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Examining the Relationship Between Deafness and Mental Health Status: An Analysis of the Behavioral Risk Factor Surveillance System (BRFSS) 2022

Brianna Stroud-Williams
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Examining the Relationship Between Deafness and Mental Health Status: An Analysis of the Behavioral Risk Factor Surveillance System (BRFSS) 2022

Brianna Stroud-Williams

Epidemiology

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Abstract

Objective: The objective of the research is to examine the association between mental health status as measured by number of mentally healthy days in the past month and deafness and binge drinking.

Methods: *The* Behavioral Risk Factor Surveillance System (BRFSS) study was conducted via telephone survey in 50 states, including the District of Columbia and US territories. The sample size is 402,156 participants. Univariate, bivariate, and multivariate regressions, odds ratio, and 95% confidence interval were used to measure the data.

Results: Deaf respondents have 1.56 times the odds of having poor mental health than those who are not deaf. (95% CI=1.44, 1.69). The association between binge drinking and poor mental health is significant (aPOR = 1.22; 95% CI= 1.15, 1.28). Age groups and education do not have a significant association with poor mental health. Black and multiracial people have higher odds of poor mental health.

Conclusion: There is an association between poor mental health and deafness. Alcohol consumption may contribute to poor mental health. Further studies are needed to analyze the association between alcohol usage and deaf populations.

Introduction

Deaf and hard-of-hearing or people with hearing loss are one of the most understudied populations in the United States.[1] This certain population is more prevalent to experience behavioral health conditions that impact their mental health compared to their hearing counterparts.[1] There is very little research on deafness and mental health regarding substance use such as alcohol consumption.[1]

Poor mental health is considered as a score above or equal to 10 based on an 8-item version of the Patient Health Questionnaire depression scale (PHQ-8).[2] To be considered as having poor mental health, a person would have to have at least 14 days of poor mental health.[2] There is a known association between poor mental health status and alcohol consumption.[3] Poor mental health status often leads to higher alcohol consumption.[3] At the moment, there are very few studies conducted on the effects of alcohol usage among deaf people/people with hearing loss population.[4]

Binge drinking is the most common drinking problem in the United States.[5] The Centers for Disease Control and Prevention (CDC) have defined binge drinking as consuming at least five drinks for men and at least four drinks for women on occasion.[5] Binge drinking cost the United States $249 billion in 2010.[5] Binge drinking is described as the most common form of excessive alcohol usage in the United States.[5-6]

The national prevalence of alcohol usage among people who are deaf or hard of hearing or people with hearing loss population is not well-studied.[4] Several studies were conducted on deaf or people with hearing loss population and alcohol/drugs, but they are outdated.[4] The Issacs, Martin, and Buckley study on alcohol consumption among the deaf and hard-of-hearing population was conducted in 1979[7]. The study found that there is no difference in alcohol abuse among the deaf population compared to the hearing population.[4]

The objective of the research is to examine the association between mental health status as measured by number of mentally healthy days in the past month and deafness and binge drinking. The

hypothesis is deaf people/people with hearing loss who have poor mental health are more likely to binge drink compared to hearing people with poor mental health. The exposure variable is deaf people/people with hearing loss; the outcome variable is mental health status.

Methods

Study Design

This cross-sectional analysis used the 2022 Behavioral Risk Factor Surveillance System (BRFSS) data. A complex stratification design was used to collect data in BRFSS. This design used a complex random dialing system to contact landline and cellular users to collect the samples. This was done to ensure that the sampling was done accurately. The participants were interviewed and asked to provide information about what they had done in the past 30 days or if they had ever been told they had a particular condition.

Setting

The BRFSS study was conducted via telephone survey in 50 states, including the District of Columbia, Guam, Puerto Rico, and the US Virgin Islands[8].

Participants/Sample

In total,445,132 people participated in the BRFSS study.[8] Most projects used a disproportionate stratified sample design to sample the population, while Guam, Puerto Rico, and the U.S. Virgin Islands used a simple random sample design.[8] The inclusion criteria are adults 18 years of age who answered questions about alcohol consumption (if they had more than five drinks a week [males] or more than four drinks a week [females]), mental health (number of poor mental health days in past 30 days), and answered either yes or no to deafness questions (“Are you deaf, or do you have serious difficulty hearing?”) Cases with missing data were excluded. None of the variables had more than 10% missing values. The final sample size is 402,156 participants.

Hearing Status

As an exposure variable, hearing status was measured by the question, “Are you deaf, or do you have serious difficulty hearing?” Respondents were prompted to answer the question by saying “yes” or “no.” Those who answered “Don’t know” or refused to answer the question were excluded from the sample. The reference group is people without hearing loss or who are not deaf.

Mental Health Status

As an outcome variable, mental health status was measured by the question, “How many days, during the past 30 days, was your mental health not good?” If a person report having more than 15 days of poor mental health days, they are categorized as poor mental health based on PHQ-8.[2] Mental health status was collected as numerical data. Zero-day was coded as “88” in the BRFSS dataset. The data was converted into categorical data by stratifying the data into two categories. Days 0-14 were measured as “good mental health,” and days 15-30 were measured as “poor mental health.” The reference group is people with good mental health.

Instruments/Measures

Binge drinking was used in the analysis. Binge drinking is chosen as one of the variables of interest because binge drinking is often associated with poor mental health.[3] Respondents were asked to self-report if they had more than five drinks on occasion (males) or more than four drinks on occasion (females) in the past 30 days by answering “yes” or “no”. Non-binge drinkers were categorized as a reference group.

Demographic characteristics used in the study are sex (male or female), race (White only/non-Hispanic, Black only/non-Hispanic, Hispanic, Multiracial, and Other), level of education completed (attended high school, graduated high school, attended college/technical school, and graduated college/technical school) and age in years (18-24, 25-34, 35-44, 45-54, 55-64, and 65 or older). Socio-demographics are used to determine if there is any potential confounding or effect modification between poor mental health and deafness. As for sex, males with poor mental health are more likely to

engage in binge drinking than females with poor mental health.[9] Race is included to see the difference in mental health status among diverse populations. Level of education is also used to observe the information based on risky behavior, i.e., binge drinking, acquired over the years, such as never graduating from high school compared to graduating college/trade school. The final demographic, age, is observed based on the differences in mental health of the elderly compared to their younger counterparts. The reference groups are male, White, graduated college/technical school, 18-24 years old, and binge drinking population.

Data Collection

The data was collected via Computer-Assisted Telephone Interview (CATI) systems.[8] Participants were interviewed by data collectors who provided questions from questionnaires. The calls were made seven days per week during daytime and evening hours. The data was compiled and added to the CDC website. The data was downloaded from the website.

Data Analysis

The analysis was conducted in SAS Studio 3.81 (SAS Institute, Cary, North Carolina). Univariate regression was performed to analyze the demographic characteristics. Bivariate regression was performed to compare poor mental health and good mental health groups against the sociodemographic, and deafness. Adjusted multivariate regression was used to analyze the possible confounders, including sex, age, race, and education. Prevalence and adjusted prevalence odds ratios were reported in a 95% confidence interval. Data were weighted using the provided weights to account for the complex stratification method used in BRFSS.

Ethical Approval

This study used publicly available de-identified public health surveillance data and was therefore not subject to IRB oversight.

Results

Approximately seven percent of respondents reported being deaf or having difficulty with hearing (Table 1). Twenty-one percent of the respondents are informed that they were depressed, and 16.7% of the sample are binge drinkers. Poor mental health (more than 15 days) was 14.9% among the respondents. The smallest number of participants (11.8%) did not graduate from high school, while the most significant percentage of people graduated from college or technical school was 31.1%. More than one-fifth of the population is 65 or older. Female respondents were larger than the male respondents at 51.5%. Most of the sample is identified as White (59.3%).

Deafness (POR= 1.49, 95% CI = 1.40, 1.59), binge drinking (POR= 1.39; 95% CI = 1.33, 1.46), female (POR= 1.50; 95% CI = 1.44, 1.56) showed a significant association of having higher odds of having poor mental health compared to having good mental health in Table 2. Black (POR= 1.08; 95% CI = 1.02,1.15) and multiracial (POR= 1.72; 95% CI = 1.56,1.90) had a significant association of having higher odds of poor mental health, while Hispanic (POR= 0.99; 95% CI = 0.93,1.05) and other race (OR= 0.79; 95% CI = 0.76,0.87) were not significantly associated with having poor mental health in Table 2.

Did not graduate high school (POR = 2.00; 95% CI = 1.86, 2.16), graduated from high school (POR = 1.74; 95% CI= 1.66,1.83), attended college/technical school (POR = 1.70; 95% CI= 1.78) were significantly associated with having poor mental health in Table 2. 25-34 years (POR = 0.76; 95% CI= 0.71,0.81), 35-44 years (POR = 0.60; 95% CI= 0.56,0.64), 45-54 years (POR = 0.53; 95% CI= 0.50,0.57), 55-64 years (POR = 0.48; 95% CI= 0.44,0.51), and 65 years and older (POR = 0.31; 95% CI= 0.29,0.33) were not significantly associated with having poor mental health.

After controlling for potential confounders in Table 3, the results from the adjusted multivariate analysis showed that deaf/hearing loss (aPOR= 1.56; 95% CI = 1.44, 1.69), binge drinking (aPOR = 1.22; 95% CI= 1.15, 1.28), and female (aPOR = 1.23; 95% CI= 1.18,1.29) were significantly associated with higher odds of having poor mental health. Black (aPOR= 1.21; 95% CI= 1.13,1.30) and Multiracial (aPOR = 1.31; 95% CI= 1.17,1.47) were significantly associated with higher odds of having poor mental health.

However, Hispanic (aPOR = 0.84; 95% CI= 0.84,0.96) and other races (aPOR = 0.96; 95% CI= 0.86,1.08) were not significantly associated with having poor mental health.

Education status shows significance in Table 3. Did not graduate high school (aPOR = 2.00; 95% CI= 1.83,2.19), Graduated from high school (aPOR = 1.67; 95% CI= 1.58,1.76), attended college/technical school (aPOR = 1.50; 95% CI= 1.42,1.58) were significantly associated with having poor mental health. Age groups did not show any significance in Table 3. 25-34 years (aPOR = 0.81; 95% CI= 0.75,0.88), 35-44 years (aPOR = 0.68; 95% CI= 0.63,0.73), 45-54 years (aPOR = 0.61; 95% CI= 0.56,0.66), 55-64 years (aPOR = 0.50; 95% CI= 0.46,0.54), and 65 years and older (aPOR = 0.36; 95% CI= 0.33,0.39) were not significantly associated with having poor mental health.

Discussion

The objective of the research is to examine the association between mental health status as measured by number of mentally healthy days in the past month and deafness and binge drinking. The hypothesis is that deaf people/people with hearing loss who have poor mental health are more likely to binge drink compared to hearing people with poor mental health.

The association between binge drinking and poor mental health is significant. It showed that people with poor mental health have higher odds of binge drink. However, binge drinking may cause a person to have poor mental health.[11] This relationship is bi-directional but was not explored in the study.[11] If this relationship is explored in the study, we may see a similar association as the effects of mental health on binge drinking.

In the analysis, education status had an impact on mental health. People who have lower education status were at higher odds of having poor mental health. One study described people who dropped out of education early as being associated with having poor mental health.[12] It is shown that age groups did not have a significant association with poor mental health. Several studies focus on

mental health in various age groups. These studies showed that poor mental health can impact anyone regardless of age.[13-14]

Hispanic and other races did not have a significant association of having poor mental health, while Black and Multiracial had a significant association of having poor mental health. Based on a study, many races have underlying causes of poor mental health due to cultural differences and racial stressors.[15]There are not many studies on the relationship between mental health and race.

The limitations of the study are that the participants are deaf and use American Sign Language as their primary language because those who use American Sign Language often do not have the same access to information as those who use English as their primary language. The deaf population who use American Sign Language may be missing information that is not fully accessible.[10,16-17] Public health officials/researchers who conduct studies geared towards deaf people/people with hearing loss need to provide American Sign Language interpreters to gather information from deaf people who use American Sign Language.[12] With this information available, the association between deafness and mental health status may be explored further by conducting additional studies that include other variables unavailable in the BRFSS.

BRFSS was conducted as a cross-sectional study. Recall and self-report biases were likely because people were asked to provide information about their habits in the past 30 days. People may have answered the questions about their binging habits or number of days of poor mental health incorrectly, which leads to recall bias or self-report bias.

Public Health Importance

It is not known how many deaf people are dependent on alcohol and how it affects their mental health compared to their hearing counterparts.[4] There are several outdated studies on the relationship between alcohol/drug use and deaf populations, such as the Issacs, Martin, and Buckley study[4]. The association between alcohol usage and deaf populations should be further analyzed. Future studies

should emphasize improving mental health services for the deaf population as a public health responsibility. With the increase of future studies geared toward the deaf population, public health officials may recognize the need to improve mental health services to be more accessible to this population. The improved access to mental health services may support the deaf population to overcome their addiction; therefore, we may see an improvement in the mental health of deaf people/people with hearing loss.

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Table 1. Description of the Study Population, 2022 BRFSS (n= 402,156)

Variable	N (%)
Hearing Status	
Deaf/Hearing Loss	36, 051 (6.9%)
No Hearing Loss	366,105 (93.1%)
Binge Drinking	
Non-Binge Drinker	319,195 (83.3%)
Binge Drinker	54,413 (16.7%)
Mental Health Status	
Good Mental Health (≤14 days)	349,635 (85.1%)
Poor Mental Health (≥15 days)	52,521 (14.9%)
Education	
Did not graduate from high school	22,246 (11.8%)
Graduated from high school	97,504 (27.3%)
Attended College or Technical School	109,287 (30.4%)
Graduated College or Technical School	171,995 (31.1%)
Age	
18-24	24,333 (11.9%)
25-34	43,148 (17.0%)
35-44	53,289 (16.5%)
45-54	59,411 (15.1%)
55-64	72,210 (16.4%)
65 or older	146,765 (23.1%)
Sex	
Male	187,791 (48.5%)
Female	214,365 (51.5%)
Race/Ethnicity	
White only, Non-Hispanic	301,362 (59.3%)
Black only, Non-Hispanic	32,125 (11.6%)
Hispanic	39,004 (18.2%)
Multiracial	8,929 (3.2%)
Other	20,734 (7.7%)
Mean (SD)	
Number of Days Mental Health Not Good	4.93 (0.03)

N = frequency, SD = Standard Deviation, % = weighted percentage

Table 2: Measures of Deafness and Sociodemographic Characteristics by Mental Health: 2022 BRFSS (n= 402,156)

Variable	Good Mental Health N (%)	Poor Mental Health N (%)	Prevalence OR (CI)
Hearing Status			
Hearing	319,492 (93.5%)	46,613 (90.6%)	Reference
Deaf/Hearing Loss	30,143 (6.5%)	5,908 (9.4%)	1.49 (1.40, 1.59)
Binge Drinking			
Non-Binge Drinker	279,442 (84.1%)	39,753 (79.2%)	Reference
Binge Drinker	45,439 (15.9%)	8,974 (20.8%)	1.39 (1.33, 1.46)
Education			
Did not graduate from high school	18,106 (10.7%)	4,140 (14.1%)	2.00 (1.86, 2.16)
Graduated from high school	82,459 (26.7%)	15,045 (30.7%)	1.74 (1.66, 1.83)
Attended College or Technical School	92,425 (29.9%)	16,862 (33.5%)	1.70 (1.62, 1.78)
Graduated College or Technical School	155,655 (32.7%)	16,340 (21.6%)	Reference
Age y			
18-24	18,684 (10.7%)	5,649 (18.9%)	Reference
25-34	34,774 (16.2%)	8,374 (21.8%)	0.76 (0.71, 0.81)
35-44	44,601 (16.3%)	8,688 (17.3%)	0.60 (0.56, 0.64)
45-54	50,748 (15.3%)	8,663 (14.3%)	0.53 (0.50, 0.57)
55-64	65,696 (16.8%)	9,514 (14.1%)	0.48 (0.44, 0.51)
65 or older	135,132 (24.7%)	11,633 (13.6%)	0.31 (0.29, 0.33)
Sex			
Male	167,604 (50.0%)	20,187 (40.0%)	Reference
Female	182,031 (50.0%)	32,334 (60.0%)	1.50 (1.44, 1.56)
Race/Ethnicity			
White only, Non-Hispanic	263,422 (59.4%)	37,940 (58.8%)	Reference
Black only, Non-Hispanic	27,664 (11.5%)	4,461 (12.3%)	1.08 (1.02, 1.15)
Hispanic, any race	33,233 (18.3%)	5,771 (17.8%)	0.99 (0.93, 1.05)
Multiracial	7,072 (2.9%)	1,857 (4.9%)	1.72 (1.56, 1.90)
Other	18,242 (7.9%)	2,492 (6.8%)	0.79 (0.76, 0.87)

OR = odds ratio, N = frequency, CI = 95% confidence interval, % = weighted percentage, y = years

Table 3: Adjusted Multivariable Logistic Regression: Impact of Sociodemographic Variables on Poor Mental Health Status: BRFSS 2022 (n= 402,156)

Variable	Crude POR (CI)	aPOR (CI)
Hearing Status		
Hearing	Reference	Reference
Deaf/Hearing Loss	1.49 (1.40,1.59)	1.56 (1.44,1.69)
Binge Drinking		
Non-binge drinker	Reference	Reference
Binge drinker	1.39 (1.33, 1.46)	1.22 (1.15, 1.28)
Education		
Did not graduate from high school	2.00 (1.86, 2.16)	2.00 (1.83,2.19)
Graduated from high school	1.74 (1.66, 1.83)	1.67 (1.58,1.76)
Attended College or Technical School	1.70 (1.62, 1.78)	1.50 (1.42,1.58)
Graduated College or Technical School	Reference	Reference
Age y		
18-24	Reference	Reference
25-34	0.76 (0.71,0.81)	0.81 (0.75,0.88)
35-44	0.60 (0.56,0.64)	0.68 (0.63,0.73)
45-54	0.53 (0.50,0.57)	0.61 (0.56,0.66)
55-64	0.48 (0.44,0.51)	0.50 (0.46,0.54)
65 or older	0.31 (0.29,0.33)	0.36 (0.33,0.39)
Sex		
Male	Reference	Reference
Female	1.50 (1.44,1.56)	1.23 (1.18,1.29)
Race/Ethnicity		
White only, Non-Hispanic	Reference	Reference
Black only, Non-Hispanic	1.08 (1.02, 1.15)	1.21 (1.13,1.30)
Hispanic, any race	0.99 (0.93,1.05)	0.84 (0.84,0.96)
Multiracial	1.72 (1.56,1.90)	1.31 (1.17,1.47)
Other	0.79 (0.76,0.87)	0.96 (0.86,1.08)

POR = prevalence odds ratio, aPOR = adjusted prevalence odds ratio, CI = 95% confidence interval, % = weighted percentage, y = years

Appendix

Brianna Stroud-Williams grew up in Atlanta, GA. After graduating with a bachelors, she worked as a science teacher at a deaf school for five years. She taught at two deaf schools, Model Secondary School for the Deaf and Florida School for the Deaf and the Blind. She discovered her passion for public health as an undergraduate at Gallaudet University. She became interested in public health as an undergraduate student when the Ebola outbreak was happening. She noticed that many members of the deaf community got scared and started to spread misinformation about Ebola because they did not have access to the information about Ebola. She resides in Jacksonville, Florida, with her spouse and kids.

Appendix

Brianna Stroud-Williams

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SUMMARY OF QUALIFICATIONS:
Adaptable, people oriented, with a positive attitude. Able to prioritize and manage time effectively. Self-motivated with strong organizational and problem-solving skills.

EDUCATION:
Master of Public Health in Epidemiology Anticipated graduation date: May 2024
University of Nebraska Medical Center, Omaha, NE

Bachelor of Arts in Biology May 2016
Gallaudet University, Washington, DC

EXPERIENCE:

Middle School Science Teacher
2022-2023 Teacher of the Year
Florida School for the Deaf and the Blind February 2020-Present
Saint Augustine, FL

- Teach 6th, 7th, and 8th grade science classes
- Create lesson plans and activities that are aligned with Next Generation Sunshine State Standards
- Draft individualized education plans that fit each student's needs
- Communicate with student's parents to showcase their child's progress

Summer Intern July 2023
Chippenham Hospital Richmond, VA

- Worked with the Director of Infection Prevention and her team
- Created various handouts on hand hygiene and care guide for patients' port accesses
- Created an interactive game for the hospital staff to play and remind them the importance of hand hygiene
- Went on patient rounds to learn more about central lines and ports and how to prevent hospital acquired infections

Laboratory Coordinator August 2019-December 2019
Gallaudet University
Washington, D.C.

- Prepared all laboratory activities for each class

- Taught a lab course
- Maintained and ordered the lab equipment as necessary for teaching and Center for Science and Technology Research laboratories

Teaching Fellow August 2016-June 2018
Model Secondary School for the Deaf
Washington, D.C.

Taught Chemistry, Honors Chemistry, Medical Terminology - Grades 9-12 August 2016-June 2017
Taught Biology, Forensic Science, Environmental Science - Grades 9-12 August 2017-June 2018

- Planned, prepared, and delivered instructional activities that facilitated active learning experiences.
- Established and communicated clear objectives for all learning activities.
- Provided a variety of learning materials and resources for use in educational activities.
- Instructed and monitored students in the use of learning materials and equipment.
- Used relevant technology to support instruction.
- Observed and evaluated student's performance and development.
- Prepared required reports on students and activities.
- Assisted in the development of individualized education plans, consulting with educational team members and parents.

Summer Intern May 2015-August 2015
National Institutes of Health Bethesda, MD

- Worked at Flow Cytometry Core at National Eye Institute
- Analyzed data from cytometer and fed data to Cytobank
- Interpreted data by using high dimensional tools from Cytobank

Laboratory Assistant October 2014-December 2014
Gallaudet University Washington, D.C.

- Assisted instructor with laboratory classes
- Prepared materials for laboratory experiments
- Maintained experiments that required 24/7 attention
- Provided support to students in class and lab

AREAS OF CERTFICATION:
Florida Department of Education, Professional Teaching Certificate
Biology (grades 6-12)
Deaf and Hard-of-Hearing (K-12)

SKILLS:

Fluent in American Sign Language * Experienced in all Microsoft programs * First Aid/CPR certified * Know basic conversational Spanish * Some experience with SAS