

The Impact of Alcohol Misuse and Intellectual Disability on Occupational Safety

By

Mary Eickemeyer

December 2024

Director of Thesis: Dr. Michael Behm

Major Department: Technology Systems

ABSTRACT

In the United States, people with disabilities have the right to live and work in the least restrictive environments possible based on their needs. However, workers with intellectual disabilities struggle with shortcomings in both intellectual ability and adaptive capacity which can put them at higher risk for occupational injury particularly if they also cannot recognize how their own behaviors such as binge drinking might impact that risk at work. The objective of this research was to discover if disability status and/or disability type had an effect on binge drinking in the state of Minnesota when controlling for age, sex(m/f), and race. Data from the 2018 Minnesota Behavioral Risk Factor Surveillance System was utilized for this study. Negative binomial regression analysis revealed that there was no statistical significance related to disability status or disability type. However, both sex and age were statistically significant at a 95% confidence level. Similar to other research, this result found that younger men in general including those with disabilities were more likely to binge drink than women and people in any other age group. Occupational safety implications include offering alcohol misuse counseling services in the work setting, screening for off-hours alcohol use routinely as a part of occupational accident

investigations, and encouraging workers to seek support when feeling pressured to binge drink during social situations.

The Impact of Alcohol Misuse and Intellectual Disability on Occupational Safety

A Thesis

Presented to the Faculty of the Department of Technology Systems

East Carolina University

In Partial Fulfillment of the Requirements for the Degree

Master of Science in Occupational Safety

By

Mary Eickemeyer

December 2024

Director of Thesis: Michael Behm

Thesis Committee Members:

Carolyn Dunn

Charles John Lesko, Jr.

Acknowledgements

Consilium meum agnoscere cupimus quod in hoc documento recensetur, centrum pro Facultate Progressu, et statum Minnesotae.

ad Dominum

TABLE OF CONTENTS

LIST OF TABLES	v
CHAPTER 1: INTRODUCTION	1
CHAPTER 2: LITERATURE REVIEW.....	3
Definition of the Problem	12
Research Question	12
Hypotheses	13
CHAPTER 3: METHODS	14
Specific Aim	14
Sample	14
Analysis	15
Chapter 4: RESULTS AND DISCUSSION.....	19
Chapter 5: CONCLUSION.....	23
REFERENCES.....	26
APPENDIX 1: Demographics	29
APPENDIX 2: Multiple Regression	32
APPENDIX 3: Negative Binomial Regression	35

List of Tables

1. Employment Challenges and Top Strategies.....	7
2. Model Summary for Multiple Regression.....	16
3. Multiple Regression ANOVA.....	17

Chapter 1. Introduction

In 1999, the Supreme Court of the United States (SCOTUS) handed down a landmark decision based on their interpretation of the Americans with Disabilities Act (ADA) by ruling that people with disabilities have the right to live and work in the least restrictive environment possible based on the needs of the persons involved (U.S. Department of Justice, 2022). The SCOTUS required states to have a system in place to evaluate those services needed and received by people with disabilities who would have had the right to receive supportive services from the state if an institution was their only choice. This decision is particularly important for people with cognitive and intellectual disabilities who need support in language, communication, and comprehension as one of the primary symptoms of cognitive disability is difficulty with language formation (National Library of Medicine, 2021). This communication roadblock impacts their ability to understand daily work routines and social environment interactions as was often observed by this researcher in a previous work environment. A lack of intellectual ability puts people with cognitive disabilities at a higher risk than a more abled worker for injury in both home and work environments. This is particularly true if they cannot or are not willing to identify behaviors which impact their ability to remain injury-free when working at a job with limited supervision. Interestingly, the United States Equal Employment Opportunity Commission (EEOC) discusses this same issue from a slightly different mindset when looking at how to uphold the Americans with Disabilities Act of 1990 while evaluating performance and holding employees with disabilities to conduct requirements in work environments (US EEOC, 2024). The EEOC points out that performance supervision done correctly minimizes discrimination and lets employees know the expectations of the job. However, employees with disabilities sometimes fail to acknowledge that their disability can hinder their ability to carry out essential functions of the job. This can be especially true with workers with intellectual disabilities since they have major shortcomings in both intellectual ability and adaptive capabilities (Luna, 2024). More specifically, intellectual disability affects learning, problem solving, and

general and social judgement by affecting language, reading, writing, math, reasoning, knowledge, and memory. It also impacts social behaviors such as empathy, communication skills, and the ability to follow rules. All these areas are important in job safety particularly when considering the use of machinery, the proper use of chemicals, and the proper use of personal protective equipment. Additionally, any shortcoming in cognitive skills such as reading and writing as well as the ability to retain information has bearing on how well a worker can be trained to avoid hazards and use tools safely. Schulte et al. (2014) made a case for providing alcohol misuse screenings and intervention in workplaces instead of limiting these assessments to clinics and social services settings. Their study which examined the impact of a web-based feedback program demonstrated that the use of technology in alcohol misuse screening/intervention can be very effective particularly with younger employees. All this points out that one of the at-risk behaviors for people with disabilities which can impact worker safety is alcohol misuse. This was also identified by The United States Center for Disease Control and Prevention (CDC) as binge drinking (2024).

Chapter 2. Literature Review

According to the CDC, binge drinking is defined as ingesting five or more alcoholic drinks for a man and four or more alcoholic drinks for a woman together during one event (2024). Binge drinking is the most common excessive use of alcohol in the United States and is the largest contributor to economic loss related to excessive alcohol use (Bouchery et al., 2006). While most people who binge on alcohol are not considered alcohol dependent, binge drinking contributes to significant health issues and is considered preventable in an average population (CDC, 2024). According to WebMD (2022), binge drinking occurs when the blood alcohol level is raised up to the legal limit for driving over a short amount of time. Adults under 35 who make over \$75k per year and are more highly educated tend to binge drink more than the average person. Men are twice as likely to binge drink as women. One in four Americans have several alcoholic drinks in a short amount of time at least once a year. One in six will binge drink several times a month. Developing periods of brain blackout are common with binge drinking which makes operating motorized vehicles extremely hazardous for the person who has binged on alcohol. Other short-term effects of binge drinking which can lead to workplace safety issues include:

- Poor muscle motor control and slower than normal reaction times.
- Shorter attention spans and difficulty concentrating.
- Dehydration.
- Sleepiness.
- Depression which can affect interpersonal relationships at work.
- Hostility which may create a hostile work environment and emotional safety issues for peers.
- Lowered blood pressure which can contribute to feelings of dizziness and fatigue and, consequently, contribute to industrial accidents.

Researchers who focus on people with developmental disabilities believe that substance use disorders are more than a behavioral problem for people with intellectual disabilities. Studies in addiction medicine have discovered that substance use disorders often exist because of complex interactions among genetic, mental, and societal factors (Conrod et al., 2000; Merikangas & McClair, 2012). The start of substance use itself is often dependent on environmental/social cues. Biological and psychological factors such as genetics and personality traits contribute to the likelihood in each person for developing a substance use disorder (Merikangas & McClair, 2012). The synthesis of these complex factors either increase or decrease the risk for developing a substance use disorder. In part, due to these reasons, people with intellectual disabilities are more likely to develop a substance use disorder and are less likely to divulge that same information (van Duijvenbode et al., 2014). Synopsis articles (van Duijvenbode, et al., 2014; Williams et al., 2018) written on the subject tend to point out the difficulty on collecting data on alcohol misuse in people with intellectual disabilities largely due to the lack of self-report ability of the target population, the amount of variation of ability within the intellectual disability diagnosis, and a lack of screening tools with documented reliability and validity for this population. Lack of access to addiction services and lack of screening by significant others who interact regularly with people with intellectual disabilities makes it difficult to know how many people in this group abuse alcohol on a regular basis. When Taggart et al. (2006) sent a questionnaire related to alcohol use to community teams specializing in support for people with intellectual disabilities and addiction support teams in Northern Ireland, they discovered that 75% of the sample had been misusing alcohol for over 5 years. Primary characteristics of those who abused alcohol included being young, being male, having borderline/mild intellectual disability, living independently, and being diagnosed with a psychological issue. As a result of their study, Taggart et al. (2006) encouraged screening for alcohol abuse among people with intellectual disabilities who belonged to the borderline/mild group particularly given that this group tends to live more independently and tends to interact more in the community setting both

socially and occupationally than people with intellectual disabilities in the lower functioning groups.

Researchers who examined drug and alcohol use among college students with disabilities (SWD) using a stratified random sampling technique of 122 colleges and universities located in the United States also found that age made a difference. Younger students were significantly more likely than older students ($p = 0.05$) to binge drink. Additionally, SWD who used marijuana or amphetamines were significantly ($p = 0.05$) more likely to binge drink. They were also more likely to drink if they socialized more daily (>2 hours), studied less (<4 hours), and used marijuana or amphetamines (West et al., 2017).

In 2007, Taggart et al. interviewed 10 individuals with mild to moderate intellectual disability to discover why they misused alcohol and drugs and to explore services received by the participants for their alcohol misuse. All ten of the participants in the study misused alcohol for at least five years. Most of the participants lived either independently or semi independently. Qualitative data was obtained using semi structured interviews. During data analysis, two main themes emerged within the realm of alcohol misuse: psychological trauma and isolation/loneliness/disconnect from a larger community. The impact alcohol misuse had on participants included financial problems, becoming unstable psychologically, deterioration of their physical health, and deterioration of their overall relationships with others. Only two out of the 10 participants found mainstream addiction services to be supportive and helpful. Based on the results, the authors suggested that an integrated approach is needed to assist individuals with disabilities in their quest to master the issues associated with alcohol misuse. This would include a combination of services from disability providers, addiction services, and health care specialists.

The Institute for Work & Health in Toronto, Ontario, Canada utilized a two-part Delphi study to gather information on employment challenges and strategies for overcoming those challenges related to younger people with disabilities in the work world (Jetha, 2024). Process details included:

- Identifying nine future trends related to work in general via a horizon scan done in 2021.
- Six of those future trends were viewed by study participants as having significant potential impact for people with disabilities in the work world.
- Study participants included younger adults who were acutely aware of the impact of living with one or more disabilities, government policy makers, disability employment service agencies, clinicians, and human resource experts. All participants were recruited using purposeful and snowball sampling techniques.

The first part of the Delphi study asked participants to identify those trends they believed would impact the ability of people with disabilities to function in a working world and write strategies they thought would enhance inclusion of people with disabilities. The identified trends were classified as “Challenges”.

- The second part of the Delphi study asked the same group of participants to rank strategies in the areas of the above-mentioned challenges from most effective to least effective.

The six top challenges identified by study participants and corresponding top strategies are summarized in Table 1 on page 8.

Of the challenges listed in Table 1, advancing digital technologies, cultural tensions around workplace inclusivity, climate change, and external shocks speeding up the pace of change are most likely to affect direct occupational safety outcomes when considering younger adults with intellectual disabilities who also binge drink. As previously mentioned, people with intellectual disabilities struggle with learning,

problem solving, judgement, and communication. In combination with the short-term effects of binge drinking such as reduced motor control, slowed reaction times, shortened attention spans, and lack of alertness, a person with intellectual disabilities who also binge drinks may have a very difficult time learning new skills, identifying hazards, and understanding how to implement proper safety precautions in any work setting.

Table 1: Employment challenges and strategies for overcoming those challenges related to younger people with disabilities in the work world (Jetha, 2024).

Challenge	Top Strategy
Advanced digital technologies	Assist young adults with disabilities to learn new job skills by funding life-long training for them.
Impact of artificial intelligence in human resource decision making.	Use the lens of diversity, equity, inclusion, and accessibility when designing and applying AI in HR programs.
Digital globalization	Apply a minimum standard for accessibility and employment rights internationally.
Cultural tensions around workplace inclusivity	Build employer confidence to create more disability-inclusive workplaces.
Climate change	Increase options for remote work/flexible work arrangements.
External shocks speeding up the pace of change	Facilitate employment in jobs that may be less affected by shock events and are more likely to be stable over time.

The top strategy in advancing digital technologies was to help assist those with disabilities to learn new job skills by providing greater access via technology platforms to life-long training. Technology could be used to make customized learning modules to meet the needs of the person with intellectual disabilities. However, retention of information given in training could be lost if the worker has an intellectual disability and binge drinks. Given that workers with intellectual disabilities do not always have the communication skills to let supervisors know when they cannot remember information pertinent to the job, safety could become an issue if the worker does not have regular oversight from a supervisor who understands the kind of support needed by intellectually disabled workers, particularly if the employee is already compromising their chances of being safe at work by binge drinking.

Addressing cultural strain while creating a more encompassing workplace for people with disabilities was the next area on the list that has application to occupational safety. The National Institute for Occupational Safety and Health (NIOSH) lists psychosocial hazards as a work-related risk/hazard and defines it as elements in the occupational environment that cause worry, tension, or interpersonal issues for the employee (CDC; 2022, April 28). The recommended strategy from the Delphi study is to build up the confidence of businesses and their workers to help create a more disability-friendly environment without the added burden of psychosocial hazards. As mentioned earlier, both hostility and depression (aka anger without the enthusiasm) can be short term side effects of binge drinking. Both can contribute to creating psychosocial hazards in the workplace especially if the employees with those emotions already have difficulty with effective communication related to intellectual disability.

Increasing possibilities to include remote work and utilizing accommodating work plans was the top strategy in the challenge area of climate change with the focus of making work more inclusive for people

with disabilities during times of extreme weather. Ideally, a flexible schedule would assist people with disabilities to travel to work without being endangered by harmful environmental conditions. Remote work from home also is seen as an option within the Delphi report and was utilized significantly by many businesses during the COVID-19 pandemic. However, changing the work environment itself for people with intellectual disabilities can also change their ability to discern environmental hazards indoors and may lead to other issues such as ergonomic strain when using a chair and table that do not properly fit the worker and have not been evaluated by a safety professional. People with disabilities who also use alcohol may have a hard time setting boundaries for themselves when working in a remote environment if they live independently and/or with very limited supervision. Drinking on the job is usually discouraged in most businesses and remote work may open up that possibility for workers who binge drink.

The final challenge identified by the Delphi study participants of external shocks speeding up the pace of change has importance for occupational safety when considering overwhelming far-reaching events which can change the labor market and alter working conditions quickly. The COVID-19 pandemic was a prime example of this with many people with disabilities losing their jobs as businesses were shut down or working in environments with potential safety ramifications when businesses who were required to stay open were failing to properly educate employees on the use of handwashing, disinfecting chemicals, personal protective gear, and the need for increased proper ventilation. Delphi study participants felt the top strategy in this area would be to facilitate employment pathways for people with disabilities in jobs which are less likely to be impacted by external shock occurrences. As noted in the report, people with disabilities often hold lower-paying jobs and are therefore much more likely to be affected by large global events. People with intellectual disabilities may have a hard time communicating their concerns

about the changes going on when these events occur and may act out at work when they perceive a significant change of routine has occurred. They may also use alcohol as a way to deal emotionally with the substantial change which has occurred.

While people with intellectual disabilities have been drawn to employment for financial, social, and status reasons (Andrews & Rose, 2010), alcohol misuse within this group can impair their work as excessive alcohol use has been strongly correlated to occupational injury. In 1994, Dawson examined data from a 1988 National Health Interview survey. When controlling for age, gender, education, occupation, and physical job intensity, she discovered that the odds of occupational injury increase with the frequency of heavy drinking. In fact, people who drank heavily daily had an odds ratio of 1.74 and were significantly more likely ($p = 0.05$) to have an occupational injury than the average worker (Dawson, 1994). Even today, this impacts the bottom line of the US economy as the National Safety Council (2024) estimates that 167 billion dollars were spent nationally on occupational injuries in 2022 and equates to \$1040 per worker, \$40k per injury which required a clinic visit, and \$1.39 million per worker death. Businesses were impacted by the 108 million lost days of work in 2022 with 33 million injuries primarily having occurred the year before, 75 million occurring in 2022, and 60 million injuries to be expected to carry over to future years.

Another study published in 1998 calculated potential occupational injury among older workers with visual and hearing impairments using 1994 National Health Interview Survey data and compared this to previous results based on an earlier national health and retirement study (Zwerling et al., 1998). The 1994 data confirmed what the older data also indicated: older workers (ages 51-61) with visual and auditory impairments were much more likely ($p = 0.05$) to suffer occupational injuries than workers

without those types of impairments. Using national survey data from 2006-2013, Seabury et al. (2017) examined data from the American Community Survey and the Survey of Income and Program Participation to look at the relationship between work injury rates and race/ethnicity. They discovered non-Hispanic black workers and foreign-born Hispanic workers ages 50-64 had significantly higher rates of workplace injury than workers in other race/ethnic groups, largely due to working in jobs with higher average occupational injury risk. This was true even after controlling for the variables of education and biological sex.

When surveying patients in an emergency room (ER) setting, McLean, et al. (2008) discovered that people who presented themselves with work injuries were as likely as people with non-work injuries to be at at-risk drinkers. Based on the self-report of people who chose to participate in their survey, 35% of people who presented themselves with work injuries in the ER were classified as using excessive alcohol. Chau et al. (2009) discovered that alcohol abuse was more likely to correlate ($p = 0.05$) to occupational injury in jobs with high physical job demands in workers under the age of 30 and those who were 45 and older. Spicer, Miller, & Smith (2003) used a match case-controlled study to look at workplace problems, substance use, and occupational injury. They discovered that employees who had problem behaviors at work and had an indicator of substance abuse (by self-report and/or agency corrective behavior processes) were much more likely ($p = 0.015$) to also have an occupational injury.

Studies regarding the incident rate of occupational injury in adults with intellectual disabilities have been mixed. A 2011 study which used workers compensation records in Canada found that adults with intellectual disabilities who worked in a non-profit social business were significantly less likely ($p=0.05$) to have injuries requiring workers compensation support than workers without intellectual disabilities (Lysaght et al., 2011). This was also true in this researcher's experience when working with people with

intellectual disabilities in a similar work environment. In this case, most of the people who required workers compensation were staff who were supervising individuals with disabilities and were, in fact, charged with ensuring the safety of the intellectually compromised worker. However, the individuals served by work programs had significantly more reports filed for minor injuries such as cuts, abrasions, and minor falls than staff members did. In 2017, Bonander and Jernbro examined gender differences when looking at people with intellectual disability and accidental work injury risks. Using longitudinal data from a Swedish birth cohort where the participants were followed from childhood to ages 55 years of age, they found a negative correlation between childhood IQ and accident injury with one standard deviation decrease equivalent to a 17.8% increase. They also discovered that gender makes a difference as the risk is twice as large for men versus women.

Definition of the Problem

People with intellectual disabilities have the right to work and live in the least restrictive environment possible. However, with that freedom comes the risk of behaviors which may elevate their risk for injury on the job. One of those at-risk behaviors that has been identified through medical and psychiatric research is binge drinking. The purpose of this research is to identify associations among people with disabilities who binge drink in the state of Minnesota.

Research Questions

1. What is the rate of binge drinking among people with intellectual disabilities in the state of Minnesota?

2. Is there an association among disability status, disability type, age, sex, and race/ethnicity and binge drinking in the state of Minnesota?
3. And how might this use affect occupational safety strategies when employing people with disabilities?

Objective

The objective of this research is to discover if disability status and/or disability type have an effect on binge drinking in the state of Minnesota when controlling for age, sex(m/f), and race. Data for this study will come from the 2018 Minnesota Behavioral Risk Factor Surveillance System (BRFSS) survey.

Hypotheses

Null Hypotheses:

H₀₁: Disability status will not have an effect on binge drinking when controlling for age, sex, and race.

H₀₂: Disability type will not have an effect on binge drinking when controlling for age, sex, and race.

Alternative Hypotheses:

H_{A1}: Disability status will have an effect on binge drinking when controlling for age, sex, and race.

H_{A2}: Disability type will have an effect on binge drinking when controlling for age, sex, and race.

Chapter 3. Methods

Specific Aim

The specific aim of this study is to determine whether or not disability status and/or disability type have an effect on binge drinking when controlling for age, sex, and race. As previously discussed, more than one research article indicate that the presence of a disability and its type could potentially have some impact on binge drinking activity. Additionally, it would be interesting to see how demographic variables under consideration might also impact binge drinking as younger adults have been found in literature reviews to be more likely to participate in alcohol misuse than adults in the older age groups in general and including those with disabilities.

Sample data

The data utilized in this research is from the 2018 Minnesota State Behavioral Risk Factor Surveillance System (BRFSS). The study sample consists of 16990 people ages 18 and older who were residents of the state of Minnesota in 2018 who were able to speak and understand the English language well enough to provide information to the interviewers when they were collecting data.

Minnesota BRFSS information was gathered at a state level via telephone interview using a standard questionnaire for all participants in the state sample. Participants were selected through the utilization of random digit dialing techniques and needed to be age 18 or older to be included in the data collection phase. (Centers for Disease Control and Prevention, 2024). Participants needed to live in a dwelling with a separate entrance where occupants ate separately from others on the property and where the property was occupied as a primary or secondary residence. People who lived in vacation homes less than 30 days/year, in groups homes, and in institutions did not qualify to participate, nor did households who lived in states other than the state-specific BRFSS survey being done. Since 2011, adult students living in university housing have been included as acceptable participants for the purposes of the survey

(Centers for Disease Control and Prevention, 2013). The CDC's online Disability and Health Data System (DHDS) extracted its information from the BFRSS and provided data on 30 health categories for adults with and without disabilities. Data on disability was collected on six specific areas (cognition, hearing, independent living, mobility, self-care, and vision) which were not mutually exclusive. A survey participant was considered to have a disability if any one of the areas of disability is identified during the survey and survey participants could easily fall into more than one category. For the purposes of this research study, the disability areas of cognition, hearing, and vision will be considered as those are the ones which were most commonly reflected in previous supporting research.

Analysis

All of the independent variables used in this research study are categorical variables. Categorical variables represent information/data which can be categorized or grouped such as sex, race, disability status, disability type, and binge drinking (yes/no). Because the variable of age is grouped into 5-year sections, for the purposes of this study, it is also considered a categorical variable. A categorical variable represents something or someone that contains its own unique characteristic. The summary data sets created during the survey data collection process reflect numbers in the grouping of each variable through the use of zero and/or positive numbers. Because of this, categorical variables are often displayed in frequency and/or contingency tables. Both positive and negative numbers might be used when coding variables for statistical analysis (Hui Bian, personal communication, November 8, 2024). In this study, the dependent variable binge drinking is also a count variable. Count variables reflect the number of times an event happens within a specific time slot (Hazra et al., 2016; Cox et al., 2009).

Using categorical variables in standard multiple regression can pose some real problems (Cox et al., 2009) as the tables below demonstrate. When using multiple regression in SPSS to look at the effects of

independent variables of type of disability (intellectual/cognitive disability, deafness, and hearing impairment) and the dependent count variable of binge drinking while controlling for race (with White as the constant), the R Square and Adjusted R Square values listed in the Model Summary are small- both less than 13 %. This means that the model of standard multiple regression explains around 12.5-12.6% of the relationship between the dependent variable (Binge Drinking) and the independent variables. While this model information does not mean there is not a relationship between binge drinking and independent variables, it does not provide support for the independent variables listed as having predictive effect on the dependent variable. Additionally, due to the dependent variable being a count variable and not a continuous variable, negative binomial regression is a better choice for analysis vs linear regression (Hui Bian, personal communication; November 8, 2024).

Table 2: Model Summary for Multiple Regression^b

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.355 ^a	.126	.125	.42464	2.014

a. Predictors: (Constant), Cognitive Disability, Sex/MF, race=Multicultural, race=Other, race=Black, race=Hispanic, Impaired Vision, Deaf, Age in 5-year range.

b. Dependent Variable: Binge Drinking

The ANOVA section of the regression adds more confusion when indicating that the relationship between the dependent and independent variables is significant as shown in the table below with the predictors listed.

Table 3: ANOVA^a

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	255.347	9	28.372	157.342	<.001 ^b
	Residual	1770.201	9817	.180		
	Total	2025.548	9826			

a. Dependent Variable: Binge Drinking

b. Predictors: (Constant), Cognitive Disability, Sex/MF, race=Multicultural, race=Other, race=Black, race=Hispanic, Impaired Vision, Deaf, Age in 5-year rang

In order for a linear regression model to work for categorical data, there need to be some rules in place.

One of these understandings is that the model errors have some level of normalcy which is generally reflected by a normal bell-shaped curve of data residuals (Coxe et al., 2009). When looking a histogram of the dependent variable (Binge Drinking) and the highest-level independent variable (Age), it is obvious that the data is skewed (Appendix 2, Figure 1) and a bell-shaped curve is lacking. Another assumption used to ensure regression model applicability is the evaluation of scatter plots with the same variables. When evaluating the same dependent variable and independent variable, the partial regression plot from the multiple linear regression data tables shows widely dispersed points in two distinct areas of the graph instead of any type if linear relationship (Grande, 2015) as is shown in Figure 2 in Appendix 2. And when examining the relationship between observed and expected data for the dependent variable alone, even then there is no linear relationship (Appendix 2, Figure 3) as the line is curved and plotted points do not maintain approximately the same amount of distance from the most likely line through those points.

All of this indicates a different method of statistical analysis needs to be done with this count data to find out if there is any connection between disability and binge drinking in the state of Minnesota. According to Cox et al. (2009), a generalized linear model (GLiM) is most likely a much better fit for count data than straight regression as it allows for a change of the expected outcome when the collected data points are counts and the projected numbers then become natural logarithms of the count data. The GLiM is more flexible than linear regression in its requirements in the area of error methodology for count variables. Additionally, negative binomial regression (NBR) models account for overdispersion of data. This occurs when data is skewed and particularly when there are a large number of zeros present in a variable count. The NBR uses the lesser-known gamma distribution to represent the distribution of means and a mixture of 2 probability distributions (gamma and Poisson) in its error function calculations.

Data from the 2018 Minnesota BFRSS was analyzed using the Statistical Package for the Social Sciences (SPSS) with support from the Center for Faculty Excellence at East Carolina University. As previously discussed, the negative binomial regression (NBR) model was used for analysis of the effect the independent variables/factors of disability (deaf, impaired vision, cognitive disability), sex (male/female), and race (Black, other, multicultural, and Hispanic) had on the likelihood of the occurrence of binge drinking. In this generalized linear regression model, the variable of age is analyzed as a covariate and the race of White is used as a constant (Hui Bian, personal communication; October 22, 2024). The confidence level of 95% was used when computing significance levels.

Both the Goodness of Fit test and the Omnibus Test indicated that the NBR model was an appropriate model to use for this data. This was reflected in the closeness of the deviance and Pearson Chi-Square values in the Goodness of Fit test. Similarly, the Omnibus Test shows that the Likelihood Ratio Chi-Square metric is significant at less than 0.001. See Appendix 3, Tables E and F for more information.

Chapter 4. Results and Discussion

Demographics

Respondents in the sample self-identified as female 51% of the time while 48.7% of respondents self-identified as male. Forty-eight respondents which comprised of 0.3% of the sample did not identify their sex/gender (Appendix 1, Table 1). According to the United States Census Bureau estimates for 2018 in the state of Minnesota (Bureau, 2021), the BRFSS sample distribution by sex is closely representative of the estimated state population as 50.2% of respondents in their survey self-identified as female and 49.8% self-identified as male. The mean age of the sample was represented by those in the age 50-54 group and the median age made up of the 55-59 age range. See Appendix 1, Figure A and Table C for more information.

Minnesota BRFSS sample participants self-identified race in the following way:

- White: 86.2%
- Black: 3.1%
- Other, non- Hispanic: 4.0%
- Multicultural, non-Hispanic: 1.2%
- Hispanic: 4.0%
- No Response: 1.5%

The classification of White was used as a constant during statistical analysis since this group was the largest race group interviewed with other race groups being compared to it when evaluating the statistical significance of binge drinking.

Null Hypotheses:

H₀₁: Disability status will not have an effect on binge drinking when controlling for age, sex, and race.

This hypothesis was supported. As shown in Appendix 3, Table G: Tests of Model Effects, simply having a disability was not statistically significant at a 95% confidence level with being more likely to binge drink.

H₀₂: Disability type will not have an effect on binge drinking when controlling for age, sex, and race. This

hypothesis was supported. As shown in Appendix 3, Table G: Tests of Model Effects, none of the disability types were statistically significant at a 95% confidence level for binge drinking. As also shown in the same table, sex (male/female) and age were statistically significant at 95% confidence level.

However, of all the variables which were not, having impaired vision and having a cognitive disability were closer to being statistically significant at a 95% confidence interval than the others (being deaf and race variables).

Alternative Hypotheses:

H_{A1}: Disability status will have an effect on binge drinking when controlling for age, sex, and race. This

hypothesis was not supported. As shown in Appendix 3, Table G: Tests of Model Effects, simply having a disability was not statistically significant at a 95% confidence level with being more likely to binge drink.

H_{A2}: Disability type will have an effect on binge drinking when controlling for age, sex, and race. This

hypothesis was not supported. As shown in Appendix 3, Table G: Tests of Model Effects, none of the disability types were statistically significant at a 95% confidence level for binge drinking. As also shown

in the same table, sex (male/female) and age were statistically significant at 95% confidence level.

However, of all the variables which were not, having impaired vision and having a cognitive disability were closer to being statistically significant at a 95% confidence interval than the others (being deaf and race variables).

Discussion

The Test of Model Effects in Appendix 3, Table G indicates that both sex and age are significant for predicting binge drinking. The table of Parameter Estimates in Appendix 3, Table H includes the same information while also sharing the beta coefficient for the designated variable that indicates direction of effect. Both sex and age have negative coefficients and thus have inverse relationships. For sex/mf variable, a negative correlation indicates that males are more likely to binge drink than females.

Similarly, the inverse coefficient for age indicates that the older a person is, the less likely that person is to binge drink. Thus, younger males are significantly more likely to binge drink than other people in the state of Minnesota in 2018 which reflects similar findings from other researchers as previously discussed.

Both tables also indicate that, of all the variables which are not significant at a 95% confidence level, the disabilities of impaired vision and cognitive disability are the next closest to being significant at 0.059 and 0.076 respectively. This means that they could bear some watching and comparison to other levels in other states might provide more information about potential course of direction for those groups of people. This is particularly true given that participants in the data collection process were living independently and were able to communicate effectively with others over a telephone. As pointed earlier, individuals with cognitive disabilities who are less impaired by their disability have more opportunity to interact in the community, work in the community, and, thus, also more opportunity to binge drink. Knowing the results of this study hopefully will encourage employers and safety professionals who work with younger adults with and without disabilities in occupational settings to

include history of binge drinking in their accident assessments. As previously discussed, this area of concern is rarely evaluated, particularly in adults with disabilities. Further evaluation of data provided by the CDC and state governments in regard to binge drinking, age, sex, race, and disability may assist in painting a more comprehensive picture of the scope of the effects of binge drinking on the United States as a whole. With the Behavioral Risk Factor Surveillance System already in place, adding an additional question about occupational injury might help strengthen the ties between the BRFSS data and other safety data already collected occupationally by the CDC and NIOSH.

Chapter 5. Conclusions

In conclusion, this study has shown that age and sex had a statistically significant effect on binge drinking in Minnesota in 2018. Additionally, certain kinds of disability (impaired hearing and cognitive disability) are potentially headed in that same direction particularly if the persons under consideration are fairly independent. The findings of this study replicate parts of information coming from other studies; namely, that younger men in general including those with disabilities are more likely to be binge drinking than women and people in other age groups. Given the closeness of statistical significance at 95% of people with impaired hearing and cognitive disabilities and binge drinking, people in disability services and occupational safety environments who support younger people and men in particular who fall into those age groups should be aware of that potential in relation to injury and accident in an occupational setting. While there is a strong desire to see people with disabilities succeed in work settings as pointed out by the previously mentioned Delphi Study, binge drinking can impact employment pathways for that same group particularly when attempting to establish jobs which will provide employment opportunities in spite of economic and world shock events. Community business leaders are critical allies for the disability community in occupational settings. Providing in-center alcohol misuse information and counseling can help people with disabilities identify alcohol misuse and binge drinking in their own lives and this, in turn, will help them maintain a safer work environment to a greater degree than without that type of support. Both work supervisors and occupational safety professionals are also critical to the safe functioning of people with disabilities and become de facto members of the support team for employees with disabilities. One implication of this research is the need for work supervisors to develop a trusting relationship with workers who have intellectual disabilities as supervisors are often the first ones to identify unusual behaviors at work associated with the side effects of binge drinking such as unusual sleepiness, unexplained depression, unprovoked anger towards co-workers, difficulty concentrating on work, and the smell of alcohol on the person's breath.

Occupational safety professionals are often the first to correlate types of accidents and injuries associated with workers with disabilities particularly if those employees work in multiple crews and at different sites throughout the week. Safety professionals should not hesitate to contact the employee to discuss the reports received and to do a deep dive into any off duty causes which might be impacting their work including drinking with friends/buddies outside of work. Having alcohol misuse support services readily available at a place of employment is invaluable in meeting the need of an employee struggling with the effects of binge drinking who also has limited resources and supports outside of the work environment.

Areas of future research should include the examination of data related to the effects of disability status, disability type, age, sex(m/f), and race on binge drinking in other parts of the United States to help determine if the results found here also extend to other regions and/or the nation as a whole. In-depth studies with employed people with disabilities who also binge drink might provide significant answers as to how many occupational issues /injuries are a result of their disability vs alcohol misuse and provide clues to the most effective type of intervention/support needed. Additionally, examining correlations among alcohol misuse, other substance abuse, and injury type/rates in occupational settings could help solidify the relationship of those variables which appear to exist based on research. It would also be interesting to see if implementing supportive work strategies for people with disabilities such as those identified by the Delphi Study carried out by the Institute of Work and Health in Canada would reduce the need for people with disabilities to binge drink. In theory, supportive work strategies should help reduce the feelings of isolation which were identified by people with disabilities in one study as an impetus for binge drinking.

Limitations of this study include the use of data generated through phone calls where English is the primary language used. It would be much better to assess any impact on race when using data generated with the availability of an interpreter so the respondent could speak in a native language. Another limitation is the cultural understanding of binge drinking and whether it is supported within the family/culture structure of the person being interviewed or not. A third limitation is the obvious issue with not being able to directly assess the impact of binge drinking on people with disabilities in an occupational setting by collecting data about such at an occupational work site. All of these limitations could be channeled to create new research opportunities as people with disabilities are considered employees by the Occupational Safety and Health Administration (OSHA) of the United States of America. The goal of OSHA is that every person can go home to their families at night after working at their job during the day. This same goal should also be extended to those employees who live with the experience of disability while still striving to enjoy the challenge and experience of work.

References

- Andrews, A. & Rose, J.L. (2010). A Preliminary Investigation of Factors Affecting Employment Motivation in People with Intellectual Disabilities. *Journal of Policy and Practice in Intellectual Disabilities*, 7, 239-244. <https://doi.org/10.1111/j.1741-1130.2010.00272.x>
- Bonander, C. & Jernbro, C. (2017). Does gender moderate the association between intellectual ability and accidental injuries? Evidence from the 1953 Stockholm Birth Cohort study. *Accident Analysis and Prevention*, 106, 109-114.
- Bouchery, E.E., Harwood, H.J., Sacks, J.J., Simon, C.J., & Brewer, R.D. (2011). Economic Costs of Excessive Alcohol Consumption in the U.S., 2006. *American Journal of Preventative Medicine*, 41(5), 516-524. <https://doi.org/10.1016/j.amepre.2011.06.045>.
- Bureau of Labor Statistics. (2018). U.S. Department of Labor. *Employment of people with a disability* at <https://www.bls.gov/opub/ted/2019/employment-of-people-with-a-disability-in-2018.htm> accessed on September 23, 2024.
- Bureau, U. C. (2021, October 8). *State population by characteristics: 2010-2019*. Census.gov. <https://www.census.gov/data/tables/time-series/demo/popest/2010s-state-detail.html> accessed October 30, 2024.
- Chau, N., Bhattacharjee, A., Kunar, B.M., & Lorhandicap Group. (2009). Relationship between job, lifestyle, age, and occupational injuries. *Occupational Medicine*, 59, 114-119. <https://doi.org/10.1093/occmed/kgp002>
- Centers for Disease Control and Prevention. (2013, August 15). The BRFSS Data User Guide. https://www.cdc.gov/brfss/data_documentation/pdf/UserGuideJune2013.pdf
- Centers for Disease Control and Prevention. (2022, April 28). *Psychosocial hazards*. Centers for Disease Control and Prevention. <https://www.cdc.gov/niosh/learning/safetyculturehc/module-2/8.html>.
- Centers for Disease Control and Prevention. (2024). *Disability and Health Data System (DHDS)*. Centers for Disease Control and Prevention. <https://dhds.cdc.gov/methods>
- Coxe, S., West, S. G., & Aiken, L. S. (2009). The analysis of Count Data: A gentle introduction to poisson regression and its alternatives. *Journal of Personality Assessment*, 91(2), 121–136. <https://doi.org/10.1080/00223890802634175>
- Dawson, D.A. (1994). Heavy drinking and the risk of occupational injury. *Accident Analysis & Prevention*, 26(5), 655-665. [https://doi.org/10.1016/0001-4575\(94\)90027-2](https://doi.org/10.1016/0001-4575(94)90027-2).
- Grande, T. (2015). *Testing the Assumption of Independent Errors with ZRESID, ZPRED, and Durbin- Watson using SPSS*. Youtube. Retrieved October 28, 2024, from https://youtu.be/Lyk_S9T-oCw?si=ul2xxt8TkzDHaQt9.

- Green, J. A. (2021). Too many zeros and/or highly skewed? A tutorial on modelling health behaviour as count data with Poisson and negative binomial regression. *Health Psychology and Behavioral Medicine*, 9(1), 436–455. <https://doi.org/10.1080/21642850.2021.1920416>.
- Hazra, A., & Gogtay, N. (2016). Biostatistics Series Module 4: Comparing Groups - Categorical Variables. *Indian journal of dermatology*, 61(4), 385–392. <https://doi.org/10.4103/0019-5154.185700>.
- Jetha, A. (2024). *Supporting young persons with disabilities in the future of work: Top-ranked strategies based on a three-year Delphi study*. Institute for Work & Health. <https://www.iwh.on.ca/scientific-reports/supporting-young-persons-with-disabilities-in-future-of-work>.
- Luna, R. (Ed.). (2024, March). *What is intellectual disability?* Psychiatry.org - What is Intellectual Disability? <https://www.psychiatry.org/patients-families/intellectual-disability/what-is-intellectual-disability>.
- Lysaght, R., Sparring, C., Ouellette-Kuntz, H., & Marshall, C.A. (2011). Injury incidence and patterns in workers with intellectual disability: A comparative study. *Journal of Intellectual & Developmental Disability*, 36 (4), 280-284.
- McLean, S.A., Blow, F.C., Walton, M.A., Gregor, M.A., Barry, K.L., Maio, R.F. and Knutzen, S.R. (2003). Rates of At-risk Drinking among Patients Presenting to the Emergency Department with Occupational and Nonoccupational Injury. *Academic Emergency Medicine*, 10,1354-1361. [https://doi.org/10.1197/S1069-6563\(03\)00538-4](https://doi.org/10.1197/S1069-6563(03)00538-4)
- National Library of Medicine. (2021) Medical Encyclopedia. *Intellectual Disabilities*. Accessed on 12/9/21 at <https://medlineplus.gov/ency/artoc/e/001523.htm>.
- National Safety Council. (2024). *Work injury costs - injury facts*. www.injuryfacts.nsc.org. Accessed <https://injuryfacts.nsc.org/work/costs/work-injury-costs/> on October 2, 2024.
- Seabury, S. A., Terp, S., & Boden, L. I. (2017). Racial and ethnic differences in the frequency of workplace injuries and prevalence of work-related disability. *Health Affairs*, 36(2), 266–273. <https://doi.org/10.1377/hlthaff.2016.1185>
- Schulte, B., O'Donnell, A. J., Kastner, S., Schmidt, C. S., Schäfer, I., & Reimer, J. (2014). Alcohol screening and brief intervention in workplace settings and social services: A comparison of literature. *Frontiers in Psychiatry*, 5, 1–9. <https://doi.org/10.3389/fpsyt.2014.00131>
- Spicer, R.S., Miller, T.R., & Smith, G.S. (2003). Worker substance use, workplace problems, and the risk of occupational injury: A matched case-control study. *Journal of Studies on Alcohol*, 64(4), 570-578. <https://doi.org/10.15288/jsa.2003.64.570>.
- Taggart, L., McLaughlin, D., Quinn, B., & McFarlane, C. (2007). Listening to people with intellectual disabilities who misuse alcohol and drugs. *Health and Social Care in the Community*, 15(4), 360-368.

- Taggart, L., McLaughlin, D., Quinn, B. & Milligan, V. (2006). An exploration of substance misuse in people with intellectual disabilities. *Journal of Intellectual Disability Research*, 50, 588-597. <https://doi.org/10.1111/j.1365-2788.2006.00820.x>
- US Department of Justice. (2022). *Justice blogs*. Accessed on October 18, 2022, at <https://www.justice.gov/opa/blog/justice-department-commemorates-anniversary-olmstead-v-lc-1>.
- U.S. Equal Employment Opportunity Commission. (2024). *Applying performance and conduct standards to employees with disabilities*. US EEOC. Access on 8/15/2024 at <https://www.eeoc.gov/laws/guidance/applying-performance-and-conduct-standards-employees-disabilities>.
- van Duijvenbode, N., VanDerNagel, J.E.L., Didden, R., Engels, R.C.M.E., Buitelaar, J.K., Kiewik, M., & de Jong, C.A.J. (2015). Substance use disorders in individuals with mild to borderline intellectual disability: Current status and future directions. *Research in Developmental Disabilities*, 38, 319-328. <https://dx.doi.org/10.1016/j.ridd.2014.12.029>.
- West, S. L., Graham, C. W., & Temple, P. (2017b). Rates and correlates of binge drinking among college students with disabilities, United States, 2013. *Public Health Reports*, 132(4), 496–504. <https://doi.org/10.1177/0033354917713470>
- Williams F, Kouimtsidis C, Baldacchino A. (2018). Alcohol use disorders in people with intellectual disability. *British Journal of Psychological Advances*, 24(4), 264-272.
- Zwerling, C., Whitten, P.S., Davis, C.S., & Sprince, N.L. (1998). Occupational Injuries Among Older Workers with Visual, Auditory, and Other Impairments. A Validation Study. *Journal of Occupational & Environmental Medicine*, 40(8), 720-723.

Appendix 1: Demographics

Table A: Sex/MF

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Female	8669	51.0	51.2	51.2
	Male	8273	48.7	48.8	100.0
	Total	16942	99.7	100.0	
Missing	System	48	.3		
Total		16990	100.0		

Table B: Race

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	White	14649	86.2	87.5	87.5
	Black	526	3.1	3.1	90.7
	Other	679	4.0	4.1	94.7
	Multicultural	200	1.2	1.2	95.9
	Hispanic	685	4.0	4.1	100.0
	Total	16739	98.5	100.0	
Missing	System	251	1.5		
Total		16990	100.0		

Figure A: Age in 5-year Ranges

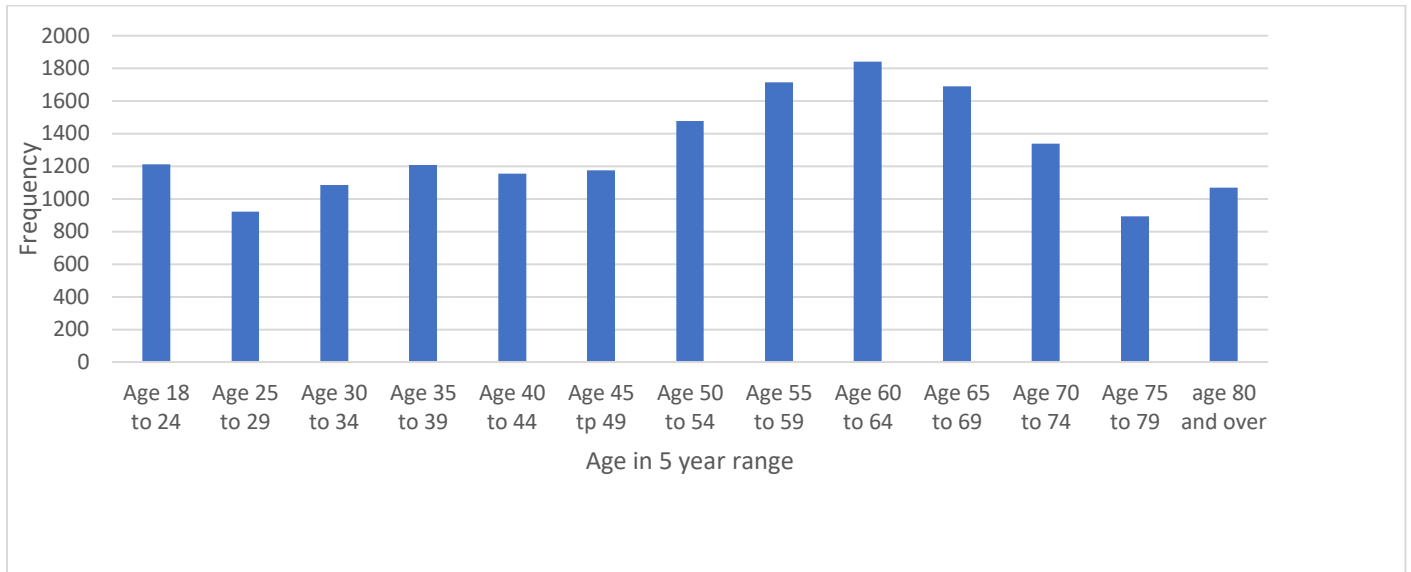


Table C: Statistic- Sample Age Range, MN, 2018

N	Valid	16781
	Missing	209
Mean		7.2017
Median		8.0000
Mode		9.00
Skewness		-.171
Std. Error of Skewness		.019

Appendix 2: Multiple Regression

Figure A: Residual/Error Distribution of the Dependent Variable

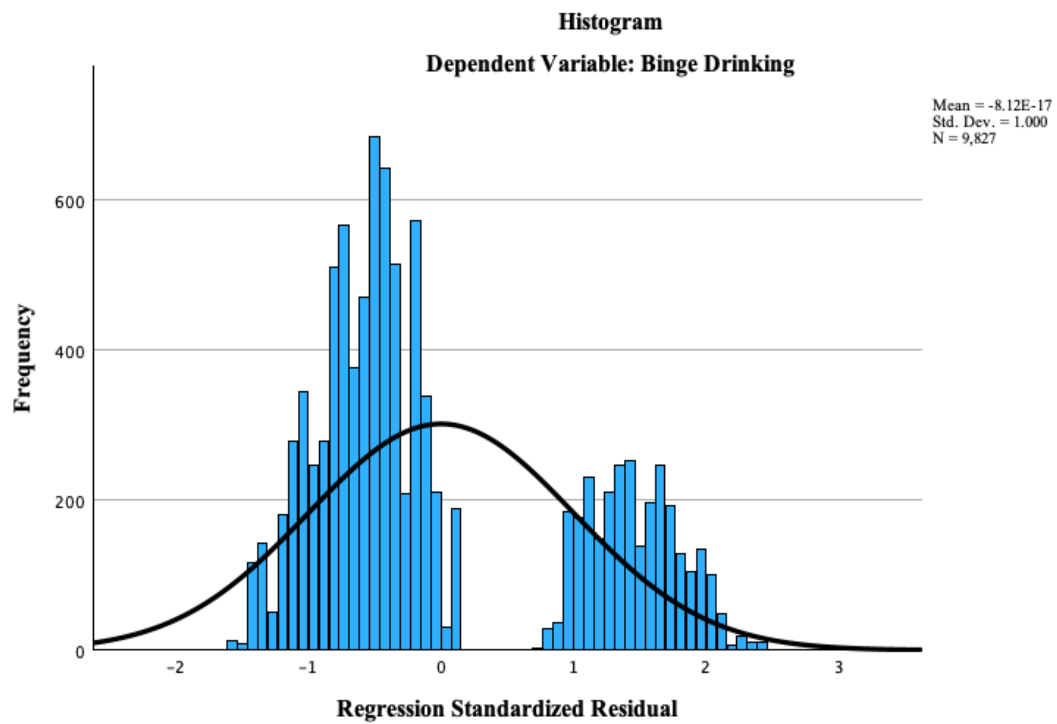


Figure B: Partial Regression Plot
Age x Binge Drinking

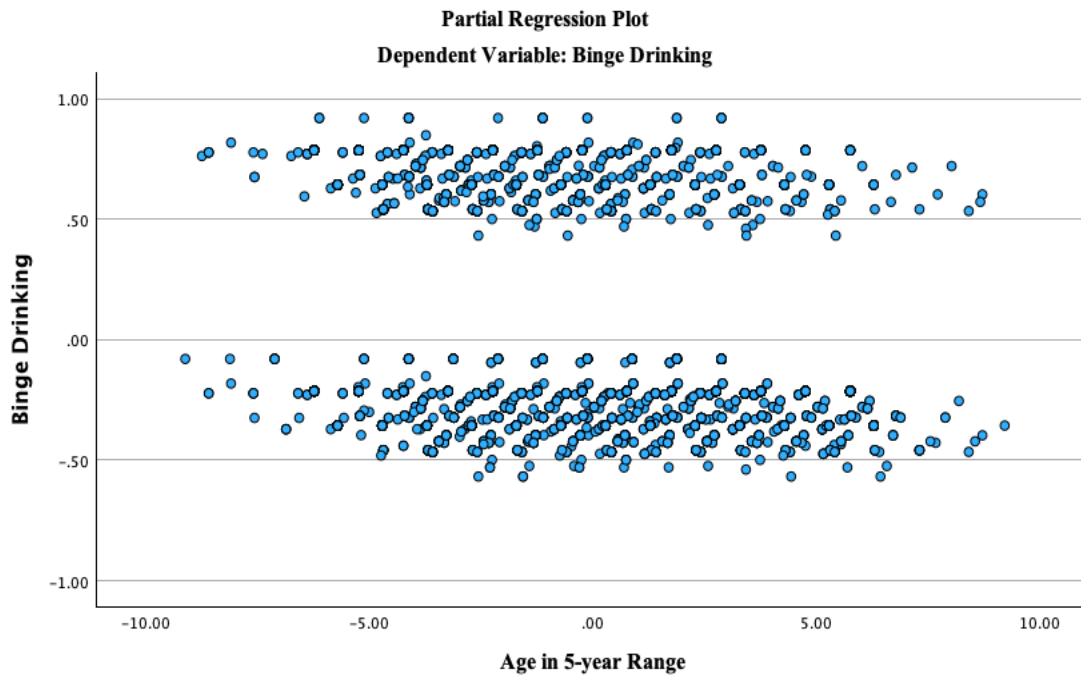
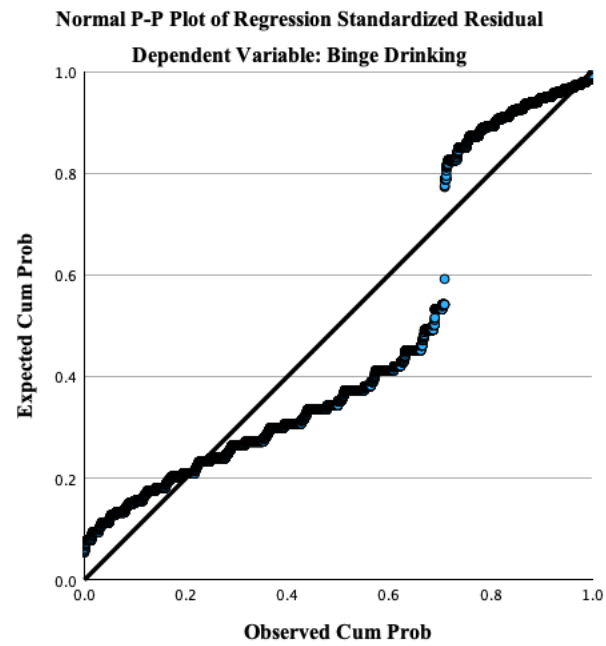


Figure C: Linear correlation



Appendix 3: Negative Binomial Regression

Table A: Model Information

Dependent Variable	Binge Drinking
Probability Distribution	Negative binomial (1)
Link Function	Log

Table B: Case Processing Summary

	N	Percent
Included	9827	57.8%
Excluded	7163	42.2%
Total	16990	100.0%

Table C: Categorical Variable Information

			N	Percent
Factor	Deaf	No	9066	92.3%
		yes	761	7.7%
		Total	9827	100.0%
	Impaired Vision	No	9553	97.2%
		yes	274	2.8%
		Total	9827	100.0%
	Cognitive Disability	No	9197	93.6%
		yes	630	6.4%
		Total	9827	100.0%
	Sex/MF	female	4731	48.1%
		male	5096	51.9%
		Total	9827	100.0%
	race=Black	.00	9622	97.9%
		1.00	205	2.1%
		Total	9827	100.0%
	race=Other	.00	9566	97.3%
		1.00	261	2.7%
		Total	9827	100.0%
	race=Multicultural	.00	9713	98.8%
		1.00	114	1.2%
		Total	9827	100.0%
	race=Hispanic	.00	9529	97.0%
		1.00	298	3.0%
		Total	9827	100.0%

Table D: Continuous Variable Information

		N	Minimum	Maximum	Mean	Std. Deviation
Covariate	Binge Drinking	9827	.00	1.00	.2905	.45403
	Age in 5-year range	9827	1.00	13.00	6.9488	3.39090

Table E: Goodness of Fit^a

	Value	Df	Value/df
Deviance	4919.131	9817	.501
Scaled Deviance	4919.131	9817	
Pearson Chi-Square	5451.207	9817	.555
Scaled Pearson Chi-Square	5451.207	9817	
Log Likelihood ^b	-6417.436		
Akaike's Information Criterion (AIC)	12854.872		
Finite Sample Corrected AIC (AICC)	12854.894		
Bayesian Information Criterion (BIC)	12926.800		
Consistent AIC (CAIC)	12936.800		

Dependent Variable: Binge Drinking

Model: (Intercept), Deaf. Impaired Vision, Cognitive Disability, Sex/MF, race=Black, race=Other, race=Multicultural, race=Hispanic, Age in 5-year range^a

a. Information criteria are in smaller-is-better form.

b. The full log likelihood function is displayed and used in computing information criteria.

Table F: Omnibus Test^a

Likelihood Ratio Chi-Square	Df	Sig.
692.129	9	<.001

Dependent Variable: Binge Drinking

Model: (Intercept), Deaf, Impaired vision,
Cognitive Disability, Sex/MF, race=Black,
race=Other, race=Multicultural, race=Hispanic,
Age in 5-year range^a

a. Compares the fitted model against the
intercept-only model.

Table G: Tests of Model Effects

Source	Type III		
	Wald Chi-Square	Df	Sig.
(Intercept)	4.278	1	.039
Deaf	.679	1	.410
Impaired Vision	3.565	1	.059
Cognitive Disability	3.140	1	.076
Sex/MF	93.998	1	<.001
race=Black	.293	1	.588
race=Other	.128	1	.720
race=Multicultural	.200	1	.655
race=Hispanic	2.561	1	.110
Age in 5-year range	479.549	1	<.001

Dependent Variable: Binge Drinking

Model: (Intercept), Deaf, Impaired Vision, Cognitive Disability, Sex/MF, race=Black, race=Other, race=Multicultural, race=Hispanic, Age in 5-year range

Table H: Parameter

	B	Std. Error	Hypothesis Test			Exp(B)
			Wald Chi-Square	Df	Sig.	
(Intercept)	-.109	.3253	.113	1	.737	.896
[Deaf=.00]	.081	.0982	.679	1	.410	1.084
[Deaf=1.00]	0 ^a	.	.	.	.	1
[Impaired Vision=.00]	-.251	.1331	3.565	1	.059	.778
[Impaired Vision=1.00]	0 ^a	.	.	.	.	1
[Cognitive Disability=.00]	-.149	.0841	3.140	1	.076	.862
[Cognitive Disability=1.00]	0 ^a	.	.	.	.	1
[Sex/MF=.00]	-.437	.0450	93.998	1	<.001	.646
[Sex/MF=1.00]	0 ^a	.	.	.	.	1
[race=Black=.00]	.077	.1415	.293	1	.588	1.080
[race=Black=1.00]	0 ^a	.	.	.	.	1
[race=Other=.00]	-.043	.1210	.128	1	.720	.958
[race=Other=1.00]	0 ^a	.	.	.	.	1
[race=Multicultural=.00]	.084	.1872	.200	1	.655	1.087
[race=Multicultural=1.00]	0 ^a	.	.	.	.	1
[race=Hispanic=.00]	.191	.1196	2.561	1	.110	1.211
[race=Hispanic=1.00]	0 ^a	.	.	.	.	1
Age in 5-year range	-.154	.0070	479.549	1	<.001	.857
(Scale)	1 ^b					
(Negative binomial)	1 ^b					

