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Prevalence of Five Lifestyle Risk Factors Among U.S. Adults With and Without Stroke

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Abstract

Background.—History of stroke increases cardiometabolic risk, which can be exacerbated by the presence of unhealthy lifestyle factors. Population-based estimates of lifestyle risk factors in people with stroke are lacking but could be used to inform research, policy, and healthcare practice.

Objective.—To compare population-based estimates of the prevalence of five lifestyle risk factors—low fruit and vegetable consumption, insufficient physical activity, smoking, heavy alcohol consumption, and overweight/obesity—among U.S. adults with and without stroke.

Methods.—Representative data from noninstitutionalized adults aged ≥18 years (stroke, n=37,225; no stroke, n=851,607) from the 2015 and 2017 Behavioral Risk Factor Surveillance System (BRFSS) were used to estimate prevalence of individual and total number of risk factors. Logistic regression models were used to determine the odds of lifestyle risk factors in adults with stroke, adjusting for sex, age, ethnicity, marital status, education, income, and disability.

Results.—Prevalence and adjusted odds ratios (AOR) were higher in individuals with stroke compared to those without stroke for insufficient physical activity (56.5% vs. 49.5%, AOR: 1.14) and smoking (30.1% vs. 16.6%, AOR: 1.16), but lower for heavy alcohol consumption (5.4% vs. 6.1%, AOR: 0.76). Prevalence for low fruit and vegetable consumption (51.7% vs. 46.0%) and overweight/obesity (70.2% vs. 64.5%) was higher among adults with stroke, but differences were attenuated by demographic characteristics. Additionally, clustering of 4–5 lifestyle risk factors was higher in adults with stroke (9.0% vs. 5.3%, AOR: 1.12).

Conclusion.—Additional research and healthcare interventions are needed to improve lifestyle risk factors in adults with stroke.

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Keywords

BRFSS; health behaviors; physical activity; prevalence; stroke

Introduction

Among people that have experienced stroke, lifestyle risk factors increase risk for chronic disease and recurrent stroke through their effect on cardiometabolic risk factors, including hypertension, dyslipidemia, glucose disorders, and overweight/obesity.¹ In their Guidelines for the Prevention of Stroke in Patients With Stroke and Transient Ischemic Attack, the American Heart Association recommends that lifestyle risk factors should be discussed with patients, and modified where possible to reduce cardiometabolic risk.¹ Specific lifestyle risk factors addressed include inadequate nutrition, physical inactivity, smoking, alcohol consumption, and obesity. Importantly, engaging in healthy lifestyle behaviors protects against all-cause and cardiovascular mortality in adults with stroke.²

Despite recommendations to modify lifestyle risk factors, data on the prevalence of lifestyle risk factors among stroke survivors is sparse and dated. Previous investigations have utilized data from the National Health and Nutrition Examination Survey (NHANES)² and the Behavioral Risk Factor Surveillance System (BRFSS)³ to estimate prevalence of lifestyle risk factors, but these data were collected between 1988 and 1999. Updated estimates are needed to understand the current prevalence of lifestyle risk factors among adults with stroke and to inform current and future research, provision of healthcare services, and local and national policy. Additionally, investigation of lifestyle risk factors by demographic variables and health characteristics may identify gaps in knowledge that need to be examined in greater detail. Therefore, the purpose of this study is to calculate and compare population-based prevalence estimates of five lifestyle risk factors—low fruit and vegetable consumption, physical inactivity, smoking, alcohol consumption, and overweight/obesity—among United States (U.S.) adults with and without stroke using data from the 2015 and 2017 Behavioral Risk Surveillance System (BRFSS).

Methods

BRFSS is an annual, national, telephone-based survey conducted by the Centers for Disease Control and Prevention to examine health behaviors in the U.S. population. Self-reported data from the 2015 and 2017 BRFSS surveys were obtained from community-dwelling adults, aged 18 years from all 50 states, the District of Columbia, Puerto Rico, and Guam. Additionally, data from the US Virgin Islands were available for 2015. Response rates were 48.2% and 45.3% for landlines and 47.2% and 44.5% for cellphones for 2015 and 2017, respectively. Additional information about the 2015 and 2017 BRFSS is available online (<https://www.cdc.gov/brfss/about/index.htm>).

Variables of Interest

The five lifestyle risk factors studied were low fruit and vegetable consumption, does not meet weekly aerobic physical activity (PA) recommendations, current smoker, heavy

drinking, and overweight/obesity. Low fruit and vegetable consumption was defined as consuming <1 fruit and <1 vegetable daily. Does not meet weekly aerobic PA recommendations was defined as accruing <150 minutes of moderate PA weekly, <75 minutes of vigorous PA weekly, or not accruing an equivalent combination of moderate and vigorous PA weekly. Current smoker was defined as currently smoking “daily” or “some days”. Heavy drinking was defined as consuming >14 alcoholic drinks for men or >7 alcoholic drinks for women weekly. Overweight/obesity was defined as having a Body Mass Index (BMI) $\geq 25\text{kg/m}^2$. The BRFSS questions on fruit and vegetable consumption are used to identify at-risk populations and are not meant to assess dietary quality; thus, low fruit and vegetable consumption as used in this study reflects an unhealthy dietary behavior. Selection of all variables was based on their concordance with clinical recommendations found in the American Heart Association’s Guidelines for the Prevention of Stroke in Patients With Stroke and Transient Ischemic Attack.¹ To examine clustering of lifestyle risk factors, we calculated the total number of lifestyle risk factors for each participant by summing the number of individual risk factors and categorizing them into three levels: 0–1, 2–3, and 4–5 lifestyle risk factors.

Demographic variables and health characteristics were also examined. Demographic variables included sex, age, ethnicity, marital status, education, and annual household income (see Table 1 for variable categories). Health characteristics included hypertension, high cholesterol, diabetes, and stroke, which were reported in response to the question, “Has a health professional ever told you that you had _____(condition)?” Disability was an additional health characteristic, and was determined by a positive response to at least one of six BRFSS questions used to determine disability status: deaf or hard of hearing; blind or serious difficulty seeing; difficulty with concentrating, remembering, or concentrating due to a physical, mental, or emotional condition; difficulty walking or climbing stairs; difficulty bathing or dressing; and difficulty doing errands outside of the home due to a physical, mental, or emotional condition. The 2015 BRFSS did not include the question about deaf or hard of hearing, so only five questions were used to determine disability status for 2015 data.

Data Analysis

SAS for Windows, Version 9.4 (SAS Institute, Inc.; Cary, NC) was used to analyze data and account for the complex sampling design. Data were weighted to adjust for survey non-response and selection probability. Prevalence estimates with 95% confidence intervals (CIs) were computed for all variables of interest after age-adjustment to the 2000 U.S. standard population to account for differences in proportions of participants across age categories. When calculating the total number of lifestyle risk factors, only participants who provided data for each lifestyle risk factor were included in the analysis. Logistic regression was conducted to examine odds for individual and total number of lifestyle risk factors for adults with stroke, using adults without stroke as the reference group. Adjusted odds ratios (OR) were also computed, controlling for demographic variables and disability (i.e. sex, age, ethnicity, marital status, education, income, and disability). P-values were not reported because most variables achieved statistical significance due to the large sample size obtained when weighting the data, but significance can be inferred by examining overlap of odds ratio 95% CIs.⁴

Results

Of 891,472 total participants (BRFSS 2015, n=441,456; BRFSS 2017, n=450,016), 888,832 reported their stroke status (stroke=37,225; no stroke=851,607) and were included in the analysis. Demographic variables and health characteristics are presented in Table 1.

Prevalence estimates for age 45–64 and 65+ years, non-Hispanic black, previously married, some high school, and annual household income <\$15,000 and \$15,000 to <\$25,000 were higher in adults with stroke compared to adults without stroke. Estimated prevalence was also higher for hypertension, high cholesterol, diabetes, and disability in adults with stroke.

Age-adjusted prevalence of individual lifestyle risk factors is displayed in Table 2. Low fruit and vegetable consumption, not meeting weekly aerobic PA recommendations, current smoker, and overweight/obesity were higher in adults with stroke. Prevalence of heavy drinking was similar between groups. Logistic regression demonstrated that, compared to adults without stroke, adults with stroke had increased unadjusted odds for low fruit and vegetable consumption (OR: 1.20, CI: 1.14–1.26), not meeting weekly aerobic PA recommendations (OR: 1.51, CI: 1.44–1.59), being a current smoker (OR: 1.56, CI: 1.48, 1.65), and overweight/obesity (OR: 1.37, CI: 1.30–1.44); and lower unadjusted odds for heavy drinking (OR: 0.65, CI: 0.58–0.73) (see Figure 1). However, the relationships for low fruit and vegetable consumption and overweight/obesity were attenuated after adjusting for demographic variables and disability.

When calculating the total number of lifestyle risk factors, only 693,320 participants provided data for all five lifestyle risk factors and were thus included in the analysis (stroke, n=28,296; no stroke, n=665,024). Age-adjusted prevalence of the total number of lifestyle risk factors is displayed in Table 2. Prevalence of 0–1 lifestyle risk factor was lower among adults with stroke compared to adults without stroke, while prevalence of 2–3 and 4–5 lifestyle risk factors was higher. Logistic regression demonstrated that, compared to adults without stroke, adults with stroke had decreased unadjusted odds for 0–1 lifestyle risk factor (OR: 0.63, CI: 0.60–0.66), but increased unadjusted odds for 2–3 lifestyle risk factors (OR: 1.36, CI: 1.29–1.43) and 4–5 lifestyle risk factors (OR: 1.63, CI: 1.48–1.79) (see Figure 1). The relationship for 2–3 lifestyle risk factors was attenuated following adjustment for demographic variables and disability, while the relationships for 0–1 and 4–5 lifestyle risk factors were maintained following adjustment.

Discussion

This study provides nationally representative prevalence estimates of lifestyle risk factors among U.S adults with and without stroke. The prevalence of three lifestyle risk factors (i.e. low fruit and vegetable consumption, not meeting weekly aerobic PA recommendations, and overweight/obesity) and two health characteristics (i.e. hypertension and disability) were present in a majority of adults with stroke, with a third health condition (i.e. high cholesterol) at approximately 50%. Additionally, the prevalences of 2–3 and 4–5 lifestyle risk factors were higher in adults with stroke compared to adults without stroke. These high prevalences indicate that lifestyle risk factors and health conditions co-occur in adults with stroke at a higher proportion than occurs in adults without stroke. Co-occurrence of lifestyle

risk factors is of great concern because a dose-response relationship exists between presence of multiple lifestyle risk factors and poor health⁵ and all-cause mortality.⁶ Furthermore, the co-occurrence of health conditions is also concerning because experiencing multiple chronic conditions simultaneously (i.e. multimorbidity) is associated with poor health, major declines in health, and all-cause mortality.⁷ Taken together, these results suggest that adults with stroke are at great risk for poor and worsening health, and death.

Previous prevalence estimates of lifestyle risk factors among stroke survivors include 2% for consuming <1 fruit *or* vegetable daily and 68% for no regular exercise (i.e. exercising 12 times/month).² These estimates cannot be directly compared with those reported in this study because fruit and vegetable intake and physical activity were defined differently in each study. In this study, an estimated 52% of adults with stroke did not consume at least 1 fruit *and* 1 vegetable daily, which is concerning because data have demonstrated that consuming 3–5 or >5 servings of fruits and vegetables daily can reduce stroke risk by 11% and 26%, respectively.⁸

At a slightly higher prevalence, an estimated 57% of adults with stroke did not meet weekly aerobic PA recommendations of approximately 150 minutes/week of moderate PA. This prevalence of insufficient PA is similar to the 62% reported among adults with disability.⁹ Barriers to physical activity after stroke commonly reported include environmental factors (e.g. accessible design, transportation), problems with health, and stroke-related cognitive and motor impairments.¹⁰ Interventions for individuals and communities along with local and national policies are needed to remove these barriers and increase opportunities for PA after stroke.

Estimated prevalence of overweight/obesity in adults with stroke was 70%. Current clinical guidelines from the American Heart Association recommend screening for obesity but do not offer specific recommendations for weight reduction for the purpose of secondary stroke prevention,¹ even though weight reduction is recommended for primary stroke prevention among overweight adults or those with obesity.¹¹ Nonetheless, many experts suggest that weight loss for adults with stroke and with overweight/obesity should be encouraged because weight loss as low as 3–5% can lead to cardiometabolic improvement.^{12,13} Although stroke survivors are educated to modify lifestyle behaviors to reduce risk for recurrent stroke, many have indicated that such education is poorly timed; it is often provided during inpatient rehabilitation when patients are struggling to adjust to stroke-related impairments and not focused on secondary prevention.¹⁴ Such education could occur at a later time when individuals are better-prepared to comprehend and act on the information. For example, referral to community-based interventions, such as the Diabetes Prevention Program that aims for 7% weight loss through dietary and physical activity modifications,¹⁵ may be appropriate for addressing low fruit and vegetable consumption, low PA, and overweight/obesity in adults with stroke and should be explored.

Estimated prevalence of current smoking was 30% in adults with stroke—nearly twice as high as adults without stroke. Smoking can acutely increase heart rate, blood pressure and arterial stiffness, which is particularly problematic for stroke survivors with hypertension.¹⁶ For this reason, clinical guidelines recommend smoking cessation for current smokers.¹

Little is known about how stroke survivors modify their smoking behavior after stroke. Two studies indicated that 8–20% of former smokers quit,^{17,18} which suggests that further research and intervention is warranted. Odds for heavy drinking was lower in adults with stroke compared to those without stroke despite a similar prevalence between groups (i.e. 5%). High alcohol consumption is associated with increased risk for hypertension and diabetes, which increases risk for recurrent stroke and secondary conditions.¹⁶ The American Heart Association recommends that adults with stroke who are heavy drinkers should eliminate or reduce their alcohol consumption, and counsels that nondrinkers should not be counseled to begin drinking.¹

The results presented here suggest multiple avenues for further exploration that were beyond the scope of investigation in this brief report. Differences in demographic variables between groups and the attenuation of some lifestyle risk factor ORs after adjustment suggest that demographic variables moderate lifestyle risk factor prevalence, and should be investigated in greater detail. Similarly, the potential moderating roles of disability specifically and multimorbidity generally should be examined to enhance our limited understanding of lifestyle risk factors among adults with stroke. Finally, all lifestyle risk factor variables were dichotomous variables in this study, but each exists along a continuum in the real-world. Investigations of lifestyle risk factors in other populations demonstrate differential benefits or harms at different levels of many health behaviors (e.g. >5 vs. <5 servings of fruit and vegetables⁸; light- vs. moderate-intensity physical activity¹⁹; current smoker vs. prior smoker vs. never smoker²⁰; heavy vs. moderate vs. no alcohol consumption¹; obese vs. overweight vs. normal weight²¹). Such variation in benefits and harms may also exist among adults with stroke for lifestyle risk factors and should be explored.

As with any survey-based investigation, several considerations limit generalizability of study findings. First, data were from community-dwelling adults who were able to participate in the BRFSS phone-based survey; thus, data may not be representative of individuals who are institutionalized (e.g. skilled nursing, assisted living) or who experience functional limitations that would limit one's ability to participate in such a survey. Second, data on stroke-specific characteristics (e.g. hemiparesis, neglect, cognitive impairment, etc.) are not collected by BRFSS, and therefore the potential moderating effect of these characteristics on lifestyle risk factors could not be examined. Third, data were cross-sectional and obtained via self-report; objective measurement and longitudinal data collection is needed to examine trends in lifestyle risk factors in adults with stroke over time. Despite these limitations, the major strength of the study is that data were obtained from a sufficiently large, national sample of U.S. adults with and without stroke to generate reliable estimates of lifestyle risk factors within the national population.

Conclusion

Lifestyle risk factors increase risk for chronic disease, disability, and death. Prevalence estimates and odds ratios for not meeting weekly aerobic PA recommendations, smoking, and reporting 4–5 lifestyle risk behaviors were higher in adults with stroke than adults with stroke. Additionally, multiple lifestyle risk factors and multimorbidity (e.g. hypertension and disability) co-occurred among many adults with stroke, which further increases risk for poor

health and death. The presence of modifiable health behaviors in adults with stroke indicates that additional research, healthcare intervention, and social policy are needed to modify lifestyle risk factors in adults with stroke at individual and community levels, which could be further enhanced by a better understanding of the moderating role of demographic variables and health characteristics on lifestyle behaviors.

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Figure 1.

Crude (filled box) and adjusted (open circle) odds ratios for individual and total number of lifestyle risk factors. Adults without stroke was the reference group (i.e. odds ratio = 1).

Adjusted odds ratios control for sex, age, ethnicity, marital status, education, annual household income, and disability.

Table 1.

Age-adjusted prevalence of demographic variables and health characteristics among U.S. adults by stroke status (stroke: n=37,225; no stroke: n=851,607).

Characteristic	Number of Participants *	Total % (95% CI) **	Stroke % (95% CI) **	No Stroke % (95% CI) **
Sex				
Male	384,434	48.9 (48.7, 49.1)	48.0 (45.4, 50.7)	48.9 (48.6, 49.1)
Female	504,123	51.1 (50.9, 51.3)	52.0 (49.3, 54.6)	51.1 (50.9, 51.4)
Age, years				
18–24	50,376	12.7 (12.5, 12.8)	1.5 (1.1, 2.0)	13.0 (12.9, 13.2)
25–44	192,546	33.7 (33.5, 33.9)	10.8 (10.0, 11.6)	34.4 (34.2, 34.7)
45–64	336,039	33.6 (33.4, 33.8)	38.8 (37.7, 39.9)	33.4 (33.2, 33.6)
65+	309,871	20.0 (19.9, 20.2)	48.9 (47.8, 49.9)	19.1 (18.9, 19.2)
Ethnicity				
Non-Hispanic White	671,395	62.0 (61.8, 62.2)	59.2 (56.9, 61.6)	62.1 (61.9, 62.3)
Non-Hispanic Black	69,943	11.9 (11.8, 12.1)	18.16 (16.3, 20.1)	11.7 (11.6, 11.9)
Hispanic	72,634	17.6 (17.4, 17.8)	14.4 (12.6, 16.3)	17.6 (17.4, 17.8)
Other	58,854	8.5 (8.4, 8.7)	8.2 (7.0, 9.4)	8.5 (8.4, 8.7)
Marital Status				
Married or Un-married Couple	492,208	55.3 (55.1, 55.5)	44.2 (41.6, 46.8)	55.7 (55.4, 55.9)
Previously Married	249,255	19.0 (18.9, 19.2)	30.6 (29.1, 32.2)	18.7 (18.5, 18.3)
Never Married	141,253	25.7 (25.5, 25.9)	25.1 (22.8, 27.5)	25.7 (25.5, 25.8)
Education				
Some High School	66,538	13.9 (13.7, 14.1)	24.7 (22.0, 27.4)	13.6 (13.4, 13.8)
Graduated High School	245,032	27.9 (27.7, 28.1)	29.3 (27.5, 31.1)	27.8 (27.6, 28.0)
Some College	244,482	31.0 (30.8, 31.3)	32.3 (29.7, 34.9)	31.0 (30.8, 31.3)
Graduated College	329,360	27.2 (27.0, 27.4)	13.7 (12.5, 14.9)	27.6 (27.4, 27.8)
Annual Household Income, \$				
<15,000	75,257	11.3 (11.2, 11.5)	27.9 (24.8, 31.0)	11.0 (10.8, 11.2)
15,000 to <25,000	120,721	17.1 (16.9, 17.3)	25.5 (23.4, 27.6)	16.8 (16.6, 17.0)
25,000 to <35,000	78,754	10.5 (10.3, 10.6)	12.4 (10.7, 14.1)	10.4 (10.3, 10.6)
35,000 to <50,000	104,989	13.4 (13.2, 13.6)	10.5 (9.2, 11.7)	13.5 (13.3, 13.7)
50,000	355,407	47.7 (47.4, 47.9)	23.7 (21.4, 26.1)	48.3 (48.0, 48.5)
Hypertension	357,777	30.0 (29.8, 30.2)	58.0 (55.2, 60.7)	29.3 (29.1, 29.4)
High Cholesterol	315,436	30.5 (30.2, 30.7)	47.2 (44.8, 49.6)	30.0 (29.8, 30.2)
Diabetes	117,152	9.7 (9.6, 9.8)	22.6 (20.9, 24.3)	9.3 (9.2, 9.4)
Disability	238,066	23.6 (23.4, 23.7)	63.3 (60.6, 66.1)	22.5 (22.3, 22.7)

* Unweighted number of participants. For demographic variables, categories may not sum to survey total because some participants did not respond to all survey questions. For health characteristics, the number of participants with the specific characteristic is reported.

** Weighted estimates. Percentages may not sum to 100% because some participants did not respond to all survey questions.

Abbreviation: CI, Confidence Interval.

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Table 2.

Age-adjusted prevalence of individual and total number of lifestyle risk factors among U.S. adults by stroke status (stroke: n=37,225; no stroke: n=851,607).

Lifestyle Risk Factor	Number of Participants *	Total, % (95% CI) **	Stroke, % (95% CI) **	No Stroke, % (95% CI) **
Low Fruit and Vegetable Consumption	335,989	46.2 (45.9, 46.4)	51.7 (48.9, 54.5)	46.0 (45.7, 46.2)
Does Not Meet Weekly Aerobic PA Recommendations	375,744	49.8 (49.6, 50.1)	56.5 (53.9, 59.1)	49.5 (49.3, 49.8)
Current Smoker	124,526	16.9 (16.8, 17.1)	30.1 (27.5, 32.7)	16.6 (16.5, 16.8)
Heavy Drinking	46,415	6.1 (6.0, 6.2)	5.4 (4.3, 6.5)	6.1 (6.0, 6.2)
Overweight/Obesity	543,229	64.6 (64.4, 64.8)	70.2 (67.6, 72.8)	64.5 (64.3, 64.7)
Number of Lifestyle Risk Factors ***				
0–1	287,258	39.3 (39.0, 39.5)	28.6 (25.9, 31.3)	39.6 (39.3, 39.9)
2–3	373,638	55.3 (55.1, 55.6)	62.5 (59.6, 65.4)	55.1 (54.9, 55.4)
4–5	32,424	5.4 (5.3, 5.5)	9.0 (7.8, 10.1)	5.3 (5.1, 5.4)

* Unweighted number of participants. The number of participants who reported each individual and total number of lifestyle risk factors is displayed.

** Weighted estimates.

*** Only participants who provided data for all 5 lifestyle risk factors were included in the analysis (total, n=693,320; stroke, n=28,296; no stroke, n=665,024).

Abbreviations: CI, Confidence Interval; PA, Physical Activity.