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ORIGINAL ARTICLE

# Depression and body mass index, differences by education: Evidence from a population-based study of adult women in the U.S. Buffalo-Niagara region

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**Summary** 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 significance. There were no differences in the association for

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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.

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## Introduction

An association between mental health and obesity is well established [1–4], 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 to ≤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 hypothesised, 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 35–80 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.<sup>1</sup> Controls aged 65–80 were randomly selected from the Health Care

<sup>1</sup> Approximately 95% of the western New York residents in this age range hold a driver's license.

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