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Bullying and Adolescent Obesity in Vermont High School Students

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Introduction

The rate of obesity in American youth has significantly increased over the last several decades. National childhood obesity levels (defined as > 95th percentile for body mass index) reached 19% in 2019, with Vermont's prevalence hovering over 13%.[1, 2] The prevalence of both traditional bullying and cyberbullying have also risen—trends spurred by increased technology use. Moreover, obese adolescents (defined by WHO as 10-19 years old) are more likely to be bullied than their non-obese peers.[3, 4, 5]

Growing reports of bullying may also contribute to increasing mental health disorders, as adolescent bullying is associated with higher rates of depression, anxiety, and low self-esteem.[6] Bullying aside, obese adolescents are more likely to suffer from mental health disorders than non-obese adolescents.[7] The emotional impact of bullying may negatively impact eating habits, with adolescents targeted by weight-based teasing having increased risk of developing disorganized eating habits, including emotional eating and eating when not hungry—factors known to contribute to obesity.[8, 9]

Given the rising rates of bullying and adolescent obesity, the association between being bullied and both poor mental health and disorganized eating habits, and that obese adolescents are at increased risk for being bullied, the objective of this research is to examine the VYRBS for an association between being bullied and obesity in high school students.

Methods

We used data from the 2019 VYRBS to analyze the association between bullying and obesity in Vermont high school students. The VYRBS was administered between February and April 2019. Voluntary responses to this 108-question survey were collected in 9th-12th grade from 66 high schools. This sample is representative of Vermont youth and is generalizable statewide.

Our research meets UVM IRB exemption criteria by the University of Vermont (UVM) Committees on Human Research. Data cleaning yielded 16,994 cases with reported bullying and BMI percentile. We used *BMI Categories* as the main independent variable and *Days Bullied* as the dependent variable. BMI percentages were categorized as healthy weight (BMI between 5th – 85th percentiles) or obese (BMI ≥ 95th percentile), using cut-offs established by previous literature.[10] Demographic variables analysis included Sex (Female or Male), Grade (9th, 10th, 11th, or 12th), Race/Ethnicity (White non-Hispanic students or Students of Color), and Sexual Identity (heterosexual or LGBT). We grouped all students not identifying as "White non-Hispanic" into a "SOC" due to small case numbers. Similarly, we grouped lesbian, gay, bisexual, and transgender students into "LGBT".

We included two protective factors in our analysis: *students strongly agree they matter in their community* (Y/N) and having *at least one adult in school to talk to if they have a problem* (Y/N). Other covariables included *substance use* (Y/N), *participated in < 60 minutes physical activity in a week* (Y/N), *suicide attempt* (Y/N), and *feeling sad or hopeless* (Y/N).

Analysis of demographic data is included in Table 1. Frequency tables comparing demographic groups were observed for categorical variables. We used a χ^2 test of independence to determine associations between demographics and other variables, and three bivariate logistic regression

models to analyze the relationship between our predictor and outcome variables. Statistically significant differences are noted by comparing the 95% confidence intervals of two or more values ($P < .05$).

Results

The total sample consisted of 19,556 students, of whom 3,072 were identified as obese. Half of the participants were in 9th and 10th grade (50%), 52% were male, 85% were white, and 83% identified as heterosexual. Study participation and inclusion can be found in supplemental materials.

Participants bullied 1-9 days were 1.40 times more likely to be obese than students who were not bullied (95% CI 1.25-1.55, $P < .001$); students bullied 10-30 days were 2.35 times more likely to be obese compared to students who were not bullied, controlling for demographic factors, sexual identity and grade (95% CI 1.95-2.84, $P < .001$) (Table 1). Our analysis of protective factors revealed that students reporting that they matter in their communities were 0.43 times less likely to be obese (95% CI 0.53-0.63, $P < .001$) and students who had an adult or teacher to talk to were 1.26 time *more* likely to be obese (95% CI 1.11-1.36, $P < 0.001$) compared to students without these protective factors, controlling for days bullied, demographics, and grade (Table 1).

Stratifying our data by demographic and protective factors, grade, sexual identity, feeling sad or hopeless, attempted suicide, substance abuse, and physical activity yielded an association between days bullied and obesity when controlling for gender, grade, sexual identity, race, protective factors, feeling sad or hopeless, attempted suicide, and physical (1-9 days bullied: 1.23, 95% CI 1.08-1.41, $P = .002$; 10-30 days 2.02, 95% CI 1.59-2.57, $P < .001$). Additionally, there was an association between attempted suicide and obesity (1.24, 95% CI 1.03-1.50, $P = .025$) and physical activity and obesity (0.64, 95% CI 0.56 – 0.71, $P < .001$). There was no relationship between obesity and feeling sad or hopeless and substance abuse, respectively (felt sad or hopeless: 1.10, 95% CI 0.98-1.23, $P = .095$; substance abuse: 0.97, 95% CI 0.86-1.08, $P = .966$). Our bivariate logistic regression analysis indicates that being bullied is associated with obesity, controlling for demographic and protective factors, substance abuse, physical activity, suicide attempt, and feeling sad or hopeless.

Table 1: Bivariate Logistic Regression of Bullying and Obesity: Burlington, VT; Vermont Youth Risk Behavior Survey (VYRBS); 2019		
Characteristic	**Adjusted Odds Ratio**	**95% CI**
Controlling for Demographic Factors		
Days bullied		
0 days	1 (Reference)	
1-9 days	1.40	(1.25, 1.55)***
10-30 days	2.35	(1.95, 2.84)***
Grade		
9th- 10th	1 (Reference)	
11th - 12th	1.11	(1.03, 1.20)**
Gender		
Female	1 (Reference)	
Male	1.79	(1.65, 1.94)***

Sexual Identity		
Heterosexual	1 (Reference)	
LGBTQ+	2.13	(1.94, 2.35)***
Race		
White	1 (Reference)	
Non-White	0.95	(0.85, 1.06)

Controlling for Demographic and Protective Factors

Days Bullied		
0 days	1 (Reference)	
1-9 days	1.24	(1.10, 1.40)***
10-30 days	2.19	(1.80, 2.67)***
Grade		
9th- 10th	1 (Reference)	
11th - 12th	1.09	(1.01, 1.19)*
Gender		
Female	1 (Reference)	
Male	1.82	(1.67, 1.98)***
Sexual Identity		
Heterosexual	1 (Reference)	
LGBTQ+	1.96	(1.77, 2.17)***
Race		
White	1 (Reference)	
Non-White	0.92	(0.82, 1.03)
Strongly agree they matter in the Community		
No	1 (Reference)	
Yes	0.57	(0.53, 0.63)***
Have an adult in school to talk if they have a problem		
No	1 (Reference)	
Yes	1.26	(1.11, 1.36)***

Stratified by Demographic and Protective Factors

Days Bullied		
0 days	1 (Reference)	
1-9 days	1.23	(1.08, 1.41)**
10-30 days	2.02	(1.59, 2.57)***
Grade		
9th- 10th	1 (Reference)	
11th - 12th	1.08	(0.98, 1.79)
Gender		
Female	1 (Reference)	
Male	1.80	(1.64, 1.99)***
Sexual Identity		
Heterosexual	1 (Reference)	
LGBTQ+	1.75	(1.56, 1.96)***
Race		
White	1 (Reference)	
Non-White	0.84	(0.74, 0.96)**
Strongly agree they matter in the Community		
No	1 (Reference)	
Yes	0.59	(0.54, 0.65)***
Have an adult in school to talk if they have a problem		
No	1 (Reference)	

Yes	1.27	(1.13, 1.43)***
Felt sad or hopeless		
No	1 (Reference)	
Yes	1.10	(0.98, 1.23)
Attempted suicide		
No	1 (Reference)	
Yes	1.24	(1.03, 1.50)*
Substance Abuse		
No	1 (Reference)	
Yes	0.97	(0.86, 1.08)
Students were physically active		
No	1 (Reference)	
Yes	0.64	(0.56, 0.71)***

*< .05, **< .01, and ***< .001

Discussion

Our analysis revealed a significant relationship between the number of days bullied and obese BMI, indicating that being bullied is positively associated with obesity likelihood. This relationship held when controlling for demographic variables, sexual identity, and grade. We also found significant positive associations between obesity and suicide and between obesity and physical inactivity. In contrast to the protective effects we observed from physical activity and from students reporting that they strongly mattered in their communities, students who reported having an adult to talk to were *more* likely to be obese.

While the focus of our research was aimed at adolescents in Vermont, our study reinforces previous research and national trends. A longitudinal study tracking BMI values of bullied adolescents into adulthood found that overweight and obese adolescents had increased odds of both experiencing bullying and of being overweight or obese as young adults in comparison to non-bullied peers.[11] Other studies have reported similar associations between bullying and obesity and that bullying during adolescence increases adulthood obesity risk.[12]

One limitation to the current study is that we used a χ^2 test—a statistical test that tends to inflate significance with large numbers—to analyze the effects of demographic variables. Our analysis only included obese and normal-weight BMI categories; including overweight and underweight categories would likely impact our findings. For example, students with BMIs between the 85th and 95th percentile were not accounted for in our analysis.

Our research underscores the importance of current initiatives in Vermont that provide mental health support for bullying and for those targeting adolescent obesity. In line with the approach used by Vermont-based programs like UP for Learning's "Getting to Y", which employs participatory action research to give students an opportunity to engage with VYRBS data, evidence-based bullying interventions and early actions to decrease obesity risk in adolescents are particularly effective in school settings.[13] The protective effects we observed from physical activity in the association between bullying and obesity offers support for current initiatives like the Vermont Board of Education's push to establish mandatory physical education requirements throughout high school, as few high schools have requirements for 11th and 12th-grade students.[14]

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