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Trends in modifiable lifestyle-related risk factors following diagnosis in breast cancer survivors

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Abstract

Purpose—Evidence suggests that high-risk lifestyle behaviors exacerbate the health of cancer survivors and increase cancer mortality. This study examined the prevalence of lifestyle-related risk factors among female breast cancer survivors by duration of survivorship in the United States.

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Methods—We analyzed data from 7,443 women aged ≥18-years who participated in the 2009 Behavioral Risk Factor Surveillance System and reported having ever-diagnosed breast cancer. Adjusted prevalence with 95 % confidence interval for lifestyle-related risk factors (including current smoking, excessive alcohol drinking, obesity, engaging in physical activity ≥150 min/week, and consuming fruits and vegetables ≥5 times/day) was estimated using log-linear regression while controlling for confounders.

Results—Overall, the prevalence estimates for lifestyle-related risk factors were 10.2 % for current smoking, 6.8 % for excessive alcohol drinking, 24.7 % for obesity, 53.8 % for engaging in physical activity ≥150 min/week, and 33.9 % for consuming fruits and vegetables ≥5 times/day among female breast cancer survivors. After adjustment for covariates, with increasing years of survivorship, a linearly increasing trend was observed for current smoking (P=0.038), and quadratic trends were observed for excessive alcohol drinking (P<0.001) and obesity (P=0.048). The adjusted prevalence estimates for engaging in physical activity ≥150-min/week and consuming fruits and vegetables ≥5 times/day did not vary significantly by duration of survivorship.

Conclusion—Continuing efforts on counseling and encouraging breast cancer survivors to adopt healthy lifestyles are needed to improve their health.

Implications for cancer survivors—Understanding the trends of modifiable lifestyle-related risk factors among breast cancer survivors with varying duration of survivorship may assist health care providers to provide appropriate counseling for breast cancer patients to improve their health. Clinical and public health intervention programs should seek to maximize the number of recommended healthy behaviors especially in those women who are at high risk for failing to comply with the healthy lifestyle guidelines.

Keywords

Breast cancer; Cancer duration; Health-related behaviors; Lifestyles; BRFSS

Introduction

High-risk lifestyle behaviors such as smoking, excessive alcohol drinking, physical inactivity, and consuming a poor diet have been linked to elevated incidence rates of cancer (including breast cancer) [1–3], poor prognosis after cancer diagnosis [4–8], and higher risk for cancer mortality [9–11]. In contrast, among cancer patients, adoption of healthy lifestyles is associated with improved survival, reduced risks for recurrent and second cancers, reduced cancer mortality, and improved quality of life [12–20]. For example, compared with women who were physically inactive both before and after diagnosis of breast cancer, women diagnosed with breast cancer who increased physical activity after diagnosis had a 45 % lower risk for death; but women who decreased physical activity after diagnosis had a threefold higher risk for death [18]. Women diagnosed with breast cancer who consumed diets with a higher score on the Healthy Eating Index had a 60 % reduced risk for all-cause mortality and 88 % reduced risk for breast cancer mortality [4]. Thus, understanding the behavioral risk factors related to cancer prognosis is important for public health and health care professionals to implement effective interventions to achieve

optimal survivorship. To date, evidence has shown the percentages of cancer survivors who adhere to lifestyle behavior recommendations remain low. Blanchard et al. reported that only 37.1 % of breast cancer survivors met physical activity recommendation (i.e., engage in at least 150 min of moderate-to-strenuous or 60 min of strenuous physical activity per week), 18.2 % met the fruit and vegetable consumption recommendation (i.e., consume at least five servings of fruits and vegetables per day), and 88.1 % met the smoking recommendation (i.e., not smoke) [21]. In addition, significant racial and ethnic differences in behavioral risk factors among breast cancer survivors have been reported [22]. In these studies, however, how prevalent the lifestyle-related risk factors are among breast cancer patients through the time course of cancer survivorship is unknown. Given that lifestyle modification elicits significant impact on prognosis among cancer survivors [23–25] and women living with breast cancer are likely to be interested in lifestyle modification to decrease cancer recurrence and mortality risk, more in-depth studies are necessary to extend our understanding on how modifiable health-related risk factors vary across the course of cancer survivorship. This is important for developing effective intervention programs for breast cancer patients to improve their survivorship and increase their physical and emotional wellbeing. Therefore, using data from a large, population-based sample of US adult women, we examined the prevalence of lifestyle-related risk factors among female breast cancer survivors by duration of survivorship.

Methods

We analyzed the data from the 2009 Behavioral Risk Factor Surveillance System (BRFSS). The BRFSS uses state-based, random-digit-dialed telephone surveys to collect health information including health and lifestyle behaviors, preventive health practices, health care access, and related chronic conditions among non-institutionalized adults aged ≥18-years. The BRFSS sampling methodology has been described elsewhere [26], and BRFSS data have been found to provide valid and reliable estimates of population prevalence consistent with those derived from national household surveys in the US [27, 28]. The median response rate was 52.5 %, and the median cooperation rate (the percentage of eligible residents contacted by BRFSS officials who completed the survey) was 75.0 % for the 2009 BRFSS. The BRFSS is a state-based population survey; the BRFSS data are publically accessible (http://www.cdc.gov/BRFSS/) and can be retrieved by individual states.

Cancer diagnosis was assessed using the following questions: (1) “Have you ever been told by a doctor, nurse, or other health professional that you had cancer?”, (2) “How many different types of cancer have you had?”, (3) “At what age were you told that you had cancer (for the first diagnosis of cancer if having more than one type of cancer)?”, and (4) “What type of cancer was it (for the most recent diagnosis if having more than one type of cancer)?”. We limited our analytic sample to women who reported being diagnosed with breast cancer only; women with breast cancer who also had other types of cancer were excluded because their survival years since breast cancer diagnosis could not be determined. The years of survivorship were calculated as participants’ age subtracted by the age at cancer diagnosis, and was categorized as <1, 1–4, 5–9, 10–14, 15–19, 20–24, 25–29, and ≥30 years.

We examined lifestyle-related risk factors like smoking and alcohol drinking as well as healthy behaviors like engaging in physical activity and eating a healthy diet rich in fruits and vegetables. Current smoking was defined as participants who had smoked at least 100 cigarettes during their lifetime and were still smoking at the time the survey was conducted [29]. Alcohol drinking was assessed by asking female respondents how many days per week or per month they had had at least one drink (equivalent to a 12-ounce beer, a 5-ounce glass of wine, or a drink with one shot of liquor) of any alcoholic beverages during the past 30 days, how many drinks they had on average on the days when they drank, and how many times they had four or more drinks on an occasion. Excessive alcohol drinking was defined as women who consumed a daily average of any alcohol beverages of >1drink or had ≥1 episode of consuming at least four drinks on one occasion during the previous 30 days [30]. Obesity was defined as having a body mass index of ≥30 kg/m^2. Physical activity was assessed by asking participants whether, in a usual week, they did moderately intensive activities (such as brisk walking, bicycling, gardening, or anything else that causes small increases in breathing or heart rate) or vigorously intensive activities (such as running, aerobics, heavy yard work, or anything else that causes large increases in breathing or heart rate) for at least 10 min at a time. If the answer was “yes”, they were further asked about how many days per week and how much total time per day they engaged in the activities. We then calculated the average minutes per week (min/week) for these activities with a conversion of 1 min of vigorous-intensity activities equivalent to 2 min of moderate-intensity activities. Following the 2008 Physical Activity Guidelines [31], participants were categorized as engaging in moderate–intensive physical activity ≥150 min/week or not. Fruit and vegetable consumption was assessed by asking participants how many times per day (or per week, per month, per year) they drank fruit juices or ate fruit, green salad, potatoes (excluding French fries, fried potatoes, or potato chips), carrots, or any other vegetables. Following the American Cancer Society guidelines [32], participants were categorized as consuming fruit and vegetables either ≥5 times/day or not.

The potential confounding factors for our analyses included age (18–44, 45–64, and ≥65 years), race/ethnicity (non-Hispanic white, non-Hispanic black, Hispanic, and other), education (<high school diploma, high school graduate, some college/technical school, and ≥college graduate), routine health check-up during the past year (yes or no), health insurance coverage (yes or no), and the number of chronic conditions including diabetes, heart disease, stroke, hyper-tension, asthma, arthritis, and disability. These conditions were assessed by asking participants whether they had ever been told by a healthcare professional that they had the conditions or still had asthma at the time when the survey was conducted. Disability was assessed by asking participants whether they were limited in any way in any activities because of physical, mental, or emotional problems or whether they were required to use special equipment such as a cane, a wheelchair, a special bed, or a special telephone because of any health problem; participants answering ‘yes’ to either question were defined as having a disability. The number of chronic conditions (including disability) was summed, and participants were categorized as having 0, 1, 2, and ≥3 chronic conditions.

Statistical analysis

The unadjusted and adjusted prevalence estimates with 95 % confidence intervals for lifestyle-related risk factors were weighted to the census 2009 US population and were then estimated using log-linear regression models with robust variance estimator without and with controlling for study covariates. Trends in the prevalence of lifestyle-related risk factors were tested using orthogonal contrasts. We conducted the analyses using SAS (version 9.2, SAS Institute, Cary, NC) and SUDAAN software (release 10.0.1, Research Triangle Institute, Research Triangle Park, NC) to account for the multistage, complex sampling design.

Results

Of 10,314 women diagnosed with breast cancer who participated in the BRFSS, we excluded 1,396 women who also had other types of cancers. After we further excluded participants who responded “don’t know/not sure” or had missing responses to any of the study variables, there were 7,443 female breast cancer survivors who were eligible for our analysis. Participants’ median age was 64.2 years, and the median survivorship time was 7.4 years. By race/ethnicity, 78.6 % of breast cancer survivors were non-Hispanic white, 10.4 % non-Hispanic black, 6.6 % Hispanic, and 4.4 % other racial/ethnic group. Approximately 65.0 % of breast cancer survivors had attained an educational level of greater than a high school diploma; 95.7 % reported having health insurance coverage; and 84.8 % had a routine medical check-up during the past year. About 28.9 % reported having one chronic condition; 23.4 % had two conditions; and 25.8 % had at least three conditions.

Overall, the weighted, unadjusted prevalence estimates for lifestyle-related risk factors among breast cancer survivors were 10.2 % (95 % CI, 8.9–11.5 %) for current smoking, 6.8 % (95 % CI, 5.9–7.9 %) for excessive alcohol drinking, 24.7 % (95 % CI, 22.9–26.5 %) for obesity, 53.8 % (95 % CI, 51.6–56.0 %) for engaging in physical activity ≥150 min/week, and 33.9 % (95 % CI, 31.9–36.0 %) for consuming fruits and vegetables ≥5 times/day (Table 1). With increasing levels of education, current smoking, and obesity decreased significantly whereas excessive alcohol drinking, engaging in physical activity ≥150 min/week, and consuming fruits and vegetables ≥5 times/day increased significantly ($P \leq 0.001$ for all); however, the opposite trends were observed with increasing number of chronic conditions ($P < 0.05$ for all except for current smoking, Table 1).

After multivariate adjustment for covariates including age, race/ethnicity, education, routine health check-up, health insurance coverage, and the number of chronic conditions, with increasing years of survivorship, a linearly increasing trend was observed for the prevalence of current smoking ($P = 0.038$), and quadratic trends were observed for the prevalence of excessive alcohol drinking ($P < 0.001$) and obesity ($P = 0.048$; Fig. 1). Compared with women who were recently diagnosed with breast cancer (within a year), those who survived for at least 30 years had an adjusted prevalence ratio of 2.03 (95 % CI, 0.98–5.25) for current smoking, 0.36 (95 % CI, 0.13–0.99) for excessive alcohol drinking, and 0.57 (95 % CI, 0.35–0.93) for obesity. The adjusted prevalence estimates for engaging in physical activity ≥150-min/week and consuming fruits and vegetables ≥5 times/day did not vary much by years survived since cancer diagnosis (Fig. 1).

Discussion

The strength of the present study is that our data were derived from a large, population-based sample of women who reported being breast cancer survivors, which provided a unique opportunity for us to report nationally representative estimates for the prevalence of modifiable lifestyle-related risk factors across different survivorship periods after cancer diagnosis. To our knowledge, this has not been previously described in the literature. Our results showed that among long-term breast cancer survivors (≥30 years after cancer diagnosis), favorable changes were observed for excessive alcohol drinking and obesity; however, there was about twofold increase in the prevalence of current smoking compared to those who were diagnosed with cancer recently. The prevalence of meeting recommendations for physical activity participation and fruit/vegetable consumption did not vary much by duration of survivorship, which is consistent with previous findings [32, 33].

Our findings have several important implications in the development of effective long-term care programs for breast cancer patients. First, our study showed an overall low prevalence of meeting lifestyle recommendations among breast cancer survivors, suggesting more effects from clinical care providers and public health professionals are needed to encourage cancer survivors to adhere to lifestyle recommendations. Second, our results showed some variations in health-related risk factors across the time course of survivorship period. This suggests the lifestyle education and intervention programs may emphasize different health behavioral risk factors at varying periods of survivorship; particularly, efforts should be made to promote their physical activity participation and healthy eating style across all survivorship periods, to reduce obesity and risky alcohol drinking among those who have relatively short survivorship periods after cancer diagnosis, and to reduce smoking or promote smoking cessation among those who have longer survivorship periods.

The number of women surviving breast cancer has increased despite a relatively stable incidence rate in the USA [34]. This increase may be attributed to many factors including early detection, effective treatment and subsequent follow-up care, and aging population [35]. In 2007, about 2.6 million US women were breast cancer survivors [36], which is predicted to increase to 3.4 million by 2015 [37]. To reduce the risk of cancer recurrence and mortality and improve health outcomes among cancer survivors, the American Cancer Society recently updated the guidelines on nutrition and physical activity which include avoiding tobacco products, achieving and maintaining a healthy weight, staying physically active (at least 150 min of moderate intensity or 75 min of vigorous intensity or their combination each week—preferably spread throughout the week), eating a healthy diet (high in fruits, vegetables, and whole grains and low in processed meat and red meat), and limiting alcohol intake (no more than one drink per day for women) [32, 33]. However, limited evidence from studies examining behavioral risk factors among small samples (i.e., varied from n=386 to n=2,885) of female breast cancer survivors showed that about 12–14 % of them were currently smoking [21, 38, 39] and 5 % were risky drinkers (defined as an average of ≥10 alcoholic beverages per week) [39], which is consistent with our findings that about one-tenth or fewer of breast cancer survivors reported currently smoking or excessive alcohol drinking. Our results further revealed that about 25 % of breast cancer survivors were obese, which has not been reported previously. For physical activity, our

results showed a much higher prevalence of engaging in physical activity at recommended levels than the findings of the previous studies (54% versus 20–37 %) among breast cancer survivors [21, 39]. This may have resulted from different physical activity guidelines applied to assess physical activity. In the present study, we applied the new 2008 DHHS physical activity guidelines [31], in which the requirement for frequency (at least 5 days a week) of physical activity participation has been removed and the equivalent combination of moderate and vigorous physical activity was counted. These modifications have led to a high prevalence of meeting physical activity recommendations in the general population [40]. The percentage of breast cancer survivors who reported consuming at least five times/day of fruits and vegetables was much higher than that reported by Blanchard et al (34 versus 18 %) [21], which was based on the assessment of consuming at least five servings per day of fruits and vegetables. Nonetheless, our results in combination with previous findings demonstrate that breast cancer survivors' adherence to lifestyle recommendations remains low and achieving recommended levels of lifestyle behavior modification is a distant target in these patients. Increasing efforts (such as effective counseling and health education through physicians or health care professionals) are needed to increase their knowledge about the benefits healthy lifestyles confer, particularly among subpopulations with elevated rates of unhealthy behaviors at varying stages of the survivorship period.

Our study has several limitations. First, all responses in the BRFSS were self-reported and, thus, subject to recall bias. Second, the severity of breast cancer and its treatments were not assessed due to lack of data. Third, the 2009 BRFSS survey excluded adults who had been institutionalized or hospitalized and those with only mobile telephones. Because these adults are more likely to have severe physical or mental illness (for those who were institutionalized or hospitalized) or to be of low socioeconomic status (for those with only mobile telephones), this exclusion may have led us to underestimate the prevalence of lifestyle-related behaviors among women with breast cancer. Finally, the BRFSS sampling frame did not allow to capture all cancer survivors to participate in the survey, therefore, we may not have a full picture of the health-related risk factors among breast cancer survivors, so generalizability of the results is limited.

In conclusion, to promote the overall health of breast cancer survivors through the survivorship period after cancer diagnosis, clinical and public health intervention programs should seek to maximize the number of recommended healthy behaviors especially in those women who are at high risk for failing to comply with the healthy lifestyle guidelines. Nationally prioritized lifestyle and nutrition programs may benefit all women including breast cancer survivors. In addition, the potential barriers that prevent women from improving their lifestyle behaviors need to be investigated.

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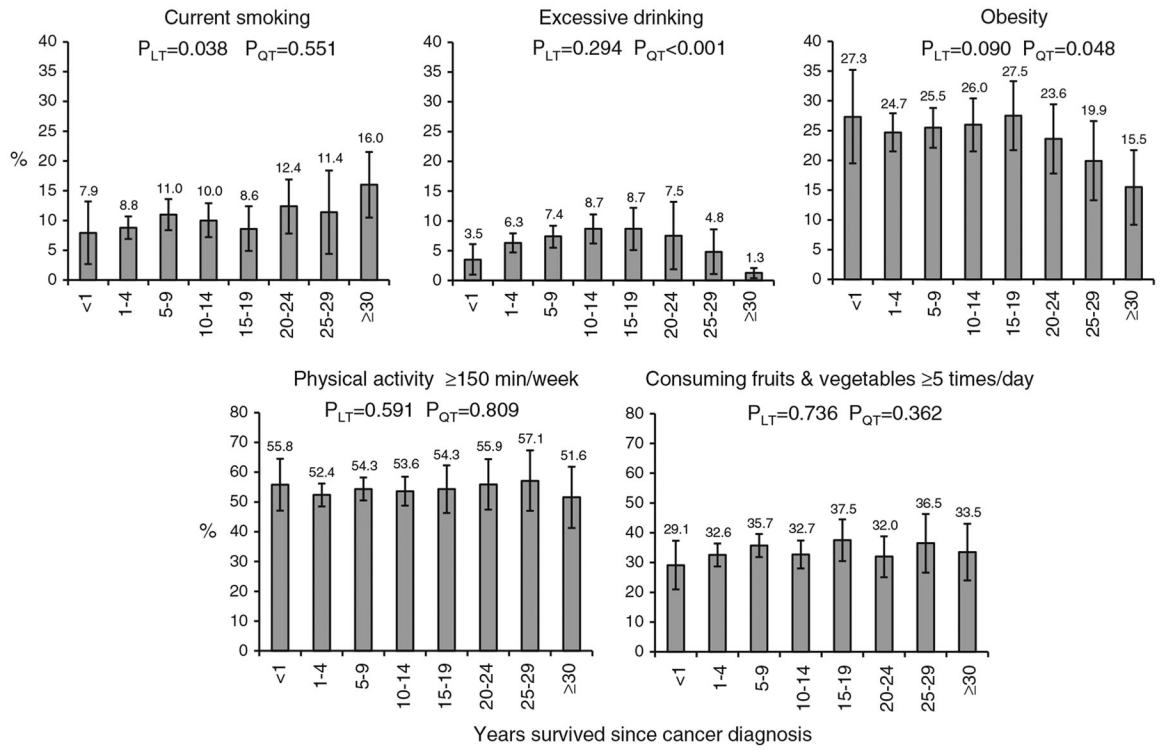

Fig. 1.

Adjusted prevalence estimates (with 95 % confidence intervals) for lifestyle-related risk factors by years survived since cancer diagnosis among female breast cancer survivors, BRFSS 2009. Adjusted for age, race/ethnicity, education, routine health check-up, health insurance coverage, and the number of chronic conditions. *LT* linear trend, *QT* quadratic trend

Table 1

Weighted prevalence (%) of lifestyle-related risk factors among female breast cancer survivors stratified by selected characteristics, BRFSS 2009

	No.	Current smoking	Excessive drinking	Obesity	Engaging in physical activity ≥150 min/ week	Consuming fruits and vegetables ≥5 times/day
Overall	7,443	10.2 (8.9, 11.5)	6.8 (5.9, 7.9)	24.7 (22.9, 26.5)	53.8 (51.6, 56.0)	33.9 (31.9, 36.0)
Age (years)						
18–44	246	12.3 (7.9, 18.4)	12.6 (7.4, 20.6)	34.0 (24.9, 44.5)	60.2 (49.8, 69.7)	34.4 (25.3, 44.8)
45–64	2,832	12.3 (10.4, 14.6)	8.7 (7.2, 10.6)	24.5 (21.8, 27.6)	60.8 (57.3, 64.1)	34.6 (31.3, 38.0)
≥65	4,365	8.0 (6.5, 9.9)	4.5 (3.7, 5.5)	23.7 (21.5, 26.1)	47.0 (44.1, 49.9)	33.2 (30.7, 35.9)
Race/ethnicity						
Non-Hispanic white	6,356	10.0 (8.9, 11.3)	7.6 (6.6, 8.8)	22.9 (21.2, 24.7)	55.1 (53.0, 57.1)	34.3 (32.3, 36.3)
Non-Hispanic black	501	11.9 (6.7, 20.4)	4.5 (2.0, 9.8)	42.0 (33.1, 51.4)	42.9 (33.8, 52.4)	32.8 (24.5, 42.4)
Hispanic	260	6.9 (3.1, 14.7)	3.6 (1.3, 9.9)	24.0 (15.5, 35.3)	48.3 (34.1, 62.7)	35.0 (23.4, 48.7)
Other	326	13.1 (7.5, 21.8)	2.6 (1.2, 5.4)	15.6 (9.7, 24.3)	64.4 (52.0, 75.2)	27.9 (18.3, 40.2)
Education						
<High school	534	18.3 (13.0, 25.1)	2.2 (1.2, 4.0)	38.7 (31.0, 47.1)	37.2 (29.5, 45.7)	21.3 (14.7, 29.7)
High school graduate	2,292	12.8 (10.2, 16.0)	3.8 (2.7, 5.3)	29.8 (26.4, 33.5)	45.6 (41.8, 49.6)	24.7 (21.5, 28.2)
Some college/technical	2,139	11.6 (9.6, 14.1)	7.1 (5.5, 9.1)	26.8 (23.5, 30.5)	53.7 (50.0, 57.4)	35.0 (31.5, 38.6)
College graduate	2,478	5.6 (4.1, 7.5)	9.7 (8.0, 11.9)	16.6 (14.2, 19.4)	62.9 (58.7, 66.9)	42.3 (38.4, 46.2)
Routine check-up visit						
Yes	6,320	9.8 (8.5, 11.3)	6.7 (5.7, 7.8)	24.9 (23.0, 26.9)	53.7 (51.4, 56.0)	34.4 (32.3, 36.7)
No	1,123	12.2 (9.4, 15.7)	7.6 (5.2, 11.0)	23.2 (18.6, 28.6)	54.3 (47.0, 61.4)	30.9 (25.6, 36.7)
Health insurance						
Yes	7,156	9.5 (8.3, 10.9)	6.9 (6.0, 8.0)	24.6 (22.8, 26.5)	53.9 (51.8, 56.1)	34.2 (32.1, 36.2)
No	287	25.0 (15.7, 37.3)	4.7 (2.3, 9.7)	25.4 (16.3, 37.2)	50.4 (32.7, 67.9)	28.0 (17.2, 42.0)
No. of chronic condition						
0	1,378	9.6 (7.0, 12.8)	9.8 (7.5, 12.6)	10.8 (8.4, 13.8)	66.5 (60.2, 72.3)	38.1 (33.0, 43.5)
1	2,060	8.6 (6.9, 10.8)	7.7 (5.8, 10.0)	20.5 (17.4, 23.9)	61.9 (57.9, 65.9)	34.2 (30.5, 38.1)
2	1,878	12.1 (9.2, 15.8)	6.7 (5.2, 8.5)	23.5 (20.2, 27.2)	53.2 (49.0, 57.3)	31.2 (27.5, 35.1)
≥3	2,127	10.6 (8.6, 13.0)	3.5 (2.4, 5.2)	42.2 (38.4, 46.1)	34.3 (30.9, 38.0)	32.4 (28.7, 36.3)
Years of survivorship						
<1	327	7.8 (4.1, 14.2)	4.0 (1.9, 8.1)	27.9 (20.6, 36.6)	57.3 (47.9, 66.2)	30.1 (22.5, 39.1)

	No.	Current smoking	Excessive drinking	Obesity	Engaging in physical activity ≥150 min/week	Consuming fruits and vegetables ≥5 times/day
1–4	1,922	9.6 (7.8, 11.9)	6.9 (5.3, 8.9)	25.4 (22.0, 29.1)	54.8 (50.5, 59.0)	32.3 (28.5, 36.4)
5–9	1,813	11.0 (8.7, 13.9)	8.1 (6.2, 10.5)	24.5 (21.3, 28.0)	56.2 (52.0, 60.2)	36.4 (32.4, 40.5)
10–14	1,327	10.4 (7.8, 13.8)	8.4 (6.3, 11.1)	25.6 (21.3, 30.5)	52.9 (48.0, 57.6)	32.4 (28.0, 37.1)
15–19	771	7.4 (4.7, 11.4)	7.7 (4.9, 11.9)	25.7 (19.6, 32.9)	52.5 (43.6, 61.3)	38.5 (31.1, 46.5)
20–24	539	11.7 (7.7, 17.3)	5.9 (2.8, 12.0)	25.2 (19.0, 32.7)	51.1 (42.7, 59.5)	30.9 (24.4, 38.1)
25–29	282	10.3 (5.7, 18.0)	4.0 (1.8, 8.3)	19.3 (13.4, 27.2)	53.2 (44.0, 62.2)	36.0 (27.1, 45.9)
≥30	462	13.4 (6.2, 26.6)	0.9 (0.5, 1.7)	17.3 (10.6, 27.0)	44.7 (35.5, 54.2)	32.0 (23.4, 42.2)