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The Effects of Psychological Stress on Abdominal Obesity Among African American Women

Sankan W. Nyanseor

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ABSTRACT

THE EFFECTS OF PSYCHOLOGICAL STRESS ON ABDOMINAL OBESITY AMONG AFRICAN AMERICAN WOMEN

By

SANKAN WORHWINN NYANSEOR

April 22, 2016

African American women have the highest prevalence of obesity than other groups in the United States. Consequently, they are at a disproportionately high risk for chronic diseases associated with obesity such as stroke, type 2 diabetes mellitus and cancer. Research has shown that stress may be a risk factor for obesity. Furthermore, it has been shown that stress related to obesity may be more prevalent within African American women. The aim of this study was to identify if there is an association between psychological stress in African American women in the United States and abdominal obesity. A cross sectional study design was employed using secondary data from the 2011-2012 National Health and Nutrition Examination Survey (NHANES). There were 655 African American female participants included in the study sample. The exposure variable was psychological stress assessed by a select group of questions from the interview portion of the NHANES survey. The outcome variable was abdominal obesity measured by waist circumference. Logistic regression was used to examine if there is a relationship between psychological stress and abdominal obesity among African American women. The main results of this study was that psychological stress was correlated with increased odds of abdominal obesity upon adjusting for age, BMI, educational level and marital status (OR=1.192 95% CI 0.305 – 4.655). However, the association was not statistically significant. When examining the relationship between the other covariates and abdominal obesity, having a formal education and being a married woman were each found to be associated with decreased odds of abdominal obesity. The results were not generalizable, but they do suggest areas of promise in better understanding the impact of abdominal obesity among African American women which could lead to targeted interventions to reduce this outcome in this population as well as others.

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AMERICAN WOMEN

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Author's Statement Page

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INTRODUCTION

1.1 Background/Literature Review

Obesity is a majorly increasing epidemic affecting populations worldwide. According to the World Health Organization, between 1980 and 2014, the worldwide prevalence of obesity more than doubled (“WHO | Obesity,” 2016). It is defined as “a medical condition where excess body fat has accumulated to 20% or more over an individual’s ideal body weight and may result in adverse health effects” (Clark, Taylor, Wu, & Smith, 2013). African American women are disproportionately affected having the highest prevalence of overweight or obesity compared to other groups in the United States. Between 2011-2012, 82% of African American women were overweight or obese with a BMI ≥ 25 (Ogden, Carroll, Kit, & Flegal, 2014). Consequently, African American women are at a disproportionately high risk for numerous chronic diseases associated with obesity such as stroke, osteoarthritis, sleep apnea, high blood pressure, type 2 diabetes mellitus, cardiovascular diseases, endometrial cancer, breast cancer and other types of cancer (Sutherland, 2013).

The standard measure of obesity is the Body Mass Index (BMI). BMI is calculated by taking a person’s weight in kilograms and dividing it by the square of his or her height in meters. A person with a BMI equal to or greater than 25 is classified as overweight whereas a person with a BMI equal to or greater than 30 is classified as obese. BMI is a simple, inexpensive and reliable measure for showing the positive correlation between body mass and risk of obesity-related diseases (Harris, 2013). A limitation to using BMI as a measure for classifying obesity is that it does not distinguish between fat mass and fat-free mass (i.e. bone, muscle) and it does not measure body fat distribution which is often associated with certain health risks (Harris, 2013). The interpretation of BMI in terms of body fatness and in relation to weight standards varies according to gender, age and other factors. A given value for BMI may be numerically the same for men or women or people of different ages but it may not represent the same body fat percentage, the same degree of risk or the same degree of overweight. In other words, BMI measures are not generalizable across ethnicities, genders, or ages.

Abdominal obesity is a form of obesity in which excess fat is developed around the abdomen. Abdominal fat is composed of three compartments: visceral, retroperitoneal, and

subcutaneous (Abate et al., 1996; Jensen, Kanaley, Reed, & Sheedy, 1995; Sjöström, Kvist, Cederblad, & Tylén, 1986). Studies have illustrated that abdominal obesity is a strong predictor of adverse metabolic and/or cardiovascular outcomes (Despres, 2006). It is suggested that the visceral fat component of abdominal fat is the most strongly associated with those risk factors (Björntorp, 1988; Després et al., 1989; Fujioka, Matsuzawa, Tokunaga, & Tarui, 1987; Pouliot et al., 1992). Abdominal obesity is a key component of metabolic syndrome and it has also been associated with increased risk of all-cause mortality as well as certain cancers such as colorectal and breast (Okosun, Annor, Seale, & Eriksen, 2014). The most accurate assessment of abdominal obesity is through imaging methods such as computer tomography (CT) scans. However, waist circumference is a commonly used measure to evaluate abdominal fat distribution because of its simplicity (Bagchi & Preuss, 2013). Accumulating evidence suggests that waist circumference and other measures of abdominal fat are positively associated with risks for chronic diseases such as cardiovascular disease, diabetes mellitus and some cancers (Zhang, Rexrode, van Dam, Li, & Hu, 2008). The waist circumference cutoff points for which there is an increased relative risk of disease from obesity is a measured circumference of greater than 88 cm (35 in) in women and a measured circumference of greater than 102 cm (40 in) in men (“Obesity Education Initiative Electronic Textbook--Treatment Guidelines,” 2016).

Some research indicates that the quantity of abdominal fat is a more accurate predictor of disease risk and/or death than BMI. In fact, in some ethnic groups such as African Americans, the use of BMI to establish obesity has resulted in individuals being misidentified as normal weight versus overweight or obese thereby misclassifying potential health risks (Clark et al., 2013). Because of this, it may be more advantageous to assess obesity according to the regional distribution of fat, particularly in the abdominal region, since BMI is unable to account for differences in body types as a result of ethnic variations.

Research has shown that stress may be a risk factor for obesity. According to Barrington et al. (2012), stress happens when environmental demands tax or exceed the adaptive capacity of an individual and those demands result in physiologic or psychological processes that increase the individual’s risk for disease. Acute stress is a form of stress that occurs over a short period of time and can be triggered by daily hassles or major life events. Chronic stress is another form

of stress in which minor day-to-day stressors accumulate across a long-term period. Both acute and chronic stress can have long-term consequences (Flier, Underhill, & McEwen, 1998). Stressors are believed to influence the development of diseases by causing negative affective states, such as anxiety and depression, which in turn exert direct effects on biological processes or behavioral patterns that influence disease risk (Cohen, Kessler, & Gordon, 1995).

Physiological responses to stress are controlled by the hypothalamus in the brain. When a stress response is activated, the hypothalamus sends a signal to two other parts of the brain: the pituitary gland and the adrenal medulla via the Hypothalamic-Pituitary-Adrenal (HPA) axis (“What is the Stress Response | Simply Psychology,” 2016). Stress is measured physiologically by measuring stress hormones produced as a result of an individual’s exposure to stressors. Cortisol is a stress hormone produced by the adrenal cortex which surrounds the adrenal medulla and is often used to objectively measure an individual’s stress response. According to some studies, cortisol may contribute to the development of visceral fat. Cortisol activates lipoprotein lipase, the regulator of lipid accumulation in fat cells known as adipocytes. Also, in the presence of insulin, cortisol prohibits the lipid mobilization systems. These events are mediated by glucocorticoid receptors which are part of the HPA axis. Glucocorticoid receptors are higher in density in intra-abdominal fat deposits than in other fat deposits on the body. Therefore, cortisol activity leading to fat accumulation is amplified in the areas of visceral fat (Rosmond & Björntorp, 2000).

Stress is evaluated psychologically in two ways; one is by assessing environmental stressors or stimuli such as daily hassles or major life events such as the death of a loved one, loss of a job, divorce, moving, or going to court. The second is by assessing an individual’s perception of being stressed and their emotional response to it (Kopp et al., 2010). The premise is that the more events that take place, the greater the stress experienced (“MacArthur SES & Health Network | Research,” 2016). These types of assessments are generally performed through self-report questionnaires.

Literature has shown that the influence of stress on obesity levels may be more prevalent within African American women than other races (Sutherland, 2013). One study used a prospective design to examine the relationship between perceived stress and percent change in

BMI among African American men and women over a 13-year timespan. They found that among the African American women in the study, higher levels of perceived stress were associated with greater weight gain (Fowler-Brown et al., 2009). Higher levels of stress have also been seen among African American women with low income and low education. This could be attributed to the fact that impoverished African American women often bear the primary responsibility for the social and economic survival of their families and communities (Sutherland, 2013). Another study reported that perceived racism experienced among African American women can act as a psychological stressor resulting in weight gain and increased BMI levels (Cozier, Wise, Palmer, & Rosenberg, 2009). In the context of U.S. society, the combined social and economic stressors experienced by African American women daily in addition to the unique stressor racism could potentially be a causal factor in the high prevalence of obesity rates found among this population.

1.2 Research Question

The primary aim of this study was to determine the association between reported psychological stress in African American women and abdominal obesity measured by waist circumference.

METHODS AND PROCEDURE

2.1 Study Design

A cross sectional study design was employed using secondary data obtained from the 2011-2012 National Health and Nutrition Examination Survey (NHANES). NHANES is a program that combines interviewing and physical examination data to assess the health and nutritional status of adults and children in the United States. The target population for NHANES is the noninstitutionalized civilian resident population of United States. It is owned by the National Center for Health Statistics under the Center for Disease Control and Prevention and available for public use.

In 2011-2012, 13,431 persons were selected to participate in NHANES from 30 different study locations. Of those, 9,756 completed interviews and 9,356 of those individuals were physically examined. Eligible participants in this study were Non-Hispanic Black women

between the ages of 20-80 years old. They must not have tested pregnant at the time of examination and they must have had available waist circumference measurements.

2.2 Exposure Variable

The exposure variable of interest was psychological stress assessed by a series of questions selected from the interview portion of the NHANES survey. The questions were asked by trained interviewers using the Computer-Assisted Personal Interviewing (CAPI) system as part of the Mobile Examination Center (MEC) in a private interview. Nine interview questions were selected that best assessed daily life stressors of the participants or assessed the degree to which the participants perceived themselves as being stressed (see Appendix A for the specific questions that were selected from the NHANES survey to assess psychological stress). Eight of the questions asked the participants to report on the frequency of experiencing a life stressor or the frequency of experiencing a feeling associated with being stressed within a specific timeframe (i.e. two weeks, 30 days). For each of these questions, the participant was given a score of one if they reported experiencing a stressor or stress-related feeling for more than half of the specified time period. The participant was given a score of zero for each question if they reported experiencing a stressor or stress-related feeling half of the specified time or less. For example, one of the questions selected was “Over the last 2 weeks, how often have you been bothered by the following problems: poor appetite or overeating?” The responses available to the participant were “Not at all”, “Several days”, “More than half the days” and “Nearly every day”. For that question, the participant would be given a score of one if they responded with “More than half the days” or “Nearly every day”. The participant would be given a score of zero for that question if they responded with “Not at all” or “Several days”. The ninth question was a discrete question that asked whether or not the participant experienced a particular stress-related feeling. They were given a score of one for responding with “Yes” and a score of zero for responding with “No”. Missing answers for each question were given a score of zero (these included omitted responses, responses in which the participant refused to answer or answered as “Don’t know”).

A psychological stress scale was developed from these nine questions. A participant could receive a composite score ranging from 0 to 9. From this composite score, a participant

was defined as having psychological stress if their total score was greater than 50% of the maximum possible score which was 9. In other words, if a participant had a composite score greater than 4.5, they were classified as having been exposed to psychological stress. If a participant had a composite score less than 4.5, they were classified as unexposed to psychological stress.

2.3 Covariates

Demographic data on the selected participants was obtained from the 2011-2012 NHANES survey to include age at time of screening in years (this is the age at which they participated in the survey), educational level, marital status, annual household income and total number of people in household. This information was obtained through demographics questionnaires that were administered, in the home, by trained interviewers using the Computer-Assisted Personal Interviewing (CAPI) system. BMI data was also included in the study. BMI was calculated as weight in kilograms divided by height in meters squared, and then rounded to one decimal place. The standing height of participants was measured in meters using a stadiometer with a fixed vertical backboard and an adjustable headpiece. The weight of participants was measured in kilograms using a digital weight scale.

2.4 Outcome Variable

The outcome variable of interest was abdominal obesity measured by waist circumference (cm). Waist circumference measurements were taken by positioning measuring tape around the waist just above the uppermost lateral border of the iliac crest on the left and right side of the participants. Both BMI and Waist Circumference were collected from participants at Mobile Examination Centers by trained health technicians. The health technician was assisted by a recorder during the body measures examination. Waist circumference greater than 88 cm indicated abdominal obesity whereas a waist circumference less than 88 cm did not.

2.5 Data Analysis

Of the 4900 women who participated in the 2011 – 2012 NHANES survey, the final analytical sample for this study consisted of 655 women who identified as Non-Hispanic Black (African American) between the ages of 20-80 years old. Women younger than 20 years old (n=2080) and of other ethnicities were excluded (n=3528). Further exclusions were made for

women who tested pregnant at the time of examination (n=57) as well as women who had missing waist circumference measurements (n=84). All analyses were performed using SAS version 9.3 (SAS Institute, Cary, NC). Univariate analyses and Pearson's Chi Square test were used to examine the relationship between each of the covariates and the outcome of abdominal obesity. Logistic regression was used to examine the main question of whether or not there is a relationship between psychological stress and abdominal obesity among the African American female participants. A priori methods for controlling confounding included the exclusion of pregnant women due to the fact that hormonal changes experienced by women during pregnancy can affect stress levels as well as weight. Adjusted odds ratios were computed during the logistical regression tests to control for confounding by age, BMI, educational level and marital status.

RESULTS

3.1 Participants/Descriptive Data

The basic characteristics of the study participants are shown in Table 1. The mean age of the participants in this study was 49.05 years (SD 16.62). The mean BMI of the participants was 31.98 kg/m² (SD 8.05). The mean household size of the participants was 3.10 individuals (SD 1.68). The educational level for the majority of the participants was "Some college or AA degree" at 37.71% (247/655). The marital status for the majority of the participants was "Never married" at 33.49% (219/654). The next highest marital status of participants was "Married" at 28.75% (188/654). The majority of the participants had an annual household income of \$25,000 to \$34,999 at 12.38% (78/630). The next highest annual household income of participants was \$100,000 and over at 12.22% (77/630).

Of the study participants, 78.17% (512/655) of the participants were classified as abdominally obese whereas 21.83% (143/655) were not classified as abdominally obese. 7.18% (47/655) of the participants were defined as having psychological stress whereas 92.82% (608/655) of the participants were not defined as having psychological stress.

3.2 Outcome Data

Age and BMI showed a statistical significance in their distribution among the African American female participants that were abdominally obese compared to those who were not (see Table 1). African American female participants who were abdominally obese had a mean age of 50.48 years (SD 15.69) whereas those who were not abdominally obese had a mean age of 43.94 years (SD 18.78). Abdominally obese African American female participants had a mean BMI of 34.36 kg/m² (SD 7.39). African American female participants that were not classified as abdominally obese had a mean BMI of 23.44 kg/m² (SD 2.90). Educational level and marital status were also significantly associated with abdominal obesity among the African American female participants. Females with “Some college or an AA degree” had the highest percentage of abdominal obesity among all of the females classified as abdominally obese at 29.16%. Married African American females had the highest percentage of abdominal obesity among all of the abdominally obese females at 24.16%. Household size and income were not statistically significant in their association with abdominal obesity.

Table 1. Basic Characteristics of African American Female Participants			
Covariates	Abdominally Obese (%)		P-Value
	Yes	No	
Age	50.48 (15.69) ^A	43.94 (18.78) ^A	0.0001 ^B
BMI (3 missing)	34.36 (7.39) ^A	23.44 (2.90) ^A	0.0001 ^B
Household Size	3.05 (1.66) ^A	3.28 (1.73) ^A	0.1631 ^B
Educational Level			
Less than 9th grade	1.98	0.46	0.0476 ^C
9 - 11th grade (includes 12th grade with no diploma)	12.37	2.44	0.0476 ^C
High school graduate/GED or equivalent	19.69	3.97	0.0476 ^C
Some college or AA degree	29.16	8.55	0.0476 ^C
College graduate or above	14.96	6.41	0.0476 ^C
Marital Status (1 missing)			
Married	24.16	4.59	0.0033 ^C
Widowed	10.7	2.45	0.0033 ^C
Divorced	11.62	1.83	0.0033 ^C
Separated	4.89	1.53	0.0033 ^C
Never married	23.55	9.94	0.0033 ^C
Living with partner	3.21	1.53	0.0033 ^C
Income (25 missing)			
\$0 to \$4,999	3.02	0.79	0.1089 ^C
\$5,000 to \$9,999	6.35	2.06	0.1089 ^C
\$10,000 to \$14,999	8.57	0.79	0.1089 ^C
\$15,000 to \$19,999	5.56	1.11	0.1089 ^C
\$20,000 to \$24,999	5.71	1.59	0.1089 ^C
\$25,000 to \$34,999	8.73	3.65	0.1089 ^C
\$35,000 to \$44,999	8.41	1.43	0.1089 ^C
\$45,000 to \$54,999	3.97	0.95	0.1089 ^C
\$55,000 to \$64,999	4.29	0.79	0.1089 ^C
\$65,000 to \$74,999	3.17	1.43	0.1089 ^C
\$20,000 and Over	4.44	1.9	0.1089 ^C
Under \$20,000	1.27	0	0.1089 ^C
\$75,000 to \$99,999	5.56	2.22	0.1089 ^C
\$100,000 and Over	9.21	3.02	0.1089 ^C
^A Mean(Standard Deviation)			
^B The p-value was determined using the Wilcoxon Rank Sums Two-Sample procedure.			
^C The p-value was determined using the Chi-Square procedure.			

3.3 Main results

The results of the univariate logistic regression analysis of the association between selected independent variables and abdominal obesity are shown in Table 2. Increases in age (OR =1.024 95% CI 1.013 – 1.036) and BMI (OR=2.049 95% CI 1.791 – 2.343) were associated with increased odds of abdominal obesity. Although psychological stress showed a positive association with abdominal obesity (OR=1.391), it was not statistically significant. Having a formal education and being a married woman were each found to be associated with decreased odds of abdominal obesity.

Covariates	Crude Odds Ratio	95% CI
Psychological Stress	1.391	0.635 - 3.048
Age	1.024	1.013 - 1.036
BMI	2.049	1.791 - 2.343
Household Size	0.923	0.828 - 1.028
Educational Level	0.769	0.639 - 0.926
Marital Status	0.813	0.729 - 0.907
Income	0.965	0.925 - 1.007

A multivariate logistic regression analysis was employed to assess the main question of whether or not there is an association between psychological stress and abdominal obesity among African American women adjusting for age, BMI, educational level and marital status (see Table 3). As shown, psychological stress was correlated with increased odds of abdominal obesity upon adjusting for age, BMI, educational level and marital status. However, like the results of the univariate analysis, the association was not statistically significant. When examining the relationship between the other covariates and abdominal obesity, increased BMI (OR =2.238 95%CI 1.910 – 2.622) was also found to be associated with abdominal obesity after adjusting for other independent variables.

Covariates	Adjusted Odds Ratio	95% CI
Psychological Stress	1.192	0.305 - 4.655
Age	1.045	1.020 - 1.070
BMI	2.238	1.910 - 2.622
Educational Level	0.800	0.576 - 1.112
Marital Status	0.894	0.716 - 1.117

DISCUSSION/CONCLUSION

The purpose of the study was to determine the association between psychological stress and abdominal obesity in African American women. The main findings of the study showed a positive association in which psychological stress resulted in increased odds of abdominal obesity among African American women after adjusting for age, BMI, educational level and marital stress. These results were similar to a study which found that German men exposed to stress in their work environment exhibited higher levels of abdominal obesity (Rosmond & Björntorp, 2000). However, in this study the association between psychological stress and abdominal obesity among African American women was not statistically significant.

This is the first study, to the author's knowledge, that examined the association between psychological stress and abdominal obesity in African American women. Being that there is a biological mechanism linking stress to the development of abdominal obesity, assessing stress from a psychological perspective is a quick and cost efficient way of indirectly measuring the stress response in individuals and determining the risks of abdominal obesity and its associated diseases. The psychological stress scale used in this study was modeled after the Schedule of Recent Experiences (SRE) inventory developed by Holmes and Rahe (Holmes & Rahe, 1967). The SRE is commonly used to measure psychological stress by assessing important environmental events experienced by an individual. Each event on the inventory is assigned a unit score and the summation of the scores is taken as the indicator of the amount of stress an individual has experienced (Dohrenwend, 2006). The SRE inventory is often used in research on the role of stressful life events because of the consistent relationships found between the life events listed and psychological stress. In this study, missing responses for each question in the scale resulted in the treatment of the total score for that question as being missing (assigning score of zero). This is a method used in computing scores for psychological scales and is considered reasonable when data in an observation is missing completely at random as the reduced score for that observation is considered to represent the overall score of the observation. On the other hand, this approach can result in misleading and biased conclusions when the missing data is relative to the measure of interest, in this case, psychological stress (Siddiqui, 2015).

Some weaknesses of the study are that the questions selected from the NHANES survey to assess psychological stress may not have been specific enough to define psychological stress thereby resulting in an inaccurate measure and skewed results. In addition, the questions may not have been specific enough to account for intracategory variability which is a key concern when using psychological stress scales because a positive response to a question on the scale can represent different types of actual experience from one participant to another if the question does not explicitly describe the stress event (Dohrenwend, 2006). Furthermore, this study was limited in that it relied on secondary data previously collected from the NHANES survey. Therefore, there was no way to modify the questions to get a more specific assessment of stress from the participants. It may have been more beneficial to collect primary data, especially when trying to measure psychological stress as there a number of reliable stress scales available that can explicitly measure stress. Another potential issue is that the selected questions from the NHANES survey used to assess psychological stress relied on self-reported data from the participants which are subject to recall bias and could also have contributed to inaccurate stress measures. Also, the age variable was not adjusted to account for potential confounding effects of menopause which occurs in older women and causes hormonal changes that could affect abdominal obesity levels.

The results of this study cannot be generalized towards all African American women in the United States because the sample of African American women in this study were not representative of African American women in the US. The participant data obtained from the NHANES survey is susceptible to sampling bias because the survey relied on whichever participants agreed to take part in the survey and physical examination. Thus, the sample was not truly random. Although the results of this study may not be generalizable, they do suggest some areas of promise in better understanding the causes of abdominal obesity among African American women with more research. Also, it is recommended that further research be done to investigate how marital status and educational level may impact abdominal obesity among African American women as the results of this study showed a decrease in the odds of the outcome. Investigating those relationships more in-depth could lead to targeted interventions that could reduce occurrences of abdominal obesity in this population as well as others.

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APPENDIX A. Select NHANES Survey Questions used to assess Psychological Stress

Question 1: During the past 30 days, for about how many days have you felt worried, tense or anxious?

Possible Answers: Number of days from 0 -30, Refused, Don't Know, Missing

Question 2: Over the last 2 weeks, how often have you been bothered by the following problems: little interest or pleasure in doing things?

Possible Answers: Not at all, Several days, More than half the days, Nearly every day, Refused, Don't Know, Missing

Question 3: Over the last 2 weeks, how often have you been bothered by the following problems: feeling down, depressed, or hopeless?

Possible Answers: Not at all, Several days, More than half the days, Nearly every day, Refused, Don't Know, Missing

Question 4: Over the last 2 weeks, how often have you been bothered by the following problems: trouble falling or staying asleep, or sleeping too much?

Possible Answers: Not at all, Several days, More than half the days, Nearly every day, Refused, Don't Know, Missing

Question 5: Over the last 2 weeks, how often have you been bothered by the following problems: feeling tired or having little energy?

Possible Answers: Not at all, Several days, More than half the days, Nearly every day, Refused, Don't Know, Missing

Question 6: Over the last 2 weeks, how often have you been bothered by the following problems: poor appetite or overeating?

Possible Answers: Not at all, Several days, More than half the days, Nearly every day, Refused, Don't Know, Missing

Question 7: Over the last 2 weeks, how often have you been bothered by the following problems: feeling bad about yourself – or that you are a failure or have let yourself or your family down?

Possible Answers: Not at all, Several days, More than half the days, Nearly every day, Refused, Don't Know, Missing

Question 8: Over the last 2 weeks, how often have you been bothered by the following problems: trouble concentrating on things, such as reading the newspaper or watching TV?

Possible Answers: Not at all, Several days, More than half the days, Nearly every day, Refused, Don't Know, Missing

Question 9: Are you limited in any way in any activity because of a physical, mental or emotional problem?

Possible Answers: Yes, No, Refused, Don't Know, Missing