Summer 2020

Pattern of health behavior and its association with self-rated health: evidence from the 2018 behavioral risk factor surveillance system in the United States

Linh Nguyen
DePauw University

Mamunur Rashid
DePauw University, mrashid@depauw.edu

M. Mazharul Islam
Sultan Qaboos University, Oman

Pattern of health behavior and its association with self-rated health: evidence from the 2018 behavioral risk factor surveillance system in the United States

Linh Nguyen[1], Mamunur Rashid[1] and M. Mazharul Islam[2]

[1]Department of Mathematics, DePauw University, Greencastle, IN 46135, USA

[2]Department of Statistics, Sultan Qaboos University, Muscat, Oman

*Corresponding author: Mamunur Rashid, PhD, Department of Mathematics, DePauw University, 2 E. Hana Street, Julian Science Center (JSC), Room #313, Greencastle, IN 46135, USA

E-mail: mrashid@depauw.edu

Abstract:

Aim: To improve public health services, we need to keep policymakers updated with health-related issues. This study (1) examines the recent pattern of physical activities, smoking, alcohol consumption, and SRH, and (2) investigates the association between the behaviors and SRH status among US citizens.

Method: We extracted data from the latest state-based survey of the 2018 Behavioral Risk Factor Surveillance System (BRFSS), which provides a nationally representative sample of 437,436 American adults. We analyzed the data, mainly employing chi-square tests and logistic regression models.

Results: Physical inactivity and smoking are more common among participants with lower education and household income. Normal-weight individuals or those with higher education and income level are associated with drinking and optimal SRH. Younger ages smoke and report optimal SRH more often, whereas older adults tend to be more physically inactive. Women and people with chronic diseases tend to be less physically inactive, drink, and report optimal SRH than those in the same categories. Optimal SRH is less common among people who smoke and are physically inactive. Surprisingly, people who have at least one drink monthly report optimal SRH more often than those who do not.

Conclusion: We encourage policy formulators to maintain the public space, increase taxes on tobacco products, and make educational campaigns targeting the youth.

Key words: physical inactivity, tobacco use, alcohol consumption, self-rated health, association, pattern

Introduction

Health-related behaviors comprise habits of individuals that make up a lifestyle, which is influenced by numerous social, demographic and environmental factors (Lawrence et al. 2017; Ford et al. 2011). A group of lifestyle habits, including physical inactivity, tobacco use, alcohol consumption, is well-known to predispose people to mortality and morbidity (WHO 2015; Wagner 2012).

According to the Physical Activity Guidelines issued by the US Department of Health and Human Services (HHS), physical activity boosts people's well-being, bodily functions (HHS 2018). It reduces the risk of morbidity and mortality for all genders, races, ethnicities, ages, and health conditions (HHS 2018; Singh et al. 2019; Kavouras et al. 2007). On the other hand, the world population's life expectancy was estimated to increase by 0.68 years with the elimination of physical inactivity (Lee et al. 2012).

According to the 2014 Surgeon General's Report published by HHS, cigarette smoking remains the single major factor leading to preventable morbidity and mortality. It is responsible for almost 500,000 premature deaths annually in the US. Smoking-attributable aftermaths, such as direct medical care of smokers, lost productivity due to premature death and exposure to secondhand smoke, sucked between 289 to 332.5 billion dollars out of the United States each year (HHS 2014).

According to a 2018 WHO report, heavy alcohol consumption is one of the top-10 risks causing the burden of diseases worldwide (WHO 2018). The harmful use of alcohol caused approximately 3.2%-3.7% of all US cancer deaths, and alcohol-attributable cancers resulted in 17.0 to 19.1 years of potential life lost (YPLL) (Nelson et al. 2013). In 2016, it was responsible for 7.2% of all premature deaths, and 5.1% of all disability-adjusted life years (WHO 2018). In 2010, excessive alcohol use, mainly binge drinking, also drained $249 billion from the US economy, with 40% of this cost must have been paid by federal, state, and local governments (CDC 2018).

Self-rated health (SRH) - to use a standardized question to ask people to assess their health on a five-point scale (excellent, very good, good, fair, or poor) - is well-known and widely used indicator of overall health status (DeSalvo et al. 2006; Benyamini 2011). Numerous studies have demonstrated strong association between SRH and a wider context of health outcomes including physical functional difficulties (Tetteh et al. 2019; Mavaddat et al. 2011). The direct association with individuals' bodily sensations and symptoms of SRH, which is strongly relying on the continuous monitoring of our bodies - information that is mostly unavailable to physicians and researchers - can account for the legitimacy of this health measuring tool (Benyamini 2011). Moreover, according to a clinical review in 2004, persons with 'poor' SRH had a 2-fold higher mortality risk than those with excellent SRH (DeSalvo et al. 2006) Existing evidence also shows that SRH predictive validity is substantially growing over time (Schnittker et al. 2014).

Today, the lifestyle habits mentioned are attracting a rising number of researchers. The available studies clearly show that these behaviors constitute the determinants of SRH in different populations. Most previous empirical studies worldwide have also agreed that low physical activity levels are related to a higher occurrence of poor SRH (HHS 2014; Duncan et al. 2014; Chan et al. 2015; Tran et al. 2013).

Deconstructing SRH into its major determinants is essential for enhancing public health services' effectiveness and policy-making by informing the public health professionals of groups that need interventions. To

improve public health services, we need to keep policymakers updated with health-related issues. Yet, to our knowledge, there are limited numbers of recent research on the combination of those lifestyle behaviors as the determinants of self-rated health (SRH) in the US. Therefore, this study (1) examines the pattern of physical activities, smoking, alcohol consumption, and SRH status, and (2) investigates the association between the behaviors and SRH status among American adults by utilizing the latest state-based survey data of the 2018 Behavioral Risk Factor Surveillance System (BRFSS).

Methods and Materials

Data source

We utilized the latest data from the BRFSS held in 2018, which was administered and supported by the Centers for Disease Control and Prevention (CDC)–a chief national public health institute of the United States. The BRFSS is an ongoing, cross-sectional, random-digit–dialed telephone survey that collects information on health-related risk behaviors, chronic health conditions, health care access, and use of preventive services related to the leading causes of death and disability in the country from the American non-institutionalized adult population aged ≥ 18 years. In 2018, 437,436 adult populations residing in all 50 U.S. states, the District of Columbia, Puerto Rico, and Guam were interviewed. The details regarding the survey and its purpose, sampling methods, data collection procedure and reporting can be found elsewhere (CDC 2018).

Description of variables

Variables included in the analysis were: smoking (every day, some day, not at all), alcohol consumption (at least one drink in a month, none drink in a month), age (18–24, 25–34, 35–44, 45–64, 65 and older), sex (male/female), race/ethnicity (White, Non-Hispanic; Black, Non-Hispanic; Hispanic; Asian; others), education (Less than high school, high school graduates, college education), employment status (employed, unemployed, not in workforce, student), marital status (married, divorced/widowed/separated, single), metropolitan status (urban, rural), household income (below $15,000, $15,000 to less than $25,000, $25,000 to less than $35,000, $35,000 to less than $50,000, and $50,000 or more), body mass index (BMI) (underweight, normal weight, overweight, obese), sexual orientation (gay, straight, bisexual, something else). Other variables from polar questions (Yes/No) that we have used in this study were: physical activity, health care coverage, Medicare possession, diabetes, heart attack, arthritis, coronary heart disease, kidney disease, depressive disorder. All the variables listed above were categorical.

Statistical analyses

We used univariate analysis to create a frequency table and its equivalent chart to summarize the data. Next, we performed cross-classification between two variables, each being from health-related behaviors and other characteristics, respectively, and determined the empirical relationship between them using bivariate analysis. Chi-square test was used to test for a statistically significant relationship between each two chosen variables. Finally, to examine the association between the reporting optimal SRH and selected health behaviors among the adult people, a dichotomous logistic regression model was employed. In the survey, respondents were asked to rate their health status on the day of interview as ‘excellent’, ‘very good’, ‘good’, ‘fair’ or ‘bad’. We dichotomized it by combining the categories ‘excellent’, ‘very good’ and ‘good’ into one category of optimal SRH and the categories ‘fair’ and ‘bad’ into another category of not optimal SRH. We set up the model as follows:

$$y = \begin{cases} 1, \text{if the adults have optimal SRH (i. e. good, very good and excellent)} \\ 0, \text{if the adults do not have optimal SRH (i. e. fair or bad)} \end{cases}$$

and a set of selected categorical health behavior explanatory variables is the following

x_1: physical acitity (yes, no)

x_2: smoking (every day, some day, not at all)

x_3: alcohol consumption (at least one drink in a month, none)

To investigate the association between the selected explanatory variables and the binary outcome variable, after controlling the socio-economic, demographic and health measures we express the logistic regression model as the following

$$ln\left[\frac{P(y=1|x)}{1-P(y=1|x)}\right] = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3 + \cdots + \beta_p x_p$$

The parameters of the model were estimated using a standard statistical software and the results of the fitted model were reported in Table 3.

Results

In total, 437,436 adults participated in the 2018 BRFSS (Centers for Disease Control and Prevention 2018). However, the total number varies from variable to variable due to omitting the missing data that were categorized as "Don't know/Not Sure," "Refused," and "Not ask or missing." The percentages presented are valid.

Most participants were women (54.8%), 45-64 of age (35.7%), White (75.72%), relatively well educated (65.2% reported at least some college education), employed (50.8%), married (51.5%), urban citizens (84.9%), and earned more than $50,000 of annual household income (50.1%). Further details about the participants' demographics are available in Table 1 (CDC 2018).

Composite statistics indicate that most participants are overweight (35.8%), with health care coverage (91.9%) and without Medicare (54.9%). For chronic diseases, arthritis (34.4%) was the most prevalent among the participants, followed by those with depressive order (18.8%), diabetes (14.8%), coronary heart diseases (9.3%), heart attack (6.1%), and kidney diseases (3.8%), respectively (Table 1).

Figure 1 presents the distribution of adult people by SRH status and the selected health behaviors. The majority of the respondents rated their health as either good (31.7%) or very good (32.6%) or excellent (16.5%). Thus, 80.8% of the respondents rated their health as optimal; about 19% of respondents reported their health as fair or bad. One in every four (25.3%) adults were found to be physically inactive. Most participants do not smoke (66.0%); while 34.0% reported to smoke everyday (24.2%) or someday (9,8%). Slightly more than half (51.6%) of the participants reported having at least one drink in a month.

Among those who are physically inactive, the prevalence of the behavior increases with the age groups and decreases with education levels and household income. People with some college education (19.2%) are significantly less likely than those with less than high school education (45.5%) to be physically inactive (Table 1). Females are slightly less physically active than males (27.5% vs. 22.5, respectively). Hispanics (32.1%) are the most physically inactive, closely followed by non-Hispanic blacks (31.8%). People not in the workforce (32.6%) are the least likely to be physically active, while students (13.4%) have the highest tendency to do so. Participants who are divorced/widowed/separated (33.8%) are the least likely to do exercise than those with another marital status (married:

21.6%, single: 22.9%). Rural individuals (29.6%) are less active than urban ones (24.2%). People who are obese (32.8%) and underweight (31.2%) have the similar highest prevalence of physical inactivity among the group, while people with standard weight (19.2%) are the most physically active. Participants with chronic diseases (diabetes, heart attack, arthritis, coronary heart disease, kidney disease, and depressive disorder) are significantly less active than those who do not.

An inversely proportional association exists between smoking prevalence and each of the three categories: age, education levels, and household income. The prevalence of smoking is quite similar in men and women (33.2% vs. 34.9%, respectively), rural and urban citizens (37.1% vs. 33.4%, respectively). The unemployed (57.0%) tend to smoke the most, followed by the students (48.9%). Single persons (52.5%) and the underweight (57.1%) tend to smoke the most. People without healthcare coverage (58.2%) or Medicare (40.9%) tend to smoke more than those who do have them (31.7% and 26.1%, respectively). Excluding depressive disorder, people with other chronic diseases tend to smoke less than those who do not.

People aged 25-34 (62.5%) and those who are employed (61.5%) tend to drink the most. Males are inclined to drink considerably more than females (58.5% vs. 6.1%, respectively). The non-Hispanic white (54.3%) drink more than any other race. There is an increase in the occurrence of drinking with more educated people. Married (55.3%) and single adults (54.4%) tend to drink the most. Urban citizens (53.1%) drink more than rural counterparts (45.5%). A directly proportional relationship exists between household income and prevalence of drinking. People with average weight (55.9%) drink the most, closely followed by the overweight (55.5%). The gay (64.8%) drink more than anybody else in the same group of sexual orientation. Individuals who do not have the diseases drink more than the ones who do.

The prevalence of optimal SRH decreases as age increases and increases as education level increases. Males (81.5%) and females (80.2%) have a similarly high prevalence of optimal SRH, with that of the males being slightly more than the females. Students (91.3%) are most likely to report their health as optimal, closely followed by the employed (89.7%), while people who are not in the workforce (70.3%) are the least likely to do so. Being married (85.3%) tends to have optimal SRH, while being divorced/widowed/separated (71.6%) has the least tendency to do so compared to those of other marital statuses. Urban people (81.6%) are more positive about their health than their rural counterparts (77.6%). As income increases, optimal SRH tends to become more common, with 91.3% of the people earning more than $50,000 a year reporting optimal SRH. As predicted, normal-weight (85.7%) participants are the most likely to report optimal health. People without healthcare coverage (76.2%) are less likely to report optimal health; on the other hand, people without Medicare (87.2%) are more likely to do so. People without diseases are significantly more likely to report optimal health.

Table 2 presents the significant bivariate association between SRH and the three selected measures of health behaviors. Participants who do physical activity (86.7%) are more likely to report optimal health than those who do not (63.4%). Nonsmokers are more likely to report their health as optimal than those who smoke every day (77.7% Vs. 67.5%, respectively). People who have at least one drink in a month (87.4%) tend to have optimal SRH more than those who do not (73.7%).

Table 3 shows the results of multiple logistic regression analyses for reporting optimal SRH by the health factors among adult people after controlling the effects of socioeconomic, demographic, and other health conditions. The model identifies that among adults who did not engage in the physical exercise had odds of optimal SRH 0.337 times the odds of optimal SRH for adults who did (AOR=0.337;95% CI: 0.327 - 0.343; P-value<0.001). The odds of optimal SRH for adults who smoke someday were 1.04 times the odds of optimal SRH for adults who did smoke every day (P-value=0.06). The odds of optimal SRH for adults who did not smoke at all were 1.483 times the odds of optimal SRH for adults who smoke every day (AOR=1.483; 95% CI: 1.445, 1.522; P-value<0.001). This model also shows the odds of optimal SRH for adults who did not consume any alcohol at all were 0.45 times the odds of optimal SRH for adults who consume at least one drink in a month (AOR=0.45; 95% CI: 0.444, 0.465; P-value<.001). Therefore, the study shows that adults who exercise, drink at least once a month, and are nonsmokers, are significantly better for holding optimal SRH.

Discussion

The present study examined the pattern of physical activities, smoking, alcohol consumption, and SRH status. It also investigated the link between the behaviors and SRH levels among the US adult people by using the most recent state-based survey of the BRFSS in 2018.

Physical activity pattern

The prevalence of physical activity has significant associations with some sociodemographic factors, and the participants' health status. The previous study in Ireland found that individuals in their physically inactive cluster were more likely to be 18-29 years old (Conry et al. 2011); another Portuguese research indicated no significant relationship between physical activity and age (Marques et al. 2015). However, our finding found that the prevalence of physical inactivity increases with the age groups, consistent with the results from Tanzania (Msambichaka et al. 2018) and Chile (Celis-Morales et al. 2016). A possible explanation is that people of different life phases have distinct physical abilities and attitudes towards physical activities because each life stage requires them to focus on different things. The difference in the results of different studies above might be due to the differences in the culture.

Our study found that physical inactivity was lower for individuals with high, compared to low, education, or income levels. This finding was in line with some studies in Iran (Akbarpour et al. 2018) and Southern Tanzania (Msambichaka et al. 2018), which showed that participants who attained higher education had a lower risk of physical inactivity. A Chilean study (Celis-Morales et al. 2016) agreed with both of our points. In contrast, although agreeing with our findings of income and physical inactivity trend, the Portuguese study found that the relationship between meeting the physical activity recommendation and educational levels only existed in women (Marques et al. 2015). Another study in Poland found no statistically significant differences in physical activity patterns between participants with different educational levels (Biernat and Tomaszewski 2015). The role of education in health behaviors is essential as low education levels might lead to less understanding about the benefits of the healthy practices shown by scientific research, which, in turn, causes worse decision-making. Also, low education can result in low income, limiting access to good health care, and exposing people to unhealthy social networks. Moreover,

low income can affect people's living areas; poor socioeconomic regions tend to have old unmaintained social settings, which can discourage the residents from physical activity.

The present research reinforces most previous ones, which reported that females engage in less physical activity than males (Msambichaka et al. 2018; Celis-Morales et al. 2016; Biernat and Tomaszewski 2015; Haenle et al. 2006; Noble et al. 2015). The prevailing social perception that men are related to great strength, while women are the "weaker sex," might be the cause for the phenomenon, which does not happen everywhere. For instance, research concerning the population of Ireland (Conry et al. 2011) and Portugal (Marques et al. 2015) reported that men are not more active than women.

Unlike a study from Tanzania (Msambichaka et al. 2018), which showed no relation between ethnicity and insufficient physical activity, we found that Hispanics and non-Hispanic blacks were the most physically inactive.

Below are some other findings about the physical activity pattern in our sample. Individuals who are obese have the highest prevalence of physical inactivity among the group, while people with normal weight are the most physically active. Participants who are divorced/widowed/separated are the least likely to do physical activity compared to those with other marital status (married, single). Participants having chronic diseases (diabetes, heart attack, arthritis, coronary heart disease, kidney disease, and depressive disorder) are significantly less active than people who do not have them.

Smoking pattern

Our study found an inversely proportional association between smoking prevalence and each of the three categories: age, education levels, and household income. As age and education levels increase, people gain more experience and understanding of smoking's health-related consequences. Also, as income levels rise, people might care more about their health and the quality of healthcare they receive. However, the German study (Haenle et al. 2006) contrasted with ours, illustrating that older men reported the highest daily tobacco consumption among former and current smokers. Research using cluster analysis from Australia showed that adults aged less than 55 have higher odds of being in clusters with the highest prevalence of smoking, risky alcohol, and drug use among all classes (Noble et al. 2015). Regarding the educational levels, our findings are in line with several studies using clustering analysis techniques in Iran and Netherlands, which concluded that individuals who are in the unhealthy lifestyle clusters are less educated than those in the most healthy class (Akbarpour et al. 2018; Vermeulen-Smit et al. 2015).

In contrast to most large-scale population studies worldwide using different statistical analysis, we found that the prevalence of smoking in the US is quite similar in men and women (Conry et al. 2011; Akbarpour et al. 2018; Haenle et al. 2006; Noble et al. 2015; Kraja et al. 2016). The difference in outcomes of the studies can be due to different cultural norms: in many countries, women are frown upon if they smoke.

While our result that the unemployed tend to smoke the most in the employment category, matches that of the indigenous Australians (Noble et al. 2015), several other clustering-utilized study reports that individuals who were in unhealthy lifestyle clusters (including smoking) more often have a paid job or self-employed (Akbarpour et al. 2018; Vermeulen-Smit et al. 2015). A possible reason for our findings is that the unemployed are more stressed than those with another employment status, leading them to find smoking as a relieving method. Our result can reinforce this as participants with depressive disorder smoke more than those who do not.

Single persons tend to smoke the most compared to people with another marital status; this discovery matches a clustering-applied study, which states that individuals in the cluster include smokers, heavy episodic drinkers, and active, unhealthy diet most often lived without a partner (Vermeulen-Smit et al. 2015). People living alone often have fewer responsibilities to restrict them from doing harmful activities.

Alcohol consumption pattern

In the present study, we found that the employed are more likely to drink than others who are not in the workforce or unemployed or students. Our finding is similar to the discovery of the study in Iran, indicating that those in the unhealthy lifestyle cluster (alcohol consumption, smoking, and consumption of sweet-tasting soft drinks) were more self-employed or laborers (Akbarpour et al. 2018).

We also found that there is an increase in drinking prevalence with more educated people, which opposed to the other studies (Akbarpour et al. 2018; Vermeulen-Smit et al. 2015). stating that individuals in the clusters that practice unhealthy behaviors (including alcohol consumption) often are less educated than those who are in the healthy ones.

Equally important, we identified that a directly proportional relationship exists between household income and prevalence of drinking. This might be because drinking is considered a means of communication in the business world.

In line with most previous studies, our analysis showed that drinking is more prevalent among males than females (Akbarpour et al. 2018; Haenle et al. 2006; Noble et al. 2015; Vermeulen-Smit et al. 2015; Kraja et al. 2016).

Also, non-Hispanic white, people with normal weight, homosexuality, living in urban areas, and subjects who do no have the diseases drink more than those in the same categories.

SRH pattern

Like most large-scale population analysis, we found that the prevalence of optimal SRH decreases as age increases and increases as education level increases (Kraja et al. 2016; Asfar et al. 2007). As people become old, their bodily functions gradually worsen, possibly leading to worse SRH. People of higher education might understand more about the risks of unhealthy behaviors, thereby giving more care to their health and having better health. While agreeing with our findings regarding the relationship between age and SRH pattern, the study in Senegal reported that education was not associated with SRH neither in a Senegalian urban city nor a rural town (Duboz et al. 2017).

Students are most likely to report their health as optimal, closely followed by the employed, while people who are not in the workforce are the least likely to do so, which is inconsistent with the Albanian study showing that unemployment is a significant predictor of poor SRH (Kraja et al. 2016).

In our sample, males are slightly more likely to report optimal SRH, which is consistent with most other research findings, stating that women more often perceive their health as poor than men (Asfar et al. 2007, Duboz et al. 2017). In contrast, a study in Albania concluded that men perceived poor health more often than women (Kraja et al. 2016). A reason behind our outcome might be that women are more concerned with minor health problems than men, leading to less tolerance than men while facing the same issues.

Previous studies have indicated that marital status does not associate with SRH in urban and rural Senegal (Duboz et al. 2017), or being married is a predictor of poor SRH in Syrian women (Asfar et al. 2007). However, our

results suggest that being married has the most tendency to have optimal SRH, while being divorced/widowed/separated has the least inclination to do so, compared to those of other marital statuses.

Also, the study in Senegal agrees with our outcomes that urban people are more positive about their health than rural ones, and optimal SRH tends to become more common, as income increases (Duboz et al. 2017). Many other researchers worldwide supported the latter result (Kraja et al. 2016; Asfar et al. 2007; Desesquelles et al. 2009), which is understandable as urban residents and people with higher incomes tend to have more access to good health care.

As predicted, our study found that normal-weight participants are the most likely to report optimal health; however, Senegal's research found no association between BMI and SRH (Duboz et al. 2017). The contrast in results can be explained by what the researchers of Senegal's study have mentioned: plumpness in Senegalese women is more perceived as a symbol of peace and wealth in the household than a risk of disease, which might not be the case in the US.

Lastly, in the current study, people without chronic diseases are significantly more likely to report optimal health, which matches most previous research (Duboz et al. 2017; Moradi-Lakeh et al. 2015). This might be because people not having the diseases are less likely to experience the pain, which leads to better SRH.

The association between SRH and unhealthy lifestyle behaviors

A strong relationship between physical activity and optimal SRH appears in our study, consistent with most other studies around the globe (HHS 2014; Duncan et al. 2014; Chan et al. 2015; Tran et al. 2013). We also found that smokers are less likely to report their health as optimal than those who do not smoke; existing research has even indicated similar associations (HHS Services 2014). When considering nationality, research focusing on citizens of different countries and ethnicities, such as Malaysian, and foreign-born Chinese, Korean, and Vietnamese Americans, found the same patterns (Duncan et al. 2014; Chan et al. 2015; Tran et al. 2013). For the Greeks, people from 15-29 years old, who are less active with past or heavy smoking tend to report their health as "poor" (Darviri et al. 2011). Concerning the Albanian adults, a research found that smoking was a significant predictor of poor SRH (Kraja et al. 2016). On the other hand, a study from Saudi Arabia saw a lack of association between poor SRH and smoking together with low physical activity (Moradi-Lakeh et al. 2015). The other one from Syria has reported that the relationship only exists among men, not among women (Asfar et al. 2007). Finally, conflicting findings have emerged regarding the association between drinking and SRH across different studies and populations. While a study of the Malaysians demonstrated that former and current drinkers tend to have poor SRH (Chan et al. 2015), those concerning the Australians and the foreign-born Asian Americans had similar intriguing results of better SRH being more prevalent among people with higher consumption of alcohol (Duncan et al. 2014; Chan et al. 2015; Tran et al. 2013). Surprisingly, the results from our study that people who have at least one drink in a month tend to have optimal SRH more often than the ones who do not, supports the latter.

Strengths and Limitations

This study's distinction is the representativeness/ the use of an extensive heterogeneous sample, with a variety of demographic status, lifestyle characteristics, and other health factors. Thereby, the observations can be qualified to extrapolate to the American adult population in recent years. Moreover, the survey is conducted under the control of

the US health protection agency CDC. The contractors only employ experienced interviewers in conducting telephone surveys, who would then have been through additional training on the BRFSS questionnaire and procedures before being approved to interview the participants. Therefore, the survey data we use is more trustworthy and has a higher response rate than other studies.

Besides some strengths, limitations also exist in our studies. First, the causal connection between lifestyle behaviors and SRH might not have been accurate because of the survey's cross-sectional nature. Second, all measurements were self-reported, which might bring some bias despite all of the questionnaire's validity. Finally, although our research considered factors regarding unhealthy behaviors and SRH among adults, there may be other variables found to be associated with SRH in previous studies that were not examined in this study.

Conclusion

Poor health behaviors can negatively impact people's well-being, and SRH is proven by many studies to be a valid health predictor. This study attempts to examine the pattern of SRH level and specific unhealthy lifestyle factors, including physical activity, smoking, and alcohol consumption. Another main goal of this research is to identify the relationship between SRH status and each of the health behaviors among American adults. Based on our analysis of the 2018 BRFSS survey, physical inactivity is more pronounced among women, older ages, lower education or household income, Hispanic race, people who are not in the workforce, who are divorced/widowed/separated, who live in rural areas, who are obese, who lives with chronic diseases, in the US. We also found that younger ages, lower educational attainment, less income, being unemployed, marital single, living without the chronic diseases other than depressive disorder, are significant predictors of smoking. On the other hand, people of the age 25-34, the employed, male sex, the non-Hispanic white, individuals living in urban areas, having normal weight, higher education or income level, or those without the diseases are more likely to drink than those of their categories. Some of the important determinants of optimal SRH in our US sample are younger age, high income or education level, male gender, Asian race, being married, urban residents, having normal weight, those without the illness. Lastly, the likelihood of rating health as optimal is substantially less for people who smoke and are physically inactive. Surprisingly, people who have at least one drink a month report optimal SRH much more often than the ones who do not. In this study, we have pinpointed the targeted groups of different unhealthy behaviors and SRH levels that need more attention from the policy-makers and informed the health-care professionals of the link between the selected lifestyle risk factors and the prevalence of optimal SRH. In addition, we encourage the policy formulators to consider educational campaigns targeting the communities, especially the youth to raise awareness about the harmful health effects of the unhealthy behaviors. Also, health promotion strategies should further focus on the maintenance of the public space for everyone to encourage them to do physical activity, raise tax for cigarettes or tobacco products. To reinforce the observed outcomes and to allow certain generalizations for our conclusions, we need more studies concentrating on the adult population using the recent survey.

References:

Akbarpour S, Khalili D, Zeraati H, Mansournia MA, Ramezankhanim A, Fotouhi A (2018) Lifestyle patterns in the Iranian population: Self- organizing map application. Caspian J Intern Med 9(3):268-275. https://doi.org/10.22088/cjim.9.3.268

Asfar T, Ahmad B, Rastam S, Mulloli TP, Ward KD, Maziak W (2007) Self-rated health and its determinants among adults in Syria: a model from the Middle East. BMC Public Health 7:177. https://doi.org/10.1186/1471-2458-7-177

Benyamini Y (2011) Why does self-rated health predict mortality? An update on current knowledge and a research agenda for psychologists. Psychol Health 26(11):1407-1413. https://doi.org/10.1080/08870446.2011.621703

Biernat E, Tomaszewski P (2015) Association of socio-economic and demographic factors with physical activity of males and females aged 20-69 years. Ann Agric Environ Med 22(1):118-123. https://doi.org/10.5604/12321966.1141380

Celis-Morales C, Salas C, Alduhishy A, Sanzana R, Martínez MA, Leiva A, Diaz X, Martínez C, Álvarez C, Leppe J, Munro CA, Siervo M, Willis ND (2016) Socio-demographic patterns of physical activity and sedentary behaviour in Chile: results from the National Health Survey 2009-2010. J Public Health (Oxf) 38(2):e98–e105. https://doi.org/10.1093/pubmed/fdv079

Centers for Disease Control and Prevention (2018) Behavioral Risk Factor Surveillance System Survey Data. U.S. Department of Health and Human Services, Centers for Disease Control and Prevention.

Centers for Disease Control and Prevention (2018) Excessive Drinking is Draining the U.S. Economy. Centers for Disease Control and Prevention. https://www.cdc.gov/features/costsofdrinking/index.html

Chan YY, Teh CH, Lim KK, Lim KH, Yeo PS, Kee CC, Omar MA, Ahmad NA (2015) Lifestyle, chronic diseases and self-rated health among Malaysian adults: results from the 2011 National Health and Morbidity Survey (NHMS). BMC Public Health15:754. https://doi.org/10.1186/s12889-015-2080-z

Conry MC, Morgan K, Curry P, McGee H, Harrington J, Ward M, Shelley E (2011) The clustering of health behaviours in Ireland and their relationship with mental health, self-rated health and quality of life. BMC Public Health 11:692. https://doi.org/10.1186/1471-2458-11-692

Darviri C, Artemiadis AK, Tigani X, Alexopoulos EC (2011) Lifestyle and self-rated health: a cross-sectional study of 3,601 citizens of Athens, Greece. BMC Public Health 11:619. https://doi.org/10.1186/1471-2458-11-619

DeSalvo KB, Bloser N, Reynolds K, He J, Muntner P (2006) Mortality prediction with a single general self-rated health question. A meta-analysis. J Gen Intern Med 21(3):267–275. https://doi.org/10.1111/j.1525-1497.2005.00291.x

Desesquelles AF, Egidi V, Salvatore MA (2009) Why do Italian people rate their health worse than French people do? An exploration of cross-country differentials of self-rated health. Soc Sci Med 68(6):1124–1128. https://doi.org/10.1016/j.socscimed.2008.12.037

Duboz P, Boëtsch G, Gueye L, Macia E (2017) Self-rated health in Senegal: A comparison between urban and rural areas. *PLoS One* 12(9):e0184416. https://doi.org/10.1371/journal.pone.0184416

Duncan MJ, Kline CE, Vandelanotte C, Sargent C, Rogers NL, Di Milia L (2014) Cross-sectional associations between multiple lifestyle behaviors and health-related quality of life in the 10,000 Steps cohort. PLoS One 9(4):e94184. https://doi.org/10.1371/journal.pone.0094184

Ford ES, Zhao G, Tsai J, Li C (2011) Low-risk lifestyle behaviors and all-cause mortality: findings from the National Health and Nutrition Examination Survey III Mortality Study. Am J Public Health 101(10):1922–1929. https://doi.org/10.2105/AJPH.2011.300167

Haenle MM, Brockmann SO, Kron M, Bertling U, Mason RA, Steinbach G, Boehm BO, Koenig W, Kern P, Piechotowski I, Kratzer W; EMIL-Study group (2006) Overweight, physical activity, tobacco and alcohol consumption in a cross-sectional random sample of German adults. BMC Public Health 6:233. https://doi.org/10.1186/1471-2458-6-233

Kavouras SA, Panagiotakos DB, Pitsavos C, Chrysohoou C, Anastasiou CA, Lentzas Y, Stefanadis C (2007) Physical activity, obesity status, and glycemic control: The ATTICA study. Med Sci Sports Exerc 39(4):606–611. https://doi.org/10.1249/mss.0b013e31803084eb

Kraja F, Kraja B, Cakerri L, Burazeri G (2016) SOCIO-DEMOGRAPHIC AND LIFESTYLE CORRELATES OF SELF-PERCEIVED HEALTH STATUS IN A POPULATION-BASED SAMPLE OF ALBANIAN ADULT MEN AND WOMEN. Mater Sociomed 28(3):173–177. https://doi.org/10.5455/msm.2016.28.173-177

Lawrence EM, Mollborn S, Hummer RA (2017) Health lifestyles across the transition to adulthood: Implications for health. Soc Sci Med 193:23–32. https://doi.org/10.1016/j.socscimed.2017.09.041

Lee IM., Shiroma EJ, Lobelo F, et al. (2012) Effect of physical inactivity on major non-communicable diseases worldwide: an analysis of burden of disease and life expectancy. Lancet (London, England) 380(9838):219–229. https://doi.org/10.1016/S0140-6736(12)61031-9

Marques A, Martins J, Sarmento H, Ramos M, Diniz J, Costa FC (2015) Socio-demographic correlates of leisure time physical activity among Portuguese adults. Cad Saude Publica 31(5):1061–1070. https://doi.org/10.1590/0102-311X00101614

Mavaddat N, Kinmonth AL, Sanderson S, Surtees P, Bingham S, Khaw KT (2011) What determines Self-Rated Health (SRH)? A cross-sectional study of SF-36 health domains in the EPIC-Norfolk cohort. J Epidemiol Community Health 65(9):800–806. https://doi.org/10.1136/jech.2009.090845

Moradi-Lakeh M, El Bcheraoui C, Tuffaha M, Daoud F, Al Saeedi M, Basulaiman M, Memish ZA, AlMazroa MA, Al Rabeeah AA, Mokdad AH (2015) Self-Rated Health Among Saudi Adults: Findings from a National Survey, 2013. J Community Health 40(5):920–926. https://doi.org/10.1007/s10900-015-0014-4

Msambichaka B, Abdul R, Abdulla S, Klatser P, Tanner M, Kaushik R, Bringolf-Isler B, Geubbels E, Eze IC (2018) A Cross-Sectional Examination of Physical Activity Levels and Their Socio-Demographic Determinants in Southern Tanzania. Int J Environ Res Public Health 15(6):1054. https://doi.org/10.3390/ijerph15061054

Nelson DE, Jarman DW, Rehm J, Greenfield TK, Rey G, Kerr WC, Miller P, Shield KD, Ye Y, Naimi TS (2013) Alcohol-attributable cancer deaths and years of potential life lost in the United States. Am J Public Health 103(4):641–648. https://doi.org/10.2105/AJPH.2012.301199

Noble NE., Paul CL, Turner N, Blunden SV, Oldmeadow C, Turon HE (2015) A cross-sectional survey and latent class analysis of the prevalence and clustering of health risk factors among people attending an Aboriginal Community Controlled Health Service. BMC Public Health 15: 666. https://doi.org/10.1186/s12889-015-2015-8

Schnittker J, Bacak V (2014) The increasing predictive validity of self-rated health. PloS one 9(1):e84933. https://doi.org/10.1371/journal.pone.0084933

Singh R, Pattisapu A, Emery MS (2019) US Physical Activity Guidelines: Current state, impact and future directions. Trends Cardiovasc Med S1050-1738(19)30140-9. Advance online publication. https://doi.org/10.1016/j.tcm.2019.10.002

Tetteh J, Kogi R, Yawson AO, Mensah G, Biritwum R, Yawson AE (2019) Effect of self-rated health status on functioning difficulties among older adults in Ghana: Coarsened exact matching method of analysis of the World Health Organization's study on global AGEing and adult health, Wave 2. PLoS One 14(11):e0224327. https://doi.org/10.1371/journal.pone.0224327

Tran TV, Nguyen D, Chan K, Nguyen TN (2013) The association of self-rated health and lifestyle behaviors among foreign-born Chinese, Korean, and Vietnamese Americans. Qual Life Res 22(2):243–252. https://doi.org/10.1007/s11136-012-0155-1

U.S. Department of Health and Human Services (2014) The Health Consequences of Smoking: 50 Years of Progress. A Report of the Surgeon General. U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Center for Chronic Disease Prevention and Health Promotion, Office on Smoking and Health.

U.S. Department of Health and Human Services (2018) Physical Activity Guidelines for Americans, 2nd edition. U.S. Department of Health and Human Services. https://health.gov/sites/default/files/2019-09/Physical_Activity_Guidelines_2nd_edition.pdf

Vermeulen-Smit E, Ten Have M, Van Laar M, De Graaf R (2015) Clustering of health risk behaviours and the relationship with mental disorders. J Affect Disord 171:111–119. https://doi.org/10.1016/j.jad.2014.09.031

Wagner KH, Brath H (2012) A global view on the development of non communicable diseases. Prev Med 54 Suppl:S38–S41. https://doi.org/10.1016/j.ypmed.2011.11.012

World Health Organization (2018) Global status report on alcohol and health 2018. World Health Organization. https://apps.who.int/iris/bitstream/handle/10665/274603/9789241565639-eng.pdf?ua=1

World Health Organization (2015) Guidance note on the integration of noncommunicable diseases into the United Nations development assistance framework. World Health Organization. https://www.who.int/nmh/ncd-task-force/guidance-note.pdf?ua=1

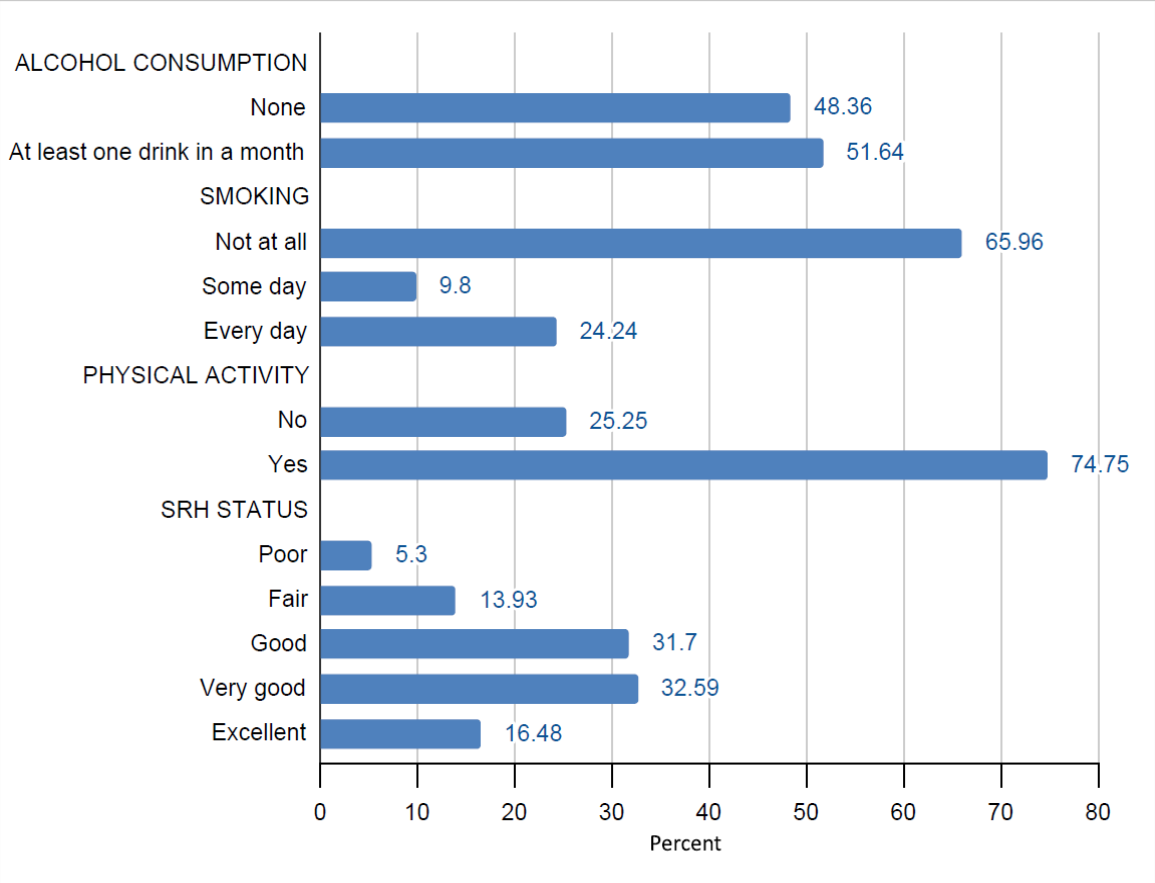

Figure 1: Percentage distribution of adults people by level of selected health behaviour

Table 2. Optimal SRH by level of selected health behavior, 2018 BRFSS, United States

Health behavior	Self-rated health		*P*-value
	Optimal	Sub-optimal	
Physical activity			≈ 0.0
Yes	86.7 (282356)	13.3 (43477)	
No	63.4 (69640)	36.6 (40183)	
Smoking			≈ 0.0
Every day	67.5 (29370)	32.5 (14134)	
Some day	71.7 (12618)	28.3 (4970)	
Not at all	77.7 (92029)	22.3 (26418)	
Alcohol consumption			≈ 0.0
At least one drink in a month	87.4 (187282)	12.6 (27086)	
None	73.7 (147715)	26.3 (52634)	

Table 3 Results of logistic regression analysis showing the adjusted odds ratio (AOR) for reporting optimal SRH by selected health behavior among adult people, 2018 BRFSS, United States

Level of health behavior	Coefficient (β)	SE(β)	AOR‡	95% CI of AOR	P-value
Physical activity					
Yes	(ref.)	--	1.000	--	--
No	-1.095	0.012	0.335	(0.327, 0.343)	<0.001
Smoking					
Every day	(ref.)	--	1.000	--	--
Some day	0.040	0.021	1.040	(0.100, 1.084)	0.060
Not at all	0.394	0.013	1.483	(1.445, 1.522)	<0.001
Alcohol consumption					
At least one drink in a month	(ref.)	--	1.000	--	--
None	-0.789	0.012	0.454	(0.444, 0.465)	<0.001

‡ Adjusted for socio-economic, demographic and chronic diseases variables