

# Health Behaviors among Stroke Survivors in the United States: A Propensity Score-Matched Study

Haytham Wali, PharmD,\* Sawsan Kurdi, PharmD,\* Jawad Bilal, MD,†  
Irbaz Bin Riaz, MD, MSCE,† and Sandipan Bhattacharjee, BPharm, MS, PhD\*

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*Goal:* The American Heart Association/American Stroke Association has specific recommendations for secondary stroke prevention. The aim of this study was to compare health behaviors engagement between stroke survivors and propensity score-matched controls. *Methods:* We conducted a retrospective, cross-sectional, matched case-control study using data from the 2015 Behavioral Risk Factor Surveillance System (BRFSS) survey. We included older adults aged 50 or older who participated in the 2015 BRFSS survey and completed the interview. Each case was matched to 3 controls (1:3) based on propensity scores to increase the power of the analyses. Stroke survivors were compared with controls on their physical activity, smoking, alcohol use, body mass index (BMI), last flu immunization, last physical checkup, last blood cholesterol check, heavy drinking, and vegetable and fruit consumption. We used binomial logistic regression to assess health behaviors among stroke survivors compared with controls. *Results:* The final study sample consisted of 13,249 stroke survivors and 39,747 controls without stroke after propensity score matching. Multivariable analyses revealed that there were significant differences between stroke survivors and matched controls in terms of BMI, physical activity, smoking status, alcohol consumption, and vegetable and fruit consumption. For example, stroke survivors were 51% more likely to be smokers (adjusted odds ratio [AOR] 1.51, 95% confidence interval [CI], 1.32-1.73) and 14% less likely to consume alcohol (AOR .86, 95% CI .78-.95). *Conclusion:* Findings from our study indicate that compared with propensity score-matched controls, stroke survivors engage in poorer health behaviors with the exception of alcohol consumption. **Key Words:** Stroke—health behavior—propensity score matching—older adults—American Heart Association/American Stroke Association guidelines.

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From the \*Department of Pharmacy Practice and Science, College of Pharmacy; and †Department of Internal Medicine, College of Medicine, The University of Arizona, Tucson, Arizona. Received December 20, 2017; revision received March 7, 2018; accepted March 13, 2018.

Conference presentation: The authors have submitted an Abstract (currently under review) from this research for presentation at the International Society for Pharmacoeconomics and Outcomes Research 23rd Annual International Meeting (May 19-23, 2018; Baltimore, MD). Address correspondence to Sandipan Bhattacharjee, BPharm, MS, PhD, Department of Pharmacy Practice and Science, The University of Arizona School of Pharmacy, 1295 North Martin Avenue, Tucson, AZ 85721. E-mail: [bhattacharjee@pharmacy.arizona.edu](mailto:bhattacharjee@pharmacy.arizona.edu).

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## Introduction

The American Heart Association/American Stroke Association (AHA/ASA) has published guidelines for the secondary prevention of stroke<sup>1</sup> including transient ischemic attack.<sup>2</sup> These guidelines promote health behaviors such as lowering consumption of cigarettes and alcohol, improving nutrition, and increasing physical activity. Recommendations of these guidelines are intended to improve the stroke morbidity and mortality among stroke survivors by controlling those risk factors and implementing health behaviors.<sup>1,2</sup>

The data on health behaviors in stroke survivors are limited. Nevertheless, existing studies have shown that stroke survivors tend to engage in fewer health behaviors.<sup>3,4</sup> A study conducted by Ellis et al using the 2006 Behavioral Risk Factor Surveillance System (BRFSS) survey specifically examined the effect of co-occurring major depression on health behaviors among stroke survivors and observed that major depression is associated with poorer health behaviors.<sup>3</sup> In a prospective, multiple-case study design conducted among 9 participants after their stroke or transient ischemic attack in the Stroke Prevention Clinic at the Montreal General Hospital of the McGill University Health Centre, researchers found that individuals making external causal attributions (such as fate and stress) showed poorer health behaviors.<sup>4</sup> However, these studies are limited by geographical locations,<sup>4</sup> small sample size,<sup>4</sup> old data (approximately a decade old),<sup>3</sup> and assessment of influence of a single (depression) comorbid condition<sup>3</sup> on health behaviors of stroke survivors. Hence, it is critical to understand the current state of health behaviors among stroke survivors. Therefore, the aim of this study was to examine the health behaviors among stroke survivors compared with matched controls using a robust study design utilizing the most recent (2015) nationally representative BRFSS data.

## Method

### *Study Design*

We adopted a retrospective, cross-sectional, matched case-control study design.

### *Data Source*

We used the publicly available 2015 BRFSS data. The BRFSS is a nationwide system of health-related telephone surveys that collect state data from U.S. residents regarding their health-related risk behaviors, chronic health conditions, use of preventive services, self-perceived health status, access to health services, and sociodemographic and environmental factors. It was established in 1984 in only 15 states, but now collects data in all 50 states, as well as the District of Columbia

and 3 U.S. territories: Puerto Rico, the U.S. Virgin Islands, and Guam.<sup>5</sup> Close to 500,000 interviews are performed annually, making the survey the largest health survey system in the world.

### *Study Sample*

A total of 441,456 interviews were included in the 2015 BRFSS data. In our study sample, we included older adults aged 50 or older who participated in the 2015 BRFSS survey and completed the interview. The Human Subjects Protection Program Institutional Review Board of The University of Arizona approved this study and determined that human subjects review is not required.

We identified stroke survivors if they responded "yes" to the question: "Has a doctor, nurse, or other health professional ever told you that you had stroke?" Existing studies have used similar definitions to identify stroke survivors from the BRFSS data.<sup>3,6</sup> The 2015 BRFSS data consisted of 18,269 participants who indicated that they had a stroke; among whom, 13,432 met our study inclusion criteria. In terms of controls without stroke, a total of 231,320 participants met our study inclusion criteria. We generated propensity scores based on age, gender, race/ethnicity, and presence of co-occurring chronic conditions (cancer, arthritis, asthma, cardiovascular disease, diabetes, hypertension, and depression). These factors were used as they are associated with either higher risk of stroke or adverse effects on health behavior. Each stroke survivor was matched to 3 controls without stroke using greedy matching algorithm with 8- to 1-digit matching. According to this algorithm, a stroke survivor is first matched to a control without stroke on the first 8 digits of the propensity score; if exact match is not found, it is matched to 7 digits and so on.

## Variables Measure

### *Dependent Variables*

The dependent variables of this study included the following AHA/ASA-supported recommended health behaviors: (1) flu shot during the past 12 months (yes/no); (2) last routine physical checkup (<2 years/>2 years); (3) last blood cholesterol check (<2 years/>2 years); (4) BMI (normal weight or underweight/overweight or obese); (5) physical activity (<150 minutes/>150 minutes of moderate to vigorous physical activity per week); (6) smoking status (current smoker/not current smoker); (7) alcohol consumption (yes/no to drinking any alcoholic beverage in the past 30 days); (8) heavy drinker (yes/no defined as adult men having >14 drinks per week and adult women having >7 drinks per week); (9) vegetable consumption (yes/no defined as consuming vegetables  $\geq 1$  times per day or <1 time per day); and (10) fruit con-

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