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The role of socio-economic status and life style characteristics in depression: NHANES 2013-2014

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2015

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Abstract

The role of socio-economic status and life style characteristics in depression: NHANES 2013-2014
By Ruoyi Tang

During 2009-2012, 7.6% of Americans aged 12 and over had symptoms of depression that had lasted for at least two weeks. Given the burden of depression in the United States and limited published information after 2012, this cross-sectional study focused on a broad range of descriptive statistics to investigate the exposure-disease relationship for depression among the U.S. population during 2013-2014. Risk factors including socio-economic status (composed of education, occupation and family monthly poverty level index) and life style characteristics (composed of smoking, alcohol and marijuana/hashish consumption), and mental health-depression severity were measured for 5393 noninstitutionalized U.S. citizens through self-reported questionnaires by NHANES. The severity of depression and presence of major depression disorder were described as continuous and dichotomized variables, respectively. ANOVA was used to test the differences in levels of depression severity among subgroups for each predictor. Linear regression models were built to assess the correlation between predictors and severity of depression; the association between predictors and odds of major depression disorder were assessed by constructing logistic regression models. Both models were adjusted for demographic characteristics (composed of sex, age and race). When considering each predictor separately adjusted for sex, age and race, the severity of depression was significantly associated with education, occupation, family monthly poverty level index, smoking and marijuana/hashish use. The odds of major depression disorder were significantly associated with education, occupation, family monthly poverty level index, smoking (only smoking everyday vs. no smoking) and marijuana/hashish use as well. When considering the combined effect, a significant negative correlation was found with education and occupation, holding other factors constant. The odds of major depression disorder of people with higher degree of education (only high level vs. low level) or with a job were also significantly lower. Significant positive association was found between the severity of depression and smoking as well as marijuana/hashish use, holding other factors constant.

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1. INTRODUCTION

Depression is a significant public health issue which is the leading cause of disability worldwide, and the global burden of depression is on the rise [1]. It is defined as mental disorder with mood, cognitive and physical symptoms lasting for at least two weeks [2]. It is often accompanied with absence of self-esteem, loss of interest and lack of energy. People may also occasionally have false beliefs, auditory illusion and visual illusion [3]. Depression can negatively affect a person's personal life including sleeping, eating habits, and general health. It also increases the risk of having other serious medical illnesses such as cancer, diabetes, heart disease, and Parkinson's disease [4].

Depression can happen at any age, but often begins in adulthood [3]. It is caused by a combination of genetic, biological, environmental, and psychological factors [5]. The risk factors of depression include personal or family history of depression, major life-changing events, certain physical illnesses, and medications. There is no laboratory test for depression so that the diagnosis of depression is based on the person's reported experiences and a mental status examination [6].

Research suggests two possible routes leading to increased risk of depression, one of which involves common risk factors [7]. Beset by growing national and international inequalities in income, education and wealth, low socioeconomic status (SES) has come into focus as a crucial determinant of depression [8]. There is growing evidence showing the negative association between SES and depression, suggesting that low SES is associated with a higher prevalence of depression [9-11]. However, most of the studies investigating this association are not representative of an entire population or country; additionally, there is little study focusing on comparing the association between SES and depression among countries [12].

The other possible route is a direct causal link [7]. Smoking, drinking and drug use are commonly believed to be anxiolytic and antidepressant, but evidence suggests that these life style characteristics may have negative effects

on individual's mental health by directly changing several neurotransmitters in the brain. Despite the strongly held belief that smoking cigarettes can relieve stress, there is evidence indicating a causal correlation between smoking and depression [7]. Though the biological mechanisms behind this correlation are not well understood, it is possible that nicotine will change neurotransmitter activity in the brain, resulting in increased risk of depression [13]. Consumption of alcohol is common in the United States. Research has revealed that both short- and long-term alcohol exposure lowers the levels of serotonin which is an important brain neurotransmitter involved in exchanging information among nerve cells [14]. This is a factor leading to symptoms of depression especially when drinking heavily or regularly. Long-term use of antidepressant medicine can also bring negative consequences to people's mental health, specifically decreasing the level of the neurotransmitters dopamine, serotonin and norepinephrine which are critical in regulating people's mood [15]. Researchers found that marijuana was commonly used among outpatients with depression and that it was associated with low recovery rate in depression, which implies marijuana can lead to more severe depression instead of ameliorating it [16].

In addition, these life style characteristics can lead to a damaging cycle during the effort to self-medicate symptoms of depression. They may affect people's relationship with their family and friends, or impact on their performance at work, making the patients feel life is difficult and depressive. It is common for people to smoke, drink or use drugs in attempt to cope with the depression, which may also trigger a depression episode and lead to a vicious cycle [17]. Therefore, more research is needed to better understand the correlation between life style characteristics and depression.

During 2009-2012, 7.6% of Americans aged 12 and over had symptoms of depression that had lasted for at least two weeks [18]. However, there is limited published information on an exposure-disease relationship in depression in the U.S. population after 2012. Given the burden of depression in the United States, the objective of this study was to focus on a broad range of descriptive statistics to evaluate the effect of SES and lifestyle characteristics on depression through the analysis of self-reported questionnaires from the civilian, noninstitutionalized U.S. population participated in NHANES during the 2013-2014 cycle.

2. METHODS

2.1 Hypothesis

Both two possible routes lead to increased risk of depression would be investigated in this study [7]; for common risk factors, low SES might be associated with depression and higher odds of major depression disorder; for direct causal factors, life style characteristics such as smoking, alcohol drinking and use of antidepressant medications which can directly change several neurotransmitters in the brain might also be associated with depression and higher odds of major depression disorder.

2.2 Study Design

NHANES, conducted by the Centers for Disease Control and Prevention's (CDC) National Center for Health Statistics (NCHS), is a continuous cross-sectional survey of the civilian, noninstitutionalized U.S. population and is designed to assess the health and nutrition conditions of the U.S. population. Although data on depression severity were collected on all participants 12 and older, only data from participants over 18 years old have been released for use in this study. The data used in this study are the most current data available on mental health from the 2013-2014 cycle.

To evaluate the role of SES on depression, the study focused on three SES indicators (education level, occupation and family monthly poverty level index), as they have strong theoretical associations with depression [8]. Besides, the use of these three indicators is also supported as they are more applicable to modern society and are easy to obtain. The study also used current smoking status, use of alcohol and antidepressant medication (Marijuana/hashish) to evaluate the effect of lifestyle characteristics on depression. The severity of depression and presence of major depression disorder in outcome were described as continuous (to indicate severity) and dichotomized (yes/no) variables, respectively. The correlation between predictors and outcome were explored controlled for confounders including sex, age and race.

2.3 Data Collection

Questionnaires were used to collect data on demographic information, SES, life style characteristics and

mental health-depression severity in NHANES and were reported in individual data files. The demographic data (data file: DEMO_H) provided individual level variables including age, sex, race and education. Occupation (data file: OCQ_H) data provided a categorical variable of type of work done last week. Income (data file: INQ_H) was reported as a categorical variable representing family monthly poverty level index which is a ratio of monthly family income to the HHS poverty guidelines specific to family size. The smoking (data file: SMQ_H) data provided a categorical variable of current smoking status. The alcohol consumption (data file: ALQ_H) data provided a continuous variable of average number alcoholic drinks per day in the past 12 months. The drug use (data file: DUQ_H) data provided a continuous variable of how many days each participant uses marijuana/hashish during the past 30 days.

The depression screening (data file: MPQ_H) data were derived from the Patient Health Questionnaire (PHQ-9) which is a multipurpose instrument for screening, diagnosing, monitoring and measuring the severity of depression symptoms over the past two weeks [19]. Response categories for the PHQ-9 - "not at all," "several days," "more than half the days," and "nearly every day" – is given a point ranging from 0 to 3. A total score is based on the sum of the points from each answer, ranging from 0 to 27. Participants with total score equal to or greater than 10 will be categorized as having major depression disorder, with 88% sensitivity and 88% specificity [20].

2.4 Statistical Analysis

Excluding the participants with missing data for question in PHQ-9, final analyses were conducted on 5393 participants. This study calculated the total score for each participant of PHQ-9. With 10 being the threshold, the total score is then categorized by setting a dichotomous variable for each participant, which determines if he/she has major depression disorder. Analysis was conducted using a set of predetermined variables (with category thresholds in parenthesis), namely sex, age (18-39,40-50, ≥60), race (NH-black, NH-white, Hispanic and other), education (low level-high school graduate/GED/equivalent/less, moderate level-some college/AA degree, high level-college graduate/above), occupation (yes-with a job/business, no-looking for work/not working), family monthly poverty level index (≤1.30, 1.30-1.85, >1.85), smoking (not at all, some days, every day), alcohol use

(yes/no) and marijuana/hashish use(yes/no).

The differences between subgroups for each predictor were tested by analysis of variance (ANOVA). For trichotomous variables, the study used Tukey's Studentized Range (HSD) Test to measure the difference of mean PHQ-9 score between each two subgroups. Report the means and 95% confidence interval of total PHQ-9 score for each subgroup as well as P-value.

A linear regression model was built to assess the correlation between predictors and severity of depression. To fit the assumption of normal distribution, we used total PHQ-9 score plus one as outcome variable in that the distributions of total PHQ-9 score were left skewed and the distributions after natural log transformed was unsatisfactory. The regression coefficients (β) and P-value for each predictor in both univariate regression model and multiple regression model were reported, which was designed for measuring the single and combined effects of all predictors, respectively. Moreover, the correlation between the predictors and major depression disorder would also be assessed by constructing logistic regression model. The P-value, adjusted odds ratios and 95% confidence intervals for each predictor in both univariate model and multiple model were reported as well. All these models were adjusted for sex, age and race. All significance tests are using $p<0.05$ as the level of significance. Data analyses are performed using SAS version 9.4.

3. RESULTS

3.1 Study Population and Demographics

Table 1 provides the characteristics of study population. Data were available on 5393 participants with 48.16% male. The racial/ethnic makeup of the sample was 43.00% Non-Hispanic black, 20.29% Non-Hispanic white, and others are Hispanic or other. 38.61% of the participants were between 18 to 39 years old, 30.59% were 40 to 59 years old and others were 60 years old or above. 43.04% of the participants had low level of education, 31.45% had moderate level and others had high level of education. 55.67% of the participants had job. 36.24% of the participants reported family monthly poverty level index less than or equal to 1.30, and 14.24% were between 1.30

(not included) and 1.85 (included) while others were above 1.85. The current smoking status result was 37.62% of the participants smoked every day and 9.18% smoked some days. 66.53% of the participants used at least 1 alcoholic drink per day on average during the past 12 months. 10.55% of the participants reported using marijuana/hashish during the past 30 days. The mean total score for PHQ-9 was 3.32 (SD=4.41) and 10% of the participants had a total score of equal to or greater than 10.

Table 1. Characteristics of study population (n=5393)

Variable	Total group	Frequency	Percent
Sex	Male	2597	48.16
	Female	2796	51.84
Age	18-39	1945	38.61
	40-50	1541	30.59
	≥60	1552	30.80
Race	NH-black	2319	43.00
	NH-white	1094	20.29
	Hispanic and other	1980	36.71
Education	Low level	2184	43.04
	Moderate level	1596	31.45
	High level	1294	25.51
Occupation	Yes	3000	55.67
	No	2389	44.33
Family monthly poverty level index	≤1.30	1851	36.24
	1.30-1.85	726	14.24
	>1.85	2530	49.52
Smoking	Not at all	1205	53.20

Variable	Total group	Frequency	Percent
	Some days	208	9.18
	Every day	852	37.62
Alcohol	No	1802	33.47
	Yes	3588	66.53
Marijuana/hashish	No	4824	89.45
	Yes	569	10.55

3.2 ANOVA

Table 2 provides the stratified results of depression for possible determinants of predictors. For demographics characteristics, women had significant higher level of depression than men (P<0.0001). A significantly positive association was found between severity of depression and age (P<0.0001). NH-black tended to have higher level of depression than NH-white and Hispanic and other, however, the severity of depression was not significantly different among the race (P=0.3124). For SES indicators, Table 2 shows that a lower educational level and lower family monthly poverty level index were both associated with significantly higher level of depression (P<0.0001 for both). The results from Tukey's Studentized Range (HSD) Test shows that all subgroups among educational level and family monthly poverty level index were significant different. Participants with no job had significant higher level of depression than participants who had job (P<0.0001). For life style characteristics, HSD Test shows that participants smoke every day had significantly higher level of depression than both who smoke someday and who do not smoke (P<0.0001 for both). Participants smoke someday had non-significant higher level of depression than who do not smoke. Participants drink alcohol during the past 12 month shows reverse non-significant association with depression (P=0.0076). Participant uses marijuana/hashish during the past 30 days was significantly associated with a high level of depression (P<0.0001).

Table 2. Stratified results for total PHQ-9 score.

Variable	Total group	Code	Total PHQ-9 score	
			Mean (95% CI)	P-value (ANOVA)
Sex	Male	1	2.67 (2.52, 2.82)	<.0001**
	Female	2	3.93 (3.75, 4.10)	
Age	18-39	1	3.05 (2.87, 3.23)	<.0001**
	40-50	2	3.44 (3.20, 3.68)	
	≥60	3	3.50 (3.28, 3.72)	
Race	NH-black	1	3.41 (3.23, 3.59)	0.3124
	NH-white	2	3.36 (3.10, 3.62)	
	Hispanic and other	3	3.21 (3.01, 3,40)	
Education	Low level	1	3.92 (3.72, 4.13)	<.0001**
	Moderate level	2	3.40 (3.19, 3.62)	
	High level	3	2.31 (2.12, 2.50)	
Occupation	Yes	1	2.62 (2.49, 2.75)	<.0001**
	No	2	4.20 (3.99, 4.40)	
Family monthly poverty level index	≤1.30	1	4.17 (3.94, 4.40)	<.0001**
	1.30-1.85	2	3.25 (2.95, 3.55)	
	>1.85	3	2.72 (2.57, 2.87)	
Smoking	Not at all	1	3.44 (3.18, 3.70)	<.0001**
	Some days	2	3.63 (3.01, 4.26)	
	Every day	3	4.78 (4.43, 5.14)	
Alcohol	No	0	3.55 (3.33, 3.77)	0.0076**
	Yes	1	3.21 (3.07, 3.35)	

Variable	Total group	Code	Total PHQ-9 score	
			Mean (95% CI)	P-value (ANOVA)
Marijuana/hashish	No	0	3.23 (3.11, 3.36)	<.0001**
	Yes	1	4.08 (3.70, 4.47)	

**P-value<0.01

3.3 Linear Regression Model

The combined effect of SES and life style characteristics on the severity of depression were studied in linear regression models. Table 3 gives the β and P-value for both univariate model of each predictor and multiple model. All these models were controlled for sex, age and race. Education (P=0.0035 in multiple model vs. P=<0.0001 in univariate model), occupation (P<0.0001 vs. P<0.0001), smoking (P<0.0001 vs. P=0.0015), Marijuana/hashish (P<0.0001 vs. P=0.0350) were significantly associated with depression when considered both separately and simultaneously with other predictors. In multiple models, after adjusting for sex, age and race, for 1 level increase in education, the total score of PHQ-9 was expected to decrease 0.44. The total score of PHQ-9 was expected to increase 1.88 when people do not have job compared to people have job. For every 1 level increase in smoking, the total score of PHQ-9 was expected to increase 0.39. The total score of PHQ-9 was expected to increase 1.66 when people use Marijuana/hashish compared to people do not use it.

For family monthly poverty level index, low index was resulted in higher level of depression, but the association was non-significant when considered simultaneously with other predictors (P<0.0001 vs. P<0.0740). For alcohol drinking, higher level of depression was found in non-drinker compared to drinker (P=0.2070 vs. P=0.2566), but the association was non-significant neither in univariate model nor in multiple model.

Table 3. Linear regression model

Predictor	Univariate model		Multiple model	
	β	P-value	β	P-value
Education	-0.82	<.0001**	-0.44	0.0035**
Occupation	1.46	<.0001**	1.88	<.0001**
Family monthly poverty level index	-0.74	<.0001**	-0.23	0.0740
Smoking	0.65	<.0001**	0.39	0.0015**
Alcohol	-0.17	0.2070	-0.28	0.2566
Marijuana/hashish	1.33	<.0001**	0.66	0.0350*

*P-value<0.05. **P-value<0.01

3.4 Logistic Regression Model

The combined effect of SES and life style characteristics on major depression disorder were studied in linear regression models. Table 4 gives the P-value, adjusted odds ratios and 95% confidence interval for both univariate model of each predictor and multiple model. All these models were controlled for sex, age and race. Education and occupation were significantly associated with major depression disorder when considered both separately and simultaneously with other predictors (all P<0.05). In multiple models, for people had moderate level of education, the odds of suffering from major depression disorder was 0.71 (0.52, 0.98) times for people had low level of education (P=0.0358). For people had high level of education, the odds of suffering from major depression disorder was 0.46(0.28, 0.76) times for people had low level of education(P=0.027). The odds of having major

depression disorder among people without job were 2.95 (2.12, 4.08) times higher than the odds of that among people with job (P<0.0001).

Low family monthly poverty level index, smoking and use marijuana/hashish resulted in higher odds of major depression, but these associations were significant only in the univariate model (all P<0.05 vs. all P>0.05). For alcohol, the odds of having major depression disorder among non-drinkers were higher than the odds of that among drinkers, but the association was non-significant in both the univariate and the multivariate models (P=0.3516 vs. P=0.5015).

Table 4. Logistic regression model

Predictor	Compared	Univariate model		Multiple model	
		P-value†	Odds ratios (95%CI)	P-value†	Odds ratios (95%CI)
Education‡	2 vs 1	<.0001**	0.63 (0.50, 0.78)	0.0358*	0.71 (0.52, 0.98)
	3 vs 1	<.0001**	0.28 (0.21, 0.39)	0.0027**	0.46 (0.28, 0.76)
Occupation	N/A	<.0001**	1.85 (1.51, 2.26)	<.0001**	2.95 (2.12, 4.08)
Family monthly poverty level index‡	2 vs 1	0.0005**	0.59 (0.44, 0.79)	0.5192	0.87 (0.56, 1.34)
	3 vs 1	<.0001**	0.41 (0.33, 0.51)	0.5492	0.90 (0.65, 1.26)
Smoking‡	2 vs 1	0.5627	1.16 (0.70, 1.92)	0.9087	1.03 (0.60, 1.78)
	3 vs 1	<.0001**	1.81 (1.36, 2.41)	0.1082	1.31 (0.94, 1.82)
Alcohol‡	N/A	0.3516	0.91 (0.75, 1.11)	0.5015	0.90 (0.65, 1.23)
Marijuana/hashish	N/A	<.0001**	2.06 (1.54, 2.76)	0.2254	1.28 (0.87, 1.90)

† The P-value of Hosmer and Lemeshow Goodness-of-Fit Test (HL test) for multiple model is 0.8606.

‡Use Education=1, Family monthly poverty level index =1, Smoking=1, Age=1 and Race=1as reference.

*P-value<0.05. **P-value<0.01

4. DISCUSSION

For common risk factors, the findings indicated that having a job was a protective SES factor against depression in general. The reason might be unemployment is one of life's most stressful experiences in that a person without a job might feel anxious about what the future holds. This result is consistent with the survey conducted by CDC in 2010 which indicated unemployment was a mental health issue in the United States by showing 8.4% of people with jobs exhibited signs of depression while 23.4% percent of unemployed people had symptoms of depression [21]. Although the severity of depression was not significantly different among the races in this study, the higher unemployment rate among people of color might partially explain why NH-black people were more likely to become depressed than NH-white and Hispanic and other. However, 8.4% of U.S. workers experience episodes of depression which indicate job-related factors could also be a contribute to depression. Couser found that some work-related factors like long hours, a poor relationship with boss and lack of control over daily tasks- factors that can get worse when the boss is pinching pennies- can contribute to depression [22]. Additionally, our findings also indicated that higher education was a protective SES factor against depression as well. The finding which outlines that education plays an important role in the prevalence of depression is also supported by another epidemiological study which illustrated an inverse association between level of education and the prevalence of major depression disorder [23]. The protective effect of education against depression is known to vary across subgroups of the population. Previous research that examined the effects of education on depression found they varied sex, age and race [24]. Our study suggested this protective effect might also depend upon level of education itself or family socioeconomic resources after adjustment for sex, age and race. The family monthly poverty level index was negatively associated with the presence of depression and higher family monthly poverty level index implies lower odds of having major depression disorder, but the correlations were non-significant in both linear and logistic multivariate models in that higher income may be due to higher level of education. The study also proved that for every 1 level increase in education level, the family monthly poverty level index was expected to increase 0.91. The correlation between income and education is consistent with the results from a

previous study that reported that high levels of educational attainment were significantly and robustly associated with higher income [25].

Smoking and marijuana/hashish use were significantly positively associated with depression and significantly associated with higher odds of having major depression disorder in univariate logistic regression model but were non-significant in multivariate logistic regression models in that these factors might be influences by other predictors such as income level and education level. According to the survey conducted by CDC in 2014, people living below the poverty level and people having lower levels of educational attainment had higher rates of cigarette smoking than the general population in the United States [26]. In both linear and logistic regression models, the findings that alcohol drinking protected against depression is contrary to most previous studies even though the association in this study were non-significant. This contrary finding is probably because the question involved in alcohol drinking in the survey asked whether participants drank alcohol each day in the past 12 months which did not take type of alcohol and alcohol consumption per day into consideration. Previous research in Spain found that drinking moderate amounts of alcohol-especially wine-was linked with a lower risk of depression; elderly people who consumed two to seven small glasses of wine weekly were 32% less likely to suffer from depression compared with people who never drank alcohol [27]. However, it would be premature to make any recommendations regarding alcohol drinking as a means of preventing the onset of depression.

The strength and novelty of the current study is that it presents the association of both SES and lifestyle characteristics on depression in the United States by conducting an analysis based on a national survey of a large sample drawn from the civilian, noninstitutionalized U.S. population. The consistency of methodology for investigating each variable maximizes the accuracy of the results in this cross-sectional study. Moreover, the outcome was measured as both severity of depression and major depression disorder. The methodology of this study has limitation. First, samples were not stratifying by state after collecting the data so that the study did not take specific factors based on geographical location such as social security and social welfare into consideration. However, post-stratification might not be reasonable since it would lead to larger design effect. Another limitation

is all the data was based on self-report questionnaires. A previous study suggests that association between predictors such as low SES and depression is greatest when using standardized clinical interviews rather than self-report questionnaires [28]. However, since there is a monotonic association between symptom severity and risk of major depression disorder [29], this limitation in this study is unlikely to significantly affect the results. To make the result more accurate, further studies can replicate the analysis based on clinical interview data.

5. CONCLUSIONS AND RECOMMENDATIONS.

In the 2013-2014 cycle of NHANES, severity of depression was measured for 5393 participants in the United States. Three SES factors and three lifestyle factors were associated with the severity of depression. When considering each predictor separately adjusted for sex, age and race, the severity of depression was significantly associated with education, occupation, family monthly poverty level index, smoking and marijuana/hashish use. The odds of major depression disorder were significantly associated with education, occupation, family monthly poverty level index, smoking (only smoking everyday vs. no smoking) and marijuana/hashish use as well. When considering the combined effect, a significant negative correlation was found with education and occupation, holding other factors constant. The odds of major depression disorder of people with higher degree of education (only high level vs. low level) or with a job were also significantly lower. Significant positive association was found between the severity of depression and smoking as well as marijuana/hashish use, holding other factors constant.

This study suggests that the SES status (composed of occupation and education) and life style characteristics (composed of smoking and marijuana/hashish use) appear to predict depression symptomatology across the United States. It supports the notion that resources could be allocated toward developing strategies to enhance educational level of the public and controlling smoking and marijuana/hashish use in order to have positive benefits that will protect against the development of depression, even major depression disorder. Moreover, our study provides future research directions where more research is need across different populations. For instance, future research could subgroup people with stressful jobs, jobs with low pay and jobs that lack much respect from

the public to evaluate the effect of people with different types of job on depression. Using older people or different birth cohorts as target population to determine whether people from disadvantaged backgrounds consistently realize greater protective effects from higher education. The study also provides a novel research direction that moderate alcohol drinking might be protective against depression. Further researchers should focus on investigating alcohol consumption in detail for each sample and avoid using highly selective sample in order to generalize the findings to other populations.

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