3-23-2016

Depression and Body Mass Index, Differences by Education: Evidence from a Population-based Study of Adult Women in the U.S. Buffalo-Niagara Region

Ashley Wendell Kranjac
Chapman University, kranjac@chapman.edu

Jing Nie
State University of New York at Buffalo

Maurizio Trevisan
City College of New York

Jo L. Freudenheim
State University of New York at Buffalo

Recommended Citation

Kranjac AW, Nie, J., Trevisan, M., & Freudenheim, J. L. (2017). Depression and body mass index, differences by education: Evidence from a population-based study of adult women in the U.S. Buffalo-Niagara region. *Obesity Research & Clinical Practice, 2017*(11): 63–71. doi: 10.1016/j.orcp.2016.03.002

Depression and Body Mass Index, Differences by Education: Evidence from a Population-based Study of Adult Women in the U.S. Buffalo-Niagara Region

HHS Public Access

Author manuscript

Obes Res Clin Pract. Author manuscript; available in PMC 2018 January 01.

Published in final edited form as:

Obes Res Clin Pract. 2017 ; 11(1): 63–71. doi:10.1016/j.orcp.2016.03.002.

Depression and Body Mass Index, Differences by Education: Evidence from a Population-based Study of Adult Women in the U.S. Buffalo-Niagara Region

Ashley Wendell Kranjac, Ph.D.,

Rice University, Department of Sociology, Kinder Institute for Urban Research, 6500 Main Street #1020, Houston, TX 77005, awkranjac@rice.edu, 682-478-6466

Jing Nie, PhD,

University at Buffalo, State University of New York, Buffalo, United States, Department of Epidemiology and Environmental Health

Maurizio Trevisan, MD, MS, and

City College of New York, United States, Sophie Davis School of Biomedical Education

Jo L. Freudenheim, PhD

University at Buffalo, State University of New York, Buffalo, United States, Department of Epidemiology and Environmental Health

Abstract

The relationship between obesity and depression is well described. However, the evidence linking depression and body mass index (BMI) across the broad range of body size is less consistent. We examined the association between depressive symptoms and BMI in a sample of adult women in the Buffalo-Niagara region between 1997 and 2001. Using logistic regression, we investigated whether increased weight status beyond normal-weight was associated with a higher prevalence of depressive symptoms, and if educational attainment modified the association between obesity and depression. There was a trend for increased weight status to be associated with higher depressive symptoms (obese II/III, OR 1.57, 95% CI 1.03–2.41), whereas higher education was associated with lower odds of depressive symptoms, in an adjusted model including BMI (more than 12 but less than 16 years, OR 0.70, 95% CI 0.49–0.98; 16 or more years of education, OR 0.61, 95% CI 0.40–0.93). The association of being obese I with depressive symptoms was different for more educated (OR 2.15, 95% CI 1.27–3.62) compared to less educated women (OR 0.90, 95% CI 0.50–1.62); the sample was larger for the more educated women and reached statistical

Correspondence to: Ashley Wendell Kranjac.

Ethical approval

The University at Buffalo Health Sciences institutional review board approved the study, and all participants provided written informed consent.

COMPETING INTERESTS

The authors report no conflicts of interest.

significance. There were no differences in the association for obese II/III women in strata of education. There was evidence of risk-difference heterogeneity (0.88, 95% CI 0.84–0.93). In this population-based sample of women in western New York State, increased weight was negligibly associated with depressive symptoms. The association of being obese I with depressive symptoms was different for more compared to less educated women.

Keywords

Depression; Obesity; Women's Health; Education

Introduction

An association between mental health and obesity is well established [1,2,3,4], as is the positive association between obesity and depression [4]. There is evidence that obesity and depression are comorbid [1], however, much less is known about the biopsychosocial variables associated with this relationship [5]. Recently, it was found that somatic, but not cognitive-affective, symptoms of depression are positively associated with body mass index (BMI) [6]. Additionally, in a meta-analysis, there was evidence of a bidirectional association between depression and metabolic syndrome [7], a cluster of several risk factors including central obesity, as well as hyperglycemia, elevated blood pressure, hypertriglyceridemia, and decreased HDL cholesterol [8].

In contrast to the association with obesity, there is less consistency with regard to evidence linking BMI and depression more generally. In recent studies there was evidence of an association between BMI and increased risk of depression [9,10], whereas in others, the association was limited to those with severe obesity (measured as a BMI >35 – ≤39.9 or >39.9) [11,12]. The implication of this and related research is that more studies are needed to isolate the mechanisms by which BMI and depression could be related.

One likely mechanism linking BMI and depression is educational attainment. There are numerous studies that have documented lower levels of depression among adults with higher education [13,14], yet, less is known about how education modifies the association between obesity and depression. A better understanding of the impact of education on increased weight status and depressive symptoms will provide much needed insight into the complex, comorbid relationship between obesity and depression. Therefore, in the present analysis, we examined the association between body weight and depressive symptoms in a sample of adult women in the Buffalo-Niagara region assessed between 1997 and 2001. We hypothesized, a priori, that increased weight status beyond normal weight would be associated with a higher prevalence of depressive symptoms, and that educational attainment would modify any observed positive association between increased weight and depressive symptoms.

The possibility that educational attainment can offset undesired effects of overweight and obesity has important implications for understanding the association between body weight and depression. For example, higher educational attainment has been shown to have a protective effect on depressive symptoms [15], and this may result in lowered obesity risk

due to the high correlation between obesity and depression [1]. Further, research indicates that those with lower levels of education are more likely to experience both obesity and depression [16]. Taken together, disparate levels of education may differentially influence the effect of increased body weight on depression.

Methods

Study Population

Healthy women, aged 35 to 80 were randomly selected from the general population in Erie and Niagara counties in western New York State between 1997 and 2001 as controls for a case-control study of breast cancer. Study population controls aged 35–64 years were randomly selected from the New York State Department of Motor Vehicles records.[1] Controls aged 65–80 were randomly selected from the Health Care Finance Association data. We assigned a computer-generated random number to each person on the complete lists of all potential participants supplied by the New York State Department of Motor Vehicles and the Health Care Finance Association. The potential participants were then sorted by their randomly assigned ascending numbers and contacted in sequential order. Introductory letters were mailed to potential interviewees prior to interviewers' telephone calls, and up to 12 callbacks were completed.

We interviewed 41.5 percent of the controls that were contacted. Trained interviewers conducted standardized, in-person interviews. The detailed interview included questions dealing with demographic traits, reproductive and menstrual history, occupational history, disease history, smoking, environmental tobacco smoke exposure, medications, diet, and several aspects of alcohol consumption throughout the lifetime. Of the original sample (n=2,115), we excluded those who had missing or questionable data (e.g., if the response given was implausible and did not fall within the appropriate scale range or data entry error) on BMI (n=72) or CES-D depression scores (n=115), resulting in a sample of 1,928 women for analysis. The University at Buffalo Health Sciences institutional review board approved the study, and all participants provided written informed consent.

CES-D Questionnaire

All participants completed the Center for Epidemiologic Studies Depression Scale questionnaire CES-D [15], a tool designed to measure depression status among the general population. The items in this scale primarily measure affective and somatic aspects of depression during the previous week through a self-reported measure. Each question is scored from 0 to 3, based on participant responses, resulting in a possible score of 0 to 60, with higher scores indicating more depressive symptoms. The subject is considered depressed if his or her score is 16 or higher. The CES-D has been evaluated extensively for both validity and reliability [17,18,19,20].

[1]Approximately 95 percent of the western New York residents in this age range hold a driver's license.

Body Mass Index

Physical measurements were made by trained interviewers using a standardized protocol which included height and weight. BMI was calculated as weight (kg)/height (m)^2. BMI categories were created using the 2000 Center for Disease Control Growth Charts: United States [21,22]. Standard weight status categories associated with BMI were used: underweight (<18.5), normal-weight (18.5 – ≤24.9), overweight (>25 – ≥29.9), obese I (>30 – ≤34.9), obese II (>35 – ≤39.9), or obese III (>39.9) [21,22]. The classifications of Obese I (low-risk), Obese II (moderate-risk), or Obese III (high-risk) is related to the likelihood of developing obesity–related health problems [21,22]. Following classification of participants into these six weight categories, we excluded women in the underweight category (n = 18) and combined obese II and obese III categories, due to the association between being underweight and depressive symptoms [9] and the small number of cases in the obese III category (n = 92).

Measurement of Other Relevant Covariates

In self-administered and interviewer-administered questionnaires, data were collected regarding demographic, socioeconomic, and lifestyle characteristics. We examined age as a continuous measure, race as a dichotomous measure, white and other race, with white as the reference, education was a self-reported categorical measure, and classified as less than twelve years, equal to twelve years, greater than twelve years but less than sixteen years, greater than or equal to sixteen years, with twelve years as the reference, income was a categorical measure, categorized as less than $20,000, greater than or equal to $20 and less than $40,000, greater than or equal to $40,000 and less than $60,000, and greater than or equal to $60,000, with less than $20,000 as the reference, marital status was a dichotomous measure, married or not married at time of assessment, with not married as the reference, smoking status was a categorical measure, current smoker, former smoker, or non-smoker, with non-smoker as the reference, caloric intake was a categorical measure, representing whether the participant consumed less than, equal to, or more than the recommended 2,000 calories per day, with less than 2,000 calorie per day as the reference,[2] sleep was a categorical measure, representing whether the participant averages less than eight hours of sleep per night or the recommended eight or more hours [23], with less than eight as the reference, and physical activity was a categorical measure calculated from self-reported lifetime physical activity, categorized as less than three hours per week, three to six hours per week, or greater than six hours per week, with less than three hours as the reference. We included these potential cofounders given the widely recognized and established involvement of these factors in both obesity and depressive symptoms [23, 24].

Statistical Analyses

All analyses were completed using Stata 13.0. We compared characteristics of depressed and non-depressed women using Student's t test and χ^2 tests to examine the differences between measurements of non-depressed and depressed women for continuous and categorical variables, respectively. Spearman correlation coefficients were estimated to examine linear

[2]Caloric intake criteria were based on the average age in the sample of 57 [22].

association between continuous measures of CES-D, BMI, and education. We examined the association of BMI and depression (CES-D scores <16, non-depressed and ≥16, depressed) using logistic regression models. We further examined the association in strata of education. We also examined the interaction of BMI and education with depressive symptoms by adding a multiplicative term to the full model. We assessed significance where any *p* value below 0.05 was considered statistically significant.

Results

Descriptive characteristics of the study population are shown in Table 1, including frequencies and percentages of non-depressed and depressed participants. BMI was significantly different for those who reported being depressed compared to those who were not depressed. Depressed women were more likely to be obese ($p<0.01$). Depressed women were more often older, not married, less educated, lower income, a former- or current-smoker, less physically active, consumed more calories, and averaged less than 8 hours of sleep.

Spearman correlations of depression with BMI and years of education were calculated. The resulting rank-order correlation for BMI suggested a negligible association between increased weight and depression scores ($r=0.12$, $p<0.001$). There was a weak inverse relationship between depression and education ($r = -0.21$, $p<0.001$). Education and BMI were also weakly inversely correlated ($r = -0.17$, $p<0.001$).

As shown in Table 2, the estimated odds of depressive symptoms are significantly higher for women classified as obese I (OR=1.57, 95% CI 1.11–2.22) and obese II/ III (OR=1.88, 95% CI 1.29–2.76): Model 1). Severe obesity was also significantly associated with depressive symptoms, adjusting for other potential cofounders (Model 2). Obese I women's odds of depressive symptoms was 43% higher than normal-weight women (OR=1.43, 95% CI 0.97–2.11), and obese II/ III women's was approximately 57% higher (OR = 1.57, 95% CI 1.03–2.41) compared to women classified as normal-weight, after controlling for cofounders.

The association of BMI and depressive symptoms by educational attainment is shown in Table 2 (Model 3). Among women with > 12 years education, women classified as obese I had significantly higher odds of depressive symptoms, double that of normal-weight women with equal education (adjusted OR= 2.15, 95% CI 1.27–3.62). Among those women with ≤ 12 years of education, the point estimate was quite different (OR 0.90, 95% CI 0.50–1.62) but the sample was smaller and the confidence interval included the null. For the obese II/ III group, there were no differences in the association in the strata of education (Model 4).

To verify that the observed association between higher educated, obese I women and higher depressive symptoms is not due to the distribution of BMI in the education group, we ran the analysis by degree attainment (i.e., < 12 years, > 12 years, and >16 years of education). We confirmed that the association between weight status and depressive symptoms remained significant among women classified as obese I who obtained a Bachelor's degree (results available upon request). We found that Obese I women who graduated from college had significantly higher odds of depressive symptoms, again nearly double that of normal-weight

women with equivalent educational attainment (adjusted OR=2.82, 95% CI 0.99–8.08). In our final model, we examined the interaction of BMI and education with depressive symptoms by adding a multiplicative term to the full model. We found a statistically insignificant interaction on the odds ratio scale (1.03, 95%CI 0.99–1.08). We then tested the joint effect for education and BMI with depressive symptoms on the additive scale and found evidence of risk-difference heterogeneity (0.88, 95% CI 0.84–0.93).

Discussion

We examined the association of BMI with depressive symptoms, and whether educational attainment modifies that association in a population-based cross-sectional study of healthy adult women in Western New York. Our resulting rank-order correlation between increased weight and depression scores suggested a statistically significant, yet negligible positive association in our sample. Although BMI and depression were negligibly correlated as compared to prior reports [4] one likely reason for this discrepancy in findings is that the CES-D measures affective and somatic aspects of depression, and prior research has shown that it is the somatic, but not cognitive-affective, symptoms of depression that are positively associated with BMI [6], therefore potentially diluting the effect.

Findings support our a priori hypothesis that increased weight status is associated with higher depressive symptoms, as previously shown [9,10]. We further observed an inverse relationship between depression and education. This finding is in line with the existing literature that shows depression levels among women fall more sharply as education increases [24,25]. Here we show that the association of obese I category with depressive symptoms was different in groups of women defined by their education. Our results indicate that among obese I women of higher educational attainment, there is an increased risk of depressive symptoms compared to normal weight women with equal education. Consequently, education modifies the association between weight status and depressive symptoms for women classified as obese I, but not in the expected direction.

Previous studies show that obese women of *lower* education are more likely to exhibit depressive symptoms relative to normal weight women with comparable levels of education [26]. In our sample, obesity is a significant risk factor for depression among women classified as obese I with *higher* educational attainment. This contradictory finding may reflect growing evidence from varied methodological approaches that show individuals with higher educational attainment have an increased risk of comorbid depressive symptoms and obesity, compared to those with less education [27,28,29,30, 31]. On the other hand, there is evidence that because people with lower education have fewer economic and social resources to successfully cope with mental health issues, they are therefore more likely to suffer from depression and obesity [33]. For example, a study of randomly selected U.S. adults suggested that lower education may increase the risk of comorbid obesity and depression [34]. The reason for this difference is not known. More research is needed to test this finding further. Our findings contribute to this debate by showing that obese I women of higher educational attainment have increased risk of depressive symptoms relative to normal weight women of equal education.

Recent research indicates that women have significantly more chronic difficulties and face more cumulative disadvantage compared to men [35]. Our study provides evidence that in the examination of ongoing strain and cumulative stressors leading to depressive symptoms in women's lives, considering weight status and other factors concurrently may be informative. This connection is particularly relevant for practitioners when developing treatments for depression and treatments for obesity, as greater educational attainment should be considered independent of the association between obesity and depression. A major strength of our study lies in our study population, a large population-based sample of healthy adult women that included a detailed description of lifestyle history characteristics. Standardized anthropometric measures, and the use of the validated CES-D questionnaire to assess depressive symptoms, add credence to the present analysis. We also had the ability to adjust for a number of factors that are known to influence weight status.

In assessing these findings, there are several study limitations that need to be considered. The cross-sectional design is a limitation to our analysis, as this is a design that allows for determination of associations but does not allow for determination of temporality and causality. We do not know whether obesity precedes the depression or was a result of the depression. In fact, there is reason to believe that the relationship is bi-directional, and that both factors affect each other [5,23]. Additionally, given the likelihood that depressive symptoms and weight status fluctuate, a single measure may not be indicative of the average state of the study participants. As such, longitudinal analyses testing would prove useful.

Another limitation in the generalizability of the findings is the small number of racial and ethnic minority group members in the study sample, particularly because there is evidence that racial-ethnic disparities exist in health behaviors [36]. Additionally, we analyzed overweight and obesity as a discrete consequence of depression although it is likely that higher weight status can lead to depression *or* anxiety disorder *or* social phobia. Thus, such disparate outcomes may prove more useful if compiled into a single summary measure of poor health rather than focusing on one outcome, such as depressive symptoms. Further, while the study participants were selected as representative of healthy individuals in the population, BMI may be a function of underlying disease that was not measured. We were limited in our ability to examine effect modification by education by the available study sample. While the categories of education that we examined are those most frequently used in the literature, an analysis looking at smaller gradations of education may provide additional insight.

Despite these limitations, to our knowledge, no study has used a large, population-based sample to study the association between depression, weight status, and education level. By studying this association in healthy women without other chronic diseases or disorders, we are better able to understand the associations between depression, increased weight status, and the impact of educational attainment.

Acknowledgments

FUNDING

This work was supported in part by the National Institute on Alcohol Abuse and Alcoholism (P50-AA09802), the Department of Defense (DAMD 179616202 and DAMD 17030446), and the National Cancer Institute (R01CA 092040).

References

1. Scott KM, Bruffaerts R, Simon GE, Alonso J, Angermeyer M, Girolamo GD, Demyttenaere K, Gasquet I, Haro JM, Karam E, Kessler RC, Levinson D, Medina Mora ME, Oakley Browne MA, Ormel J, Villa JP, Uda H, Kroff M Von. Obesity and mental disorders in the general population: results from the mental world health surveys. International Journal of Obesity. 2008; 32:192–200. [PubMed: 17712309]
2. McElroy SL, Kotwal R, Malhorta S, Nelson EB. Are mood disorders and obesity related? A review for the mental health professional. Journal of Clinical Psychiatry. 2004; 65(5):634–651. [PubMed: 15163249]
3. Klinitzke G, Steinig J, Bluher M, Kersting A, Wagner B. Obesity and suicide risk in adults—a systematic review. Journal of Affective Disorders. 2013; 145:277–284. [PubMed: 22871535]
4. De Wit L, Luppino F, Van Straten A, Penninx B, Zitman F, Cuijpers P. Obesity and depression: a meta-analysis of community based studies. Psychiatry Res. 2010; 178:230–235. [PubMed: 20462641]
5. Preiss K, Brennan L, Clarke D. A systematic review of variables associated with the relationship between obesity and depression. Obesity Rev. 2013; 14:906–918.
6. Wiltnik J, Michal M, Wild PS, Zwiener I, Blettner M, Munzel T, Schulz A, Kirschner Y, Beutel ME. Associations between depression and different measures of obesity (BMI, WC, WHtR, WHR). BMC Psychiatry. 2013; 13:223. [PubMed: 24028572]
7. Pan A, Keum N, Okereke OI, Sun Q, Kivimaki M, Rubin RR, Hu FB. Bidirectional association between depression and metabolic syndrome: A systematic review and meta-analysis of epidemiological studies. Diabetes Care. 2012; 35:1171–1180. [PubMed: 22517938]
8. Grundy SM, Cleeman JI, Daniels SR. American Heart Association; National Heart, Lung, and Blood Institute. Diagnosis and management of the metabolic syndrome: and American Heart Association/National Heart, Lung, and Blood Institute Scientific Statement. Circulation. 2005; 112:2735–2752. [PubMed: 16157765]
9. Johnston E, Johnson S, Johnston M. The relation of body mass index to depressive symptoms. Canadian Journal of Public Health. 2004; 95(3):179–183. [PubMed: 15191118]
10. Istvan J, Zavela K, Weidner G. Body weight and psychological distress in NHANES I. International Journal of Obesity and Related Metabolic Disorders. 1992; 16(12):999–1003. [PubMed: 1335980]
11. Lyketsos CG, Eaton WW, Onyike CU, Crum RA, Lee HB. Is obesity associated with major depression? Results from the third national health and nutrition examination survey. American Journal of Epidemiology. 2003; 158(12):1139–1147. [PubMed: 14652298]
12. Faith, Myles S., Matz, Patty E., Jorge, Marie A. Obesity—Depression associations in the population. Journal of Psychosomatic Research. 2002; 53(4):935–942. [PubMed: 12377306]
13. Adler, Nancy E., Thomas, Boyce, Margaret, A. Chesney, Sheldon, Cohen, Susan, Folkman, Kahn, Robert L., Leonard, Syme S. Socioeconomic Status and Health: The Challenge of the Gradient. American Psychologist. 1994; 49:15–24. [PubMed: 8122813]
14. Kessler, Ronald C., McGonagle, Katherine A., Zhao, Shanyang, Nelson, Christopher B., Hughes, Michael, Eshleman, Suzann, Wittchen, Han-Ulrich, Kendler, Kenneth S. Life-time and 12-Month Prevalence of DSM-JJJ-R Psychiatric Disorders in the United States. Archives of General Psychiatry. 1994; 51:8–19. [PubMed: 8279933]
15. Radloff AS. The CES-D Scale: A self-reported depression scale for research in the general population. Applied Psychological Measurement. 1977; 1(3):385–401.
16. Dutton, GR., Needham, BL. The Oxford Handbook of Depression and Comorbidity. Richards, S., OHara, MW., editors. New York: Oxford University Press; 2014.
17. Devins, GM., Orme, CM. Center for Epidemiological Studies Depression Scale. In: Keyser, DJ., Sweetland, RC., editors. Test critiques. Vol. 2. Kansas City, MO: Test Corporation of America; 1985. p. 144-160.

18. Devins GM, Orme CM, Costello CG, Binik YM, Frizzell B, Stam HJ, et al. Measuring depressive symptoms in illness populations: Psychometric properties of the Center for Epidemiological Studies Depression (CES-D) Scale. Psychology and Health. 1988; 2:139–156.

19. Shafer, Alan B. Meta-analysis of the factor structures of fours depression questionnaires: Beck, CES-D, Hamilton, and Zung. Journal of Clinical Psychology. 2005; 62(1):123–146. [PubMed: 16287149]

20. Van Dam NT, Earleywine M. Validation of the Center for Epidemiologic Studies Depression Scale Revised (CESD-R): pragmatic depression assessment in the general population. Psychiatry Research. 2011; 32:186, 128.

21. World Health Organization. [Accessed April 28, 2014] 2012. www.who.org/factsheets/overweight/obesity

22]. Kuczmarski RJ, Ogden CL, Guo SS, Grummer Strawn L, Felgal M, Mei S, et al. 2000 CDC growth charts for the United States: Methods and development. National Center for Health Statistics. Vital Health Statistics. 2002; 11:246.

23. Renn BN, Feliciano L, Segal DL. The bidirectional relationship of depression and diabetes: A systematic review. Clinical Psychology Review. 2011; 31:1239–1246. [PubMed: 21963669]

24. Faith MS, Matz PE, Jorge MA. Obesity—depression associations in the population. Journal of Psychosomatic Research. 2002; 53:935–942. [PubMed: 12377306]

25. Ross CE, Mirowsky J. Sex differences in the effect of education on depression: resource multiplication or resource substitution? Social science & medicine. 2006; 63(5):1400–1413. [PubMed: 16644077]

26. Bauldry S. Variation in the protective effect of higher education against depression. Society and Mental Health. 2015; 5(2):145–161. [PubMed: 27840772]

27. Gavin AR, Simon GE, Ludman EJ. The association between obesity, depression, and educational attainment in women: The mediating role of body image dissatisfaction. Journal of Psychosomatic Research. 2010; 69(6):573–581. [PubMed: 21109045]

28. Onyike CU, Crum RM, Lee HB, Lyketsos CG, Eaton WW. Is Obesity Associated with Major Depression? Results from the Third National Health and Nutrition Examination Survey. American Journal of Epidemiology. 2003; 158(12):1139–1147. [PubMed: 14652298]

29. Ma J, Xiao L. Obesity and depression in US women: results from the 2005–2006 National Health and Nutritional Examination Survey. Obesity (Silver Spring). 2010; 18:347–353. [PubMed: 19590500]

30. Umberson D, Montez Jennifer Kras. Social relationships and health: A flashpoint for health policy. Journal of Health and Social Behavior. 2010:S54–S66. [PubMed: 20943583]

31. Turner, R Jay, Wheaton, Blair, Lloyd, Donald A. The Epidemiology of Social Stress. American Sociological Review. 1995; 60:104–125.

32. Scott KA, McGee MA, Wells JE, Browne MAO. Obesity and mental disorders in the adult general population. J Psychosom Res. 2008; 64:97–105. [PubMed: 18158005]

33. Jorm AF, Korten AE, Christensen H, Jacomb PA, Rodgers B, Parslow RA. Association of obesity with anxiety, depression and emotional well-being: a community survey. Aust N Z J Public Health. 2003; 27:434–440. [PubMed: 14705308]

34. Ross CE. Overweight and depression. J Health Soc Behav. 1994; 35:63–79. [PubMed: 8014430]

35. Thoits, Peggy A. Stress and health: Major findings and policy implications. Journal of Health and Social Behavior. 2010:S41–S53. [PubMed: 20943582]

36. Schnittker, Jason, McLeod, Jane D. The Social Psychology of Health Disparities. Annual Review of Sociology. 2005; 31:75–103.

Table 1

Descriptive characteristics of Study Participants in Erie and Niagara Counties, Western NY 1997 to 2001

	Non-Depressed		Depressed		
Variable	**n or mean**	**% or SD**	**n or mean**	**% or SD**	**pValue**
BMI					
	28	(6)	29	(7)	
BMI Categories					
Underweight	7	(3)	11	(1)	0.005*
Normal-weight	578	(33)	78	(29)	
Overweight	543	(33)	86	(29)	
Obese I	303	(19)	68	(22)	
Obese II	123	(8)	39	(14)	
Obese III	77	(5)	15	(5)	
Age					
	57	(12)	58	(12)	
Age Categories					
35–50	557	(34)	101	(34)	0.04
51–64	507	(31)	82	(28)	
≥65	567	(35)	114	(38)	
Demographics					
Race					
White	1,505	(92)	267	(90)	0.16
Other	125	(8)	30	(10)	
Marital Status					
Married	1,133	(70)	167	(56)	<0.001
Not married	498	(30)	130	(44)	
Education					
	14	(2)	13	(2)	
Education Categories					

	Non-Depressed		Depressed		
Variable	**n or mean**	**% or SD**	**n or mean**	**% or SD**	**pValue**
<12 years	131	(8)	53	(18)	<0.001
12 years	492	(30)	105	(35)	
>12 – <16 years	581	(36)	88	(30)	
≥16 years	421	(26)	50	(17)	
Income (in $1,000)					
	12	(23)	14	(28)	
Income Categories					
<$20,000	289	(19)	88	(34)	<0.001
≥$20 – <40,000	458	(30)	77	(30)	
≥$40 – <60,000	340	(23)	44	(17)	
≥$60,000	418	(28)	52	(19)	
Lifestyle					
Smoker					
Never smoker	814	(50)	127	(42)	0.04
Current smoker	235	(14)	56	(19)	
Former smoker	578	(35)	113	(38)	
Average Lifetime Physical Activity h/week					
<3	349	(21)	79	(27)	0.08
≥3 – <6	854	(52)	155	(52)	
≥6	427	(27)	63	(21)	
Diet K_cal					
Low	376	(23)	74	(26)	0.03
Moderate	1,041	(64)	168	(57)	
High	214	(13)	53	(18)	
Hours of Sleep per night					
<8	1,043	(64)	219	(74)	<0.001
≥8	588	(36)	78	(26)	
N	1,631		297		

CES-D scores <16, non-depressed and ≥16, depressed

*P-values are results of Students t tests and χ^2 tests for continuous and categorical variables, respectively.

Notes: Significance levels for Students t test and χ^2 tests.

Table 2

Odds Ratio and 95% Confidence Intervals of Depressive Symptoms by Weight Status and Educational Attainment

	Model 1. Crude Model			Model 2. Full Model			Model 3. ≤ 12 Years Education			Model 4. > 12 Years Education			Total n by group
BMI	**OR**	**95% Confidence Interval**		**OR**	**95% Confidence Interval**		**OR**	**95% Confidence Interval**		**OR**	**95% Confidence Interval**		
Reference: Normal-Weight													656
Overweight	1.11	0.80	1.53	1.02	0.72	1.46	0.98	0.59	1.62	1.04	0.62	1.73	629
Obese I	1.57*	1.11	2.22	1.43	0.97	2.11	0.90	0.50	1.62	2.15*	1.27	3.62	371
Obese II / III	1.88**	1.29	2.76	1.57*	1.03	2.41	1.52	0.85	2.74	1.59	0.85	2.98	254
Education													
Reference: 12 years	--	--	--				--	--	--	--	--	--	164
< 12 years				1.69*	1.08	2.64							597
>12 – <16 years	--	--	--	0.70*	0.49	0.98	--	--	--	--	--	--	669
≥16 years	--	--	--	0.61*	0.40	0.93	--	--	--	--	--	--	471

Normal-weight, Overweight, Obese I, Obese II / III are categorical variables representing body mass index category. In Model 2 Education is a categorical variable representing highest years of education at assessment, included as < 12 years, = 12 years, ≥12 years but <16 years, and ≥ 16 years. In Models 3 and 4 the categorical measure of education just described was removed and models are stratified by ≤12 years and > 12 years of education. Models 2–4 are adjusted for age, race, marital status, income, smoking status, physical activity, average calories consumed, and average number of hours of sleep per night.

Sources: Data are for women in the Erie and Niagra Counties, Western NY 1997 – 2001.

Notes: Dependent Variable is depressive symptoms (<16, non-depressed and ≥16, depressed).

* $p < 0.05$,

** $p < 0.005$,

*** $p < 0.001$.