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The Epidemic of Mental Health in an Aging Population in the Context of Both Clinical and Nonclinical Settings

Introduction

Mental health is a highly prevalent global topic. The American Psychological Association defines mental health as, "a state of mind characterized by emotional well-being, good behavioral adjustment, relative freedom from anxiety and disabling symptoms, and a capacity to establish constructive relationships and cope with the ordinary demands and stresses of life" (APA). Mental health issues have been growing exponentially. In addition to that, the world's over 60 population is set to increase dramatically as well. The World Health Organization believes the over 60 population globally is likely to rise from 12 percent to 22 percent over the next 35 years. These individuals are a vital part of our population, and many are at risk of experiencing mental health problems in conjunction with the many other debilitating medical conditions that come with age. The World Health Organization stated in a report published in 2017 that approximately 15 percent of those aged 60 or older suffer from a mental health disorder (World Health Organization, 2017). Given the incidence of an aging population, and an increase in mental health disorders within the over 60 population, it is evident that an examination should be done. This should review the relationships between decreased mental health in individuals over the age of 60 and possible correlating factors.

In an expansive analysis done by members of the Optum workforce, several theories are hypothesized to be a correlating factor. The article, "Need for Comprehensive Health Care Quality Measures for Older Adults," begins its investigative research by reviewing a concentrated selection of scientific literature. The scope of their search revolved primarily on the current gaps in the aging population from a clinic level, as well as the nonclinical factors that impact well-being. A majority of the articles originated from PubMed. These highlighted some of the quality measure systems used to evaluate elderly healthcare, such as Centers for Medicare & Medicaid Services (CMS) tool, Five-Star Quality Rating System (STAR), which are derived from Healthcare Effective Data, and Information Set (HEDIS). Although these tools did a somewhat satisfactory job upon review of the clinical indicators, they performed remarkably less effectively regarding social factors. In a striking observation, the article found 43 percent of measures specifically stated do not apply to Medicare beneficiaries (the targeted group of these tools) and a mere five percent of the quality measures focus on social issues (MacLeod et al., 2018). With the clear lack of comprehensive measures to evaluate well-being in an aging population, the researchers at the RAND Health Corporation in 2000 established the Assessing Care of Vulnerable Elder (ACOVE). This improved in its collection for some social factors such as suicide risk, driving ability, etc. However, the larger items impacting quality of life for the elderly were still unexamined. The most recent measure developed is the Physician Quality Reporting System (PQRS), created by the CMS in 2017 which incorporates the most inclusive evaluation of clinical and "nonclinical" conditions. In particular, medication management, risk of falls, elder maltreatment screening, and cessation of tobacco were evaluated. Although the highest recommended measurement device the PQRS has a very low participation rate for a variety of reasons. Looking at this system in this light shows a gaping hole in the healthcare of

the aging population, specifically mental well-being. There is no adequate system in place to assess it, while the epidemic's prevalence and the elderly population continue to rise.

The quality of life of the aging population is being overlooked not only in a clinical setting, but regarding literature as well. An article published in the European Journal of Aging, "The conceptualization and measurement of quality of life in older adults: a review of empirical studies published during 1994–2006" found after a review of 47 articles examining the quality-of-life measures of the older population that only 2 articles produced support of the actual importance given to this demographic. The often-vital components overlooked are the social determinants of health. This includes economic stability, neighborhood environment, education, health and healthcare, and social context. Alongside these hardening social determinants of health, as an individual ages there is an increase in medical conditions. This means an increase in the need for treatments, visits, medications, and social support. These are not the only limitations to healthcare and its support of an aging population. The Commonwealth Fund's article, "Comparing Older Adults' Mental Health Needs and Access to Treatment in the U.S. and Other High-Income Countries," found that although older U.S. Medicare beneficiaries were likely to report being diagnosed with a mental health condition, they were also the more likely to report cost-related difficulties to receiving needed healthcare (Gunja et al., 2022). This is for a variety of reasons, including but not limited to psychiatrists or psychologists not accepting Medicare as coverage, the high prices of drugs for mental health on Medicare plans, and limited access to inpatient mental health abilities through Medicare. Additionally, The Commonwealth Fund published the finding that U.S. Hispanic Medicare users were the most likely in high-income countries to identify that they have mental health needs. The problem of mental health in the aging population is clear and needs to be evaluated in greater depth to understand the connection between different elements. Thus, taking the data collected by the Center for Disease Control and Prevention known as NHANES (National Health and Nutrition Examination Survey) to complete the full-scale analysis.

Specific Aims

The above studies encompass the foundations of this work. Given the relevant factors impacting mental health prevalence in the aging United States, the following aims were defined:

- ● A comprehensive analysis of increased mental health among the United States by age, gender, ethnicity, physical function, medical conditions, smoking habits, insurance coverage, and BMI to see if the NHANES dataset is consistent with previous findings.
- ● Perform specific comparisons using age, gender, ethnicity, physical function, medical conditions, smoking habits, insurance coverage, and BMI as independent variables and depression score totals as the dependent variable.

To achieve those aims, the following hypotheses will be analyzed:

1. Comparing overall population to individuals 60 and over with higher depression:

    1.1. The general population in the United States is not more depressed than individuals 60 and over.

2. Comparing overall population to individuals 60 and over with higher depression and their gender:

    2.1. Females in the general population are not more depressed than females aged 60 and over

2.2. Males in their 60's and over population are not more depressed than males in the general population

3. Comparing overall population to individuals 60 and over with higher depression and their BMI:

   3.1. The general population in the United States are not more depressed than individuals 60 and over with a higher BMI.

   3.2. Individuals in the underweight BMI category are not more depressed than the general population

4. Comparing overall population to individuals 60 and over with higher depression and their ethnicity:

   4.1. The general population in the United States are not more depressed than individuals 60 and Hispanic origin

   4.2. Individuals in the White Ethnicity category are not more depressed than the general population

5. Comparing overall population to individuals 60 and over with higher depression and their physical functioning:

   5.1. The general population in the United States are not more depressed than individuals 60 and over with lower physical function

6. Comparing overall population to individuals 60 and over with higher depression and their Smoking Habits:

   6.1. The general population in the United States are not more depressed than individuals 60 and over who currently smoke

7. Comparing overall population to individuals 60 and over with higher depression and their Medical Conditions:

   7.1. The general population in the United States are not more depressed than individuals 60 and over with more serious medical conditions

8. Comparing overall population to individuals 60 and over with higher depression and their Insurance Coverage:

   8.1 The general population in the United States are not more depressed than individuals 60 and over covered by Medicare

9. Comparing overall population to individuals 60 and over with higher depression and their education:

   9.1. The general population in the United States are not more depressed than individuals 60 and over with lower education.

   9.2. Individuals with high education care not more depressed than the general population

Methods

The NHANES program began in 1960 and its purpose is to collect information to provide important health data for a variety of individuals. The information is collected in a very methodical way. It is administered by highly trained medical professionals since the interviews cover sensitive health data such as demographics, socioeconomics, medical, physiological, and

laboratory results just to name a few of the categories. The NHANES data gathered by the survey is from approximately 5000 individuals per year in the United States. The scope of the data collected makes it the ideal dataset to explore the mental health of the over 60 population and the correlating factors to decreased mental well-being. In order to look at the context of mental health in this population, the dataset being chosen will be from 2017-2018. This is to avoid the obvious impacts of the pandemic on these categories. Since the problem has been identified as the epidemic of mental health in an aging population in the context of both clinical and nonclinical settings, it is first necessary to download datafiles from the CDC to correspond. The files selected for analysis were the XPT files of demographics (DEMO_J), depression screener (DPQ_J), body measures (BMX_J), health insurance (HIQ_XPT), and medical conditions (MCQ_J) as the starting files for analysis. Some of the intended information to grab, but not limited to, is the age, gender, race, education level, and household income from the demographic sections. Continuing the data selection, some of the items may be the BMI from body measures or the number of medical conditions an individual has by reviewing the MCQ_J (CDC, 2022). Additionally, the file HIQ contains the information on an individual's health insurance status for analysis. The power of the NHANES data is apparent because every obstacle posed previously can be evaluated through the surplus of downloadable data files. The start of this analysis is the downloading of the XPT files from the Center for Disease Control's website and then uploading the files into the platform of choice. In this instance the data will be transformed into CSV files using python. Specifically, the xport command in the terminal using the following code for each cvs file needed, `python -m xport PFQ_J.XPT > pfq_j.csv`. The files are then able to be merged to properly compose the data and only have one record id with all the information, as opposed to many CSV files. Once the data has been transformed the selection process can begin.

Methods: Creating the Data Frames for Analysis

A top priority of selection in this instance was for individuals over the age of 60. Once that was completed the filtering became more exclusive to only those individuals over 60 who completed the depression screener questionnaire. Filtering was done in this dataset by creating new data frames and selecting the desired variables from the preexisting data frame. An example of a code to acquire this would be, datafile_mental = datafile[(datafile.DPQ010.lt(4)) & (datafile.DPQ020.lt(4)) & (datafile.DPQ030.lt(4))& (datafile.DPQ040.lt(4))& (datafile.DPQ050.lt(4))& (datafile.DPQ060.lt(4))& (datafile.DPQ070.lt(4))& (datafile.DPQ080.lt(4))& (datafile.DPQ090.lt(4))& (datafile.DPQ100.lt(4))]. This code is showing the creation of the data frame, datafile_mental, by selecting the columns from the depression screener that start with DPQ and only focusing on values below 4 which correlates with participants completing the depression screener. This same technique was used for a large variety of the topics of interest within this population. Examples of some of the created data frames are those with a higher BMI and a higher depression score, datafile_age_high_bmi_high_mental, a lower physician function and higher depression, datafile_age_low_pf, and individuals with more serious medical conditions and higher depression, datafile_age_high_mental_medical_conditions, naming a few. With the now defined population and newly created dataframes, the analysis began.

Methods - Exploratory Data Visualization and Descriptive Analysis

Conducting univariable analyses provided an overview of the population on a personal level such as mean age, population size, and ethnicity. This will help better understand the dataset. Additionally, the univariable analysis included outcome measure totals for conditions of interest, such as smoking, higher depression score, or higher BMI, etc. The analysis ran on every column in the dataset and contained mean, median, standard deviation, minimum, maximum, variance, and correlation.

A variety of visualizations were used to better understand the context of our dataset. The first visuals created were the creation of Histograms so that the distribution would be clearly displayed. In figure one you can see the distribution of all those who completed the depression screener and then it broken down by gender of male and female as well.
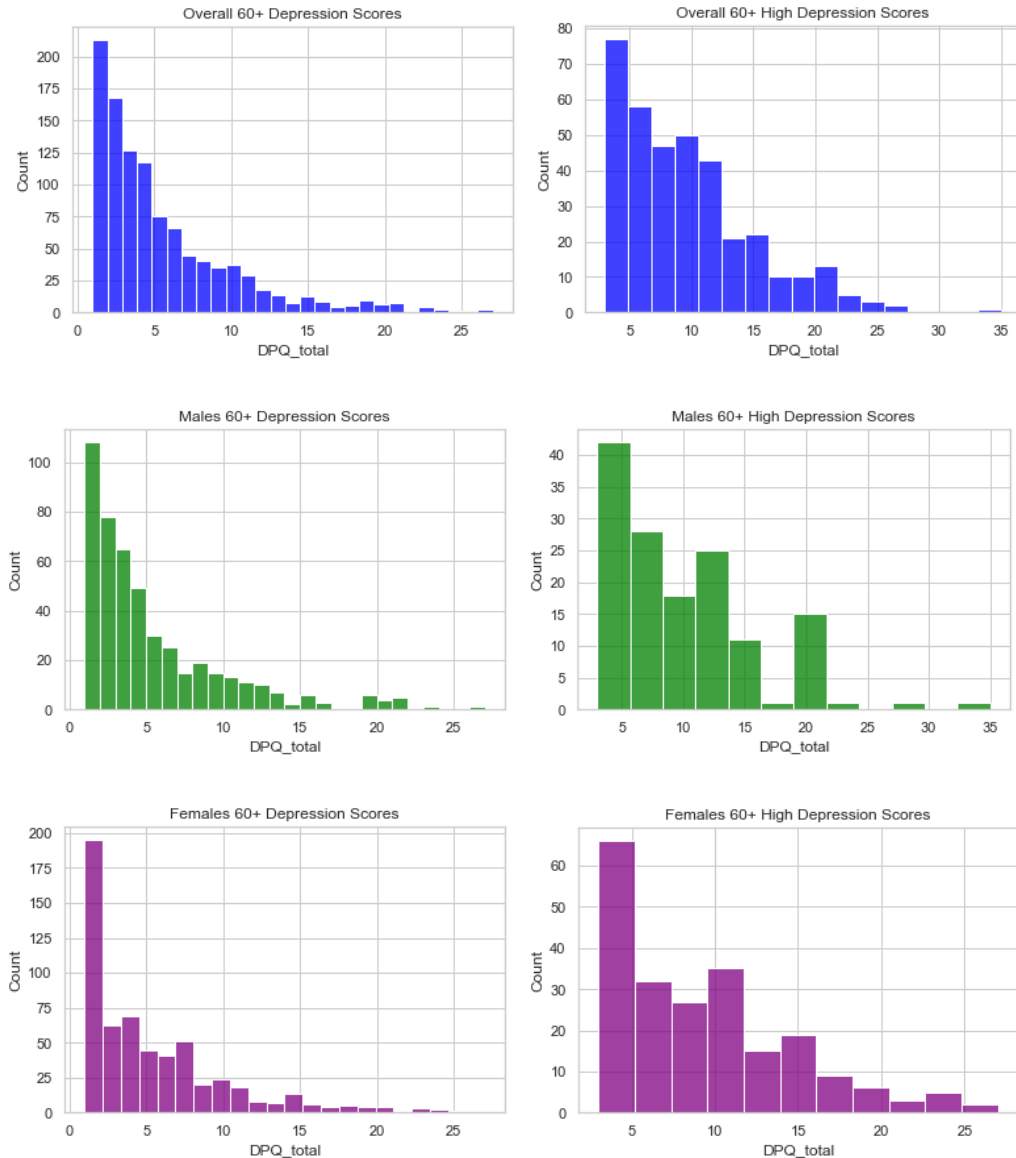

Figure 1. Histograms of the total depression score of individuals 60 and over (left) and all those 60 and over who completed the depression screeners with high scores (right) Second Row: Histograms of the total depression score of males individuals 60 and over (left) and males 60 and over who completed the depression screeners with high scores (right) Third Row:

Histograms of the total depression score of female individuals 60 and over (left) and females 60 and over who completed the depression screeners with high scores (right)

Another useful visualization chosen to display is for the category of interest regarding BMI and depression. Scatterplots are always the favored visualization to demonstrate these correlations. In figure 2 you can more easily see the distribution of the BMIs from the population of 60 and over who completed the depression screener and those 60 and older who completed the depression screener and have higher values.
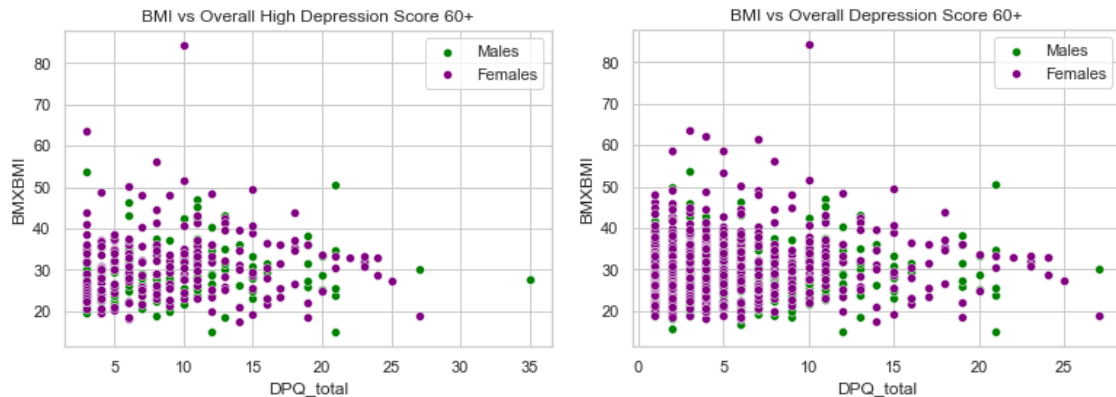

Figure 2. Scatterplots of the BMI and the total depression score of individuals 60 and over with high depression (left) and the BMI of all those 60 and over who completed the depression screeners (right)

Following the completion of the univariable analysis, and a grasp of the contextual makeup of the data's population, the bivariable analysis was the next step. In other words, what is the correlation between variables within the dataset. In the hypothesis that older adults have decreased mental health there are a lot of factors to examine. The first look for correlation was between older age and decreased mental health. This was done by comparing the higher depression scores from the questionnaire to the population of individuals over 60. After evaluating the correlation between old age and depression, the correlation to other factors such as gender, ethnicity, income, higher or lower BMI, and low physical activity were examined. Confidence intervals were run on the data to identify variability and boxplots to establish outliers before selecting the t-test to use. One-sided sample t-tests were used after reviewing the confidence intervals and the boxplots. Figure 3 below was the first set of boxplots to be run since it plays an important role of showing us the variance of 60+ with high depressions scores as opposed to the overall 60+ population. Boxplots were run on all the additional hypotheses. In figure 4 the boxplots for Hispanic individuals 60 and over is displayed, those with a higher BMI, currently smoking, and have more serious medical conditions. There were many to choose from however these were selected to show congruence with existing data.
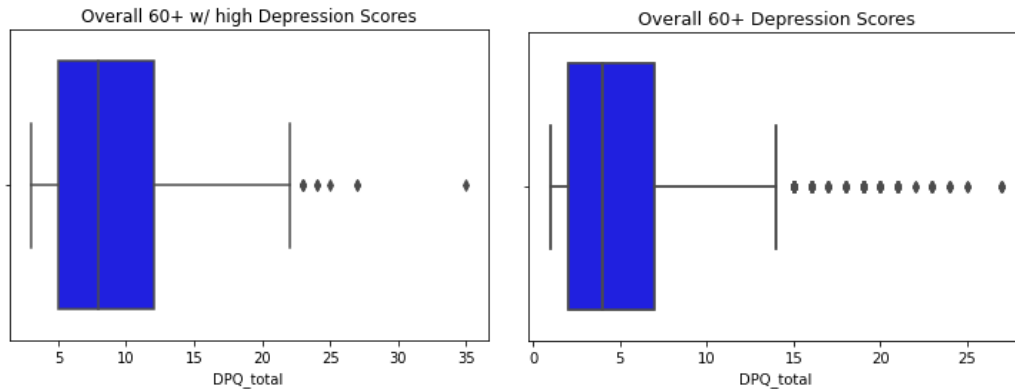
Figure 3. Boxplot of the total depression score of individuals 60 and over with high depression (left) and all those 60 and over who completed the depression screeners (right)
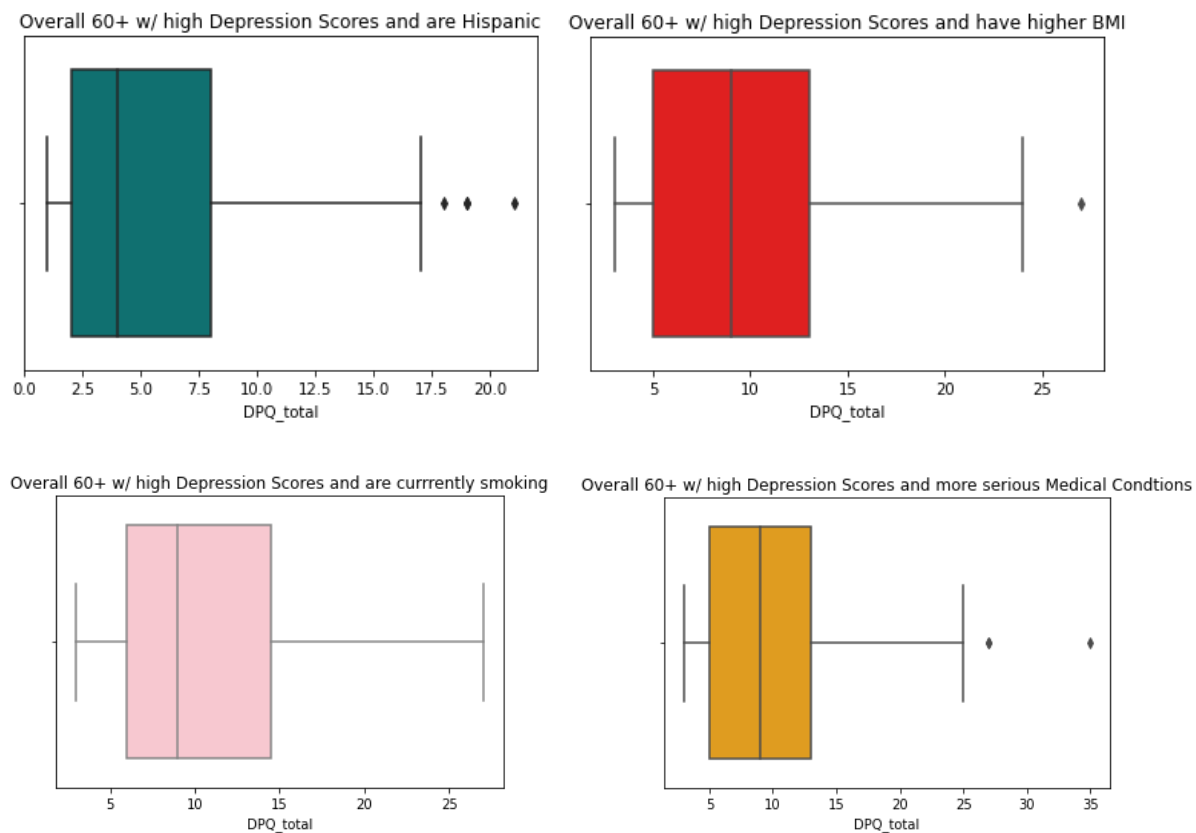

Figure 4. Displays the boxplots for high depression scores in Hispanics (upper left), high depression and higher BMI (upper right), high depression and currently smoking (lower left), and high depression and more serious medical conditions (lower right)

Results

The resulting population of the filtered data frames provided an original sample size of 1057 which was individuals 60 and over who completed the depression screener. Furthering the filtering to include the original criteria and a higher depression score resulted in a population size of 362 with a mean age of 70. To begin the univariable analysis results in that dataset were 219 females and 143 male participants. Continuing the race/Hispanic origin breakdown was 45

Mexican, 35 other Hispanic origin, 165 White, 76 African American, 28 Asian, and 13 of the other origin. Of the 362 it was found that 55 of those participants were currently smokers and 193 of them had smoked at least 100 cigarettes in their life. The count for higher depression scores and individuals in the BMI obesity class of either I, II, and III was 171 participants. Results for those who had lower physical function and a higher depression score was 312, thus demonstrating 86% of high depression screener respondents have low physical function. Another high percentage was 85% which was between those with more serious medical conditions, a count of 309, and a higher depression score. Higher poverty and higher depression analysis showed a count of 281 and percentage of 77 while lower poverty and higher depression a count a 32 for 8 percent. With a count of 262 Medicare coverage in comparison to those 60 and older with higher depression resulted in 72 percent. In table one below the null hypotheses from the specific aims sections are displayed for easier viewing. The results show significant with all the p values being below 0.05.

	Null Hypothesis	T-value	P-value	95% confidence interval	Decision
1.1	The general population in the United States is not more depressed than individuals 60 and over.	15.87191475	3.08735172E-55	4.245 +/- 0.597 OR [3.647 , 4.842]	Accept
2.1	Females in the general population are not more depressed than females aged 60 and over	12.20138614	7.08675994E-34	4.074 +/- 0.731 OR [3.343 , 4.805]	Accept
2.2	Males in their 60's and over population are not more depressed than males in the general population	11.00126933	5.35180759E-28	4.507 +/- 0.979 OR [3.528 , 5.486]	Reject
3.1	The general population in the United States are not more depressed than individuals 60 and over with a higher BMI.	12.39943651	6.89274469E-35	4.655 +/- 0.851 OR [3.804 , 5.507]	Accept
3.2	Individuals in the underweight BMI category are not more depressed than the general population	3.09343104	9.97443235E-04	6.572 +/- 5.490 OR [1.082 , 12.063]	Reject
4.1	The general population in the United States are not more depressed than individuals 60 and Hispanic origin	1.73778804	4.11688157E-02	0.843 +/- 1.029 OR [-0.186 , 1.872]	Accept
4.2	Individuals in the White Ethnicity category are not more depressed than the general population	11.22431709	4.75966694E-29	4.288 +/- 0.873 OR [3.414 , 5.161]	Reject
5.1	The general population in the United States are not more depressed than individuals 60 and over with lower physical function	16.63866770	2.79490620E-60	4.753 +/- 0.644 OR [4.109 , 5.397]	Accept

6.1	The general population in the United States are not more depressed than individuals 60 and over who currently smoke	8.43763350	2.36335331E-17	5.482 +/- 1.734 OR [3.748 , 7.215]	Accept
7.1	The general population in the United States are not more depressed than individuals 60 and over with more serious medical conditions	15.99676440	5.05289538E-56	4.591 +/- 0.649 OR [3.942 , 5.240]	Accept
8.1	The general population in the United States are not more depressed than individuals 60 and over covered by Medicare	13.91243171	3.35973924E-43	4.299 +/- 0.703 OR [3.596 , 5.002]	Accept
9.1	The general population in the United States are not more depressed than individuals 60 and over with lower education.	14.62299026	2.26049684E-47	4.919 +/- 0.795 OR [4.124 , 5.714]	Accept
9.2	Individuals with high education care not more depressed than the general population	4.66092951	1.63465899E-06	3.439 +/- 1.607 OR [1.833 , 5.046]	Reject

Table 1. This table displays the hypothesis claimed in the specific aim section and their results from analysis in order. All showed significant and are labeled to whether they accepted or rejected the null hypothesis

Discussion

Evidence from this study in congruence with previous knowledge of the mental well-being of an aging population suggests again that there is significance in decreased mental health for older individuals, specifically those 60 and over. Previous research and this study once again show correlation of increased significance with factors such as current smokers, those in poverty, those who have lower education level and those in the obesity class of I, II, or III are a greater risk for decreased mental health as well. Furthermore, Medicare coverage, low physical functioning and more serious medical conditions showed significance with increased depression as well for the aging population. These are factors that are easily screened for in a clinical setting by reviewing a chart or simple question to the patients and should continue to be reviewed so a discussion can be properly addressed with the patients. Although the weight should not lie solely on physicians there needs to be increased support in an aging population. Medicare coverage being a correlating factor to increased depression is a strong supporter to establish that viewpoint. This is also an indicator the current well-being measurement systems in place are not adequately assessing or assisting with the mental well-being of their elder respondents.

The unexpected results of this analysis questions if even that may be enough. The shocking results of seeing correlation with depression and higher education, lower poverty and a lower BMI were not predicted. Research prior to conducting this analysis did not highlight these topics as areas to be implored. Reviewing this it maybe those individuals 60 and older in any capacity are at a high risk for depression or experiencing it already. Suggesting the solution may lie past a system to evaluate and screen for mental health in this aging population and rather

develop capacities to assist them. It is naturally these systems are not currently perfected since it is only recently becoming increasingly more common for life expectancy to become so high however at this point it is abundantly clear that will continue and this population needs to be addressed. A starter would be to continue doing research and analysis in order to publish more literature and grasp s better understanding of what may be needed to tackle this growing epidemic.

One of the largest limitations to the study was removing those 60 and older who did not complete the depression screener since this left the dataset to a much smaller sample size. With that in mind, there are a couple alternative options to evaluate for future analysis which would be beneficial. The first would be to manipulate the NHANES data again and look at these factors for a different age group, perhaps 20-30 years old. Then compare the data to the aging population. The analysis for this group would be the same as the proposed analysis for older individuals. Though, an ANOVA would be run to view the variances between the two groups. Another option would be to download data from the CDC again known as the BRFSS (The Behavioral Risk Factor Surveillance System). The analysis system would be similar to the original analysis. This time however, rather than comparing the age groups of 20–30-year-olds to 60+, the idea would be to just review the original hypothesis that the aging population has decreased mental health. Within this new dataset do we see correlation between decreased mental health and an older population? BRFSS contains many of the same variables such as questions about demographics, depression, health conditions, physical measurements and more. It is an ideal second dataset. One of the differences is these are self-reported measures over the phone to trained individuals, rather than the NAHNES which is collected by highly trained medical professionals. These additional approaches to include in the analysis with the validation of these

Conclusion

The concept of an aging population and their mental health needs is only going to grow in the coming years. As previously stated, the World Health Organization has predicted a sharp increase in those over 60 years-old. This analysis shows consistency with findings through other research that social and clinical factors should be considered when evaluating an elderly patient. Continued analysis to identify the repeated correlation of mental health decrease and older age, along with the additional correlating factors such as demographics, medical conditions, body measures and more, is imminent. Results from this analysis should ignite change in the mental health care for this aging population in clinical and nonclinical settings.

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