Technological-Based Interventions in Cancer: What Factors are Associated with Use of Mobile Digital Wellness and Health Apps Among Seekers of Cancer Information

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Abstract

Background: Mobile digital wellness and health apps play a significant role in optimizing health and aiding in cancer management and decision-making

Objective: This study aims to identify the factors influencing the use of mobile health and wellness apps among cancer information seekers in the United States.

Methods: We conducted a cross-sectional study of adults using data from the Health Information National Trends Survey (HINTS). We performed weighted univariate and multivariable logistic regression to determine the association between the use of health and wellness apps and socio-economic factors, medical history and conditions, and lifestyle and behavioral factors

Results: Adults with a family history of cancer were more likely to use digital health and wellness apps compared to those without any family history of cancer (82.7% vs 17.3%). Participants with household incomes ? $50,000 had 49% higher adjusted odds of using these apps than those with incomes < $50,000 (aOR=1.49, 95% CI: 1.03 - 2.17). College graduates and those with higher educational levels were avid users compared to those with a high school diploma or less (aOR=1.84, 95% CI: 1.29 - 2.62). Internet users had over three times the odds of using these apps compared to non-users (aOR=3.31, 95% CI: 1.70 - 6.46).

Conclusions: Age, education, household income, and use of the internet are the major determinants of the adoption of digital health and wellness apps among seekers of cancer information. Hence, public health programs could be directed toward addressing these factors to improve cancer diagnosis, treatment, and management using these apps Clinical Trial: None

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Conflict of interest: None

ABSTRACT

Objective: Mobile digital wellness and health apps play a significant role in optimizing health and aiding in cancer management and decision-making. This study aims to identify the factors influencing the use of mobile health and wellness apps among cancer information seekers in the United States.

Methods: We conducted a cross-sectional study of adults using data from the Health Information National Trends Survey (HINTS). We performed weighted univariate and multivariable logistic regression to determine the association between the use of health and wellness apps and socio-economic factors, medical history and conditions, and lifestyle and behavioral factors.

Results: Adults with a family history of cancer were more likely to use digital health and wellness apps compared to those without any family history of cancer (82.7% vs 17.3%). Participants with household incomes ≥ $50,000 had 49% higher adjusted odds of using these apps than those with incomes < $50,000 (aOR=1.49, 95% CI: 1.03 - 2.17). College graduates and those with higher educational levels were avid users compared to those with a high school diploma or less (aOR=1.84, 95% CI: 1.29 - 2.62). Internet users had over three times the odds of using these apps compared to non-users (aOR=3.31, 95% CI: 1.70 - 6.46).

Conclusion: Age, education, household income, and use of the internet are the major determinants of the adoption of digital health and wellness apps among seekers of cancer information**.** Hence, public health programs could be directed toward addressing these factors to improve cancer diagnosis, treatment, and management using these apps.

Keywords: Cancer intervention, Wellness Mobile Apps, Cancer information, Health Apps, Digital health and wellness Apps, Cancer management, Telehealth

INTRODUCTION

Cancer is a major health problem worldwide and the second leading cause of death in the United States.[1] According to the World Health Organization (WHO), there were about 10 million deaths from cancer in 2020.[2] According to the National Cancer Institute, in January 2022, about 18.1 million cancer survivors were estimated in the United States, and by 2032, the number of cancer survivors would increase to 22.5 million.[3] In the United States, the increasing cancer survival rates can be largely attributed to advances in screening, early diagnoses, and treatment of cancers, as well as a growing and aging US population.[4] Many cancer survivors tend to seek health information in

addition to the information provided by their physicians.[5] A study reported that cancer survivors seek more information about good diet, exercise, and weight management while undergoing treatment.[6] Nearly 50% of Americans and over 60% of cancer survivors seek cancer-related information from at least one source, including mobile wellness and health apps.[5,7-9]

According to WHO, mobile health (mHealth) includes using smartphones, sensors, personal digital assistants, wireless monitoring devices, or other wireless devices for public health and medical practices.[10] The Center for Democracy and Technology categorizes health apps into four types: health reference, fitness tracker, diagnostic, and disease management.[11] Mobile health apps are software programs running on smartphones and tablets to promote health and primary disease prevention.[12-13] They are used to oversee, improve, and maintain the health of their users at individual and community levels.[14] Furthermore, these health apps are very useful in facilitating medication adherence, monitoring symptoms, clinical decision-making, and behavioral changes.[15-17] Among cancer patients, mobile digital health is an important consideration when seeking ways to optimize their mental health.[18]

A study has shown that mHealth apps can help in primary prevention, such as screening, as well as early diagnosis, management, survivorship, and end-of-life care among cancer patients.[19] Another study reported promising use of digital health solutions for promoting and managing the cancer care continuum within a patient-centeredness framework.[20] Furthermore, research has shown that mHealth apps can aid healthcare providers and patients in cancer diagnosis, managing psychological distress, facilitating follow-up care, devising treatment plans, delivering cancer-related information, promoting drug adherence, and addressing side effects.[21]

Socioeconomic variables such as education level and income, marital status, gender, and age, are important predictors of choice of health information source among cancer survivors in the US.[9] A study that assessed the disparities in access to mobile health devices and e-health literacy among breast cancer survivors found that older age, lack of access to mobile devices, and lower education level had a lesser association with e-health literacy.[22] This study also showed that younger women with higher education levels and from less deprived areas were more likely to access smartphones and tablets.[22] Another study also found that mHealth users were more likely to be younger, have higher education, reported excellent health, higher income, and intention to change diet and physical activity.[23] A recent review suggested the positive effect of mHealth apps on health outcomes among those suffering from chronic diseases.[24] Furthermore, research revealed that older adults exhibited diminished self-efficacy when utilizing mHealths apps often stemming from a deficiency in technical skills and resulting in a decreased inclination to engage with the technology.[25] An analysis of the

moderating effect of different age groups suggests that the perceived ease of use and vulnerability were associated to use mHealth Apps among middle-aged and elderly people.[26]

Despite the growth and promise of using mobile apps to deliver information and interventions to cancer patients and those with other chronic diseases, the factors influencing the use of mobile health apps have been well-studied primarily among cancer survivors. However, there is limited research on these factors among the broader US population seeking cancer information. Therefore, the purpose of this study is to identify the factors that impact the usage of health and wellness apps among those seeking cancer information here in the US. By employing a sequential modeling approach, this study aims to provide a deeper understanding of the factors associated with mobile app usage in this specific population, ultimately informing targeted interventions and strategies to effectively support cancer information seekers, both survivors and non-survivors.

METHODS

Data source, Study Population, and study design

This cross-sectional study analyzed data from the Health Information National Trends Survey (HINTS), a nationally representative survey of U.S. adults aged 18 and older. HINTS collects information on access to and usage of health-related information, health-related behaviors such as perceptions, knowledge of disease and cancer screening as well as telehealth among U.S. adults. Using consistent weighting algorithms, we merged data from HINTS 5 (Cycle 4, 2020) and HINTS 6 (2022), resulting in a study population of 10,117 participants. The analysis focused on 4,770 eligible participants seeking cancer information with complete outcome data. Detailed information about the methodology is available online.[27]

Study Variables

Outcome: The outcome variable was using health and wellness apps categorized as “Yes” or “No.” Two sequential survey questions were used depending on the outcome. Participants were asked if they owned tablets, computers, or smartphones. Those who owned any were further asked if they had

health and wellness apps on these devices, with response options of “Yes,” “No,” or “Don't know.” If they answered “Yes,” they were then asked if they had used these apps in the past 12 months.

Independent Variables: Based on previous literature, the sociodemographic characteristics, medical history, disease condition, lifestyle, and behavioral characteristics included in the study were age, birth gender, insurance, educational level, race/ethnicity, presence or absence of cancer, household income, general health status, use of the internet, family history of cancer, depression, diabetes, hypertension, heart condition, chronic lung disease, number of disease condition, and body mass index. Physical activity was assessed by the number of days per week and duration of moderate-intensity exercise, classified based on the World Health Organization’s recommendation of 150 minutes per week).[9,22-26]

Statistical Analysis

We used weighted frequencies and percentages to present participants’ sociodemographic characteristics, medical history, disease conditions, lifestyle, and behavioral traits by mobile health app usage status. We used Pearson’s Chi-square test to assess the statistical significance of the relationship between mobile health and wellness app usage and independent variables. We conducted bivariate and multivariable logistic regression analyses to evaluate the association between the outcome and covariates.

We fitted four (4) sequential modeling approaches in the multivariable analysis. Model 0 included the crude effects of each covariate on health and wellness app usage. Model 1 incorporated the effects of sociodemographic characteristics on health and wellness app usage. Model 2 adjusted for all covariates from Model 1 and medical history and disease conditions, such as cancer, general health status, family history of cancer, depression, diabetes, hypertension, heart conditions, chronic lung disease, and the number of chronic diseases. The final (model 3) included model 2 and lifestyle and behavioral characteristics, such as BMI and physical activities.

This sequential modeling strategy aimed at determining the degree to which mobile health app use was explained by each group of variables among Seekers of cancer information. We further explored the relative importance of medical history and disease conditions on sociodemographic factors and how medical disease conditions are related to the use of mobile apps (Model 2). We also looked at the specific importance behavior and lifestyle have in the final model (Model 3). For this study, we chose to adjust for physical activity and BMI because these variables are potential factors for the usage of wearable devices.[28 -29]

All statistical analyses were performed using SAS software, version 9.4, with significance set at a p-value < 0.05 and a 95% confidence interval.

RESULTS

A total of 4770 participants were seeking cancer information. Only 3498 participants had complete information on the use of mobile apps. Of these, 80.9 % were health and wellness app users, while 19.1% were non-users. More than half (58.4%) of the participants were females, and 78.0% were between the age group 18- 64. A larger percentage of participants were college graduates (41.5%), identified as non-Hispanic white (69.3%), had a household income exceeding $50,000 (69.9%), rated their general health as excellent or good (49.1%), and were classified as obese (60.2%). The majority of participants had no history of cancer (84.7%), had insurance (92.1%), were internet users (93.3%), had heart conditions (92.4%) and lung diseases (86.7%) (Table 1).

From the bivariate analysis, age, level of education, household income, use of the internet, history of cancer, reported health status, physical activity, hypertension, and diabetes status showed a significant association with the use of health and wellness apps ($p<0.05$). More than two-thirds (85.1%) of participants within the age group 18-64 years utilized health and wellness apps compared to (14.9%) of participants within the age group 65+. A significant proportion of college graduates (48.2%) and individuals with household incomes of $50,000 or more (77.2%) were found to utilize health and wellness apps. Among participants who use health and wellness apps, 87.3% had no history of cancer, 97.9% were internet users, 52.2% reported their general health status as excellent or very good, and 67.6% were hypertensive.

From the multivariable results in Table 2 and the final model (model 3), factors associated with the utilization of health and wellness apps included age, household income, use of the internet,

higher educational level, and physical activity. We observed that as participant's age increases, the odds of utilizing health and wellness apps decrease. Participants within the age group 18-34 were 4 times more likely (aOR: 3.75, 95% CI: 1.94 - 7.25) to utilize a health and wellness app compared to participants within the age group 75+. Compared to participants with household income below $50,000, participants in the higher income category ≥$50,000 had 49% higher odds of using mobile digital health and wellness apps (aOR:1.49, 95% CI: 1.03 - 2.17). Furthermore, consistent internet use significantly influenced the use of health and wellness apps across all three models. Internet users had 231% higher odds (aOR: 3.31, 95% CI: 1.70 - 6.46) of using mobile digital health and wellness apps compared to non-internet users. As the level of education increases, the odds of using health and wellness apps also increases. Participants with College graduate degrees and higher had 1.84 times the odds (95% CI: 1.29 - 2.62) of using health or wellness apps compared to individuals with a high school diploma or less. Physical activity was the only lifestyle and behavioral factor found to be associated with the use of health and wellness apps. Compared to participants who engaged in less than 150 minutes of physical activity per week, those who exercised 150 minutes or more per week had 1.87 times higher adjusted odds (95% CI: 1.33 - 2.62) of using health and wellness apps. (Table 2)

DISCUSSION

This study aimed to investigate the utilization of digital health and wellness apps among seekers of cancer information and identify factors predicting their use. Our results indicate a high prevalence of app usage among individuals seeking cancer information (81%), highlighting the potential of public health interventions to promote cancer prevention measures (for example, screening) and treatment through these platforms. Age and education emerged as the most significant predictors, with younger and more educated individuals showing a greater inclination toward the usage of these apps.

This finding aligns with similar studies,[23,30] including one carried out among the Dutch population, which showed that younger age groups and individuals with higher education are more likely to use mobile health apps.[31] The reason may be that older patients generally describe themselves as not highly skilled in the utilization of mobile phones and other mobile devices.[32] In addition, older adults may face barriers such as a lack of trust in the apps, concerns about data privacy, and fear of misdiagnosis.[33] Moreover, other factors, such as age-related reduction in health functions like memory, vision, and touch sensitivity, may hinder the effective use of mobile health apps.[34] Consistent with the Pew survey, which found that women were more likely to use health apps, gender differences were also observed in this study, with females being more likely to utilize health and wellness apps.[35]

In a previous study, higher incomes were correlated with digital technology ownership and usage.[36] Our study found a similar association in which participants with household incomes greater than or equal to $50,000 were more likely to use digital and wellness apps compared to participants with household incomes less than $50,000. This suggests that income may strongly influence the use of digital and wellness apps even when other factors are considered. The finding that seekers of cancer information who met weekly recommendations for physical activity were more likely to use mHealth apps compared to those who engaged in less physical activity is consistent with previous studies.[23,37] This implies using health apps may enhance the achievement of physical activity health goals which has the potential to prevent chronic diseases.[38]

Engaging in health information-seeking behavior, such as downloading mHealth apps, is acknowledged as a crucial activity during the "preparation stage" that may lead to changes in health behavior.[39] Use of the internet was found to be consistently associated with the usage of

health and wellness apps among seekers of cancer information in our study. A similar study found that most internet users indicated a greater likelihood of using at least one eHealth tool to address a health issue over 12 months with a preference for YouTube videos, a peer-to-peer support website, or a smartphone app.[40] This implies that utilizing the internet has the potential to empower individuals, enabling them to play a more active role in their healthcare and fostering changes in health behavior by providing easy access to mHealth apps. Overall, our findings underscore the potential of mobile digital wellness and health apps in supporting cancer awareness and management.

CLINICAL PRACTICE POINTS AND IMPLICATION

Technological interventions in cancer, specifically those utilizing mobile digital wellness and health apps hold great promise to enhance patient outcomes and improve quality of life. Understanding factors that influence utilization is vital for creating impactful interventions. Apps should be developed to meet some specific health requirements like phases of cancer treatment, as personalized intervention content is more likely to engage users and encourage behavioral changes, including social support features that allow users to communicate with caregivers, healthcare professionals, or individuals with similar health challenges will also go a long way toward heightening app usage and serve as a useful tool for interventions. Social support networks within the app can help users feel more connected and encouraged to share their experiences. Language and cultural differences should be considered to guarantee applicability and accessibility to a wide range of people. Enhanced engagement and effectiveness can also be achieved by providing content in multiple languages and taking cultural norms into account.

Strengths

The major strength of our study was the comprehensive dataset we used. The samples used are fully representative of the non-institutionalized U.S. population, which enhances the generalizability of our results. This dataset was created by combining information from multiple survey cycles which boosted the sample size, thereby increasing the power and precision of our study. Additionally, the utilization of pre-existing data minimized selection bias and allowed for proper comparisons with the existing literature. Finally, the consistency of our results with prior research further validates the reliability of our findings.

Limitations

Despite the strengths of our study, it has limitations that warrant due consideration, the dataset used for our study was harmonized data from different HINTS cycles which were obtained from self-administered questionnaires. This method of data collection may introduce information bias, emphasizing the importance of more rigorous study designs in establishing causal relationships. Prospective studies and clinical trials are recommended to further explore the factors influencing digital health and wellness app usage among the general population, seekers of cancer information, and their impact on health outcomes among diverse populations.

CONCLUSION

This study evaluated various factors that could impact the use of mobile health and wellness apps among cancer information seekers. Among the factors assessed; age, education, household income, use of the internet, history of cancer, and optimal health status were significantly linked to app usage. Results from this study suggest that individuals who have cancer could benefit remarkably from health apps, however, they were least likely to use the apps when compared to other factors. These apps may have the potential to address healthcare challenges, reduce disparities, and empower patients to manage their health more efficiently. Interventions can be tailored to enhance app utilization and improve health outcomes. Since we used retrospectively collected data in this cross-sectional study, further research is required to explore the causal relationships between these factors and wellness app usage, as well as to develop targeted strategies for promoting digital health engagement in diverse populations.

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Competing Interests: The authors have no relevant financial or non-financial interests to disclose

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Ethics Approval: The study subjects were de-identified and there was no patient contact; thus, the study is exempt from an Institutional Review Board's review.

Data Availability: The data access requests are publicly available at https://hints.cancer.gov/

Code Availability: The code generated and used during this study is available upon request

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Table 1: Distribution of Participants Characteristic by the Use of Wellness and Health Apps

Seekers of Cancer Information (N = 4770)				
Characteristic	Seekers of Cancer Information n(Wt%)	Used Health Awareness App (N=3498)		
		YES (n = 2705(80.9%)) n(Wt%)	NO (n = 793(19.1%)) n(Wt%)	P-valu
Sociodemographic and Economic Characteristics				
Age				<.000
18 - 34	**643(21.8)**	491(27.0)	73 (13.5)	
35-49	931(27.1)	658(28.7)	111(22.9)	
50 -64	1429(29.1)	810(29.4)	251(34.9)	
65 -75	1110(13.9)	512(10.6)	237(19.4)	
75+	575(7.2)	207(4.3)	107(9.4)	
Gender at Birth				0.175
Female	2894(58.4)	1693(59.9)	462(55.8)	
Male	1683(41.6)	893(40.1)	299(44.2)	
Insurance				0.824
Yes	4453(92.1)	2548(92.9)	724(92.6)	
No	239(7.9)	118(7.04)	54(7.4)	
Education				<.000
High school or less	1015(27.3)	410(21.8)	219(33.3)	
Some college	950(31.2)	510(30.0)	178(34.2)	
College graduates and more	2606(41.5)	1666(48.2)	367(32.6)	
Race/Ethnicity				0.425
Non-Hispanic White	2936(69.3)	1700(69.6)	467(73.3)	

Non-Hispanic Black	517(8.9)	296(8.3)	86(8.3)	
Hispanic	597(12.9)	324(12.6)	110(11.4)	
Non-Hispanic Asian/Non-Hispanic Other	332(8.9)	201(9.6)	59(7.1)	
Household Income				0.001
< $50,000	1456(30.1)	628(22.8)	273(33.6)	
≥$50,000	2854(69.9)	1853(77.2)	437(66.5)	
Use of Internet				<.000
Yes	4376(93.3)	2632(97.9)	713(91.1)	
No	392(6.7)	73(2.1)	80(8.9)	
Medical History and Disease Condition				
Ever Had Cancer				<0.00
Yes	1070(15.3)	500(12.7)	208(20.8)	
No	3538(84.7)	2098(87.3)	559(79.2)	
General Health Status				0.025
Fair/Poor	713(14.3)	307(10.8)	141(16.3)	
Good	1702(36.6)	960(37.1)	295(35.3)	
Excellent and very good	2256(49.1)	1378(52.2)	340(48.4)	
Family History of Cancer				0.528
Yes	3648(83.2)	2093(82.7)	593(84.4)	
No	647(16.8)	366(17.3)	105(15.6)	
Depression /Anxiety				0.395
No	3337(29.3)	1833(69.2)	587(72.1)	
Yes	1322(70.7)	809(30.8)	186(27.9)	
Diabetes				0.049
Yes	908(16.1)	458(13.8)	160(18.3)	
No	3744(83.9)	2181(86.2)	612(81.7)	
Hypertension				0.004
Yes	2034(35.1)	1047(32.4)	375(41.2)	
No	2621(64.9)	1594(67.6)	399(58.8)	

Heart Condition				0.765
Yes	460(7.6)	220(6.8)	73(6.4)	
No	4198(92.4)	2422(93.2)	701(93.6)	
Chronic Lung Disease				0.531
Yes	694(13.3)	394(13.7)	115(12.5)	
No	3961(86.7)	2247(86.3)	658(87.5)	
Number of Disease Conditions				0.104
None	2031(51.7)	1227(53.8)	326(48.5)	
One	1499(30.2)	866(30.1)	236(30.6)	
Two or More	1096(18.1)	534(16.1)	208(20.9)	
Lifestyle and Behaviors				
Body Mass Index				0.54
Underweight	186(3.9)	90(3.8)	30(3.4)	
Normal Weight	523(11.9)	300(11.9)	84(9.3)	
Overweight	1157(23.9)	661(24.8)	194(24.3)	
Obese	2868(60.2)	1637(59.6)	477(63.1)	
Physical Activity				0.000
< 150 Minutes per Week	2948(61.4)	1566(57.7)	526(70.3)	
≥150 Minutes per Week	1822(38.6)	1139(42.3)	267(29.7)	

n = unweighted number of participants; w% = weighted percentages
significant, *p < 0.05, ** < 0.01, *** < 0.001

Table 2: Bivariable and multivariable logistic regression analyses of the association between participant characteristics and the Use of Wellness and Health Apps

Characteristics	Seekers of Cancer Information			
	Used Health and Wellness App			
	Model 0	Model 1	Model 2	Model 3
	Crude OR (95%CI)	Adjusted OR (aOR) (95%CI)	Adjusted OR (aOR) (95%CI)	Adjusted OR (aOR) (95%CI)
	(Yes Vs No)	(Yes Vs No)	(Yes Vs No)	(Yes Vs No)
Age				
18 - 34	**4.43 (2.75 - 7.14) *****	**3.48(1.967 - 6.156) *****	**3.68(1.90 - 7.10) *****	**3.75(1.94 - 7.25) *****
35-49	**2.77 (1.72 - 4.46) *****	**2.27(1.31 - 3.942) *****	**2.40 (1.29 - 4.45) *****	**2.33 (1.26 - 4.33) *****
50 -64	**1.86 (1.21 - 2.87) *****	1.49(0.91 - 2.44)	1.68 (0.97 - 2.91)	1.71 (0.99 - 2.97)
65 -75	1.21 (0.79 - 1.86)	1.12(0.65 - 1.92)	1.18 (0.62 - 2.12)	1.12 (0.63 - 1.99)
75+	1.0	1.0	1.0	1.0
Gender at Birth				
Female	1.0	1.0	1.0	1.0
Male	0.85 (0.66 - 1.08)	0.082(0.63 - 1.07)	0.81 (0.62 - 1.07)	0.78 (0.60 - 1.03)
Insurance				
No	1.0	1.0	1.0	1.0
Yes	1.06 (0.64 - 1.74)	1.340 (0.720 - 2.492)	1.24 (0.62 - 2.47)	1.23 (0.61 - 2.51)
Education				

High school or less	1.0	1.0	1.0	1.0
Some college	1.34 (0.91 - 1.99)	1.95 (0.78 - 1.84)	1.23 (0.79 - 1.90)	1.23 (0.79 - 1.92)
College graduates and more	**2.26 (1.66 - 3.06) *** **	**1.84 (1.28 -2.64) *** **	**1.95 (1.35 - 2.82) *** **	**1.84 (1.29 - 2.62) *** **
Household Income				
< $50,000	1.0	1.0	1.0	1.0
≥$50,000	**1.71 (1.23 - 2.38) *** **	**1.47 (1.04 - 2.09) *** **	**1.49 (1.02 - 2.16) *** **	**1.49 (1.03 - 2.17) *** **
Use of Internet				
No	1.0	1.0	1.0	
Yes	**4.53(2.63 - 7.79) *** **	**3.73 (1.97 - 7.08) *** **	**3.48 (1.75 - 6.93) *** **	**3.31 (1.70 - 6.46) *** **
Race/Ethnicity				
Non-Hispanic White	1.0	1.0	1.0	1.0
Non-Hispanic Black	1.05 (0.66 - 1.65)	1.30(0.78 - 2.15)	1.20 (0.69 - 2.07)	1.19 (0.68 - 2.09)
Hispanic	1.16 (0.81 - 1.68)	1.32(0.86 - 2.02)	1.41 (0.88 - 2.25)	1.41 (0.86 - 2.28)
Non-Hispanic Asian/Non-Hispanic Other	1.43 (0.90 - 2.27)	1.16 (0.73 - 1.86)	1.16 (0.70 - 1.93)	1.12 (0.67 - 1.87)
General Health Status				
Fair/Poor	1.0		1.0	1.0
Good	**1.59 (1.10 - 2.30) *** **		1.28 (0.82 - 1.99)	1.27 (0.81 - 2.00)
Excellent and very good	**1.63 (1.15 - 2.32) *** **		1.24 (0.76 - 2.00)	1.14 (0.69 - 1.89)
Ever Had Cancer				
No	1.0		1.0	1.0

Yes	**0.55 (0.41 - 0.75) *** **		0.81 (0.57 - 1.15)	0.84 (0.59 - 1.19)
Family History of Cancer				
No	1.0		1.0	1.0
Yes	0.88 (0.60 - 1.30)		0.90 (0.58 - 1.39)	0.87 (0.57 - 1.33)
Depression /Anxiety				
No	1.0		1.0	1.0
Yes	1.15(0.83 - 1.59)		0.92 (0.61 - 1.39)	0.96 (0.63 - 1.45)
Diabetes				
No	1.0		1.0	1.0
Yes	0.71(0.51 - 1.01)		0.91 (0.40 - 2.12)	0.93 (0.40 - 2.16)
Hypertension				
No	1.0		1.0	1.0
Yes	**0.68 (0.53 - 0.89) *** **		0.77 (0.36 - 1.66)	0.83 (0.39 - 1.79)
Heart Condition				
No	1.0		1.0	1.0
Yes	1.07(0.69 - 1.67)		1.67 (0.94 - 2.95)	1.74 (0.97 - 3.10)
Chronic Lung Disease				
No	**1.0**		1.0	1.0
Yes	1.12 (0.79 - 1.57)		1.08 (0.55 - 2.11)	1.15 (0.58 - 2.26)
Number of Disease Conditions				

None	1.0		1.0	1.0
One	0.89 (0.65 - 1.22)		1.55(0.74 - 3.26)	1.47 (0.69 - 3.12)
Two or More	**0.69 (0.52 - 0.94) *** **		1.46 (0.39 - 5.54)	1.33 (0.35 - 5.01)
Body Mass Index				
Underweight	1.0			1.0
Normal weight	1.124(0.61 - 2.09)			0.77 (0.21 - 2.85)
Overweight	0.89(0.46 - 1.75)			0.77 (0.18 - 3.24)
Obese	0.83(0.43 - 1.59)			0.77 (0.18 - 3.22)
Physical Activity				
< 150 Minutes per Week	1.0			1.0
≥150 Minutes per Week	**1.73(1.29 - 2.33) *** **			**1.87 (1.33 - 2.62) *** **

Model 0: Univariate Analysis
Model 1: Sociodemographic factors
Model 2: Sociodemographic Factors + Medical History and Disease Condition
Model 3: Sociodemographic factors + Medical History and Disease Condition + Lifestyle and Behavioral Factors
p-value: *p < 0.05, ** < 0.01, *** < 0.001
aOR: Adjusted Odds Ratio