

Socioeconomic Status and Mental Health Outcomes

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1. Rationale

1.1 Literature Review

Mental health has emerged as a significant global concern in recent years, encompassing various challenges faced by individuals. The impact of socioeconomic factors on mental well-being has garnered considerable attention, revealing a complex relationship between the two. Individuals with lower socioeconomic status (SES) tend to experience higher rates of mental disorders, encounter barriers in accessing mental health services, and often suffer from increased psychological distress. Conversely, individuals with higher SES generally exhibit lower rates of mental disorders, possess better access to resources and support, and enjoy stronger social networks. Understanding the influence of socioeconomic factors on mental health outcomes is crucial for the development of targeted interventions and policies. This overview aims to provide a foundation for further exploration of the connection between mental health and socioeconomic factors, emphasizing the need to comprehend and address these factors to improve mental health outcomes globally.

Socioeconomic status encompasses multiple components, including income level, educational attainment, and occupational status, which are crucial factors when examining the relationship between socioeconomic factors and mental health outcomes. Income level refers to an individual's or household's financial resources, including earnings, investments, and government support. Educational attainment plays a significant role in an individual's ability to navigate the modern world and take care of themselves. Occupational status indicates the type of work an individual engages in and their position within the occupational hierarchy, with lower-ranking individuals often having limited access to both luxuries and necessities. These factors, among others, are believed to be associated with mental health outcomes.

Individuals with lower SES face a higher risk of experiencing mental disability and psychiatric hospitalization (Hudson, 2005). However, they often encounter barriers in accessing mental health services due to financial constraints, lack of health insurance, or inadequate availability of services in their communities. Chronic stressors such as financial hardships, housing instability, and discrimination further contribute to elevated levels of psychological distress among individuals living in low SES conditions.

Conversely, individuals with higher SES tend to have lower rates of mental disorders compared to those with lower SES. They typically have better access to mental health resources, including private healthcare, therapy, and counseling services. Additionally, high SES individuals often benefit from larger social networks and stronger social support systems, which can serve as protective factors against mental health issues (Vaalavuo et al., 2022). Overall, individuals with better SES conditions tend to have better mental health outcomes, but it is important to consider which factors are the most influential in this regard.

One influential factor is the level of education, which contributes to cognitive skills, resilience, and social integration. Higher education levels are associated with greater competence and control over one's life, leading to improved well-being (Zhang et al., 2022). Attending higher education programs is also an indicator of family SES level, as those in more favorable financial conditions have the ability to pursue higher levels of study. Formal education enhances cognitive abilities, critical thinking, problem-solving skills, and emotional resilience, which can buffer against mental health challenges. Furthermore, a larger educational gap is associated with a higher proportion of social participation, fostering a sense of belonging and creating opportunities for personal growth and empowerment (Zhang et al., 2022). Parental education is

also strongly associated with mental health outcomes in children (Vaalavuo et al., 2022), reinforcing the importance of education as an SES factor.

Income and employment status are additional factors with significant implications for mental health. Those with lower levels of income are at a higher risk of decreased mental health compared to those in more favorable conditions (Nagasu et al., 2019). Income level is a crucial determinant of mental health, with higher income generally associated with lower prevalence of mental disorders and better overall well-being. Higher disposable income enables individuals to access better nutrition, housing, medical care, and health awareness, leading to improved mental health outcomes (Zhang et al., 2022). Economic stress, such as poverty, unemployment, and housing unaffordability, most dramatically impacts individuals who are low on the SES scale (Hudson, 2005). Limited access to healthcare and other benefits further compounds the challenges faced by individuals with lower income and employment status.

In contrast, individuals working in occupations with increased benefits, such as government jobs, have better access to resources and a safer and healthier working environment, leading to a stronger awareness of health service utilization (Vaalavuo et al., 2022). While income and employment status are closely related, further exploration is needed to determine the specific income levels and occupational statuses that have the most significant effect on mental health outcomes.

1.2 Purpose Of Study

This literature review suggests that there are many influential socioeconomic factors, but it is important to consider what, more specifically, are these factors and the possible differences in impact there might be between children and adults. The purpose of this study is to identify

these relationships between different socioeconomic factors and their impact on mental health outcomes as well as the potential difference between age groups. The identification of these relationships can help doctors better identify high-risk individuals, policy makers create legislation to get more individuals out of specific situations, and the general population to help notice these issues in themselves or friends and get the proper help. By recognizing this influence of socioeconomic factors on mental health and identifying their specific relationships, we can work towards creating a more inclusive and supportive environment for all individuals, regardless of their SES background.

1.3 Research Questions

This research paper aims to make conclusions on the following questions, each building up on top of each other.

1. What specific socioeconomic factors among adults in the United States have a profound impact on mental health outcomes?
2. Do these factors have a similar impact on adults vs. children?

2. Methods and Materials

2.1 Sample

The participants or sample for this research study utilized publicly available data from the National Health Interview Survey (NHIS) for the year 2021. The target population consisted of the general civilian population of those living within the 50 states and the District of Columbia at the time of the interview. This study aimed to cover all demographics, as it is a national study, and based its sampling procedure off the 2010 census data. This means that all genders, races,

and socioeconomic backgrounds were attempted to be proportionally represented in the census, giving an unbiased picture of the current state of the nation's health.

2.2 Exclusion Criteria

To maintain the focus on the civilian noninstitutionalized population within the United States, certain individuals were excluded from the NHIS sample. These exclusions included individuals without a fixed household address, active duty military personnel and civilians living on military bases, individuals in long-term care institutions, individuals in correctional facilities, and U.S. nationals living in foreign countries.

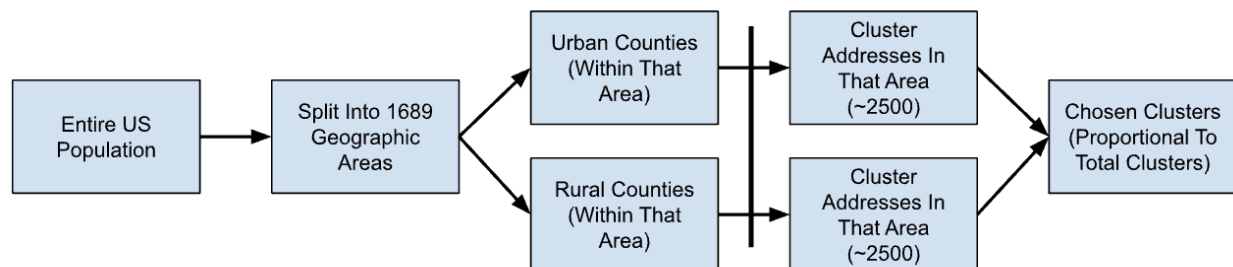
2.3 Sampling Procedure

Sampling was conducted via geographically clustered sampling. The United States was divided into 1,689 geographic areas, including counties, county equivalents, or groups of counties. In states with varying population densities, two strata were established, distinguishing between urban and rural counties. Within each stratum, clusters of addresses were defined, with an approximate size of 2,500 addresses per cluster. Clusters were then systematically selected and the number chosen was proportional to the total number in each stratum. However, exceptions were made for the 10 least populous states and the District of Columbia, where additional clusters were selected to meet minimum statistical requirements.

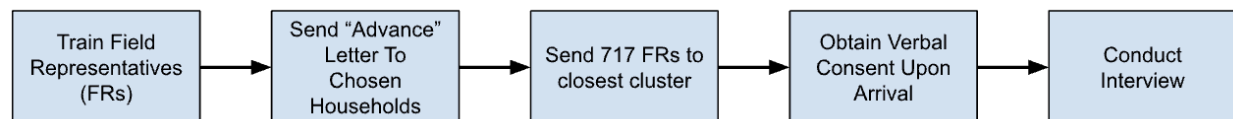
The data collection was conducted using trained Census interviewers called Field Representatives (FRs). Approximately 717 FRs conducted face-to-face interviews in respondents' homes throughout the year. These interviewers received training and supervision from health survey supervisors in the Census Bureau Regional Offices. To ensure participant

understanding and consent, selected households receive an "Advance letter" before the interview. This letter explains the NHIS purpose, time requirements, and emphasizes voluntary participation. Verbal consent for survey participation was obtained from respondents prior to conducting the interview.

Sample Selection Diagram



Interview Process



2.4 Measures

Below are the independent/explanatory variables that were tested on in this study. All variables are categorical and nominal (no purposeful order) and are described as so. "Refused", "Not Ascertained", and "Don't Know" values were omitted as the proportion of those values were minimal to none and didn't therefore have a drastic impact on the study. The most common or mode value of each count distribution is bolded. A sample of the full dataset including only these values can be found in Appendix A.

Name	Description	Categories	Adult Counts	Child Counts
URBRRL	Urban/Rural Classification	1 - Large Central Metro 2 - Large Fringe Metro 3 - Medium and Small Metro 4 - Nonmetropolitan	1 - 8945 2 - 6949 3 - 9315 4 - 4273	1 - 2527 2 - 2084 3 - 2529 4 - 1121

REGION	Region Of US	1 - Northeast 2 - Midwest 3 - South 4 - West	1 - 4775 2 - 6327 3 - 10731 4 - 7649	1 - 1191 2 - 1759 3 - 2995 4 - 2316
NOTCOV	Coverage Status	1 - Not covered 2 - Covered	1 - 2313 2 - 27072	1 - 334 2 - 7889
SEX	Gender	1 - Male 2 - Female	1 - 13378 2 - 16102	1 - 4257 2 - 4002
HISPALLP	General Race	1 - Hispanic 2 - Non-Hispanic White only 3 - Non-Hispanic Black/African American only 4 - Non-Hispanic Asian only 5 - Non-Hispanic AIAN only 6 - Non-Hispanic AIAN and any other group 7 - Other single and multiple races AIAN = American Indian and Alaskan Native	1 - 4081 2 - 19658 3 - 3160 4 - 1810 5 - 182 6 - 224 7 - 367	1 - 2089 2 - 4204 3 - 814 4 - 611 5 - 59 6 - 84 7 - 400
PCNTADLT	Number Of Adults In Family	1 - 1 adult 2 - 2 adults 3 - 3+ adults	1 - 10899 2 - 14401 3 - 4182	1 - 1121 2 - 5264 3 - 1874
PHSTAT	General Health Status	1 - Excellent 2 - Very Good 3 - Good 4 - Fair 5 - Poor	1 - 6657 2 - 10105 3 - 8350 4 - 3353 5 - 1004	1 - 5511 2 - 1775 3 - 805 4 - 145 5 - 21
PAYBLL12M	Difficulty In Paying For Healthcare	1 - Yes 2 - No	1 - 2864 2 - 26450	1 - 917 2 - 7285
EDUCP	Highest Education Level Received (Adult) Highest Education Level In Family (Child)	00 - Never attended/kindergarten only 01 - Grade 1-11 02 - 12th grade, no diploma 03 - GED or equivalent 04 - High School Graduate 05 - Some college, no degree 06 - Associate degree: occupational, technical, or vocational program 07 - Associate degree: academic program	00 - 0 01 - 2069 02 - 464 03 - 645 04 - 6606 05 - 4453 06 - 1126 07 - 2566 08 - 6968 09 - 3284 10 - 1149	00 - 0 01 - 265 02 - 100 03 - 110 04 - 1269 05 - 1156 06 - 312 07 - 805 08 - 2210 09 - 1562 10 - 564

		08 - Bachelor's degree (Example: BA, AB, BS, BBA) 09 - Master's degree (Example: MA, MS, MEng, MEd, MBA) 10 - Professional School or Doctoral degree (Example: MD, DDS, DVM, JD, PhD, EdD)		
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For all of these variables, the mode value is the same, except for SEX and PHSTAT. For SEX, this difference can be attributed to random selection, as the survey did not consider gender during their sampling method. For PHSTAT, this could potentially be due to health outcomes worsening as one gets older. These differences were further explored while comparing the relationship between these variables between these age groups.

The dependent/response variable, DEPFREQ (frequency of depression episodes), is a categorical and nominal variable that was used to measure mental health outcomes.

Categories: 1 - Daily, 2 - Weekly, 3 - Monthly, 4 - A few times a year, 5 - Never.

Adult Counts: 1 - 1186, 2 - 1789, 3 - 2220, 4 - 8407, **5 - 15182.**

Child Counts: 1 - 77, 2 - 264, 3 - 390, 4 - 1340, **5 - 4007.**

2.5 Analysis Procedure

The collected data were organized and prepared for analysis through various steps. Two separate CSV data files were used, one containing adult responses and the other containing child responses. Prior to analysis, data cleaning, such as removing missing values, and coding procedures were performed to ensure proper formatting and ease of use. Then, the respective counts of each combination of the target independent variable and depression frequency was tabulated. This resulted in an nx5 table, where n was the amount of levels in the target variable.

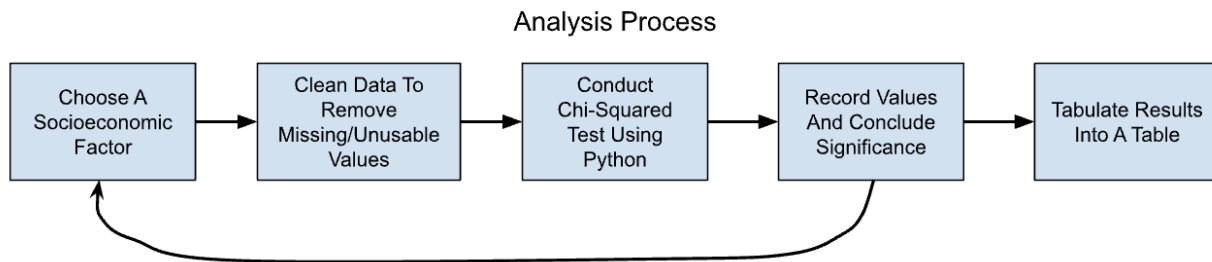
To identify which socioeconomic factors were most influential to worse mental health outcomes in adults, a chi-squared test of independence at a 95% confidence level was employed on each target variable. Only adult responses were used in the tests as child responses can introduce some external variables such as parental impact. This allowed for the examination of the relationship between the independent target factors and depression levels. If the p-value is less than 5%, the relationship between these two variables is significant and there is most likely some sort of relationship between them.

To identify if there is a difference in factors between adults and children, similar chi-squared tests as the one performed on the adults were performed for each target factor of the data on children. If the relationship between the target factor and depression frequency between both age groups was the same (significant or not significant), it would be concluded that the factor has a similar impact regardless of age group. If they were not the same, it would be suggested that the factor doesn't have a similar impact, but varying impact depending on the age group of the individual.

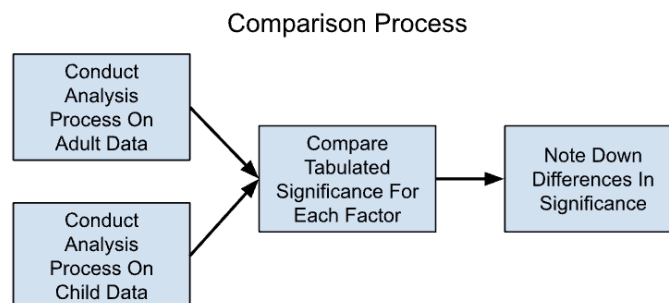
All statistical analyses and data handling procedures were conducted using the Python programming language, utilizing the libraries Pandas, Numpy, and Stats from Scipy. Expected values, degrees of freedom, chi-squared statistics, and p-values were calculated using the `chi2_contingency(observed_data)` function from the stats class from scipy. The detailed code used for the analysis can be found in Appendix B section of this research paper.

2.6 Analysis Diagrams

What specific socioeconomic factors have a profound impact on mental health outcomes for adults?



Do these factors have a similar impact on adults vs. children



3. Results

A significance test was performed on every socioeconomic factor to assess its relationship with depression frequency. The significant factors are the tests with $p\text{-value} < 0.05$ (α).

All of these target variables were tested using the following format.

Hypothesis:

H_0 : The <TARGET VARIABLE> and depression outcomes for <ADULTS/CHILDREN> are independent from each other.

H_a : The <TARGET VARIABLE> and depression outcomes for <ADULTS/CHILDREN> are not independent from each other.

Conditions:

- Random: This data was collected in randomized geographic sampling of the US.
- Large Counts: All expected values are greater than 10.

- Independence: Each individual only falls in 1 category for each variable.

If any conditions weren't met, the chi-squared test did not proceed. This was not an issue in this study as all conditions were met during all tests.

Table 1. Chi-squared independence test results across all socioeconomic factors in adults. This table shows that for adults, all the following variables have some sort of correlation with depression frequency.

<i>Variable</i>	<i>Degrees Of Freedom</i>	<i>Chi-square statistic</i>	<i>P-value</i>	<i>Significant?</i>
URBRRL	12	52.962	$4.184 * 10^{(-7)}$	Yes
REGION	12	57.943	$5.337 * 10^{(-8)}$	Yes
NOTCOV	4	12.009	0.0173	Yes
SEX	4	346.537	$9.811 * 10^{(-74)}$	Yes
HISPALLP	24	290.875	$1.147 * 10^{(-47)}$	Yes
PCNTADLT	8	342.520	$3.573 * 10^{(-69)}$	Yes
PHSTAT	16	2808.269	~ 0	Yes
PAYBLL12M	4	814.895	$4.560 * 10^{(-175)}$	Yes
EDUCP	36	395.611	$4.147 * 10^{(-62)}$	Yes

Table 2. Chi-squared independence test results across all socioeconomic factors in children. This table shows that for children, all except urban-rural classification (URBRRL), coverage (NOTCOV), and number of adults in the family (PCNTADLT) have some sort of correlation with depression frequency.

<i>Variable</i>	<i>Degrees Of Freedom</i>	<i>Chi-square statistic</i>	<i>P-value</i>	<i>Significant?</i>
URBRRL	12	13.389	0.341	No
REGION	12	29.366	0.003	Yes
NOTCOV	4	8.515	0.074	No
SEX	4	49.739	$4.093 * 10^{(-10)}$	Yes
HISPALLP	24	104.244	$5.625 * 10^{(-12)}$	Yes
PCNTADLT	8	12.769	0.120	No

PHSTAT	16	415.798	$1.769 * 10^{(-78)}$	Yes
PAYBLL12M	4	78.592	$3.460 * 10^{(-16)}$	Yes
EDUCP	36	63.898	0.003	Yes

4. Discussion

4.1 Introduction

The goal of this paper was to explore the intricate relationships between various socioeconomic factors and mental health outcomes, with a special focus on adults residing in the United States, as well as the difference in impact based on age group. The literature review shed light on the crucial role of socioeconomic factors in shaping mental health, emphasizing the intricate dance between socioeconomic status (SES) and overall well-being. Building upon the insights gained from existing research, our study aimed to identify the specific socioeconomic factors that hold a profound influence on mental health outcomes. Additionally, we sought to investigate whether these factors exhibit a similar impact on adults when compared to children. The upcoming results can be applied to the entire population of the United States due to the size of the population sampled but can not be attributed to cause and effect conclusions due to the nature of this observational study and the lack of randomization during the sampling procedure. These insights hold significant value for healthcare professionals, policymakers, and the wider community, as we strive to create an inclusive and supportive environment that transcends socioeconomic backgrounds.

4.2 Socioeconomic Factors and Mental Health Outcomes in Adults

The first research question was to uncover the specific socioeconomic factors that are the most impactful to mental health outcomes in adults. All of the factors we examined were found

to have a significant impact, revealing that it's not only specific factors, but many different, seemingly unimportant factors that affect mental health outcomes in adults (Figure 1).

Our study analyzed a range of factors, including income level, educational attainment, and occupational status. It became evident that individuals with lower socioeconomic status (SES) faced a higher risk of mental disorders, encountered barriers in accessing mental health services, and endured heightened psychological distress. Conversely, those with higher SES experienced lower rates of mental disorders, enjoyed better access to resources and support, and benefited from stronger social networks.

Our findings align with the previous literature reviewed, which outlined the intricate relationship between socioeconomic factors and mental health outcomes. Previous research had also indicated a higher risk of mental disability and psychiatric hospitalization among individuals with lower SES. Similarly, the positive association between higher education levels and enhanced mental well-being, as well as the impact of family and social connections on mental health, resonated with the existing body of knowledge.

Our study also uncovered new, seemingly unexplored areas of socioeconomic prediction. For adults (Figure 1), urban rural classification (URBRRL) and region in the US (REGION) had a significant relationship with depression outcomes, suggesting that the location in which someone lives also has an impact on their mental health outcomes. Previous research explored the impact of income, which could suggest that the urban rural classification and region is related to the income of the population of that area, therefore similarly impacts mental health outcomes.

4.3 The Difference in Impact Between Adults and Children

The second question explored was whether the impact of socioeconomic factors on mental health outcomes is similar for adults and children. Our findings indicated that the majority of socioeconomic factors had a similar impact on both adults and children, with some exceptions.

Firstly, urban-rural classification (URBRRL) was not found to be a significant factor for children, whereas it showed a significant impact on mental health outcomes in adults. This suggests that living in urban or rural areas may have different effects on mental health depending on age group. This could also be because children have their parents as a backbone or government programs support high-risk areas through Title 1 schools and community programs.

Secondly, coverage (NOTCOV), which refers to the absence of health insurance coverage, was not considered a significant factor for children. In contrast, it was found to have a significant impact on mental health outcomes in adults. This implies that the availability of health insurance may play a more critical role in shaping mental health outcomes for adults compared to children. This could be attributed to a child's access to a free school counselor or being in better social conditions compared to adults, resulting in less undesirable mental health outcomes regardless of coverage status.

Lastly, the number of adults in the family (PCNTADLT) was not found to be a significant factor for children, while it exhibited a significant impact on mental health outcomes in adults. Children are constantly supported by teachers, family, and friends, unlike adults who are most likely on their own unless they have the support of their family. This suggests that this support is beneficial to the mitigation of mental health outcomes.

These findings provide valuable insights into the differential impact of socioeconomic factors on mental health outcomes for adults and children. They support existing literature on the

impact of education, including a study discussed in the literature review outlining the effects of parental education on mental health outcomes for children. It also introduces new information on the different outcomes these factors have based on age group and what external factors, such as steady schooling can do to mitigate these outcomes.

4.4 Suggestions for Further Research

In light of the findings that all socioeconomic factors examined were similarly significant in both adults and children, except for urban-rural classification (URBRRL), coverage (NOTCOV), and number of adults in the family (PCNTADLT), where these variables were not considered significant for children, there are several suggestions for further research to address the identified gaps in knowledge related to the research questions.

Firstly, it would be valuable to explore the introduction of urban-rural classification and US region as additional socioeconomic factors. Further investigation is needed to identify specific combinations of these variables that pose a higher risk for mental health issues. By understanding these at-risk combinations, policymakers and hospitals in those regions can be better prepared to identify individuals who may be struggling with mental health issues and ensure adequate resources and support are available for their treatment.

Furthermore, there is a need for research to investigate the external factors that contribute to the differences in the impact of socioeconomic factors on mental health outcomes between children and adults. Factors such as consistent schooling, regional funding, extracurricular activities, sports, and more should be examined to determine their influence. This line of research can provide insights into what adults may be missing in their lives and how

incorporating these factors into their lives can help mitigate undesirable mental health outcomes, even within specific socioeconomic situations.

By addressing these gaps in knowledge and exploring potential avenues for future research, we can gain a more comprehensive understanding of the relationships between socioeconomic factors and mental health outcomes in both children and adults. This knowledge can inform the development of targeted interventions, policies, and support systems to create a more inclusive and supportive environment for individuals of all socioeconomic backgrounds.

4.5 Recommendations for Application of Findings

Based on these findings, several recommendations can be made to guide the practical application of the research findings. Firstly, policymakers, healthcare professionals, and mental health practitioners should take into account the identified significant socioeconomic factors when developing interventions and formulating policies. This holistic approach ensures that interventions are tailored to address the specific needs of individuals from diverse socioeconomic backgrounds. Factors such as income level, educational attainment, and occupational status should be considered when designing targeted interventions to improve mental health outcomes.

Furthermore, it is important to recognize that the lack of significant associations between URBRL, NOTCOV, PCNTADLT, and mental health outcomes in children suggests that interventions and policies targeting these variables may not have as pronounced an impact on children as they do on adults. Therefore, resources and efforts should be redirected towards other socioeconomic factors that have shown significant associations with mental health outcomes in both children and adults. For instance, focusing on income level, educational opportunities, and

access to mental health resources may yield more fruitful outcomes in enhancing mental well-being among children.

However, it is vital to acknowledge the potential limitations and challenges in implementing these recommendations. The intricate nature of socioeconomic factors calls for a comprehensive and collaborative approach involving various stakeholders. Adequate funding, resources, and infrastructure are necessary to effectively implement interventions that address socioeconomic disparities in mental health outcomes. Additionally, it is essential to address broader societal and structural factors that contribute to these disparities, such as systemic inequalities and discrimination, in order to foster sustainable and equitable change.

In conclusion, the findings of this study underscore the significance of socioeconomic factors in shaping mental health outcomes for individuals of all ages. By considering these factors and tailoring interventions accordingly, policymakers and healthcare professionals can contribute to the creation of a more inclusive and supportive environment for individuals from diverse socioeconomic backgrounds. It is essential to remain cognizant of the variables that may have differential impacts on children and adults, as identified in this study. By applying these recommendations and addressing associated challenges, we can make strides in improving mental health outcomes and promoting overall well-being for individuals of all ages.

5. Reflection

Throughout this project, I've gained a wealth of invaluable skills and knowledge that have truly transformed me as a researcher. One skill that has made a profound impact is my newfound ability to dive deep into literature reviews. As I immersed myself in the existing body of knowledge related to our topic, I discovered how to navigate through a vast sea of

information, critically assess its content, and distill the most significant insights. This skill has not only shaped me as a researcher but has also proven to be incredibly useful in everyday life. Whether I'm exploring a new hobby, planning a trip, or making well-informed decisions about my health, I can now employ my literature review skills to gather relevant information, weigh different perspectives, and confidently make informed choices.

Moreover, this project has significantly enhanced my proficiency in data analysis. Through collecting and analyzing diverse datasets, I've developed a solid command of statistical techniques and software applications. This newfound expertise extends far beyond research and finds practical applications in various professional settings. I now possess the ability to dissect complex datasets, uncover trends and patterns, and draw meaningful conclusions that inform business strategies, marketing campaigns, or financial planning. This is also particularly useful in the understanding and application of machine learning concepts, which are highly based on statistical concepts. In today's data-driven world, the art of making sense of data is highly valued, equipping me with a valuable skill set applicable to a wide range of industries and roles.

The project has also underscored the paramount importance of time management and organization in conducting research. Balancing multiple tasks, meeting deadlines, and collaborating with team members taught me the art of effective prioritization and resource allocation. These skills have immediate and practical applications in both personal and professional spheres. In my personal life, I can now manage my time more effectively, strike a harmonious work-life balance, and dedicate time to activities that bring me joy and fulfillment. In a professional setting, I'm equipped to handle multiple projects simultaneously, meet deadlines with composure, and collaborate seamlessly with colleagues.

In conclusion, the skills and knowledge I've acquired throughout this project have had an immense impact on my growth as a researcher. The ability to immerse myself in comprehensive literature reviews, proficiency in data analysis, honed critical thinking and problem-solving abilities, and strengthened time management and organizational skills are just a few examples of how this project has shaped me into a more versatile and capable researcher. Moreover, these competencies extend beyond the realm of research, enabling me to make informed decisions, analyze information effectively, think creatively, solve problems, and manage my time adeptly in various aspects of life. As I embark on future endeavors, these skills will undoubtedly continue to be instrumental in my success and enable me to make meaningful contributions.

Appendix A

Sample of analyzed data excluding unused variables and truncated. The full dataset has about 6,000 lines for the adult and children data separately. The following data has been truncated to 30 lines to just help give a sense of what the data looked like.

Child	Adult
URBRRL, REGION, NOTCOV_C, SEX_C, HISPALLP_C, PCNTADLT_C, PHSTAT_C, PAYBLL12M_C, MAXEDUCP_C	URBRRL, REGION, NOTCOV_A, SEX_A, HISPALLP_A, PCNTADLT_A, PHSTAT_A, PAYBLL12M_A, EDUCP_A
1, 3, 2, 1, 3, 2, 1, 2, 5.0	4, 3, 2, 1, 2, 1, 2, 2, 1
1, 3, 2, 1, 3, 1, 2, 2, 4.0	4, 3, 2, 1, 3, 1, 2, 2, 7
1, 3, 2, 2, 2, 2, 1, 2, 9.0	4, 3, 2, 1, 2, 1, 2, 2, 8
1, 3, 2, 1, 2, 2, 1, 2, 8.0	3, 3, 2, 2, 2, 3, 4, 2, 5
3, 3, 2, 1, 3, 3, 3, 2, 5.0	1, 3, 2, 1, 3, 1, 3, 2, 4
3, 3, 2, 1, 2, 2, 4, 1, 5.0	1, 3, 2, 1, 3, 2, 3, 2, 5
4, 3, 2, 1, 2, 3, 1, 1, 2.0	1, 3, 2, 1, 2, 2, 1, 2, 9
3, 3, 2, 1, 2, 2, 1, 2, 7.0	1, 3, 2, 1, 3, 2, 1, 2, 5
3, 3, 2, 1, 3, 1, 2, 2, 1.0	1, 3, 2, 2, 3, 1, 2, 2, 4
3, 3, 2, 2, 1, 3, 1, 2, 4.0	1, 3, 2, 2, 2, 2, 1, 2, 9
3, 3, 2, 2, 3, 2, 1, 2, 4.0	1, 3, 2, 2, 2, 2, 1, 2, 9
2, 3, 2, 1, 3, 3, 1, 2, 8.0	1, 3, 2, 1, 2, 2, 2, 2, 8
3, 3, 2, 2, 2, 3, 1, 2, 9.0	1, 3, 2, 2, 2, 2, 3, 1, 8
3, 3, 1, 2, 2, 2, 1, 2, 8.0	1, 3, 2, 2, 3, 1, 2, 2, 6
4, 3, 2, 2, 3, 2, 2, 1, 1.0	1, 3, 2, 1, 2, 1, 2, 2, 4
3, 4, 1, 1, 2, 2, 3, 2, 7.0	3, 3, 2, 1, 2, 2, 3, 2, 8
3, 4, 1, 1, 1, 2, 1, 2, 4.0	3, 3, 2, 1, 3, 3, 3, 2, 1
3, 4, 2, 1, 7, 2, 1, 2, 8.0	3, 3, 1, 2, 3, 3, 3, 2, 1
3, 4, 2, 2, 4, 2, 1, 2, 4.0	3, 3, 2, 2, 2, 2, 4, 1, 5
3, 4, 2, 1, 4, 2, 2, 2, 4.0	3, 3, 2, 1, 2, 1, 3, 2, 8
3, 4, 2, 2, 2, 2, 2, 2, 7.0	4, 3, 2, 1, 2, 3, 4, 1, 1
3, 4, 2, 1, 3, 1, 3, 2, 4.0	4, 3, 2, 2, 2, 1, 5, 2, 6
1, 4, 1, 2, 1, 2, 2, 2, 4.0	4, 3, 2, 2, 2, 2, 5, 1, 1
1, 4, 2, 1, 1, 3, 1, 1, 8.0	3, 3, 2, 2, 2, 2, 3, 2, 7
1, 4, 2, 1, 1, 3, 3, 2, 4.0	3, 3, 1, 1, 2, 3, 2, 2, 2
1, 4, 2, 2, 2, 2, 5, 2, 9.0	3, 3, 2, 2, 3, 1, 4, 2, 5
1, 4, 2, 1, 2, 2, 2, 2, 8.0	3, 3, 2, 1, 3, 1, 4, 2, 1
1, 4, 2, 2, 3, 2, 2, 2, 7.0	3, 3, 1, 1, 1, 3, 1, 2, 4
1, 4, 2, 2, 2, 2, 1, 2, 9.0	2, 3, 2, 1, 2, 2, 5, 2, 8
3, 4, 2, 2, 1, 2, 1, 2, 5.0	2, 3, 2, 2, 2, 2, 2, 2, 9

The full data can be found at this link: [cdc.gov/nchs/nhis/data-questionnaires-documentation.htm](https://www.cdc.gov/nchs/nhis/data-questionnaires-documentation.htm)

Appendix B

Code used to compute chi-squared statistics.

```
import math
from scipy import stats
import pandas as pd
import matplotlib.pyplot as plt
import numpy as np

#import data
child = pd.read_csv("child21.csv")
adult = pd.read_csv("adult21.csv")

#where total counts were stored
table = [
    [0, 0, 0, 0, 0],
    [0, 0, 0, 0, 0]
]

array = #child or adult
val1 = "" #target factor
val2 = "DEPFREQ_C"

for i in range(len(array[val1])):
    if(not (math.isnan(array[val2][i]) or array[val2][i] == 7 or array[val2][i] == 8 or
array[val2][i] == 9) #checking if 7, 8, or 9
    and not (math.isnan(array[val1][i]) or array[val1][i] == 7 or array[val1][i] == 8 or
array[val1][i] == 9)): #checking if 7, 8, or 9
        table[int(array[val1][i])-1][int(array[val2][i])-1] += 1 #adding value to table based on result

print(np.array(table)) #printing counts

# Example data (2D array)
observed_values = np.array(table)

# Perform chi-squared test
chi2, p_value, dof, expected_values = chi2_contingency(observed_values)

# Print the results
print("Chi-square statistic:", chi2)
print("P-value:", p_value)
print("Degrees of freedom:", dof)
print("Expected values:")
print(expected_values)
```

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