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BRIEF REPORT

Differences in health characteristics and health behaviors between rural and non-rural community-dwelling stroke survivors aged ≥65 years in the USA

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Abstract

Objectives: To examine differences in health characteristics and health behaviors between rural and non-rural stroke survivors in the USA.

Methods: Data were extracted from the 2017 and 2019 Behavioral Risk Factor Surveillance System (BRFSS) to compare prevalences of health characteristics (i.e., diabetes, disability, poor health, high cholesterol, hypertension, no health care coverage, weight status) and health behaviors (i.e., fruit consumption, vegetable consumption, physical inactivity, high alcohol consumption, smoking) among community-dwelling stroke survivors, stratified by rural status (i.e., rural vs. non-rural). Logistic regression was used to calculate odds ratios (ORs) for health characteristics and health behaviors to examine the association of rural status with each variable of interest (reference group=non-rural).

Results: Data from 14,599 respondents (rural: $n = 5{,}039$; non-rural: $n = 9{,}560$) were available for analysis. The majority of respondents were female (61.4%), non-Hispanic white (83.2%), previously married (56.1%), had at least some college education (55.2%), and had an annual household income ≥USD $25,000 (56.9%). Prevalences of disability, poor health, weekly aerobic exercise, and smoking were higher among rural respondents compared to non-rural respondents. Logistic regression showed increased odds (odds ratio range: 1.1–1.2) for these variables among rural respondents; however, odds ratios were attenuated after controlling for sociodemographic and health characteristics.

Conclusions: We did not find evidence of differences in the investigated health characteristics and health behaviors between rural and non-rural community-dwelling stroke survivors in the USA. Additional research is needed to confirm these findings and to identify alternative sociodemographic and health factors that may differ between rural and non-rural community-dwelling stroke survivors.

Keywords: cardiometabolic risk factors; health behavior; rural health; social determinants of health; stroke

Introduction

Stroke is the second-leading cause of death and the third-leading cause of death and disability combined globally (Feigin et al., 2021), and disproportionally affects adults ≥65 years of age (Feigin et al., 2021; Virani et al., 2020). Differences in cardiovascular risk factors exist between rural and urban areas globally (Howard, 2021; Li et al., 2019; Nakibuuka et al., 2015; Sridharan et al., 2009), which has prompted the American Heart Association to prioritize programs, research, and policy to eliminate health disparities between urban and rural areas (Harrington et al., 2020). Systematic reviews have reported higher rates of diabetes, obesity, hypertension, and tobacco use in rural areas compared

to urban areas (Harrington et al., 2020; Howard, 2021); and observational studies have found higher prevalences of heart disease, heavy alcohol consumption, inadequate fruit and vegetable consumption, and lower likelihood of access to health insurance in rural areas (Howard et al., 2017; Kapral et al., 2019). These health characteristics and health behaviors contribute to increased stroke risk, and indeed rates of incident stroke are higher in rural areas compared to urban areas (Howard, 2021).

Less attention has been paid to rural–urban differences in recurrent stroke risk. Approximately 23% of annual strokes in the USA are recurrent events (Virani et al., 2020), and recurrent stroke doubles the likelihood of 30-day mortality and new disability compared to incident stroke (Hardie et al., 2004). Many health characteristics and health behaviors underlying stroke risk factors are more prevalent among stroke survivors compared to adults without history of stroke; such characteristics and behaviors include hypertension, high cholesterol, diabetes, disability, physical inactivity, and smoking (Bailey et al., 2019). Secondary stroke prevention, therefore, is of paramount importance for stroke survivors, yet few well-designed research studies have examined rural–urban differences in health characteristics and health behaviors among community-dwelling stroke survivors. Therefore, the purpose of this study was to examine differences in health characteristics and health behaviors between rural and non-rural stroke survivors living in the USA using data from the 2017 and 2019 Behavioral Risk Surveillance System (BRFSS).

Methods

BRFSS is a national, telephone-based survey conducted annually and coordinated by the Centers for Disease Control and Prevention that examines health characteristics and health behaviors among U.S. adults. BRFSS data are collected from non-institutionalized adults, aged ≥18 years from all 50 states, the District of Columbia, Puerto Rico, and Guam using random telephone number dialing. Additional information about the BRFSS is available online (https://www.cdc.gov/brfss/about/index.htm).

For this study, cross-sectional data from the 2017 and 2019 BRFSS surveys were extracted for respondents with a history of stroke aged ≥65 years for whom rural status could be determined. The 2018 BRFSS survey did not collect data on health behaviors relevant to this study (i.e., fruit and vegetable consumption and physical activity), and therefore could not be used. The age criterion was selected because stroke was two times more common among respondents aged ≥65 years (vs. <65 years) and because rural status was not collected for >75% of respondents aged <65 years. History of stroke was determined by a positive response to the BRFSS question, 'Has a health professional ever told you that you had a stroke?' For rural status, the 4-level BRFSS variable 'Metropolitan Status Code' was used, which is based on the Metropolitan Statistical Area (MSA) taxonomy used by the Census Bureau (Hart et al., 2005). Rural was defined as not dwelling in an MSA. Non-rural was defined as dwelling in the center city of a MSA, outside the center city of a MSA but inside the county containing the center city, or inside a suburban county of an MSA.

Variables of interest

Variables of interest included sociodemographic characteristics, health characteristics and health behaviors. Sociodemographic characteristics included sex, race/ethnicity, marital status, education, and annual household income (see Table 1 for variable categories).

Health characteristics included diabetes, disability, poor health, high cholesterol, hypertension, no health care coverage, and weight status. Diabetes, high cholesterol, and hypertension were determined by a positive response to the BRFSS question, 'Has a health professional ever told you that you have _____(condition)?' Disability was determined by a positive response to any of the six BRFSS disability status questions (i.e., disability in hearing, seeing, cognition, mobility, self-care, or independent living). Poor health was determined by a response of 'fair' or 'poor' to the BRFSS question, 'Would you say that in general your health is _____?' No health care coverage

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Table 1. Prevalence of Sociodemographic Characteristics among 14,599 Stroke Respondents (Rural: $n = 5{,}039$; Non-rural: $n = 9{,}560$), Behavioral Risk Factor Surveillance System, 2017 & 2019

Characteristics†	Total % (95% CI)	Rural % (95% CI)	Non-Rural % (95% CI)
Sex			
Male	38.6 (37.8–39.3)	38.4 (37.1–39.8)	38.6 (37.6–39.6)
Female	61.4 (60.7–62.2)	61.6 (60.2–62.9)	61.4 (60.4–62.4)
Race/Ethnicity			
Non-Hispanic White	83.2 (82.6–83.7)	87.0 (86.1–87.9)	81.2 (80.4–81.9)
Non-Hispanic Black	9.6 (9.1–10.0)	5.6 (5.1–6.3)	11.6 (11.0–12.2)
Hispanic	2.1 (1.8–2.3)	1.2 (0.9–1.5)	2.5 (2.2–2.8)
Other	5.2 (4.9–5.5)	6.1 (5.5–6.7)	4.7 (4.3–5.1)
Marital Status			
Married or Un-married Couple	38.7 (37.9–39.5)	39.2 (37.9–40.6)	38.5 (37.5–39.5)
Previously Married	56.1 (55.3–56.9)	56.4 (55.0–57.8)	56.0 (55.0–57.0)
Never Married	5.1 (4.8–5.5)	4.4 (3.8–4.9)	5.6 (5.1–6.0)
Education			
Some High School	11.3 (10.8–11.8)	13.6 (12.7–14.6)	10.1 (9.5–10.7)
Graduated High School	33.5 (32.7-34.2)	37.2 (35.9–38.5)	31.5 (30.6–32.4)
Some College	28.4 (27.7–29.1)	27.7 (26.4–28.9)	28.8 (27.9–29.7)
Graduated College	26.8 (26.1–27.5)	21.5 (20.4–22.6)	29.7 (28.8–30.6)
Annual Household Income, $USD			
<15,000	15.5 (14.8–16.2)	19.7 (18.5–20.9)	13.2 (12.5–14.0)
15,000 to <25,000	27.5 (26.7–28.4)	29.9 (28.4–31.3)	26.3 (25.3–27.3)
25,000 to <35,000	15.1 (14.5–15.8)	15.3 (14.2–16.4)	15.1 (14.2–15.9)
35,000 to <50,000	15.3 (14.7–16.0)	15.2 (14.1–16.3)	15.4 (14.6–16.2)
≥50,000	26.5 (25.7–27.3)	19.9 (18.7–21.2)	30.0 (29.0–31.1)

Abbreviation: CI, Confidence Interval.
†Categories may not sum to survey total because some participants did not respond to all survey questions. Number of participants with missing data: sex ($n = 4$), race ($n = 318$), marital status ($n = 68$), education ($n = 60$), annual household income ($n = 3{,}384$).

was determined by a negative response to the BRFSS question, 'Do you have any kind of healthcare coverage?' Weight status is a four-level categorical variable defined by Body Mass Index (BMI), which was calculated from self-reported height and weight: Underweight (<18.5 kg/m^2), Normal Weight (18.5 to <25 kg/m^2), Overweight (25 to <30 kg/m^2), and Obesity (≥30 kg/m^2).

Health behaviors included the following BRFSS variables: consuming <1 fruit daily, consuming <1 vegetable daily, performing <150 min of weekly moderate-to-vigorous physical activity (MVPA), high alcohol consumption (>14 drinks/week for men and >7 drinks/week for women), and current smoker. These variables were selected because of their association with stroke recurrence and are consistent with American Heart Association guidelines (Billinger et al., 2014; Kleindorfer et al., 2021) that recommend high intakes of fruits and vegetables, performing regular MVPA (i.e., 150 min/week of MVPA) consistent with Physical Activity Guidelines for Americans (U.S. Department of Health & Human Services, 2018), consuming alcoholic beverages ≤14 times/week for men and ≤7 times/week for women, and smoking cessation.

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Data analysis

SAS 9.4 (SAS Institute; Cary, NC; www.sas.com) software was used to perform all analyses. PROC SURVEYREG and PROC SURVEYFREQ commands were used to account for complex survey sample design, stratification, and clustering since data were collected nationally. Linear regression was used to calculate prevalence estimates and 95% confidence intervals (CIs) for all variables of interest. Logistic regression was used to calculate odds ratios (ORs) and 95% CIs for health characteristics and health behaviors to examine the association of rural status with each variable of interest (reference group = non-rural). Sequential, block-wise selection was used to enter sociodemographic characteristics, followed by health characteristics, followed by health behaviors in the regression model. This selection was chosen based on the relationship of sociodemographic factors with health characteristics (i.e., many sociodemographic characteristics are physiological and social determinants of health) and some health characteristics may influence health behaviors (e.g., physical disability may result in decreased physical activity, diabetes may result in decreased fruit consumption behavior). Thus, adjusted odds ratios (AORs) for health characteristics were adjusted for sociodemographic characteristics, and AORs for health behaviors were adjusted for both sociodemographic and health characteristics. Statistically significant differences can be inferred by examining OR 95% CIs. Lastly, we performed an additional analysis using the same statistical procedures as above to compare differences in all study variables between respondents with vs. without missing data for rural status to examine representativeness of the included sample.

Ethics approval

This study was exempt from Institutional Review Board approval because de-identified BRFSS data does meet the requirements for human studies research as defined by the US Department of Health and Human Services.

Results

Of the 887,452 respondents in the 2017 and 2019 BRFSS surveys, 14,599 respondents met inclusion criteria and were included in the analytical sample for the main analysis. Excluded respondents included individuals <65 years of age ($n = 559{,}343$) and no history of stroke ($n = 830{,}583$). This resulted in 23,245 respondents aged ≥65 years with a history of stroke; 8,646 respondents were excluded from the main analysis due to missing data for rural status but were included in the additional analysis that examined the representativeness of the included sample. Approximately one-third of respondents were rural and two-thirds were non-rural. Prevalence estimates of sociodemographic characteristics are displayed in Table 1. Rural respondents were more likely to report non-Hispanic White and other race/ethnicity, less education (i.e., some high school and graduated high school), and lower annual household income (i.e., <$25,000) compared to non-rural respondents.

Prevalence estimates of health characteristics and health behaviors are displayed in Table 2. Prevalence estimates were similar for all variables of interest, except disability, poor health, <150 min/week of MVPA, and current smoker, which were higher among rural respondents compared to non-rural respondents.

Crude and adjusted OR estimates are also displayed in Table 2. Consistent with the higher prevalence estimates noted previously, crude ORs also showed higher odds of disability (OR: 1.2; 95% CI: 1.1–1.2), poor health (OR: 1.2; 95% CI: 1.1–1.3), <150 min/week of MVPA (OR: 1.1; 95% CI: 1.1–1.2), and current smoker (OR: 1.2; 95% CI: 1.1–1.3) among rural respondents. However, following adjustment of sociodemographic characteristics for disability and poor health, and adjustment of sociodemographic and health characteristics for <150 min/week of MVPA and

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Table 2. Prevalence and Odds Ratios for Health Characteristics and Health Behaviors among 14,599 Stroke Respondents (Rural: $n = 5{,}039$; Non-rural: $n = 9{,}560$), Behavioral Risk Factor Surveillance System, 2017 & 2019

Variable[†]	Total % (95% CI)	Rural % (95% CI)	Non-Rural % (95% CI)	Crude OR[¶] OR (95% CI)	AOR[¶§] OR (95% CI)
Health Characteristics					
Diabetes	31.7 (31.0–32.5)	31.5 (30.3-32.8)	31.8 (30.9–32.7)	1.0 (0.9–1.1)	1.0 (0.9–1.0)
Disability	67.0 (66.3–67.8)	69.1 (67.8-70.4)	66.0 (65.0–67.0)	1.2 (1.1–1.2)	1.0 (0.9–1.1)
Poor Health	45.2 (44.4–46.0)	48.3 (46.9-49.6)	43.6 (42.6–44.6)	1.2 (1.1–1.3)	1.1 (1.0–1.2)
High Cholesterol	61.4 (60.6–62.2)	61.3 (60.0–62.7)	61.4 (60.4–62.4)	1.0 (0.9–1.1)	1.0 (0.9–1.1)
Hypertension	76.9 (76.2–77.6)	76.9 (75.7–78.1)	76.9 (76.1–77.7)	1.0 (0.9–1.1)	1.0 (0.9–1.1)
No Health Care Coverage	1.8 (1.6–2.0)	2.1 (1.7–2.5)	1.7 (1.4–1.9)	1.3 (1.0–1.6)	1.1 (0.8–1.5)
Weight Status					
Underweight	2.3 (2.1–2.6)	2.3 (1.9–2.7)	2.4 (2.1–2.7)	1.0 (0.8–1.2)	0.8 (0.6–1.1)
Normal Weight	30.5 (29.7–31.2)	30.2 (28.9–31.5)	30.6 (29.7–31.6)	1.0 (0.9–1.1)	1.0 (0.9–1.1)
Overweight	36.0 (35.2–36.8)	35.6 (34.3–37.0)	36.2 (35.2–37.2)	1.0 (0.9–1.1)	1.0 (0.9–1.0)
Obesity	31.2 (30.4–32.0)	31.9 (30.6–33.2)	30.8 (29.9–31.8)	1.1 (1.0–1.1)	1.0 (1.0–1.1)
Health Behaviors					
<1 Fruit/Day	32.8 (32.0–33.6)	34.4 (33.0–35.8)	32.0 (31.0–33.0)	1.1 (1.0–1.2)	1.0 (1.0–1.2)
<1 Vegetable/Day	19.9 (19.2–20.6)	19.8 (18.6–21.0)	20.0 (19.2–20.9)	1.0 (0.9–1.1)	0.9 (0.8–1.0)
<150 min of Weekly MVPA	57.5 (56.6–58.3)	59.2 (57.8–60.6)	56.6 (55.5–57.6)	1.1 (1.1–1.2)	1.0 (0.9–1.1)
High Alcohol Consumption	2.6 (2.3–2.8)	2.3 (1.9–2.7)	2.7 (2.4–3.0)	0.8 (0.7–1.0)	0.9 (0.7–1.2)
Current Smoker	10.6 (10.1–11.1)	11.7 (10.8–12.6)	10.0 (9.4–10.6)	1.2 (1.1–1.3)	1.1 (1.0–1.3)

Abbreviations: AOR, adjusted odds ratio; CI, confidence interval; MVPA, moderate-to-vigorous physical activity; OR, odds ratio.
[†]Number of participants with missing data for each variable: diabetes ($n = 32$), disability ($n = 481$), general health ($n = 72$), high cholesterol ($n = 465$), hypertension ($n = 70$), no health care coverage ($n = 55$), weight status ($n = 842$), <1 fruit/day ($n = 1{,}474$), <1vegetable/day ($n = 2{,}001$), <150 min MVPA ($n = 1{,}534$), high alcohol consumption ($n = 505$), smoking ($n = 744$).
[¶]Reference group = non-rural.
[§]AORs for health characteristics were adjusted for demographic characteristics; AORs for health behaviors were adjusted for demographic and health characteristics.

current smoker, ORs were attenuated such that odds were no longer elevated for rural stroke survivors.

Our additional analysis comparing study variables between respondents with vs. without missing data for rural status indicates that respondents with missing data were more likely to be male, report Hispanic or other race/ethnicity, and have less education (Supplemental Table 1). Regarding health behaviors and characteristics, crude odds ratios indicated that respondents with missing data were more likely to report presence of diabetes, high alcohol consumption, and current smoker, and less likely to report normal body weight (Supplemental Table 2). However, following adjustment for sociodemographic characteristics and health characteristics, only odds ratios for high alcohol consumption and current smoker remained elevated. Thus, for most health behavior and characteristics, the included sample was representative of respondents with missing data; however, the sample lacked representation with respect to sex, race/ethnicity, education, alcohol consumption, and smoking.

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Discussion

This study examined prevalences of health characteristics and health behaviors among community-dwelling stroke survivors in the USA, stratified by rural status. Results demonstrated differences in prevalences of race/ethnicity, education, and annual household income between rural and non-rural stroke survivors, which are consistent with differences observed among individuals without history of stroke (Harrington et al., 2020; Howard, 2021). Results also demonstrated higher prevalences of disability, poor health, insufficient physical activity, and smoking among rural stroke survivors; however, after adjustment for potential confounders (e.g., sociodemographic and health characteristics), the higher odds associated with these factors were attenuated. Overall, the study results suggest no association of rural status with the investigated health characteristics and health behaviors among community-dwelling stroke survivors in the USA.

To the investigators' knowledge, only one other study has examined prevalences of stroke risk factors among community-dwelling stroke survivors stratified by rural status. Kapral et al. (2019) reported lower prevalences of hypertension and diabetes, a higher prevalence of inadequate fruit and vegetable intake, and fewer annual visits to healthcare providers compared to urban stroke survivors. In contrast, this study found no differences in prevalence of hypertension, diabetes, fruit consumption, and vegetable consumption between rural and non-rural stroke survivors. An important finding of Kapral et al., however, was a higher incidence of recurrent stroke among rural stroke survivors, which persisted after controlling for sociodemographic and cardiometabolic risk factors. These results suggest that other health-related factors specific to rural areas may contribute to increased recurrent stroke risk, and further research is needed to identify and address such factors.

A different study conducted in China estimated prevalences of stroke factors among rural and non-rural community-dwelling stroke survivors, but did not directly compare prevalences between the two groups. Li et al. (2019) reported higher prevalences of low education, low income, and physical inactivity, and lower prevalences of smoking, high alcohol intake, diabetes, and overweight/obesity when comparing rural and urban stroke survivors. Since statistical analysis were not performed, however, no assertion regarding the association of rural status with stroke risk factors can be made based on their findings. Another important consideration regarding the Li et al., study is the generalizability of findings to non-Hispanic, non-Asian individuals.

Although not measured in this study nor in the studies by Kapral et al., and Li et al., the quality of stroke care and stroke outcomes following incident stroke may be relevant to recurrent stroke risk. Studies across the USA, Canada, and Australia provide evidence that rural stroke patients have less access to stroke care, including not receiving care in a stroke unit, not receiving thrombolysis, having shorter lengths of stay, and experiencing differences in rehabilitation services (e.g., occupational, physical, and speech therapy) (Dwyer et al., 2019; Koifman et al., 2016). Furthermore, rural stroke patients also have poorer stroke outcomes, including a higher likelihood of experiencing a severe complication during one's hospital stay and a higher likelihood of functional dependence following hospital discharge (Dwyer et al., 2019; Koifman et al., 2016). Poorer care and outcomes predispose patients to increased mortality, morbidity, and disability, and may increase risk for stroke recurrence.

Regarding the use of self-report data, there is always the concern for response bias. Historically, BRFSS prevalence rates are comparable to other national self-report surveys (e.g., National Health Interview Study, National Health and Nutrition Examination Survey) that investigate physical activity, chronic conditions (e.g., diabetes, cardiovascular disease), and health (e.g., obesity, access to healthcare, general health); and self-report estimates are moderately reliable when compared to available objective measures (e.g., clinic-based BMI calculation, accelerometry-based physical activity calculation) (Pierannunzi et al., 2013). Furthermore, estimates of health characteristics and behaviors in this study are consistent with available published data for stroke survivors without regard to geographic location (e.g., diabetes, 22.6%; disability, 63.3%; <1 fruit and <1

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vegetable consumed daily, 51.7%; <150 min of weekly physical activity, 56.5%; and overweight/obesity, 54.6%) (Bailey et al., 2019). An obvious benefit of using self-report data is the large number of responses that that can be gathered, but the benefit must be weighed against the cost of objectivity and accuracy.

Limitations

This study has some limitations due to use of the BRFSS methodology and assessment protocols. First, all data were self-reported and not objectively measured, which, as noted above, may lead to under- or overreporting of health characteristics and health behaviors. Second, BRFSS only calculates a Metropolitan Status Code, the variable used to determine rural status, for respondents contacted via landline. Since approximately 50% of the BRFSS respondents were contacted by cellular phone, rural status was not obtained for half of BRFSS respondents, resulting in their exclusion from this study. As indicated in the additional analysis, participants with missing data for rural status differed from the included sample with respect to sex, race/ethnicity, education, alcohol consumption, and smoking, which may have attenuated results. An alternative method to calculating rural status would result in fewer excluded cases for analysis. Third, the BRFSS survey is not a stroke-specific survey; thus, important stroke-relevant variables (e.g., time since stroke, stroke severity) that might mediate study findings were not collected. Similarly, mental health (e.g., depression, anxiety), which is commonly affect by stroke, was not included among the BRFSS questions related to disability. Despite these limitations, the BRFSS survey allows for collection of data from a relatively large, national sample of community-dwelling stroke survivors, which would otherwise be unavailable due to the challenge and expense of following a large cohort of incident stroke survivors over time.

Conclusions

This study did not demonstrate differences in the examined health characteristics and health behaviors between rural and non-rural community-dwelling stroke survivors in the USA. However, there were differences between some sociodemographic characteristics and health behaviors between respondents with vs. without missing data, and analyses were not able to account for differences in stroke care and stroke outcomes between rural and non-rural respondents. Other sociodemographic, physiological, and healthcare variables likely differ between rural and non-rural stroke survivors and should be explored through additional studies. Identification of such variables could inform programs, research, and policy for eliminating rural–urban health disparities among community-dwelling stroke survivors.

Supplementary materials. For supplementary material for this article, please visit https://doi.org/10.1017/BrImp.2022.17

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References

Bailey, R. R., Phad, A., McGrath, R., & Haire-Joshu, D. (2019). Prevalence of five lifestyle risk factors among U.S. adults with and without stroke. *Disability and Health Journal*, *12*(2), 323–327. doi: 10.1016/j.dhjo.2018.11.003

Billinger, S. A., Arena, R., Bernhardt, J., Eng, J. J., Franklin, B. A., Johnson, C. M., . . . , & Tang, A. (2014). Physical activity and exercise recommendations for stroke survivors: A statement for healthcare professionals from the American Heart Association/American Stroke Association. *Stroke*, *45*, 2532–2553. doi: 10.1161/str.0000000000000022

Dwyer, M., Rehman, S., Ottavi, T., Stankovich, J., Gall, S., Peterson, G., . . . , & Kinsman, L. (2019). Urban-rural differences in the care and outcomes of acute stroke patients: Systematic review. *Journal of the Neurological Sciences*, *397*, 63–74. doi: 10.1016/j.jns.2018.12.021

Feigin, V. L., Stark, B. A., Johnson, C. O., Roth, G. A., Bisignano, C., Abady, G. G., ..., & Murray, C. J. L. (2021). Global, regional, and national burden of stroke and its risk factors: A systematic analysis for the Global Burden of Disease Study 2019. *The Lancet Neurology*, *20*(10), 795–820. doi: 10.1016/S1474-4422(21)00252-0

Hardie, K., Hankey, G. J., Jamrozik, K., Broadhurst, R. J., & Anderson, C. (2004). Ten-year risk of first recurrent stroke and disability after first-ever stroke in the Perth Community Stroke Study. *Stroke*, *35*(3), 731–735. doi: 10.1161/01.STR.0000116183.50167.D9

Harrington, R. A., Califf, R. M., Balamurugan, A., Brown, N., Benjamin, R. M., Braund, W. E., ..., & Maddox, K. E. J. (2020). Call to action: Rural health: A presidential advisory from the American Heart Association and American Stroke Association. *Circulation*, *141*(10), e615–e644. doi: 10.1161/CIR.0000000000000753

Hart, L. G., Larson, E. H., & Lishner, D. M. (2005). Rural definitions for health policy and research. *American Journal of Public Health*, *95*(7), 1149–1155. doi: 10.2105/ajph.2004.042432

Howard, G. (2021). Rural-urban differences in stroke risk. *Preventive Medicine*, *152*(Pt 2), 106661. doi: https://doi.org/10.1016/j.ypmed.2021.106661

Howard, G., Kleindorfer, D. O., Cushman, M., Long, D. L., Jasne, A., Judd, S. E., ..., & Howard, V. J. (2017). Contributors to the excess stroke mortality in rural areas in the United States. *Stroke*, *48*(7), 1773–1778. doi: 10.1161/STROKEAHA.117.017089

Kapral, M. K., Austin, P. C., Jeyakumar, G., Hall, R., Chu, A., Khan, A. M., ..., & Tu, J. V. (2019). Rural-urban differences in stroke risk factors, incidence, and mortality in people with and without prior stroke. *Circulation: Cardiovascular Quality and Outcomes*, *12*(2), e004973. doi: 10.1161/CIRCOUTCOMES.118.004973

Kleindorfer, D. O., Towfighi, A., Chaturvedi, S., Cockroft, K. M., Gutierrez, J., Lombardi-Hill, D., ..., & Williams, L. S. (2021). 2021 Guideline for the prevention of stroke in patients with stroke and transient ischemic attack: A guideline from the American Heart Association/American Stroke Association. *Stroke*, *52*(0), e364–e467. doi: 10.1161/STR.0000000000000375

Koifman, J., Hall, R., Li, S., Stamplecoski, M., Fang, J., Saltman, A. P., & Kapral, M. K. (2016). The association between rural residence and stroke care and outcomes. *Journal of the Neurological Sciences*, *363*(11), 16–20.

Li, Y., Zhang, X., Sang, H., Niu, X., Liu, T., Liu, W., & Li, J. (2019). Urban-rural differences in risk factors for ischemic stroke in northern China. *Medicine*, *98*(21), e15782.

Nakibuuka, J., Sajatovic, M., Nankabirwa, J., Furlan, A. J., Kayima, J., Ddumba, E., ..., & Byakika-Tusiime, J. (2015). Stroke-risk factors differ between rural and urban communities: Population survey in Central Uganda. *Neuroepidemiology*, *44*(3), 156–165. doi: 10.1159/000381453

Pierannunzi, C., Hu, S. S., & Balluz, L. (2013). A systematic review of publications assessing reliability and validity of the Behavioral Risk Factor Surveillance System (BRFSS), 2004-2011. *BMC Medical Research Methodology*, *13*(1), 49. doi: 10.1186/1471-2288-13-49

Sridharan, S. E., Unnikrishnan, J. P., Sukumaran, S., Sylaja, P. N., Nayak, S. D., Sarma, P. S., & Radhakrishnan, K. (2009). Incidence, types, risk factors, and outcome of stroke in a developing country. *Stroke*, *40*(4), 1212–1218. doi: 10.1161/STROKEAHA.108.531293

U.S. Department of Health and Human Services. (2018). *Physical activity guidelines for Americans* (2nd edition, U.S. Department of Health and Human Services.

Virani, S. S., Alonso, A., Benjamin, E. J., Bittencourt, M. S., Callaway, C. W., Carson, A. P., ..., & Tsao, C. W. (2020). Heart disease and stroke statistics 2020 update: A report from the American Heart Association. *Circulation*, *141*(9), e139–e596. doi: 10.1161/CIR.0000000000000757

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