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Health behaviors among people with epilepsy—Results from the 2010 National Health Interview Survey☆

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Abstract

Objectives—This study aimed to estimate and compare the prevalence of selected health behavior—alcohol use, cigarette smoking, physical activity, and sufficient sleep—between people with and without a history of epilepsy in a large, nationally representative sample in the United States.

Methods—We used data from the 2010 cross-sectional National Health Interview Survey (NHIS) to compare the prevalence of each health behavior for people with and without epilepsy while adjusting for sex, age, race/ethnicity, and family income. We also further categorized those with epilepsy into active epilepsy and inactive epilepsy and calculated their corresponding prevalences.

Results—The percentages of adults with a history of epilepsy (50.1%, 95% CI = 45.1%–55.2%) and with active epilepsy (44.4%, 95% CI = 37.6%–51.5%) who were current alcohol drinkers were significantly lower than that of those without epilepsy (65.1%, 95% CI = 64.2%–66.0%). About 21.8% (95% CI = 18.1%–25.9%) of adults with epilepsy and 19.3% (95% CI = 18.7%–19.9%) of adults without epilepsy were current smokers. Adults with active epilepsy were significantly less likely than adults without epilepsy to report following recommended physical activity guidelines for Americans (35.2%, 95% CI = 28.8%–42.1% vs. 46.3%, 95% CI = 45.4%–47.2%) and to report walking for at least ten minutes during the seven days prior to being surveyed (39.6%, 95% CI = 32.3%–47.4% vs. 50.8%, 95% CI = 49.9%–51.7%). The percentage of individuals with active epilepsy (49.8%, 95% CI = 42.0%–57.7%) who reported sleeping an

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Conflicts of interest

Wanjun Cui has no conflicts of interest to report.

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average of 7 or 8 h a day was significantly lower than that of those without epilepsy (61.9%, 95% CI = 61.2%–62.7%).

Conclusions—Because adults with epilepsy are significantly less likely than adults without epilepsy to engage in recommended levels of physical activity and to get the encouraged amount of sleep for optimal health and well-being, promoting more safe physical activity and improved sleep quality is necessary among adults with epilepsy. Ending tobacco use and maintaining low levels of alcohol consumption would also better the health of adults with epilepsy.

Keywords

Epilepsy; Health behaviors; Alcohol use; Smoking behavior; Physical activity; Sleep pattern; National Health Interview Survey

1. Introduction

Epilepsy merits public health action because it affects approximately 2.3 million adults in the United States [1], and it poses substantial population burden. People with epilepsy (PWE) not only suffer from uncontrolled seizures and face treatment complexity but are also at a higher risk for comorbidities [2] (e.g., heart disease, emphysema, or cancer), impaired mental health [3] (e.g., serious psychological disorder or insomnia), and worse health-related quality of life [4,5]. Improving appropriate medical care for PWE is a national objective for the U.S. *Healthy People 2020* [6], but promoting their health behaviors might also benefit the management of the disorder [7].

Epilepsy is a neurological spectrum disorder characterized by recurring seizures [8]. Because living with epilepsy is challenging, improving access to medical care and increasing social support are essential [9]. However, little is known about the prevalence of some common health behaviors such as alcohol use, cigarette smoking, level of physical activity, and sleep patterns In PWE. National prevalence estimates for these behaviors among PWE are uncommon. Different studies based on different data sources and statistical methods have shown different patterns of heath behaviors in this group. Alcohol use has been identified as a risk factor for conditions such as liver cancer or alcohol dependence [10], but its prevalence among PWE has not been fully investigated. For example, PWE might be discouraged from using alcohol because it may interfere with antiepileptic drugs [11] or because withdrawal from alcohol might trigger seizures among those with alcohol dependency [12,13]. However, some population-based studies report that PWE are not significantly less likely to drink alcohol than those without the disorder [14–16], while other studies show that they do drink less alcohol [17,18]. Although cigarette smoking is strongly associated with lung cancer and heart disease [19], the prevalence of cigarette smoking among those with epilepsy is unclear. Smoking may increase seizure risk for those who are chronically active smokers and for those whose mothers smoked during pregnancy [20,21]. Many studies found a higher percentage of PWE who smoke cigarettes than those without the disorder [14,15,17,18]. Although engaging in physical activity has many health benefits [22–24], PWE have previously been advised against doing so over fears of inducing seizures, even though findings from experimental/clinical trials show that exercise does not increase seizure frequency, does not trigger seizures, and does not interfere with

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antiepileptic drugs [25,26]. Because physical activity enhances cardiovascular function and reduces comorbidities and depression/anxiety among PWE, physical activity has been recommended as a complementary treatment for epilepsy [27–29]. Despite these health benefits, PWE are generally less likely to be physically active [15,18] or to be no different from those without the disorder [17,18]. Finally, some research shows that epilepsy may disrupt sleep (e.g., some antiepileptic drugs might cause sleeplessness) and that poor sleep might worsen or trigger seizures [30,31]. Unfortunately, population-based estimates for sleep (e.g., sleep hours) among PWE are rare.

Our study aimed to estimate and compare the prevalence of selected health behaviors—alcohol use, cigarette smoking, physical activity, and sleep—between people with and without a history of epilepsy in a large, nationally representative sample from the 2010 U.S. National Health Interview Survey (NHIS). Consistent with previous studies [1,2,4], we also further categorized PWE into those with active epilepsy and those with inactive epilepsy to examine if the associations between these health behaviors differ by epilepsy status.

2. Material and methods

2.1. Sample

We obtained public-use data from the 2010 cross-sectional NHIS, a nationally representative multistage household survey of the civilian noninstitutionalized population of the United States [32]. The National Center for Health Statistics (NCHS) of the Centers for Disease Control and Prevention (CDC) has conducted the NHIS annually since the 1950s to monitor the nation's health at both the household/family level (e.g., type of living quarters, family size, and total combined family income) and the individual level (e.g., various medical/health conditions, risk factors, and access to care). Its protocol and administration have been approved by the NCHS's Research Ethics Review Board, and all NHIS participants provide informed consent. The 2010 NHIS selected 34,329 households containing 89,976 persons in 35,177 families, from which 27,157 randomly chosen adults 18 years old or older agreed to participate in detailed interviews. The final analysis sample for our study was the 27,139 adults who provided complete information about their epilepsy status and health behaviors including alcohol drinking, cigarette smoking, physical activity, and sleep hours.

2.2. Epilepsy case definition

Our main variable of interest was epilepsy status, based on a history of epilepsy from participants' responses to the question: "Have you ever been told by a doctor or other health professional that you have a seizure disorder or epilepsy?" Those who responded "Yes" were considered as having a history of epilepsy, and those who responded "No" as not having such a history. We further classified those with a history of epilepsy into active epilepsy and inactive epilepsy based on their responses to two additional questions: 1) "Are you currently taking any medicine to control your seizure disorder or epilepsy?" and 2) "Today is [fill: Current Date]. Think back to last year about the same time. About how many seizures of any type have you had in the past year?" We classified respondents as having active epilepsy either if they answered "Yes" to the first question or if they reported one or more seizures during the past year in response to the second question; we classified

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respondents as having inactive epilepsy if they answered “No” or “do not know” to the first question and reported having zero seizures during the past year for the second question. Five adults with epilepsy could not be classified by activity level based on these two questions and thus were excluded from the analysis.

2.3. Health behaviors

We assessed several health behaviors by epilepsy status, including alcohol drinking, cigarette smoking, physical activity, and sleep. We classified a respondent's alcohol drinking status by using an existing 2010 NHIS recoded variable with ten response levels[1]: Lifetime abstainer, former infrequent drinker, former regular drinker, former drinker but unknown frequency, current infrequent drinker, current light drinker, current moderate drinker, current heavy drinker, current drinker-frequency/level unknown, and drinking status unknown. Because of the small sample sizes of some of these responses, we combined and further recoded them into three levels: Lifetime abstainers, former drinkers, and current drinkers. We also excluded adults with unknown drinking status from analyses (less than 2% of our total sample) using a domain analysis.

We classified a respondent's cigarette smoking behavior by his/her answers to questions about cigarette smoking status and smoking cessation attempts based on an existing NHIS recoded variable with six response levels[2]: Current everyday smoker, current some-day smoker, former smoker, never smoker, smoker—current status unknown, and unknown if ever smoked. We combined these responses into three levels: lifetime nonsmokers, former smokers, and current smokers. We also excluded those with unknown smoking status from analyses (about 0.7% of our total sample) using a domain analysis. We classified a respondent's smoking cessation efforts from a current or former smoker's responses to three separate questions about their efforts to quit smoking. Specifically, current smokers who smoked every day or on some days replied to two separate questions: “During the past 12 months, have you stopped smoking for more than one day because you were trying to quit smoking?” and “Would you like to completely quit smoking cigarettes?” Sample adults who were current smokers or former smokers who had quit in the past 12 months and had seen a doctor or other health professional in the last 12 months were also asked the question: “In the past 12 months, has a medical doctor, dentist, or other health professional advised you to quit smoking or quit using other kinds of tobacco?” Responses to these three separate questions are “Yes” and “No.”

We classified a respondent's physical activity from his/her responses to questions about their involvement in aerobic activity and walking, and if they had ever received recommendations

[1]Lifetime abstainer: <12 drinks in lifetime; former infrequent drinker: 12+ drinks in lifetime but never as many as 12 in 1 year and none in past year; former regular drinker: 12+ drinks in lifetime, 12+ drinks in 1 year, but none in past year; former drinker, unknown frequency: 12+ drinks in lifetime, none in past year, don't know if 12+ in any 1 year; current infrequent drinker: 12+ drinks in lifetime, and 1–11 drinks in past year; current light drinker: 12+ drinks in lifetime, and ≤3 drinks per week in past year; current moderate drinker: 12+ drinks in lifetime, and (male) >3 drinks per week up to 14 drinks per week or (female) >3 drinks per week up to 7 drinks per week; and current heavy drinker: 12+ drinks in lifetime, and (male) >14 drinks per week in past year or (female) >7 drinks per week in past year.

[2]Never smoker: never smoked at all or smoked less than 100 cigarettes in lifetime; former smoker: smoked at least 100 cigarettes in lifetime but not currently smoking; current everyday smoker: smoked at least 100 cigarettes in lifetime and currently smokes; and current someday smokers: smoked some days, including those who reported smoking zero days in the past 30 days.

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to begin/continue doing physical activity. Respondents' aerobic activity depended on their answers to two separate questions: "How often do you do vigorous leisure-time physical activities for at least 10 min that cause heavy sweating or large increases in breathing or heart rate?" and "How often do you do light or moderate leisure-time physical activities for at least 10 min that cause only light sweating or a slight to moderate increase in breathing or heart rate?" We classified respondents as meeting the aerobic guidelines for Americans if they reported 150 or more minutes per week of light- to moderate-intensity activity, 75 or more minutes per week of vigorous-intensity activity, or an equivalent combination of the two [33]. The equivalent combination was calculated by adding minutes of moderate-intensity activity and twice the number of minutes of vigorous-intensity activity [33]. We classified the respondents as participating in walking if they answered "Yes" to the question: "Sometimes you may walk for fun, relaxation, exercise, or walk the dog. During the past 7 days, did you walk for at least 10 min for any of these reasons? Please do not include walking for transportation." Finally, we classified respondents as receiving a recommendation to begin or to continue physical activity if they answered "Yes" to the question: "During the past 12 months, did a doctor or other health professional recommend that you begin or continue to do any type of exercise or physical activity?"

We examined sleep pattern by using one question asking: "On average, how many hours of sleep do you get in a 24-hour period?" We grouped respondent responses into the following categories: six or fewer hours, seven or eight hours, and nine or more hours.

2.4. Covariates

We adjusted for race/ethnicity (non-Hispanic White, non-Hispanic Black, Hispanic/Latino, or other race), sex (Males or Females), age in years (18–34, 35–44, 45–64, or 65+), and combined annual family income (<$25,000, $25,000–$49,999, $50,000–$74,999, or $75,000+) because they might affect the association between each health behavior and epilepsy status.

2.5. Analysis

We used multinomial logistic regression in SAS-callable SUDAAN to obtain both unadjusted and adjusted percentages (predicted marginal proportions) [34] of each epilepsy category and their 95% confidence intervals for each health behavior taking into consideration the NHIS' complex survey design. Because the unadjusted percentages and those adjusted for all covariates were similar with the exception of smoking behavior and epilepsy status, we did not present unadjusted percentages in our tables. We also did not report P-values associated with t-tests or Wald chi-square tests for the comparisons between epilepsy categories on health behaviors since nonoverlapping 95% confidence intervals (CI) of these percentage estimates imply statistically significant differences (below the significance level of 0.05) between these percentages [35]. We also examined relative standard error (RSE = (standard error / estimate) × 100) to determine the reliability of point estimates based on NCHS guidelines. We identified estimates with a RSE ≥ 30% as unreliable, and omitted them from the table. Estimates with RSEs between 20%–30% are identified in the table.

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3. Results

3.1. Descriptive statistics

In 2010, 1.8% of adults reported having epilepsy, and 1% reported having active epilepsy [1]. Fifty-two percent were women; sixty-eight percent were Non-Hispanic White; thirty-one percent were from 18 to 34 years old; and fifty-two percent were from 35 to 64 years old. Forty-nine percent reported having a combined annual family income less than $50,000.

Specifically, about 77.7% (95% CI = 73.5%–81.4%) of adults with a history of epilepsy were non-Hispanic white compared to 67.8% (95% CI = 66.9%–68.8%) among those with no history of epilepsy (Table 1). The distribution of sex was similar among both groups (Table 1). About forty-two percent (95% CI = 36.9%–47.1%) of PWE were 45–64 years old compared to 34.8% (95% CI = 34.0%–35.6%) among those without epilepsy. The percentage of adults aged 65 years or older was significantly lower among those with epilepsy compared to those without the disorder (12.3%, 95% CI = 9.5%–15.8% vs. 16.9%, 95 CI = 16.3%–17.6%; Table 1). Almost half of adults with a history of epilepsy (41.8%, 95% CI = 36.2%–47.6%) reported having annual family income of less than $25,000 compared to only 23.0% (95% CI = 22.2%–23.9%) of adults without epilepsy. Only 13.7% (95% CI = 10.2%–18.2%) of adults with epilepsy reported annual family income of more than $75,000 compared to 33.4% (95% CI = 32.3%–34.6%) among those without epilepsy.

3.2. Alcohol use

The percentages of adults with a history of epilepsy (31.1%, 95% CI = 26.3%–36.3%) and with active epilepsy (34.8%, 95% CI = 28.0%–42.3%) who reported being lifetime alcohol abstainers were significantly higher than that of those without any epilepsy (20.5%, 95% CI = 19.8%–21.3%) after adjusting for all covariates (Table 2). Correspondingly, the percentages of adults with a history of epilepsy (50.1%, 95% CI = 45.1%–55.2%) and with active epilepsy (44.4%, 95% CI = 37.6%–51.5%) who were current alcohol drinkers were significantly lower than that of those without a history of epilepsy (65.1%, 95% CI = 64.2%–66.0%).

3.3. Cigarette smoking behavior

Before adjustment, individuals with active (26.2%, 95% CI = 20.4%–33.0%) and inactive epilepsy (31.7%, 95% CI = 24.2%–40.3%) reported being current smokers at a significantly higher percentage than that of those without any epilepsy (19.2%, 95% CI = 18.6%–19.8%; data not shown). However, after adjustment, this difference became statistically nonsignificant (Table 2). In addition, after adjustment, current smokers with a history of epilepsy, active epilepsy, and inactive epilepsy did not differ from current smokers without epilepsy with respect to smoking related variables (Table 2). Among adults with active epilepsy who were classified as smokers or smoked some in the past year, 75.4% (95% CI = 61.0%–85.7%) wanted to quit and 48.3% (95% CI = 35.9%–60.9%) tried to quit smoking in the past year. However, only about 46.9% (95% CI = 33.9%–60.3%) were advised by a health professional to quit smoking, similar to the percentage advised to quit smoking among those without a history of epilepsy.

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3.4. Physical activity

Adults with a history of epilepsy (39.1%, 95% CI = 34.3%–44.1%), especially those with active epilepsy (35.2%, 95% CI = 28.8%–42.1%), were less likely than adults with no history of epilepsy (46.3%, 95% CI = 45.4%–47.2%) to follow the recommended physical activity guidelines for Americans (Table 2). Additionally, only 39.6% (95% CI = 32.3%–47.4%) of respondents with active epilepsy reported taking a walk for at least ten minutes during the past seven days, significantly less than the 50.8% (95% CI = 49.9%–51.7%) of those without a history of the disorder. Those with active epilepsy (34.4%, 95% CI = 27.5%–41.9%) were recommended by a doctor or other health professional to begin or continue to do any type of exercise to the same extent as those without a history of epilepsy (33.5%, 95% CI = 32.7%–34.4%), even though those with active epilepsy were significantly less likely to be physically active.

3.5. Sleep

The percentage of individuals with active epilepsy (49.8%, 95% CI = 42.0%–57.7%) who reported sleeping 7 or 8 h in a 24-hour period was significantly lower than that of those without any epilepsy (61.9%, 95% CI = 61.2%–62.7%; Table 2). The percentage of individuals with active epilepsy (16.1%, 95% CI = 11.4%–22.3%) who reported sleeping nine or more hours was significantly higher than that of those without the disorder (9.5%, 95% CI = 9.0%–9.9%). Those with a history of epilepsy (34.4%, 95% CI = 29.4%–39.8%) reported sleeping six or fewer hours per night more often than those without a history of epilepsy (28.6%, 95% CI = 28.0%–29.3%).

4. Discussion

It has been unclear how PWE differ in their health behaviors from the general population. Very few population-based studies have examined the prevalence of different health behaviors among PWE, and findings from these studies are often inconsistent or even contradictory [14,15,17]. One reason for these inconsistencies is that these studies have often relied on different data sources (e.g., the Behavioral Risk Factor Surveillance System (BRFSS) vs. NHIS), used different criteria to define epilepsy and health behaviors, and focused on different populations (e.g., specific states). Unfortunately, U.S. national estimates for multiple health behaviors in PWE are uncommon. Our study thus extends previous research by using a nationally representative sample and provides national baseline estimates of health behaviors for PWE.

Compared to those without the disorder, PWE, particularly those with active epilepsy, were significantly less likely to drink alcohol either currently or formerly. This finding is consistent with studies that used the 2006 BRFSS data in nine states [14], the 2002 BRFSS data in Georgia and Tennessee [18], and the 2005 California Health Interview Survey (CHIS) [17], but inconsistent with a study that used the 2006 BRFSS data in Ohio [17]. Active alcohol ingestion might increase blood levels of compounds such as homocysteine, which in turn might increase a person with epilepsy's risk for alcohol withdrawal seizures [11]. Of more concern, alcohol may also stimulate liver enzymes that metabolize and reduce serum levels of some antiepileptic drugs. Therefore, PWE might be more motivated to

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refrain from drinking alcohol. Some researchers argue that excessive but not moderate or occasional drinking increases the risk for seizures among PWE [13]. Because of a small sample size, we did not examine the frequency or level of drinking separately in this study; studies that used the 2002 NHIS and 2003–2005 BRFSS data in South Carolina [15] found no significant difference in heavy drinking between PWE and those without epilepsy. Therefore, further research to distinguish PWE based on the amount of alcohol consumed (e.g., heavy drinkers vs. light drinkers) and to examine the dose–response relationship between alcohol and epilepsy would be beneficial. Nevertheless, educating PWE and their families about the potential detrimental health consequences of alcohol is essential.

In our study, we also did not find any significant difference in smoking between PWE and those without the disorder after multivariate adjustment. This finding contradicts previous research that used the BRFSS data [14,15,17,18] and the 2005 CHIS data [17], which showed that PWE had a higher prevalence of smoking. However, this discrepancy is likely attributable to the fact that these studies focused on estimates that were not adjusted for covariates and were from specific states (e.g., in Ohio or in California) or regions but were not on national estimates. It is also worth noting that in our study, PWE reported a significantly higher prevalence of smoking than that of the general population before we adjusted for sociodemographic variables such as family income. This observation might be explained by the fact that PWE in our sample were greatly economically disadvantaged as most of them were struggling along the national poverty line.[3] Because individuals with lower levels of socioeconomic status (SES) generally report a higher prevalence of smoking cigarettes [36], controlling for the disparity in SES such as family income between PWE and those without the disorder might be expected to reduce this difference in the prevalence of smoking cigarettes. Additionally, among current smokers, we did not find any significant difference in smoking cessation behaviors between PWE and the general population or in the percentage of medical doctors or other health professionals who recommended to PWE that they quit smoking. Unfortunately, health education (e.g., smoking cessation) is often not routinely provided to patients with chronic diseases [37]. Therefore, considering the detrimental health consequences of smoking [19] and its relatively high prevalence among those with active epilepsy (one out of five), it would still be advisable to emphasize to PWE the benefits of quitting smoking, and to their health care providers the need to recommend to their patients that they should quit smoking. Furthermore, in our study, almost one-quarter (24%) of adults with epilepsy who were current smokers had not seen either a general doctor or a neurologist/epilepsy specialist in the past year (data not shown). This finding also underscores the need for other groups/organizations (e.g., community-based Epilepsy Foundation affiliate offices, local public health departments) to provide smoking cessation resources (e.g., quit lines) to PWE, especially those who might have very limited access to the health care system.

Perhaps one of the most significant findings from our study pertains to physical activity. Consistent with previous research that used the 2002 BRFSS in Georgia and Tennessee [18] and the 2003–2005 BRFSS data in South Carolina [15], we found that PWE were

[3]The federal poverty line in 2014 is $23,850 for a family of four.

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significantly less likely to obtain the recommended amount of aerobic physical activity for Americans than those without epilepsy. People with epilepsy were also significantly less likely to report walking for at least 10 min for fun or for other recreational purposes during the past 7 days. Although other population-based studies [14,17] did not observe such differences, these did not classify respondents' physical activity level based on U.S. aerobic guidelines. One possible explanation of our finding is that PWE might fear that exercise could induce or worsen their seizures or make them more prone to injury. However, an extensive review of current studies on epilepsy and exercise concluded that exercise not only can give most PWE the same benefits that healthy individuals receive from it such as preventing heart disease, but can also reduce their risk for comorbidities related to epilepsy such as depression and anxiety disorders [27–29]. Other studies have also shown that physical activity can improve PWE's well-being and quality of life and help PWE manage their epilepsy [9,38]. The Institute of Medicine also lists a range of sporting and recreational activities (e.g., baseball or bowling) that are suitable for PWE based on their associated seizure risk [9]. Unfortunately, despite these health benefits, only slightly more than one-third of doctors or other health professionals recommend physical activity to PWE, no more than any other group. Therefore, promoting safe physical activity in consultation with medical doctors among PWE [9] is essential to answer the Surgeon General's call for building a fit and healthy nation [39].

Sleep plays a vital role in epilepsy since it may influence seizure onset, particularly in certain epilepsy syndromes [30,31]. The National Heart, Lung, and Blood Institute encourages 7 to 8 h of sleep for adults to achieve optimal health and well-being and warns that sleeping too little or too much might have adverse health consequences such as increasing the risk for diabetes, cardiovascular disease, and depression [40]. Compared to those without a history of epilepsy, PWE in our study were significantly less likely to report getting the encouraged amount of sleep; instead, they were significantly more likely to sleep too little or too much. One possible explanation is that some antiepileptic drugs might disrupt normal wake–sleep cycle and reduce PWE's sleep quality [31]. Therefore, intervention programs that improve PWE's quality of sleep (e.g., reducing antiepileptic drugs' side effects) might be especially beneficial.

Our study is subject to several limitations. First, our study used self-reported 2010 NHIS data to ascertain epilepsy cases and examine reported health behaviors, which may be subject to misclassification or response biases. For example, self-reported data might slightly overestimate the prevalence of epilepsy, but this overestimate might be small [1]. Second, because NHIS is a cross-sectional survey, the cause and effect relationship between epilepsy and health behaviors cannot be established. Third, because epilepsy is fairly uncommon, the reliability of certain findings might be limited by relatively small sample sizes (e.g., ≤ 30), and although all estimates have a relative standard error <30%, we still advise readers to be cautious with the interpretation of these findings, particularly with those for inactive epilepsy.

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5. Conclusions

In conclusion, our study showed that people with epilepsy were significantly less likely to engage in health behaviors such as physical activity and getting the recommended amount of sleep than the general population. However, they were as likely to smoke cigarettes as are adults without the disorder. Primary care providers should ensure that adults with epilepsy receive comprehensive care, including access to health promotion resources and to screening and counseling for risk behaviors [2,9].

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References

1. Centers for Disease Control and Prevention. Epilepsy in adults and access to care—United States, 2010. MMWR Surveill Summ. 2012; 61:909–13.
2. Centers for Disease Control and Prevention. Comorbidity in adults with epilepsy—United States, 2010. MMWR Surveill Summ. 2013; 62:849–53.
3. Tellez-Zenteno JF, Patten SB, Jetté N, Williams J, Wiebe S. Psychiatric comorbidity in epilepsy: a population-based analysis. Epilepsia. 2007; 48:2336–44. [PubMed: 17662062]
4. Centers for Disease Control and Prevention. Epilepsy surveillance among adults—19 States, Behavioral Risk Factor Surveillance System, 2005. MMWR Surveill Summ. 2008; 57:1–20.
5. Kobau R, Zack MM, Shegog R, Price PH. Satisfaction with life domains in people with epilepsy. Epilepsy Behav. 2012; 25:546–51. [PubMed: 23153720]
6. US Department of Health and Human Services. Barriers to health care: DH-6. Office of Disease Prevention and Health Promotion; 2014. Healthy people 2020.. [Available at: http://www.healthypeople.gov/2020/topicsobjectives2020/objectiveslist.aspx?topicId=2029. Accessed March 20, 2014]
7. Kobau R, DiIorio C. Epilepsy self-management: a comparison of self-efficacy and outcome expectancy for medication adherence and lifestyle behaviors among people with epilepsy. Epilepsy Behav. 2003; 4:217–25. [PubMed: 12791322]
8. Thurman DJ, Beghi E, Begley CE, Berg AT, Buchhalter JR, Ding D, et al. Standards for epidemiologic studies and surveillance of epilepsy. Epilepsia. 2011; 52:2–26. [PubMed: 21899536]
9. Institute of Medicine. Epilepsy across the spectrum: promoting health and understanding. The National Academies Press; Washington (DC): 2012.
10. World Health Organization. Global status report on alcohol and health. [Available at: http://www.who.int/substance_abuse/publications/global_alcohol_report/en/; 2011. Accessed March 10, 2014]
11. Leach JP, Mohanraj R, Borland W. Alcohol and drugs in epilepsy: pathophysiology, presentation, possibilities, and prevention. Epilepsia. 2012; 53:48–57. [PubMed: 22946721]
12. Hillemacher T, Frieling H, Wilhelm J, Heberlein A, Karagulle D, Bleich S, et al. Indicators for elevated risk factors for alcohol-withdrawal seizures: an analysis using a random forest algorithm. J Neural Transm. 2012; 119:1449–53. [PubMed: 22622368]
13. Samokhvalov AV, Irving H, Mohapatra S, Rehm J. Alcohol consumption, unprovoked seizures, and epilepsy: a systematic review and meta-analysis. Epilepsia. 2010; 51:1177–84. [PubMed: 20074233]
14. Konda K, Ablah E, Konda KS, Liow K. Health behaviors and conditions of persons with epilepsy: a bivariate analysis of 2006 BRFSS data. Epilepsy Behav. 2009; 16:120–7. [PubMed: 19682953]

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15. Ferguson PL, Chiprich J, Smith G, Dong B, Wannamaker BB, Kobau R, et al. Prevalence of self-reported epilepsy, health care access, and health behaviors among adults in South Carolina. Epilepsy Behav. 2008; 13:529–34. [PubMed: 18585962]
16. Elliott JO, Moore JL, Lu B. Health status and behavioral risk factors among persons with epilepsy in Ohio based on the 2006 Behavioral Risk Factor Surveillance System. Epilepsy Behav. 2008; 12:434–44. [PubMed: 18178133]
17. Elliott JO, Lu B, Moore JL, McAuley JW, Long L. Exercise, diet, health behaviors, and risk factors among persons with epilepsy based on the California Health Interview Survey, 2005. Epilepsy Behav. 2008; 13:307–15. [PubMed: 18490199]
18. Kobau R, DiIorio CA, Price PH, Thurman DJ, Martin LM, Ridings DL, et al. Prevalence of epilepsy and health status of adults with epilepsy in Georgia and Tennessee: Behavioral Risk Factor Surveillance System, 2002. Epilepsy Behav. 2004; 5:358–66. [PubMed: 15145306]
19. US Department of Health Human Services. The health consequences of smoking—50 years of progress: a report of the Surgeon General. US Department of Health and Human Services, Public Health Service, Office of the Surgeon General; Rockville (MD): 2004. [Available at: http://www.surgeongeneral.gov/library/reports/50-years-of-progress/full-report.pdf. Accessed April 16, 2014]
20. Rong L, Frontera AT Jr, Benbadis SR. Tobacco smoking, epilepsy, and seizures. Epilepsy Behav. 2014; 31:210–8. [PubMed: 24441294]
21. Vahidnia F, Eskenazi B, Jewell N. Maternal smoking, alcohol drinking, and febrile convulsion. Seizure. 2008; 17:320–6. [PubMed: 18055226]
22. US Department of Health and Human Services. Physical activity and health: a report of the Surgeon General. US Department of Health and Human Services, Centers for Disease Control and Prevention, National Center for Chronic Disease Prevention and Health Promotion; Atlanta (GA): 1996. [Available at: http://www.cdc.gov/nccdphp/sgr/pdf/sgrfull.pdf. Accessed March 20, 2014]
23. Leitzmann MF, Park Y, Blair A, Ballard-Barbash R, Mouw T, Hollenbeck AR, et al. Physical activity recommendations and decreased risk of mortality. Arch Intern Med. 2007; 167:2453–60. [PubMed: 18071167]
24. Garrett NA, Brasure M, Schmitz KH, Schultz MM, Huber MR. Physical inactivity: direct cost to a health plan. Am J Prev Med. 2004; 27:304–9. [PubMed: 15488360]
25. McAuley JW, Long L, Heise J, Kirby T, Buckworth J, Pitt C, et al. A prospective evaluation of the effects of a 12-week outpatient exercise program on clinical and behavioral outcomes in patients with epilepsy. Epilepsy Behav. 2001; 2:592–600. [PubMed: 12609395]
26. Nakken KO. Clinical research physical exercise in outpatients with epilepsy. Epilepsia. 1999; 40:643–51. [PubMed: 10386535]
27. Arida RM, de Almeida AC, Cavalheiro EA, Scorza FA. Experimental and clinical findings from physical exercise as complementary therapy for epilepsy. Epilepsy Behav. 2013; 26:273–8. [PubMed: 23099288]
28. Arida RM, Scorza FA, Cavalheiro EA. Role of physical exercise as complementary treatment for epilepsy and other brain disorders. Curr Pharm Des. 2013; 19:6720–5. [PubMed: 23530515]
29. Arida RM, Scorza FA, Gomes da Silva S, Schachter SC, Cavalheiro EA. The potential role of physical exercise in the treatment of epilepsy. Epilepsy Behav. 2010; 17:432–5. [PubMed: 20159660]
30. Derry CP, Duncan S. Sleep and epilepsy. Epilepsy Behav. 2013; 26:394–404. [PubMed: 23465654]
31. Eriksson SH. Epilepsy and sleep. Curr Opin Neurol. 2011; 24:171–6. [PubMed: 21386677]
32. National Center for Health Statistics. National Health Interview Survey. Public-use data file and documentation. 2010. [Available at: http://www.cdc.gov/nchs/nhis/quest_data_related_1997_forward.htm. Accessed October 3, 2013]
33. Carlson SA, Fulton JE, Schoenborn CA, Loustalot F. Trend and prevalence estimates based on the 2008 Physical Activity Guidelines for Americans. Am J Prev Med. 2010; 39:305–13. [PubMed: 20837280]
34. Graubard BI, Korn EL. Predictive margins with survey data. Biometrics. 1999; 55:652–9. [PubMed: 11318229]

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35. Cumming G. Inference by eye: reading the overlap of independent confidence intervals. Stat Med. 2009; 28:205–20. [PubMed: 18991332]

36. Cokkinides V, Bandi P, McMahon C, Jemal A, Glynn T, Ward E. Tobacco control in the United States—recent progress and opportunities. J Clin. 2009; 59:352–65.

37. Ritsema TS, Bingenheimer JB, Scholting P, Cawley JF. Differences in the delivery of health education to patients with chronic disease by provider type, 2005 — 2009. Prev Chronic Dis. 2014; 11:E33. [Available at :http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3944949/. Accessed October 2, 2014]. [PubMed: 24602587]

38. Bautista RE, Rundle-Gonzalez V, Awad RG, Erwin PA. Determining the coping strategies of individuals with epilepsy. Epilepsy Behav. 2013; 27:286–91. [PubMed: 23507304]

39. US Department of Health and Human Services. The Surgeon General's vision for a healthy and fit nation. US Department of Health and Human Services, Public Health Service, Office of the Surgeon General; Rockville, MD: 2010. [Available at: http://www.surgeongeneral.gov/initiatives/healthy-fit-nation/obesityvision2010.pdf. Accessed February 20, 2014]

40. National Heart Lung and Blood Institute. Your guide to healthy sleep. [Available at: http://www.nhlbi.nih.gov/health/public/sleep/healthy_sleep.pdf; 2011. Accessed March 19, 2014]

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Table 1

Epilepsy categories and sociodemographic characteristics–2010 National Health Interview Survey.

Characteristics	No history of epilepsy (n = 26,659)		History of epilepsy (n = 480)	
	n	Weighted % (95% CI)	n	Weighted % (95% CI)
Race/ethnicity				
White, non-Hispanic	15,088	67.8 (66.9 – 68.8)	315	77.7 (73.5 – 81.4)
Black, non-Hispanic	4,303	11.6 (11.0 – 12.3)	83	11.1 (8.5 – 14.3)
Hispanic/Latino	5,103	14.1 (13.5 – 14.8)	55	7.5 (5.6 – 9.8)
Other race	2,165	6.4 (6.0 – 6.9)	27	3.8 (2.3 – 6.3)*
Sex				
Males	11,776	48.4 (47.6 – 49.2)	201	45.9 (40.5 – 51.5)
Females	14,883	51.6 (50.8 – 52.4)	279	54.1 (48.5 – 59.5)
Age (years)				
18 – 34	7,665	30.8 (30.0 – 31.7)	108	27.9 (23.2 – 33.1)
35 – 44	4,710	17.4(16.9 – 18.0)	91	17.9 (14.0 – 22.5)
45 – 64	8,913	34.8 (34.0 – 35.6)	208	41.9 (36.9 – 47.1)
65 +	5,371	16.9 (16.3 – 17.6)	73	12.3 (9.5 – 15.8)
Annual family income				
<$25,000	8,489	23.0 (22.2 – 23.9)	248	41.8 (36.2 – 47.6)
$25,000 – $49,999	7,146	25.4(24.7 – 26.2)	117	28.8 (24.0 – 34.3)
$50,000 – $74,999	4,360	18.1 (17.5 – 18.7)	63	15.7 (11.8 – 20.5)
$75,000 +	6,665	33.4(32.3 – 34.6)	52	13.7 (10.2 – 18.2)

Abbreviation: n, sample size; 95% CI, 95% confidence interval for weighted percentage.

*This estimate has a relative standard error ≥20% and ≤30%.

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Table 2

Health behaviors in adults aged 18 years and older by epilepsy status–2010 National Health Interview Survey.[a]

	No history of epilepsy (n = 26,659)		History of epilepsy (n = 480)		Active epilepsy[b] (n = 277)		Inactive epilepsy[b] (n = 198)	
	n	% (95% CI)	n	% (95% CI)	n	% (95% CI)	n	% (95% CI)
Alcohol drinking status[c]								
Lifetime abstainers	5,871	20.5 (19.8 – 21.3)	128	31.1 (26.3 – 36.3)	85	34.8 (28.0 – 42.3)	41	26.4(19.6 – 34.6)
Former drinkers	3,978	14.3 (13.8 – 14.9)	117	18.8 (15.4 – 22.7)	78	20.8 (16.2 – 26.2)	37	15.8 (11.2 – 21.9)
Current drinkers	16,363	65.1 (64.2 – 66.0)	226	50.1 (45.1 – 55.2)	108	44.4(37.6 – 51.5)	117	57.7 (49.7 – 65.4)
Smoking status[d]								
Lifetime nonsmokers	15,858	59.0 (58.2 – 59.8)	219	54.8 (50.2 – 59.3)	128	56.4 (50.1 – 62.6)	90	53.1 (46.1 – 59.9)
Former smokers	5,626	21.7 (21.1 – 22.3)	113	23.5 (19.9 – 27.4)	69	23.6 (18.8 – 29.2)	42	22.8 (17.5 – 29.3)
Current smokers	5,002	19.3 (18.7 – 19.9)	142	21.8 (18.1 – 25.9)	75	20.0 (15.5 – 25.4)	65	24.1 (18.3 – 30.9)
During the past 12 months, have you stopped smoking for more than one day because you were trying to quit smoking (asked only of current smokers)?								
Yes	2,359	46.6 (44.9 – 48.4)	70	48.6 (39.5 – 57.7)	36	48.3 (35.9 – 60.9)	33	48.9 (35.1 – 62.9)
Would you like to completely quit smoking cigarettes (asked only of current smokers)?								
Yes	3,179	68.9 (67.2 – 70.5)	95	67.4 (57.2 – 76.2)	52	75.4 (61.0 – 85.7)*	42	59.1 (44.5 – 72.2)
In the past 12 months, has a medical doctor, dentist, or other health professional advised you to quit smoking or quit using other kinds of tobacco (asked only of current smokers and former smokers who had seen a doctor or health professional)?								
Yes	2,241	43.3 (41.7 – 45.0)	78	41.6 (33.1 – 50.7)	48	46.9 (33.9 – 60.3)	28	35.5 (24.5 – 48.2)
Met aerobic guidelines[e]								
Yes	11,282	46.3 (45.4 – 47.2)	157	39.1 (34.3 – 44.1)	81	35.2 (28.8 – 42.1)	76	44.3 (36.5 – 52.3)
During the past 7 days, did you walk for at least 10 min for (fun, relaxation, exercise, walk the dog)?								
Yes	12,139	50.8 (49.9 – 51.7)	176	44.4 (38.6 – 50.3)	90	39.6 (32.3 – 47.4)	85	50.6 (41.5 – 59.8)
During the past 12 months, did a doctor or other health professional recommend that you begin or continue to do any type of exercise or physical activity?								
Yes	6,765	33.5 (32.7 – 34.4)	152	37.6 (31.8 – 43.8)	87	34.4 (27.5 – 41.9)	62	42.7 (33.9 – 52.1)
On average, how many hours of sleep do you get in a 24-hour period?								
6 or less	7,683	28.6 (28.0 – 29.3)	178	34.4 (29.4 – 39.8)	103	34.1 (27.3 – 41.7)	71	32.2 (24.7 – 40.7)
7 or 8	16,090	61.9 (61.2 – 62.7)	231	53.0 (47.4 – 58.6)	122	49.8 (42.0 – 57.7)	108	59.8 (50.9 – 68.1)

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	No history of epilepsy (n = 26,659)		History of epilepsy (n = 480)		Active epilepsy[b] (n = 277)		Inactive epilepsy[b] (n = 198)	
	n	% (95% CI)	n	% (95% CI)	n	% (95% CI)	n	% (95% CI)
9 or more	2,520	9.5 (9.0 – 9.9)	61	12.5 (9.3 – 16.7)	44	16.1 (11.4 – 22.3)	17	8.0 (4.5 – 13.9)*

Abbreviations: n, sample size; %, predicted marginal percentage; 95% CI, 95% confidence interval for weighted predicted marginal percentage.

[a]Model adjusted for age, race/ethnicity, sex, and family income.

[b]Those with active or inactive epilepsy are subsets of those with a history of epilepsy. Five adults with epilepsy could not be classified by activity level.

[c]Lifetime alcohol drinking status: lifetime abstainer–had fewer than 12 drinks in entire lifetime; former drinker included both former infrequent (had 12 drinks or more in lifetime, but never as many as 12 drinks in a single year, and had no drinks in the past year) and former regular (had 12 drinks or more in one year, but no drinks in the past year); or current drinker–had at least 12 drinks in lifetime and at least 1 drink in the past year.

[d]Lifetime cigarette smoking status: never smoker–never smoked at all or smoked less than 100 cigarettes in lifetime; former smoker–smoked at least 100 cigarettes in lifetime but not currently smoking; or current smoker–smoked at least 100 cigarettes in lifetime and currently smokes.

[e]Respondents were considered as meeting the aerobic activity guidelines if they participated in moderate-intensity leisure-time physical activities 150 min or more per week or in vigorous-intensity activities 75 min or more per week or an equivalent combination of the two.

*These estimates have a relative standard error ≥20% and ≤30%.