifestyle behavior.

The HINTS data sets available for public use have undergone data cleaning by Westat (2012) using predetermined processing rules for the data collected from the HINTS 4 Cycle 1 questionnaire. Rules were created to recode items without responses or items with responses that could not be determined, missing values were recoded using a forced-choice standardized data cleaning methods, and responses that allowed respondents to elaborate verbally were cleaned for spelling errors (Westat, 2012). The gender question had 103 missing responses. Cases that did not answer the gender question were not included in the sample. Responses with missing data that are included in the 1552 cases were coded by Westat (2012) with a value of -9. Westat (2012) performed the coding to include the value -9 for missing data for all responses; therefore, no modification was required to any of the 1552 cases that contained missing data because these cases are clearly identified.

A visual inspection of the information assisted in cleaning the data to remove errors prior to analysis. SPSS sorts survey responses in ascending order for each variable. SPSS was used to visually inspect the records of the responses to each survey question. Viewing the responses to each survey question in ascending order offered an easy method to identify out-of-range or misnumbered cases.

RESULTS

Statistical Analysis of the Sample

The final sample of men used for this study consisted of 990 participants. Table 1 shows the frequencies and percentages for age, education and ethnicity of the sample. The frequency and percentages of the sample were divided into two groups. One group consisted of men that used Internet applications and another group of men that did not use Internet applications. Men between the ages of 50 and 64 accounted for the highest usage of Internet applications. While Internet application usage for men between 35 and 49 years of age was similar at 30.3%, men between 50 and 64 years of age had the highest Internet application usage rate at 36.2%. Men between 18 and 34 years of age were the next largest group, utilizing Internet applications at a rate of 21.7%. Overall use of Internet applications was 33% across the entire sample; however, the percentage of men that used Internet applications dropped dramatically for men 65 years of age and older. The largest group of men (37.8%) in the entire sample not using Internet applications was between 50 and 64 years of age.

The analysis highlighted a strong correlation between college attendance and Internet application use. Internet application usage amongst college graduates was the highest at 33.7%. The next highest usage was found amongst men with postgraduate education, followed by college graduate's usage, at 26.9% and 21.7%, respectively. While college attendance significantly increases the use of Internet applications, post high school training did not have

the same impact, with only 5.3% of these men using Internet applications. High school graduates used Internet applications at a rate of 9.0%, which was significantly higher than men with post high school training.

Distinct differences between ethnic groups were depicted by the results. Non-Hispanic white men used Internet applications at a rate of 68.7%, which was the highest usage by men of any ethnicity. Hispanic and Non-Hispanic Black men had the next highest use of Internet applications following Non-Hispanic white men at rates of 9.3% and 8.7% respectively. Non-Hispanic Asian men were the only other ethnic group to have significant Internet application usage at a rate of 7.4%.

Table 1
Frequencies and Percentages of Demographic Data

Demographic	Internet Application Users		Non-Internet Application Users	
	<i>n</i>	%	<i>n</i>	%
Age				
18-34	70	21.7%	89	13.3%
35-49	98	30.3%	149	22.4%
50-64	117	36.2%	252	37.8%
65-74	30	9.3%	119	17.8%
75+	8	2.5%	58	8.7%
Education				
Less than 8 years	2	0.6%	4	0.7%
8 through 11 years	9	2.8%	18	2.7%
High School Graduate	29	9.0%	105	15.7%
Post high school training	17	5.3%	53	7.9%
Some college	70	21.7%	179	26.8%
College graduate	109	33.7%	162	24.3%
Postgraduate	87	26.9%	146	21.9%
Ethnicity				
Hispanic	30	9.3%	51	7.6%
Non-Hispanic White	222	68.7%	483	72.5%
Non-Hispanic Black	28	8.7%	68	10.0%
Non-Hispanic American Indian or Alaska Native	1	0.3%	1	0.1%
Non-Hispanic Asian	24	7.4%	27	4.0%
Hawaiian or Pacific Islander	1	0.3%	1	0.1%
Non-Hispanic multiple races	17	5.3%	36	5.5%

The mode and the standard deviation of the age of men using Internet applications differed from that of men who did not use Internet applications as depicted in Table 2. The mode of the age of men who used Internet applications is nine years less than men that did not use Internet applications. The mode and standard deviation of men that used Internet applications compared to men that did not use Internet applications in relationship to education also differed. The largest number of men who did not use Internet applications was college graduates, which was demonstrated by the mode. The standard deviation for education of men that did not use Internet applications was larger than that for men that used Internet

applications. The mode for men that used Internet applications and men that did not use Internet applications in relationship to ethnicity was the same; the standard deviation for each group was also relatively similar.

Table 2
Descriptive Statistics of the Sample

Table 2 Demographic	Internet Application Users		Non-Internet Application Users	
	Mode	SD	Mode	SD
Age	54	15.02	63	16.84
Education	College Graduate	1.58	Some College	2.25
Race/Ethnicity	Non-Hispanic White	2.22	Non-Hispanic White	2.37

Inferential Statistical Analysis

To determine if there is a quantitative effect of the use of Internet applications upon participation in healthy lifestyle behavior a group of men that used Internet applications $n = 323$ was compared to a group of men that did not use Internet applications $n = 667$. A t test was used to determine if there was a significant difference between the samples of the two groups of men in this study. Comparison of the group of men using Internet applications to the group of men that did not use Internet applications offered the opportunity to measure the effect of Internet applications by determining the differences of the means between the two groups. The mean and the standard error of the mean were used to determine the significance of the differences of the means of the two groups. Comparing the means of the two samples provide the opportunity to determine the significance of the null hypothesis.

Results of the t test are outlined in Table 3. The two-tailed t test was significant, $t = (561) = 2.738$, $p = .006$, $p < .05$ which do not support the null hypothesis. Men using Internet applications ($M = 5.42$, $SD = 1.22$) participated more in healthy lifestyle behavior than men not using Internet applications ($M = 5.21$, $SD = 1.06$). The 95% confidence interval for the difference in the means was quite distinct, ranging from .06 to .37. Calculation of an effect size of .12 indicated a small effect, which would explain approximately 1% of the total variance of the strength of the relationship between Internet application usage and participation in healthy lifestyle behavior

Table 3
Independent Samples t Test Analysis

Internet Usage	Application	n	M	SD	SEM	t	Effect Size	95 % CI	
								LL	UL
Internet Users	Application	323	5.42	1.22	0.07	2.74	.12	0.06	0.37
Non-Internet Application Users		667	5.21	1.06	0.04				

Note. CI = confidence interval; LL = lower limit; UL = upper limit.

$p = .006$, $p < .05$

Two multiple linear regression analyses were conducted to determine if the use of Internet

applications had an effect upon participation in healthy lifestyle behavior. To test the null hypothesis the average of two questions from the HINTS 4 Cycle 1 survey was used to measure the effect of the use of Internet applications by men in the sample. A yes response to either question resulted in placement in the group of men using Internet applications. Men responding no to both questions were placed in the group not using Internet applications.

Participation in healthy lifestyle behavior was measured by four questions from the HINTS 4 Cycle 1 survey. An index was created to measure diet and physical activity participation of the men in the sample. Two questions were recoded to measure healthy fruit and vegetable consumption based upon the Dietary Guidelines for Americans 2010 established by the U.S. Department of Agriculture and the U.S. Department of Health and Human Services (U.S. Department of Agriculture & U.S. Department of Health and Human Services, 2010). Two questions were recoded to measure physical activity participation based upon the physical activity guidelines outlined by the U.S. Department of Health and Human Services (U.S. Department of Health and Human Services, 2014).

The null hypothesis was rejected for the men in the group using Internet applications because there was a significant effect upon the average use of Internet applications upon participation in healthy lifestyle behavior as demonstrated by the significant statistical results illustrated in Table 4. The value of the *t* statistic and the associated significance $t(49) = -2.212, p = .032, p < .05$ also supports rejection of the null hypothesis because the probability of the *t* value was significant. The multiple linear regression analysis indicated that there was a significant effect upon Internet application use and participation in healthy lifestyle behavior.

The null hypothesis was accepted for the men in the group not using Internet Applications because there was not a significant effect upon the average use of Internet applications on participation in healthy lifestyle behavior as illustrated in Table 4. The value of the *t* statistic and the associated significance $t(49) = 1.023, p = .312, p > .05$ also supported acceptance of the null hypothesis because the probability of the *t* value was not significant. The multiple linear regression analysis suggests that men that did not use Internet applications are less likely to participate in healthy lifestyle behavior than men that do use Internet applications.

Table 4
Multiple Linear Regression Analysis

Model 1	Internet Application Users				Non-Internet Application Users			
	<i>B</i>	<i>SE_b</i>	Beta	95% CI	<i>B</i>	<i>SE_b</i>	Beta	95% CI
(Constant)	6.64	0.521			5.19	0.055		
Health tool use	-0.87	0.378	-.16	[-0.30, -0.02]	0.03	0.027	.05	[-0.04, 0.13]

Note: Internet application users $R^2 = .025, F(1, 49) = 5.298, p = .026, p < .05$.

Non-Internet application users $R^2 = .002, F(1,49) = 1.097, p = .300, p > .05$.

Review of the results of the statistical analysis measuring the effect of the use of Internet applications upon participation in healthy lifestyle behavior of men yielded a positive response. An independent samples *t* test and a regression analysis both demonstrated a significant effect of the use of Internet applications upon participation in healthy lifestyle behavior. These results are demonstrated in Tables 3 and 4.

DISCUSSION

Principle Findings

This study provides an understanding of the components of Internet applications that have the potential to increase participation of men in healthy lifestyle behavior using secondary data that is generalizable to approximately 111,372,696 men in the United States. Statistical analysis measuring the effect of the use of Internet applications upon participation in healthy lifestyle behavior of men demonstrated a significant effect of the use of Internet applications on participation in healthy lifestyle behavior. These results confirm the finding of two previous studies. Kazer et al. (2011) found that Internet applications provide the opportunity for self-management in addition to increased participation in healthy lifestyle behavior. McCully et al. (2013) conducted a study that used data from HINTS surveys collected in 2007 and 2011 that also demonstrated a significant relationship between the use of Internet applications Internet applications and participation in healthy lifestyle behavior.

The utility of self-management provided by Internet applications has been noted by several studies. Self-management has been identified as a strategy that increases the effectiveness of Internet applications (Duncan et al., 2012; (Webb, Joseph, Yardley, & Mitchie, 2010). The effectiveness of Internet applications is further increased when self-management options allow results to be tracked (Bandura, 2004; George et al., 2012; Morgan, Warren, Lubans, Collins, and Callister, 2009; Morgan, Warren, Lubans, Collins, & Callister, 2011).

The effects of self-management upon participation in healthy lifestyle behavior was confirmed by this study. Only men in the group using Internet applications, which accounted for 33% of the total sample, demonstrated a significant effect on healthy lifestyle participation. Men not using Internet applications, which represented 66% of men of the men in the total sample did not have a technological opportunity for self-management. There was no effect on participation in healthy lifestyle behavior on men in the group not using Internet applications.

The use of Internet applications offers a method of self-management of health behavior. Self-management provides successful self-regulation, which enhance self-efficacy (Bandura, 2005). Self-efficacy is the confidence a person has in their ability to develop and implement a plan to deal with possible circumstances that prevent an individual from attaining their goals (Bandura, 1995). Self-efficacy has been associated with successful health behavior changes (Chen & Lin, 2010). Self-management of health behavior supplies a vehicle for individuals to improve self-efficacy by taking responsibility for their health behaviors (Kazer, Bailey, Sanda, Colberg, & Kelly, 2011; Kelders et al., 2012). Self-efficacy along with self-management influence participation in nutrition and physical activity health interventions (Anderson-Bill et al., 2011).

Mobile phones usage is prevalent throughout the United States, as evidenced by ownership of 91% of all adult Americans (Duggan & Smith, 2013). The number of men with smartphones continues to grow, currently 59% own smartphones (Smith, 2013). The availability of Internet applications on smartphones offer men the flexibility to access Internet applications anywhere. Increasing options for self-management increase participation in healthy lifestyle behavior (Bandura, 2004; Kennedy et al., 2012). According to the ManUp study conducted by Duncan et al. (2012) men designated self-management as a major factor to change health behavior. Access to methods for self-management, self-regulation of diet, and physical activity can contribute to increasing participation in healthy lifestyle behavior. The implications for social change include proliferation of opportunities for men to engage in self-management of diet and physical activity because mobile devices are usually always with users and easily assessable (Fanning et al., 2012; Riley et al., 2011).

Internet application usage by minorities has demonstrated significant results in participation in healthy lifestyle behavior (MuCully et al., (2013). Self-management was demonstrated by this study to have a significant effect upon participation of men in healthy lifestyle behavior. Results from this study offer a solution to increase participation of minority men in healthy lifestyle behavior. Smartphone applications used to track health behavior have been downloaded at high rates by Non-Hispanic Blacks and Hispanics (Fox, 2011; Purcell, 2011). Smartphone applications, which incorporate self-management have the potential to increase participation in healthy lifestyle behavior. Designing smartphone applications that all minority men have the ability to understand can increase participation in health lifestyle behavior. Minorities are disproportionately affected by low health literacy (Berkman et al., 2011; Chaudhry et al., 2011). Implications for positive social change is the opportunity for minority men to have frequent access to Internet applications they understand and to address the health literacy challenges many minority men experience (Broderick et al., 2013). Increased participation of minority men in healthy lifestyle behavior can reduce development of chronic diseases in this population within the United States.

LIMITATIONS OF THE STUDY

This study has several limitations, including its dependency on self-reporting and the use of a cross-sectional design. Self-reporting of data is a limitation of this study. Missing or invalid responses reduced the size of the sample substantially. The original sample consisted of 1,552 men; however, the sample size was reduced to 990 due to screening. Although the size of the sample was reduced 36%, the results of this survey are still generalizable to all men in the United States because of the use of data from HINTS. Alternative survey methods may have resulted in a larger sample size.

Another limitation was the use of a cross-sectional design as opposed to a longitudinal design. The cross-sectional design used for this study only analyzed data collected from respondents to the HINTS 4 Cycle I survey, which collected data between October 2011 and February 2012. Previous data collections for HINTS surveys used different participants preventing longitudinal comparisons. As a result, it was not possible to measure long-term trends or evaluate the sustainability of the use of Internet applications by men and their participation in healthy lifestyle behaviors.

CONCLUSION

Internet applications can proliferate an increase in the participation of men in healthy lifestyle behavior because Internet applications provides options for self-management. Results from this nationally representative study of men established the significant effect of the use of Internet applications used for self-management upon participation of men in healthy lifestyle behavior. Furthermore, accessibility of Internet applications offers frequent opportunities for men to practice self-management of diet and physical activity at lower costs than services offered by physicians or medical facilities. The availability of mobile devices increases options for men to conveniently use Internet applications to participate in self-management of their health behavior.

Internet applications has made numerous contributions to healthcare. Establishment of self-regulation as a component that contributed to an increase in the participation of men in healthy lifestyle behavior demonstrates the need to develop Internet applications for men that include self-management. Increasing participation of men in healthy lifestyle behavior can reduce the development of chronic diseases, such as heart disease, cancer, and diabetes. Reducing the number of men with chronic diseases by improving the quality of life of men and

contribute to a reduction of costs the United States healthcare system incurs in the treatment of chronic diseases.

References

- Anderko, L, Roffenbender, J. S, Goetzel, R. Z., Howard, J., Millard, F., Wildenhaus, K., . . . Novelli, W. (2012). Promoting prevention through the Affordable Care Act: Workplace wellness. *Preventing Chronic Disease, 9*, 120092. doi:<http://dx.doi.org/10.5888/pcd9.120092>.
- Anderson-Bill, E. S., Winett, R. A., & Wojcik, J. R. (2011). Social cognitive determinants of nutrition and physical activity among web-health users enrolling in an online intervention: The influence of social support, self-efficacy, outcomes expectations, and self-regulation. *Journal of Medical Internet Research, 13*(1), 147-162. doi:10.2196/jmir.1551
- Bandura, A. (1995). Exercise of personal and collective efficacy in changing societies. In A. Bandura (Eds.), *Self-efficacy in changing societies* (pp. 1-45). Cambridge, United Kingdom: Cambridge University Press.
- Bandura, A. (1997). *Self-efficacy: The exercise of control*. New York, NY: W.H. Freeman and Company.
- Bandura, A. (2004). Health promotion by social cognitive means. *Health Education & Behavior, 31*(2), 143-164. doi:10.1177/1090198104263660
- Bandura, A. (2005). The primacy of self-regulation in health promotion. *Applied Psychology: An International Review, 54*(2), 245-254. doi:10.1111/j.1464-0597.2005.00208.x
- Berkman, N. D., Sheridan, S. L., Donahue, K. E., Halpern, D. J., and Crotty, K. (2011). Low health literacy and health outcomes: An updated systematic review. *Annals of Internal Medicine, 155*(2), 97-107. <http://dx.doi.org/10.7326/0003-4819-155-2-201107190-00005>
- Broderick, J., Devine, T., Langhans, E., Lemerise, A. J., Lier, S., Harris, L. (2014). Designing health literate mobile apps. Retrieved from <http://www.iom.edu/Global/Perspectives/2014/HeathLiterateApps.aspx>
- Centers for Disease Control and Prevention. (2013a). Chronic disease prevention and health promotion. Retrieved from <http://www.cdc.gov/chronicdisease/>
- Centers for Disease Control and Prevention. (2013b). *Deaths: Leading causes for 2010*. Retrieved from http://www.cdc.gov/nchs/data/nvsr62_06.pdf
- Centers for Medicare & Medicaid Services. (2014). National health expenditures continued to grow in 2013. Retrieved from <http://www.cms.gov/Newsroom>
- Chaney, B., Barry, A. E., Chavarria, E., Tennant, B., Walsh-Childers, K., Sriram, P. S., & Zagora, J. (2013). Web 2.0 chronic disease self-management for older adults: A systematic review. *Journal of Medical Internet Research, 15*(2), 1-27. doi:10.2196/jmir.2439.
- Chaudhry, S. I., Herrin, J., Phillips, C., Butler, J., Mukerjee, S., Murillo, J., . . . Krumholz, H. M. (2011). Racial disparities in health literacy and access to care among patients with heart failure. *Journal of Cardiac Failure, 17*(2), 122-127. doi.org/10.1016/j.cardfail.2010.09.016
- Chen, S., & Lin, C. (2010). Predictors of adopting a health promoting lifestyle among worksite adults with prediabetes. *Journal of Clinical Nursing, 19*, 2713-2719. doi:10.1111/j.1365-2702.2010.03320.x
- Danaei, G., Rimm, E. B., Oza, S., Kulkarni, S. D., Murray, C. J., Ezzati, M. (2010). The promise of prevention: The effects of four preventable risk factors on national life expectancy and life expectancy disparities by race and county in the United States. *PLoS Med, 7*(3), 1-13. doi:10.1371/journal.pmed.1000248
- Davies, C. A., Spence, J. C., Vandelanotte, C., Caperchione, C. M., & Mummery, W. K. (2012). Meta-analysis of Internet delivered interventions to increase physical activity. *International Journal of Behavioral Nutrition and Physical Activity, 9*(52), 1-13. doi:10.1186/1479-5868-9-52
- Duggan, M., & Smith, A. (2013). Cell Internet use 2013. Retrieved from <http://www.pewinternet.org/2013/09/16/cell-internet-use-2013/>
- Duncan, M. J., Vandelanotte, C., Rosenkranz, R. R., Caperchione, C. M, Ding, H., Ellison, M., . . . Mummery, W. K. (2012). Effectiveness of a website and mobile phone based physical activity and nutrition intervention for middle-aged males: Trial protocol and baseline findings of the ManUp Study. *BMC Public Health, 12*, 1-14. doi:10.1186/1471-2458-12-656
- Fanning, J., Mullen, S. P., & McAuley, E. (2012). Increasing physical activity with mobile devices: A meta-analysis. *Journal of Medical Internet Research, 14*(6), 1-16. doi:10.2196/jmir.2171

- Fox S. (2011). The social life of health information. Retrieved from <http://www.pewinternet.org/2011/11/02/half-of-adult-cell-phone-owners-have-apps-on-their-phones/>
- George, E. S., Kolt, G. S., Duncan, M. J., Caperchione, C. M., Mummery, W. K., Vandelanotte, C., . . . Noakes, M. (2012). A review of the effectiveness of physical activity interventions for adult males. *Sports Medicine*, 42(4), 281-300. doi:10.2165/11597220Ger
- Glasgow, R. E., Kurz, D., King, D., Dickman, J. M., Faber, A. J., Halterman, E., . . . Ritzwoller, D. (2012). Twelve-month outcomes of an Internet-based diabetes self-management support program. *Patient Education and Counseling*, 87, 81-92. doi:10.1016/j.pec.2011.07.024
- Healthy People 2020 (2013). Health communication and health information technology. Retrieved from <http://healthypeople.gov/2020/topicsobjectives2020/objectiveslist.aspx?topicId=18>
- Kazer, M. W., Bailey, D. E., Sanda, M., Colberg, J., & Kelly, W. K. (2011). An Internet intervention for management of uncertainty during active surveillance for prostate cancer. *Oncology Nursing Forum*, 38(5), 561-568. doi:10.1188/11.ONF.561-568
- Kelders, S. M., Kok, R. N., Ossebaard, H. C., & Van Gemert-Pijnen, J. E. (2012). Persuasive system design does matter: A systematic review of adherence to web-based interventions. *Journal of Medical Internet Research*, 14(6), 1-36. doi:10.2196/jmir.2104.
- Kennedy, C. M., Powell, J., Payne, T. H., Ainsworth, J., Boyd, A., & Buchan, I. (2012). Active assistance technology for health related behavioral change: An interdisciplinary review. *Journal of Medical Internet Research*, 14(3), 1-26. doi:10.2196/jmir.1893.
- Lorig, K., Ritter, P. L., Plant, K., Laurent, D. D., Kelly, P., & Rowe, S. (2012). The South Australia health chronic disease self-management Internet trial. *Health Education & Behavior*, 40(1), 67-77. doi:10.1177/1090198112436969.
- McCully, S. N., Don, B. P., & Updegraff, J. A. (2013). Using the Internet to help with diet, weight, and physical activity: results from the health information national trends survey (HINTS). *Journal of Medical Internet Research*, 15(8), e148. doi:10.2196/jmir.2612
- Miron-Shatz, T., & Ratzan, S. C. (2011). The potential of an online and mobile health scorecard for preventing chronic disease. *Journal of Health Communication*, 16, 175-190. doi:10.1080/10810730.2011.602464.
- Morgan, P. J., Warren, J. M., Lubans, D. R., Collins, C. E., & Callister, C. (2011). Engaging men in weight loss: Experiences of who participated in the male only SHED-IT pilot study. *Obesity Research & Clinical Practice*, 5(3), e239-e248. doi:10.1016/j.orcp.2011.03.002
- Morgan, P. J., Lubas, D. R., Collins, C. E., Warren, J. M., & Callister, R. (2009). The SHED-IT randomized controlled trial: evaluation of an Internet-based weight-loss program for men. *Obesity*, 17, 2025-2032. doi:10.1038/oby.2009.85
- National Cancer Institute. (2014a). *Analytics recommendations for HINTS4 – Cycle 1 data*. Retrieved from <http://hints.cancer.gov/dataset.aspx>
- National Cancer Institute. (2014b). Health Information National Trends Survey (HINTS). Retrieved from <http://appliedresearch.cancer.gov/hints/>
- Purcell, K. (2011). Half of adult cell phone owners have apps on their phones. Retrieved from <http://www.pewinternet.org/2011/11/02/half-of-adult-cell-phone-owners-have-apps-on-their-phones/>
- Riley, W. T., Rivera, D. E., Atienza, A. A., Nilsen, W., Allison, S. M., & Mermelstein, R. (2011). Health behavior models in the age of mobile interventions: Are our theories up to the task? *Journal of Translational Medicine*, 1, 53-71. doi:10.1007/S13142-011-0021-7.
- Smith, A. (2013). Smartphone ownership 2013. Retrieved from <http://www.pewinternet.org/2013/06/05/smartphone-ownership-2013/>
- Taylor, P. J., Kolt, G. S., Vandelanotte, C., Caperchione, C. M., Mummery, W. K., George, E. M., . . . Noakes, M. J. (2013). A Review of the nature and effectiveness of nutrition intervention in adult males. *International Journal of Behavioral Nutrition and Physical Activity*, 10, 1-13. doi:10.1186/1479-5868-10-13
- U.S. Department of Agriculture & U.S. Department of Health & Human Services (2010). Dietary guidelines for Americans 2010. Retrieved from <http://www.health.gov/dietaryguidelines/dga2010/DietaryGuidelines2010.pdf>
- U.S. Department of Health & Human Services (2014). Physical Activity Guidelines for Americans. Retrieved from <http://www.health.gov/paguidelines/guidelines/chapter1.aspx>

- Vandelanotte, C., Caperchione, C. M., Ellison, M., George, E. S., Maeder, A., Kolt, G. S., & Duncan, M. J. (2013). What kind of website and mobile phone-delivered physical activity and nutrition interventions do middle aged men want? *Journal of Health Communication, 0*, 1-14. doi:10.1081/10810730.2013.768731
- Webb, T. L., Joseph, J., Yardley, L., & Michie, S. (2010). Using the Internet to promote health behavior change: A systematic review and meta-analysis of the impact of theoretical basis, use of behavior change techniques, and modes of delivery on efficacy. *Journal of Medical Internet Research, 12*(1), e4. doi:10.2196/jmir.1376.
- Westat. (2012). Health Information National Trends Survey (HINTS 4) Cycle 1 Methodology Report. Retrieved from <http://hints.cancer.gov/instrument.aspx>
- Whittaker, R., Borland, R., Bullen, C., Lin, R. B., McRobbie, H., & Rodgers, A. (2009). Mobile phone-based interventions for smoking cessation. *Cochrane Database Systematic Review, 4*, 1-26. doi:10.1002/14651858.CD006611.
- Wong, J. Y., Gilson, N. D., van Uffelen, J. G., & Brown, W. J. (2012). The effects of workplace physical activity interventions in men: a systematic review. *American Journal of Men's Health, 6*(4), 303-313. doi:10.1177/1557988312436575
- Yu, C. H., Parsons, J., Mamdani, M., Lebovic, G., Shah, B. R., Bhattacharyya, O., . . . Straus, S. E. (2012). Designing and evaluating a web-based self-management site for patients with type II diabetes – systematic website development and study protocol. *BMC Medical Informatics and Decision Making, 12*(57), 1-12. doi:10.1186/1472-6947-12-5