Published in final edited form as:

Qual Life Res. 2015 September ; 24(9): 2113–2128. doi:10.1007/s11136-015-0968-9.

The relationship between four health-related quality of life indicators and use of mammography and Pap test screening in US women

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Abstract

Purpose—Limited evidence is available to explain the role of four components of health-related quality of life (HRQoL) on breast and cervical cancer screening. The objective of this study was to determine the relationship between four HRQoL aspects and use of mammography and Pap test screening in US women.

Methods—Data were obtained from the 2012 Behavioral Risk Factor Surveillance System (BRFSS). The outcome variables were receiving mammogram <2 versus ≥2 years in women aged 50–74 years, and receiving Pap test <3 versus ≥3 years in women aged 18–64 years. Eight logistic regression models were conducted to test the role of four HRQoL aspects (general health status, physical HRQoL, mental HRQoL, and activity limitation) on the two screening variables, after adjusting for covariates. Statistical analysis accounted for the complex sampling design of the BRFSS and the a priori alpha error was set at $p = 0.05$.

Results—Among respondents, approximately 74% and 78% of the women received mammography and Pap test, respectively. Three HRQoL aspects (general health status, physical HRQoL, and activity limitation) were significantly associated with mammography use (all p -values < 0.05), whereas two HRQoL aspects (general health status and physical HRQoL) were significantly associated with Pap test (p -values = 0.05). All significant relationships demonstrated higher cancer screening rates among individuals with better HRQoL.

Conclusions—HRQoL is an important factor associated with use of mammography and Pap test. Future studies should explore the mechanisms associated with an individual's HRQoL and use HRQoL assessment as an avenue to influence adherence to use of mammography and Pap tests.

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Financial support: None to disclose.

Conflict of Interest:

The authors declare no conflict of interest. We have no direct or indirect financial relationships with the sponsors.

Keywords

BRFSS; HRQoL; Mammography; Pap test; USPSTF

Introduction

Breast and cervical cancer are two most commonly diagnosed cancers for women in the United States [1,2]. According to the American Cancer Society, the estimates of diagnosed invasive breast and cervical cancers in the US in 2014 were 232,670 and 12,360, respectively [2]. The estimates of breast and cervical cancer deaths in the US in 2014 were 40,000 and 4,020, respectively [2]. In addition to morbidity and mortality, the economic burden associated with breast and cervical cancers is significant. Medical and loss of productivity costs associated with breast cancer were estimated to be \$16.5 billion and \$12.1 billion, respectively; costs of productivity loss associated with cervical cancer were estimated between \$300 and \$400 million [3,4].

Regular mammography and Pap tests are effective screening methods of early diagnosis for breast cancer and cervical cancer, respectively [2,5-7]. These screening approaches have shown to be more cost-effective than no screening [8,9]. The US Preventive Services Task Force (USPSTF) recommends that women between 50 and 74 years of age should receive mammography screenings every two years, while those between 21 and 65 years of age should receive a Pap smear every 3 years [10]. The 2010 National Health Interview Survey reported that 72.4% and 83% of the women received mammography within the previous 2 years and Pap test within the previous 3 years, respectively. However, these rates were significantly lower than the Healthy People 2020's target of 81.1% and 93% for mammography use and Pap test screening, respectively [10,11]. It is important to identify the factors that influence adherence to breast and cervical cancer screening.

Previous studies have identified several factors of adherence to breast and cervical cancer screening, including age, race, socioeconomic status, marital status, access to health care, health insurance or primary care physician, and engagement in healthy lifestyle [1,5,7,10,12-30]. Several studies have also investigated the association between health status such as chronic conditions, activity limitations, or perceived general health status, and breast and cervical cancer screening [1,6,7,12,13,15,16,24,25,31-33]. Few studies have found that women with poor perceived general health status were less likely to be adherent [5,12,24,25,33] and others have found no association [6,7,15,18,32]; whereas, some report that women with good or excellent health status were less likely to receive a mammogram or Pap test [16]. A plausible explanation for the lack of consistent findings is the inclusion of different study samples/populations, various study designs, and heterogeneous covariates (such as health status indicators) for statistical analyses. Although these studies demonstrate the relationship of only one concept of HRQoL, i.e., general health status, on breast and cervical cancer screening, to the best of our knowledge, no study has investigated the effects of all four aspects of health-related quality of life (HRQoL) (general health status, physical HRQoL, mental HRQoL, and activity limitation caused by poor mental or physical HRQoL) on breast and cervical cancer screening.

HRQoL is defined as a multidimensional concept that measures self-perceptions of physical and mental health and functioning [34]. HRQoL is a stronger predictor of future disability, morbidity, and mortality compared to several objective measures of health [34]. The Centers for Disease Control and Prevention (CDC) has developed a core set of indicators (HRQoL-4) to measure four aspects of HRQoL. Since 1993, HRQoL-4 has been included in the state-based Behavioral Risk Factor Surveillance System (BRFSS) survey.

HRQoL data are useful to identify health disparities, evaluate burden associated with disease and disability, and track unmet health needs and health services [35,36]. However, previous studies have used only perceived general health status as a proxy indicator of HRQoL to predict use of mammography and Pap test screening [5-7,12,15,16,18,24,25,32,33].

The objective of this cross-sectional study was to investigate the influence of four aspects of HRQoL (general health status, physical HRQoL, mental HRQoL, and activity limitation caused by poor mental or physical HRQoL) on the use of mammography in women 50-74 years of age and Pap test screening in women 18-64 years of age using BRFSS, a nationally representative dataset. We hypothesized a priori that women reporting better HRQoL would be more likely to participate in mammography and Pap test screening for breast and cervical cancer, respectively. This is an important issue to address because we believe screening will result in more beneficial than harmful health outcomes and we are searching the factors that can contribute to the compliance with breast and cervical cancer screening.

Methods

Study dataset: BRFSS survey

This cross-sectional study analyzed data from the 2012 BRFSS survey, which is a collaborative project between the CDC and individual states and territories of the US. The purpose of the BRFSS is to collect data on health risk behaviors, preventive health practices, and healthcare access related to chronic diseases and injuries among a probability sample of noninstitutionalized, adult (≥ 18 years) population and older living in households. BRFSS is the world's largest telephone survey, with more than 400,000 interviews in 2012. Since 2011, BRFSS collects aggregate information using both landline telephone and cell-phone-based surveys. To allow for generalization of the findings to the national population, BRFSS utilizes iterative proportional fitting weighting methodology to weight the data [37]. Since BRFSS data set is publically available and includes no personally identifying information, this study was exempt from review by the South College Institutional Review Board.

Variables

Outcome Variable: Use of Mammography and Pap test—The outcome variables utilized in this study were self-reported use of mammography for breast cancer and Pap test for cervical cancer. The time interval for mammography and Pap test were consistent with the recommended guidelines outlined by the USPSTF [38]. Women were considered as adherent to mammography screening if they were 50-74 years of age and reported use of a mammogram in the previous 2 years. Women were considered as adherent to Pap test if they were 21-65 years of age and reported use of Pap test within the previous 3 years. Consistent

with previous studies, since respondents were not asked for the first time when they had intercourse, women aged 18-20 were also included in the analyses for Pap test [7,14,24]. To investigate the factors associated with breast and cervical cancer screening, respectively, two separate dichotomous variables were created to indicate the use of mammography and Pap test screening. For the outcome of receiving a mammogram, participants were classified by receiving mammography screening <2 years versus receiving it ≥2 years (excluding never). For the outcome of receiving Pap test, participants were classified by receiving Pap test <3 years versus receiving it ≥3 years (excluding never). In other words, we were investigating factors related to 'on-time screening' compared to 'delayed screening.' We excluded those who never received mammography or Pap test screening since the mechanisms and factors influencing those never receiving screening differ than those having received screening [39,40]. Women diagnosed with any form of cancer were excluded from the analyses and only women who reported not having a hysterectomy were included in the Pap test analyses [7]. Figure 1 and Figure 2 present the inclusion and exclusion criteria for self-reported mammography and Pap test use, respectively.

Independent Variables

Primary independent variable: HRQoL—The four HRQoL variables related to general health status, physical HRQoL (physically unhealthy days), mental HRQoL (mentally unhealthy days), and activity limitation due to poor physical or mental HRQoL were included in this study. The four variables have demonstrated satisfied reliability and validity for measuring HRQoL in healthy and disabled populations [35,41,42]. The specific questions asking four aspects of HRQoL were: "Would you say that in general your health is excellent, very good, good, fair, or poor?" (general health status); "Now thinking about your physical health, which includes physical illness and injury, for how many days during the past 30 days was your physical health not good?" (physical HRQoL/physically unhealthy days); "Now thinking about your mental health, which includes stress, depression, and problems with emotions, for how many days during the past 30 days was your mental health not good?" (mental HRQoL/mentally unhealthy days); "During the past 30 days, for about how many days did poor physical or mental health keep you from doing your usual activities, such as self-care, work, or recreation?" (activity limitation due to poor physical or mental HRQoL). Consistent with previous studies, the four HRQoL variables were categorized as dichotomous variables for the purpose of statistical analyses [41,43,44]. General health status was dichotomized into adults with good or better health (consisting of responses of excellent, very good, and good health) and fair or poor health (consisting of responses of fair or poor health). Physical HRQoL, mental HRQoL, and activity limitation due to poor physical or mental HRQoL were dichotomized as <14 days compared to ≥14 days [41,44].

Other Covariates—Several demographic, socioeconomic, lifestyle, and health care access variables that may confound the association of HRQoL with mammography and Pap test were taken into account in this study. For age, participants included in the mammography analysis were categorized by 50-54, 55-59, 60-64, 65-69, and 70-74 years old; participants included in Pap test analysis were categorized by 18-24, 25-34, 35-44, 45-54, and 55-64 years old. Race was reported as non-Hispanic whites, non-Hispanic blacks, Hispanic, and

non-Hispanic other race or multiracial. Education level was coded as below high school, high school graduate, some college or technical school, and college/technical school graduate or above. Annual household income levels were classified as <\$15,000, \$15,000-\$24,999, \$25,000-\$34,999, \$35,000-\$49,999, and \$50,000. Employment status was recoded as employed or self-employed, out of work >1 year or out of work <1 year, homemaker or student, retired, and unable to work. Marital status was classified as married, divorced or separated, never married or a member of an unmarried couple, and widowed. Smoking status was classified as currently smoking everyday, currently smoking some days, former smoker, and never smoked. BMI was categorized as neither overweight nor obese (BMI <25), overweight (25 ≤ BMI <30), and obese (BMI ≥ 30). The total number of alcoholic beverages consumed was categorized based on binge drinkers (females having four or more drinks on one occasion) (yes/no). Seat belt use was classified as always and don't always wear seat belt. Routine checkup with the doctor was recoded into <1 year, 1 year, and never. Health care access with a personal doctor or health care provider was dichotomized as having no personal health care provider and having 1 health care provider. Other three variables, health insurance status (i.e., those who have any kind of healthcare coverage), adult seasonal flu shot/spray during the past 1 year, and physical activity or exercise during the past 30 days other than regular job, were categorized as yes/no. For each variable, adults who responded 'don't know/not sure' or 'refused' were treated as missing response categories.

Statistical analysis—Descriptive statistics (unweighted frequencies and weighted percentages) and Pearson chi-square statistics for associations among demographic, socioeconomic, health-related and HRQoL variables with use of mammography and Pap test were presented (Table 1 and Table 2, respectively). Consistent with previous approach, the four HRQoL variables (general health status (Model 1), physical HRQoL (Model 2), mental HRQoL (Model 3), and activity limitation due to poor mental or physical HRQoL (Model 4)) were fitted separately in logistic regression models [41]. Given the focus of four HRQoL variables and two dependent variables (use of mammography and Pap test), a total of eight multivariate logistic regression analyses were performed, adjusting for other covariates in each model. Adjusted odds ratios (ORs) and 95% confidence intervals (CIs) based on logistic regression analyses were reported. Statistical analysis was conducted using SAS version 9.3 (SAS Institute, Cary, NC) [45] which specifically accounted for the complex sampling design of the BRFSS survey, and the a priori alpha error was set at $p = 0.05$.

Results

The 2012 BRFSS data consisted of 475,687 US adults. Of these, 140,704 women aged 50-74 years old and 148,954 women aged 18-64 years old were included in the mammography and Pap test analyses, respectively (Figure 1 and Figure 2). Table 1 and Table 2 demonstrates the descriptive statistics and bivariate associations between demographic and health-related characteristics and receipt of mammography and Pap test screening in women aged 50-74 years old and 18-64 years old, respectively. An estimated 73.94% of the study sample reported receiving mammogram within the previous 2 years, whereas 77.71% of the study sample reported receiving Pap test within the previous 3 years.

Predictors of mammography use within the previous 2 years

Table 3 presents the adjusted ORs and 95% CIs based on four logistic regression analyses (Model 1 – Model 4) examining the association of HRQoL variables and mammography use within the previous 2 years, controlling for other covariates. Women with good or better general health status (OR=1.26 (95% CI=1.14 – 1.38)) were more likely to receive mammography than those with fair or poor health (Model 1). Women who had <14 physically unhealthy days (OR=1.18 (95% CI=1.07 – 1.30)) (Model 2) and <14 days of activity limitation (OR=1.19 (95% CI=1.06 – 1.33)) (Model 4) were more likely to receive mammography than those who had 14 physically unhealthy days and 14 days of activity limitation, respectively. However, the relationship between mentally unhealthy days and use of mammography was not statistically significant ($p > 0.05$) (Model 3).

Women 65-69 and 70-74 years old had lower odds of receiving mammography than women 50-54 years old and non-Hispanic black and Hispanic women had a greater likelihood to receive mammography than non-Hispanic white women; these findings were consistently observed across the four models. All four models showed that women with an annual household income level between \$25,000 and \$34,999, \$35,000 and \$49,999, and \$50,000 were more likely to receive mammography compared to those with an income level < \$15,000. Consistent across the four models, women with a routine checkup within the previous 1 year were 3.6 times more likely to receive mammography compared to those who never had a routine checkup. The odds of receiving mammography for women with access to a personal doctor or health care provider were approximately 2.3 times the odds of those without access to a personal doctor or healthcare provider. Last, women with health insurance were 2.1 times more likely than those without any health insurance to receive mammography. Other covariates influencing the likelihood of receiving mammography within the previous 2 years are presented in Table 3.

Predictors of Pap test use within the previous 3 years

Table 4 presents the adjusted ORs and 95% CIs based on four logistic regression analyses (Model 1 – 4) examining the association of HRQoL variables and Pap test within the previous 3 years. Women with good or better general health status (OR=1.14 (95% CI=1.01 – 1.28)) were more likely to receive Pap test than women with fair or poor health (Model 1). Women who had <14 physically unhealthy days (OR=1.15 (95% CI=1.00 – 1.33)) (Model 2) were more likely to receive Pap test than women who had 14 physically unhealthy days. However, the relationship between mentally unhealthy days and activity limitation and use of Pap test was not statistically significant ($p > 0.05$) (Model 3 and Model 4).

The adjusted odds of those receiving Pap test among all age groups were significantly higher compared to women 18-24 years old in all four models. Similarly, consistent across the four models, non-Hispanic and Hispanic women were more likely than non-Hispanic whites to receive Pap test. Women with an annual household income level between \$15,000 and \$24,999 had greater odds of receiving Pap test compared to those with an income level < \$15,000. In addition, women who graduated from college or technical school were approximately 1.2 times more likely to receive Pap test relative to those did not graduate high school. Consistent across the four models and similar to the logistic regression findings

for women receiving mammography within the previous 2 years, those with health insurance, routine checkup within the previous 1 year, access to a personal doctor or healthcare provider, flu shot and seat belt use, and reporting doing physical activity or exercise were more likely to receive Pap test than their counterparts. The associations among other covariates and the likelihood of receiving Pap test within the previous 3 years are presented in Table 4.

Discussion

Evidence suggests that adherence to mammography and Pap test screening is associated with early detection and mortality reduction for breast and cervical cancers, respectively [2,5-7]. The primary purpose of this study was to identify the factors contributing to the use of mammography and Pap test based on cross-sectional data set from 2012 BRFSS. We found approximately 1 out of 4 American women did not receive screening for either breast or cervical cancer. With the exception of the relationship between mental HRQoL and mammography and between mental HRQoL and activity limitation and Pap test screening, women with better HRQoL were significantly more likely to receive mammography or Pap test screening; the other three relationships were found to be not statistically significant. Importantly, two aspects of HRQoL (general health status and physical HRQoL,) alongside socio demographic, lifestyle, and accessibility to health care factors were consistently associated with the use of mammography within the previous 2 years and Pap test within the previous 3 years. These findings were replicated in the unadjusted models (results available upon request) and the adjusted models that controlled for confounders.

Previous studies have often used a single HRQoL item (typically general health status) to investigate the association with breast and cervical cancer screening [5-7,12,15,16,18,24,25,32,33]. The present study fills in the gap by examining the influence of four aspects of HRQoL (general health status, physical HRQoL, mental HRQoL, and activity limitations due to poor physical and mental HRQoL) on the use of mammography and Pap test. We found that women reporting good or better general health status were more likely to receive mammogram and Pap tests. This finding is in line with several previous studies [5,12,24,25,33] but contradict with other studies that found negative or no association [6,7,15,16,18,32]. The need to include all four aspects of HRQoL when investigating the association with use of cancer screening has previously been noted [41,46]. The measure of four aspects of HRQOL provides unique information and demonstrates acceptable reliability and validity in persons with and without disability [47].

Our findings indicate that women reporting <14 physically unhealthy days were more likely to receive mammography and Pap test; whereas, <14 days with activity limitation was more likely to receive mammography. In this regard, the function of different aspects of HRQoL on the receipt of cancer screening may not be equal or through the same mechanisms [12]. Women who perceived better general health status and better physical HRQoL may be motivated for cancer screening and potentially have a greater sense to engage in preventive health behaviors. This finding is counterintuitive to the Health Belief Model which assumes the perceived risk of health (or perceived susceptibility to a certain illness/disease) will lead an individual to take positive/optimal health behaviors such as cancer screening. In contrast,

this study found individuals reporting their health as good or better were more likely to take responsibility for their health and have a greater likelihood to participate in health screening than those reporting their health as suboptimal [48,49].

Evidence suggests that socio-economic determinants significantly influence breast and cervical cancer screening [7,50]. In this study, we found that annual household income level was an inconsistent predictor for use of mammography and Pap test. For instance, women with annual household income levels between \$25,000 and \$34,999, \$35,000 and \$49,999, and \$50,000 were more likely to receive mammography compared to those with income level <\$15,000, whereas, women with income levels \$15,000-\$24,999 were more likely to receive Pap test relative to those with income level <\$15,000. Not surprisingly, women who graduated from college or technical school were more likely to receive mammography and Pap test than those who did not graduate high school. Higher annual household income levels may be associated with higher education and greater access to health care and communication with the healthcare providers, which in turn increase the likelihood of being aware of the benefits associated with cancer screening [50]. Future studies should compare the influence of HRQoL variables between groups receiving mammography and Pap test screening.

Although the mechanisms between HRQoL and women cancer screening are still unclear, it is possible that women with better HRQoL may possess the characteristics of optimistic personality and greater self-efficacy that will encourage the engagement in healthy behaviors [48,51,52]. Such health promoting and preventive health behaviors might lead to increased participation in screening activities for breast and cervical cancer [53]. It seems appropriate that interventions targeted at improving HRQoL will increase the likelihood of receiving cancer screening in women, especially since our findings demonstrated that women with better HRQoL were more likely to engage in screening behaviors. Indeed, our and previous studies have shown the positive associations of health behaviors such as non-smoking, regular check-ups, healthcare access, seat belt and flu shot use, participation in regular physical activity or exercise, and health status with the use of mammography and Pap test [5,12,24,25,33,48]. Adjusting for health behaviors as covariates in the analyses did not change the significance in the association of HRQoL with the use of mammography and Pap test. It is likely that these factors may directly or indirectly influence healthy behaviors and the use of cancer screening. Given the nature of a cross-sectional design of this study, future longitudinal research should explore the complex mechanisms of these factors on the use of mammography and Pap test.

The study findings have important public health and policy implications. Because physicians play an essential role in educating and referring patients for cancer screening, it is important to help physicians increase adherence to cancer screening guidelines by using HRQoL assessment as an avenue to identify and overcome barriers of mammography and Pap test [54]. HRQoL is an important indicator for evaluating effectiveness of different treatment regimens, but also a useful indicator to assess health surveillance and monitor health outcomes [34,35]. Per CDC HRQoL-4 recommendations, a 14-day cutoff point is considered meaningful health outcome indicator [41,44]; therefore, physicians are encouraged to use this indicator in medical practice and research. In addition to socio-

demographic variables [7,12-16,50], policymakers and healthcare professionals can target women with lower HRQoL for increasing the national breast and cervical cancer screening rates. Future studies should evaluate the effectiveness of programs and health awareness campaigns that draw attention to the benefits of mammography and Pap test screening among women reporting lower HRQoL.

Several limitations should be noted when interpreting the study findings. First, the cross-sectional study design makes it improper to infer a causal linkage between HRQoL and use of mammography and Pap test. It is plausible that women have a better HRQoL because they received screening and knew they were healthy compared to their counterparts. Second, we were unable to distinguish women that received mammogram or Pap tests for screening or diagnostic purpose. However, women diagnosed with any form of cancer were excluded from the analyses and women who had a hysterectomy were also excluded from the analysis for use of Pap test. Third, data for use of mammogram and Pap tests were self-reported. Although evidence suggests lower reliability and measurement error due to self-reports when compared to medical records, self-reported data from nationally representative datasets such as BRFSS have been used in conducting research related to preventive health practices and examining progress towards achieving public health objectives [13,14,24]. Fourth, we excluded those who responded never receiving screening from both the mammography and Pap test analyses. Future studies should conduct separate analyses to investigate whether factors influencing those never receiving screening would differ than those receiving screenings <2 years or those receiving it ≥ 2 years. Finally, self-reported survey data can be subject to the 'Guideline Boundary Effect' (GBE). With GBE, substantial numbers of screening tests are reported after the particular time boundary indicated by various screening frequency guidelines. For instance, it is plausible that women may have reported receiving mammography and Pap test screening after the time boundary of 2 and 3 years, respectively, that are recommended by the screening frequency guidelines [55].

In summary, findings from this study indicate that HRQoL is an important factor associated with the use of mammography and Pap test. Our findings demonstrated that women with better HRQoL (especially, general health status and physical HRQoL) were more likely to receive mammography or Pap test screening. We also found that women reporting lower activity limitation (i.e., better HRQoL) were more likely to receive mammography. Future research of longitudinal data is encouraged to investigate potential factors and mechanisms to explain the association between different aspects of HRQoL and use of mammogram and Pap test in women.

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Figure 1.

Inclusion and exclusion criteria for self-reported mammography use, 2012 Behavioral Risk Factor Surveillance System (n = 140,704)

Figure 2.
Inclusion and exclusion criteria for self-reported Pap test use, 2012 Behavioral Risk Factor Surveillance System (n = 148,954)

Table 1

Sociodemographic and health-related characteristics of women aged 50-74 years old for self-reported mammography use, 2012 Behavioral Risk Factor Surveillance System^a

Characteristic	Self-reported mammography use			
	Within the previous 2 years		After 2 years	
	N (%)	Wt %	N (%)	Wt %
Age				
50-54	19839 (19.07)	26.66	6451 (22.77)	31.19
55-59	21921 (21.07)	21.54	6401 (22.60)	23.33
60-64	23080 (22.18)	21.40	6182 (21.82)	21.14
65-69	21759 (20.91)	17.42	4979 (17.58)	13.31
70-74	17438 (16.76)	12.99	4314 (15.23)	11.03
Race				
Non-Hispanic White	82810 (80.31)	72.95	22813 (81.38)	73.89
Non-Hispanic Black	10263 (9.95)	11.44	2037 (7.27)	8.85
Other race or multiracial	4443 (4.31)	5.60	1621 (5.78)	6.19
Hispanic	5597 (5.43)	10.01	1561 (5.57)	11.07
Annual Household Income				
<\$15,000	10340 (11.61)	10.59	4920 (20.11)	19.33
\$15,000-\$24,999	14582 (16.37)	15.21	5871 (24.00)	22.72
\$25,000-\$34,999	10330 (11.59)	10.68	3217 (13.15)	12.24
\$35,000-\$49,999	13971 (15.68)	15.63	3441 (14.06)	13.89
\$50,000	39871 (44.75)	47.89	7016 (28.68)	31.81
Education level				
Did not graduate high school	7504 (7.22)	10.95	3104 (10.97)	18.19
High school graduate	30349 (29.22)	29.23	9616 (33.99)	31.95
Attended college or technical school	29332 (28.24)	32.29	8383 (29.63)	31.11
Graduated from college or technical school	36679 (35.31)	27.53	7186 (25.40)	18.74
Employment status				
Unable to work	10237 (9.86)	9.63	3981 (14.09)	13.91
Retired	35111 (33.83)	29.00	7422 (26.27)	20.51
Homemaker or student	8437 (8.13)	9.87	2661 (9.42)	12.13
Out of work for more than 1 year or out of work for less than 1 year	4276 (4.12)	5.16	2067 (7.32)	9.85
Employed or self-employed	45737 (44.06)	46.34	12118 (42.90)	43.61
Marital status				
Married	57543 (55.54)	61.43	12838 (45.55)	50.97
Divorced or separated	21325 (20.58)	17.73	7466 (26.42)	23.93
Widowed	15987 (15.43)	11.64	5066 (17.76)	13.66
Never married or a member of an unmarried couple	8752 (8.45)	9.20	2894 (10.27)	11.44
BMI				
Neither overweight nor obese with BMI <25	34617 (35.46)	35.29	9671 (36.59)	35.55
Overweight (25 ≤ BMI <30)	32071 (32.85)	33.08	8128 (30.75)	31.46

Characteristic	Self-reported mammography use			
	Within the previous 2 years		After 2 years	
	N (%)	Wt %	N (%)	Wt %
Obese (BMI ≥ 30)	30926 (31.68)	31.63	8631 (32.66)	32.99
Health insurance status				
No	5712 (5.50)	6.89	5542 (19.62)	25.85
Yes	98142 (94.50)	93.11	22710 (80.38)	74.15
Routine checkup				
Never	417 (0.40)	0.43	449 (1.61)	1.60
<1 year	88633 (85.78)	85.32	12580 (45.19)	52.05
1 year	14271 (13.81)	14.25	14812 (53.20)	46.35
Health care access with a personal doctor or health care provider				
No	4490 (4.32)	5.13	5533 (19.58)	22.42
1 health care provider	99381 (95.68)	94.87	22725 (80.42)	77.58
Binge drinkers (females having more than four or more drinks on one occasion)				
Yes	6275 (6.11)	6.90	1861 (6.65)	7.70
No	96495 (93.89)	93.10	26121 (93.35)	92.30
Smoking status				
Currently smoking everyday	9239 (8.92)	8.96	5410 (19.19)	19.35
Currently smoking some days	3969 (3.83)	3.88	1687 (5.99)	7.02
Former smoker	31828 (30.74)	29.60	7940 (28.17)	26.87
Never smoked	58500 (56.50)	57.76	13150 (46.65)	46.76
Seasonal flu shot/spray				
No	47737 (45.98)	49.02	18971 (67.09)	70.26
Yes	56090 (54.02)	50.98	9306 (32.91)	29.74
Physical exercise or activity				
No	26489 (25.50)	26.01	9564 (33.83)	33.75
Yes	77400 (74.50)	73.99	18707 (66.17)	66.25
Seat belt use				
Don't always wear a seat belt	9395 (9.03)	6.73	4240 (14.98)	10.85
Always wear a seat belt	94591 (90.97)	93.27	24066 (85.02)	89.15
General health status				
Fair or poor health	21268 (20.50)	20.60	8056 (28.56)	29.03
Good or better health	82498 (79.50)	79.40	20150 (71.44)	70.97
Physical unhealthy days				
14 days	16027 (15.68)	15.92	6000 (21.63)	21.64
<14 days	86158 (84.32)	84.08	21734 (78.37)	78.36
Mental unhealthy days				
14 days	11490 (11.21)	12.03	4800 (17.27)	18.15
<14 days	91014 (88.79)	87.97	22989 (82.73)	81.85
Days with activity limitation				
14 days	10132 (9.74)	9.94	4166 (14.71)	14.38
<14 days	93905 (90.26)	90.06	24161 (85.29)	85.62

N (%): unweighted frequencies and percentages; Wt: weighted; BMI: body mass index

^a All associations were found to be statistically significant at $p < 0.0001$

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Table 2

Sociodemographic and health-related characteristics of women aged 18-64 years old for Pap test screening, 2012 Behavioral Risk Factor Surveillance System ^a

Characteristic	Self-reported Pap test			
	Within the previous 3 years		After 3 years	
	N (%)	Wt %	N (%)	Wt %
Age				
18-24	7481 (6.46)	12.84	4396 (18.88)	39.25
25-34	22283 (19.25)	26.21	2730 (11.72)	14.68
35-44	25855 (22.34)	23.69	3701 (15.89)	14.96
45-54	29571 (25.55)	21.43	5380 (23.10)	16.84
55-64	30566 (26.14)	15.84	7080 (30.40)	14.27
Race				
Non-Hispanic White	84241 (73.28)	61.59	16143 (70.02)	57.44
Non-Hispanic Black	11837 (10.30)	13.38	1818 (7.89)	9.52
Other race or multiracial	7781 (6.77)	7.54	2471 (10.72)	12.41
Hispanic	11097 (9.65)	17.49	2622 (11.37)	20.63
Annual Household Income				
<\$15,000	10937 (10.50)	12.64	4231 (21.45)	22.50
\$15,000-\$24,999	14725 (14.14)	16.68	4573 (23.18)	22.76
\$25,000-\$34,999	9851 (9.46)	9.63	2414 (12.24)	11.85
\$35,000-\$49,999	14349 (13.77)	13.17	2644 (13.40)	11.85
\$50,000	54306 (52.13)	47.88	5864 (29.73)	31.04
Education level				
Did not graduate high school	6702 (5.80)	11.49	2528 (10.87)	17.57
High school graduate	25730 (22.25)	23.18	7605 (32.71)	31.71
Attended college or technical school	32703 (28.28)	32.76	7299 (31.39)	35.43
Graduated from college or technical school	50496 (43.67)	32.57	5817 (25.02)	15.30
Employment status				
Unable to work	7287 (6.31)	5.44	2315 (9.98)	6.96
Retired	6293 (5.45)	3.34	1253 (5.40)	2.39
Homemaker or student	17633 (15.27)	20.23	4862 (20.96)	32.44
Out of work for more than 1 year or out of work for less than 1 year	7745 (6.71)	8.24	2403 (10.36)	11.03
Employed or self-employed	76537 (66.27)	62.76	12369 (53.31)	47.18
Marital status				
Married	66890 (58.01)	53.14	9194 (39.69)	30.07
Divorced or separated	19116 (16.58)	12.96	4241 (18.31)	11.61
Widowed	4370 (3.79)	2.18	1344 (5.80)	2.94
Never married or a member of an unmarried Couple	24935 (21.62)	31.72	8388 (36.21)	55.37
BMI				
Neither overweight nor obese with BMI <25	46821 (43.85)	44.91	9336 (43.48)	50.52
Overweight (25 BMI<30)	30925 (28.96)	28.66	5589 (26.03)	23.77

Characteristic	Self-reported Pap test			
	Within the previous 3 years		After 3 years	
	N (%)	Wt %	N (%)	Wt %
Obese (BMI ≥ 30)	29026 (27.19)	26.42	6545 (30.48)	25.71
Health insurance status				
No	14363 (12.43)	17.21	7423 (32.06)	33.67
Yes	101204 (87.57)	82.79	15730 (67.94)	66.33
Routine checkup				
Never	784 (0.68)	0.76	511 (2.24)	2.02
<1 year	86008 (74.94)	73.14	9357 (41.02)	46.06
1 year	27972 (24.37)	26.10	12942 (56.74)	51.92
Health care access with a personal doctor or health care provider				
No	14710 (12.73)	17.33	7798 (33.66)	36.59
1 health care provider	100860 (87.27)	82.67	15372 (66.34)	63.41
Binge drinkers (females having more than four or more drinks on one occasion)				
Yes	15277 (13.36)	14.84	2717 (11.84)	12.25
No	99039 (86.64)	85.16	20231 (88.16)	87.75
Smoking status				
Currently smoking everyday	13203 (11.45)	11.99	4503 (19.40)	15.10
Currently smoking some days	5553 (4.81)	5.24	1341 (5.78)	5.26
Former smoker	24527 (21.26)	18.49	3844 (16.56)	11.05
Never smoked	72070 (62.48)	64.28	13520 (58.26)	68.59
Seasonal flu shot/spray				
No	69252 (59.99)	65.08	17558 (75.72)	77.22
Yes	46196 (40.01)	34.92	5631 (24.28)	22.78
Physical exercise or activity				
No	22296 (19.29)	20.51	6491 (27.92)	25.22
Yes	93284 (80.71)	79.49	16754 (72.08)	74.78
Seat belt use				
Don't always wear a seat belt	13273 (11.47)	10.56	4131 (17.75)	15.94
Always wear a seat belt	102442 (88.53)	89.44	19137 (82.25)	84.06
General health status				
Fair or poor health	14923 (12.91)	13.23	4787 (20.63)	17.72
Good or better health	100645 (87.09)	86.77	18420 (79.37)	82.28
Physically unhealthy days				
14 days	11360 (9.92)	9.79	3348 (14.62)	12.09
<14 days	103198 (90.08)	90.21	19549 (85.38)	87.91
Mentally unhealthy days				
14 days	14146 (12.35)	13.26	3965 (17.29)	17.37
<14 days	100423 (87.65)	86.74	18965 (82.71)	82.63
Days with activity limitation				
14 days	7920 (6.84)	6.68	2398 (10.30)	8.32
<14 days	107836 (93.16)	93.32	20889 (89.70)	91.68

N (%): unweighted frequencies and percentages; Wt: weighted; BMI: body mass index

^a All associations were found to be statistically significant at $p < 0.0001$

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Table 3

Adjusted odds ratios and 95% confidence intervals from logistic regression analyses describing the association of four health-related quality of life aspects and having had a mammogram in the last 2 years among women aged 50-74 years old

Characteristic	Odds Ratio (95% Confidence Interval)			
	Model 1 (n=103945)	Model 2 (n=102731)	Model 3 (n=103009)	Model 4 (n=104182)
Age				
50-54 (ref)	1.00	1.00	1.00	1.00
55-59	1.00 (0.90-1.10)	0.98 (0.89-1.09)	0.98 (0.89-1.09)	0.98 (0.89-1.08)
60-64	0.91 (0.82-1.01)	0.90 (0.81-1.00)	0.90 (0.81-1.00)	0.90 (0.81-1.00)
65-69	0.85 (0.75-0.96)	0.84 (0.74-0.95)	0.84 (0.74-0.95)	0.83 (0.74-0.94)
70-74	0.74 (0.65-0.85)	0.73 (0.64-0.83)	0.73 (0.64-0.83)	0.73 (0.64-0.84)
Race				
Non-Hispanic White (ref)	1.00	1.00	1.00	1.00
Non-Hispanic Black	1.87 (1.65-2.13)	1.81 (1.59-2.06)	1.83 (1.61-2.09)	1.83 (1.61-2.09)
Other race or multiracial	0.96 (0.79-1.18)	0.98 (0.80-1.20)	0.98 (0.80-1.19)	0.96 (0.78-1.17)
Hispanic	1.52 (1.30-1.79)	1.49 (1.27-1.76)	1.49 (1.27-1.75)	1.50 (1.28-1.76)
Annual Household Income				
<\$15,000 (ref)	1.00	1.00	1.00	1.00
\$15,000-\$24,999	1.08 (0.95-1.23)	1.11 (0.97-1.26)	1.10 (0.96-1.25)	1.08 (0.95-1.23)
\$25,000-\$34,999	1.15 (1.00-1.32)	1.18 (1.02-1.36)	1.17 (1.02-1.35)	1.16 (1.01-1.33)
\$35,000-\$49,999	1.26 (1.09-1.47)	1.30 (1.12-1.51)	1.30 (1.12-1.50)	1.28 (1.11-1.49)
\$50,000	1.39 (1.20-1.62)	1.44 (1.24-1.68)	1.44 (1.24-1.67)	1.43 (1.23-1.65)
Education level				
Did not graduate high school (ref)	1.00	1.00	1.00	1.00
High school graduate	1.13 (0.99-1.29)	1.14 (1.00-1.30)	1.15 (1.01-1.32)	1.16 (1.02-1.32)
Attended college or technical school	1.13 (0.99-1.29)	1.14 (1.00-1.31)	1.15 (1.01-1.32)	1.16 (1.02-1.33)
Graduated from college or technical school	1.27 (1.10-1.47)	1.27 (1.10-1.48)	1.29 (1.12-1.50)	1.31 (1.13-1.51)
Employment status				
Unable to work (ref)	1.00	1.00	1.00	1.00
Retired	1.31 (1.12-1.52)	1.37 (1.17-1.60)	1.41 (1.21-1.64)	1.36 (1.16-1.58)
Homemaker or student	1.00 (0.84-1.19)	1.04 (0.86-1.24)	1.08 (0.91-1.30)	1.04 (0.87-1.25)
Out of work for more than 1 year or out of work for less than 1 year	1.00 (0.83-1.21)	1.06 (0.87-1.28)	1.09 (0.90-1.32)	1.05 (0.87-1.27)
Employed or self-employed	1.15 (1.00-1.32)	1.19 (1.03-1.38)	1.25 (1.09-1.44)	1.20 (1.03-1.38)
Marital status				
Married (ref)	1.00	1.00	1.00	1.00
Divorced or separated	0.85 (0.77-0.93)	0.86 (0.79-0.94)	0.85 (0.78-0.93)	0.85 (0.78-0.93)
Widowed	0.84 (0.75-0.94)	0.85 (0.76-0.95)	0.85 (0.76-0.95)	0.84 (0.75-0.94)
Never married or a member of an unmarried couple	0.80 (0.70-0.91)	0.80 (0.70-0.91)	0.80 (0.70-0.91)	0.79 (0.70-0.90)
BMI				

Characteristic	Odds Ratio (95% Confidence Interval)			
	Model 1 (n=103945)	Model 2 (n=102731)	Model 3 (n=103009)	Model 4 (n=104182)
Neither overweight nor obese with BMI <25 (ref)	1.00	1.00	1.00	1.00
Overweight (25 BMI<30)	0.99 (0.91-1.08)	0.99 (0.91-1.08)	0.99 (0.91-1.07)	0.99 (0.91-1.08)
Obese (BMI ≥30)	0.88 (0.81-0.96)	0.86 (0.79-0.94)	0.86 (0.79-0.94)	0.87 (0.80-0.95)
Health insurance status				
No (ref)	1.00	1.00	1.00	1.00
Yes	2.09 (1.87-2.33)	2.11 (1.88-2.36)	2.07 (1.85-2.32)	2.09 (1.87-2.34)
Routine checkup				
Never (ref)	1.00	1.00	1.00	1.00
<1 year	3.59 (2.59-4.97)	3.64 (2.61-5.08)	3.66 (2.63-5.09)	3.63 (2.62-5.03)
1 year	0.97 (0.70-1.34)	0.98 (0.70-1.37)	0.99 (0.71-1.38)	0.98 (0.71-1.36)
Health care access with a personal doctor or health care provider				
No (ref)	1.00	1.00	1.00	1.00
1 health care provider	2.36 (2.10-2.66)	2.33 (2.06-2.63)	2.32 (2.06-2.62)	2.32 (2.06-2.62)
Binge drinkers (females having more than four or more drinks on one occasion)				
Yes (ref)	1.00	1.00	1.00	1.00
No	0.93 (0.82-1.06)	0.95 (0.84-1.08)	0.94 (0.83-1.06)	0.94 (0.83-1.07)
Smoking status				
Currently smoking everyday (ref)	1.00	1.00	1.00	1.00
Currently smoking some days	1.06 (0.88-1.29)	1.05 (0.87-1.28)	1.06 (0.87-1.28)	1.06 (0.87-1.28)
Former smoker	1.73 (1.56-1.92)	1.73 (1.56-1.92)	1.74 (1.57-1.92)	1.72 (1.56-1.91)
Never smoked	1.91 (1.73-2.10)	1.91 (1.73-2.11)	1.91 (1.73-2.11)	1.90 (1.72-2.09)
Seasonal flu shot/spray				
No (ref)	1.00	1.00	1.00	1.00
Yes	1.83 (1.70-1.97)	1.82 (1.69-1.96)	1.81 (1.68-1.95)	1.82 (1.69-1.96)
Physical exercise or activity				
No (ref)	1.00	1.00	1.00	1.00
Yes	1.13 (1.04-1.22)	1.12 (1.04-1.21)	1.14 (1.05-1.24)	1.13 (1.04-1.22)
Seat belt use				
Don't always wear a seat belt (ref)	1.00	1.00	1.00	1.00
Always wear a seat belt	1.45 (1.30-1.62)	1.45 (1.30-1.63)	1.45 (1.29-1.62)	1.45 (1.30-1.62)
General health status				
Fair or poor health (ref)	1.00	-	-	-
Good or better health	1.26 (1.14-1.38)	-	-	-
Physically unhealthy days				
14 days (ref)	-	1.00	-	-
<14 days	-	1.18 (1.07-1.30)	-	-
Mentally unhealthy days				
14 days (ref)	-	-	1.00	-
<14 days	-	-	1.09 (0.98-1.21)	-

Characteristic	Odds Ratio (95% Confidence Interval)			
	Model 1 (n=103945)	Model 2 (n=102731)	Model 3 (n=103009)	Model 4 (n=104182)
Days with activity limitation				
14 days (ref)	-	-	-	1.00
<14 days	-	-	-	1.19 (1.06-1.33)

HRQoL: health-related quality of life; BMI: body mass index; ref: reference group

Table 4

Adjusted odds ratio and 95% confidence intervals from logistic regression analyses describing the association between four health-related quality of life aspects and having had a Pap test in the last 3 years in women aged 18-64 years old

Characteristic	Odds Ratio (95% Confidence Interval)			
	Model 1 (n=111277)	Model 2 (n=110545)	Model 3 (n=110602)	Model 4 (n=111442)
Age				
18-24 (ref)	1.00	1.00	1.00	1.00
25-34	4.52 (3.94-5.19)	4.60 (4.00-5.28)	4.54 (3.95-5.22)	4.57 (3.98-5.25)
35-44	2.98 (2.58-3.45)	2.98 (2.58-3.45)	2.96 (2.56-3.43)	2.99 (2.58-3.46)
45-54	2.14 (1.86-2.46)	2.14 (1.86-2.46)	2.14 (1.86-2.47)	2.14 (1.86-2.46)
55-64	1.61 (1.39-1.87)	1.62 (1.39-1.88)	1.59 (1.37-1.85)	1.60 (1.38-1.85)
Race				
Non-Hispanic White (ref)	1.00	1.00	1.00	1.00
Non-Hispanic Black	1.85 (1.61-2.14)	1.83 (1.59-2.12)	1.85 (1.60-2.13)	1.85 (1.60-2.13)
Other race or multiracial	0.61 (0.52-0.72)	0.61 (0.52-0.72)	0.61 (0.52-0.72)	0.61 (0.52-0.72)
Hispanic	1.24 (1.08-1.42)	1.22 (1.07-1.40)	1.23 (1.07-1.40)	1.22 (1.06-1.39)
Annual Household Income				
<\$15,000 (ref)	1.00	1.00	1.00	1.00
\$15,000-\$24,999	1.17 (1.02-1.33)	1.18 (1.03-1.35)	1.19 (1.04-1.37)	1.19 (1.04-1.36)
\$25,000-\$34,999	0.92 (0.79-1.08)	0.94 (0.80-1.10)	0.96 (0.82-1.12)	0.94 (0.80-1.10)
\$35,000-\$49,999	1.12 (0.96-1.31)	1.14 (0.97-1.33)	1.15 (0.98-1.34)	1.15 (0.98-1.34)
\$50,000	1.05 (0.90-1.21)	1.06 (0.91-1.23)	1.08 (0.93-1.25)	1.07 (0.93-1.25)
Education level				
Did not graduate high school (ref)	1.00	1.00	1.00	1.00
High school graduate	1.01 (0.86-1.19)	1.02 (0.87-1.20)	1.01 (0.86-1.18)	1.02 (0.87-1.19)
Attended college or technical school	1.20 (1.02-1.42)	1.21 (1.02-1.42)	1.20 (1.02-1.41)	1.20 (1.02-1.41)
Graduated from college or technical School	1.96 (1.65-2.33)	1.96 (1.65-2.33)	1.95 (1.64-2.32)	1.96 (1.65-2.33)
Employment status				
Unable to work (ref)	1.00	1.00	1.00	1.00
Retired	1.42 (1.12-1.78)	1.40 (1.10-1.77)	1.45 (1.15-1.82)	1.46 (1.17-1.83)
Homemaker or student	1.11 (0.91-1.37)	1.09 (0.89-1.35)	1.14 (0.93-1.39)	1.14 (0.94-1.39)
Out of work for more than 1 year or out of work for less than 1 year	1.39 (1.13-1.72)	1.40 (1.12-1.74)	1.44 (1.17-1.77)	1.43 (1.17-1.75)
Employed or self-employed	1.52 (1.26-1.83)	1.50 (1.24-1.83)	1.56 (1.30-1.87)	1.57 (1.31-1.88)
Marital status				
Married (ref)	1.00	1.00	1.00	1.00
Divorced or separated	0.73 (0.66-0.82)	0.73 (0.65-0.81)	0.73 (0.65-0.81)	0.73 (0.65-0.81)
Widowed	0.55 (0.46-0.65)	0.54 (0.45-0.65)	0.55 (0.46-0.66)	0.55 (0.46-0.66)
Never married or a member of an unmarried couple	0.50 (0.45-0.55)	0.49 (0.44-0.55)	0.49 (0.44-0.55)	0.49 (0.45-0.55)
BMI				

Characteristic	Odds Ratio (95% Confidence Interval)			
	Model 1 (n=111277)	Model 2 (n=110545)	Model 3 (n=110602)	Model 4 (n=111442)
Neither overweight nor obese with BMI <25 (ref)	1.00	1.00	1.00	1.00
Overweight (25 BMI<30)	1.11 (1.01-1.23)	1.11 (1.00-1.22)	1.11 (1.00-1.22)	1.11 (1.01-1.22)
Obese (BMI ≥30)	0.94 (0.86-1.04)	0.93 (0.84-1.02)	0.93 (0.85-1.03)	0.93 (0.84-1.02)
Health insurance status				
No (ref)	1.00	1.00	1.00	1.00
Yes	1.44 (1.30-1.60)	1.46 (1.31-1.62)	1.45 (1.31-1.61)	1.45 (1.31-1.61)
Routine checkup				
Never (ref)	1.00	1.00	1.00	1.00
<1 year	3.43 (2.51-4.68)	3.46 (2.54-4.71)	3.42 (2.50-4.67)	3.43 (2.52-4.67)
1 year	1.13 (0.83-1.53)	1.13 (0.83-1.53)	1.12 (0.82-1.52)	1.12 (0.83-1.52)
Health care access with a personal doctor or health care provider				
No (ref)	1.00	1.00	1.00	1.00
1 health care provider	1.48 (1.34-1.64)	1.48 (1.34-1.63)	1.47 (1.33-1.63)	1.47 (1.33-1.63)
Binge drinkers (females having more than four or more drinks on one occasion)				
Yes (ref)	1.00	1.00	1.00	1.00
No	0.67 (0.60-0.76)	0.67 (0.60-0.76)	0.67 (0.59-0.75)	0.67 (0.60-0.76)
Smoking status				
Currently smoking everyday (ref)	1.00	1.00	1.00	1.00
Currently smoking some days	1.27 (1.06-1.52)	1.27 (1.05-1.52)	1.28 (1.07-1.54)	1.28 (1.06-1.53)
Former smoker	1.42 (1.26-1.60)	1.42 (1.25-1.60)	1.41 (1.25-1.60)	1.42 (1.26-1.61)
Never smoked	0.98 (0.88-1.10)	0.98 (0.88-1.10)	0.98 (0.88-1.10)	0.99 (0.89-1.10)
Seasonal flu shot/spray				
No (ref)	1.00	1.00	1.00	1.00
Yes	1.34 (1.22-1.47)	1.34 (1.22-1.46)	1.34 (1.23-1.47)	1.34 (1.22-1.47)
Physical exercise or activity				
No (ref)	1.00	1.00	1.00	1.00
Yes	1.15 (1.04-1.27)	1.16 (1.05-1.28)	1.16 (1.04-1.28)	1.17 (1.05-1.29)
Seat belt use				
Don't always wear a seat belt (ref)	1.00	1.00	1.00	1.00
Always wear a seat belt	1.17 (1.03-1.31)	1.17 (1.04-1.31)	1.16 (1.03-1.30)	1.16 (1.03-1.30)
General health status				
Fair or poor health (ref)	1.00	-	-	-
Good or better health	1.14 (1.01-1.28)	-	-	-
Physically unhealthy days				
14 days (ref)	-	1.00	-	-
<14 days	-	1.15 (1.00-1.33)	-	-
Mentally unhealthy days				
14 days (ref)	-	-	1.00	-
<14 days	-	-	1.07 (0.95-1.20)	-

Characteristic	Odds Ratio (95% Confidence Interval)			
	Model 1 (n=111277)	Model 2 (n=110545)	Model 3 (n=110602)	Model 4 (n=111442)
Days with activity limitation				
14 days (ref)	-	-	-	1.00
<14 days	-	-	-	1.03 (0.89-1.20)

HRQoL: health-related quality of life; BMI: body mass index; ref: reference group