The Relationship between Body Mass Index and Adolescent Well-Being

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ABSTRACT

Background: The substantial increase in youth obesity during the last two decades may have serious biological as well as behavioral/mental health consequences. Purpose: The purpose of this study was to assess how ecological factors and hence overall well-being were related to body mass index (BMI) in youths. Methods: Three BMI categories (normal; at risk for overweight; overweight) were calculated for 847 adolescents. Behavioral/mental associations were assessed for each category as well as between normal and at risk for overweight and overweight combined. Results: Significant associations existed between BMI and depression, suicidal ideation (combined data), use/abuse of drugs (combined data), race, age, parental marital status, and parental employment status. No significant associations were found between BMI and anxiety, use/abuse of alcohol, or gender. Discussion: The significant associations between BMI and depression/suicidal ideation suggest thorough screening with at-risk youths, especially those from ethnic minority groups and those experiencing changes in parental marital or employment status. Translation to Health Education Practice: It is imperative that health care professionals who work with weight problems attend to the ecological contexts of clients/patients. Data supports the need for collaboration between the medical and mental health communities in this regard.

INTRODUCTION

Substantial increases in child and adolescent obesity have been documented during the last two decades. Current estimates indicate that 17% of children and adolescents (ages 2–19) can be classified as overweight.[1] Similarly, the National Center for Health Statistics[2] reports that 15% of children and adolescents between the ages of 6 and 19 are overweight—three times the rate in 1980. The stigmatization of overweight individuals, including young people, has coexisted with the rise of this condition. Not only is this growing epidemic problematic for the potential biological consequences of obesity, but evidence also suggests a relationship between obesity and behavioral/mental health problems.[3,4] Additional consequences of obesity for children can include social isolation and low self-esteem.[5]

Although many mental health studies focus on a few variables within a particular population, there is a need to understand how variables outside of the individual also influence mental health. Human ecology theory posits that all human development takes place within the context of the environment, and that factors in the environment have an influence on growth and development of the individual.[6] Youths are particularly vulnerable to the influence of the family, as it is central to their survival. For

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example, research on suicidal adolescents has indicated that family factors (maternal depression, parental rejection, and abuse) were related to suicidal ideation.[7] In addition, a more ecological approach identified three levels of contextual variables (societal forces, direct stressors, and individual psychology) that contributed to suicidal behavior in adolescents.[8]

This study presents an ecological approach to understanding adolescent obesity by analyzing multiple relationships both within and outside of the adolescent. Of particular interest to this study are the relationships that contextual environmental factors have with an individual's mental health. Specifically, the authors examined the association of body mass index (BMI) with a range of ecological factors: parental employment, biological parents' marital status, age, race, gender, child's use/abuse of alcohol and drugs, anxiety, depression, and history of suicidal ideation in adolescents and preadolescents. The purpose of this analysis was to gain a greater understanding of risk factors related to BMI so that health care professionals can better serve their patients by appropriately screening for variables that may influence their physical and mental well-being.

BACKGROUND

Depression and Adolescence

Although mental health is important to understand for all cultures, it may be even more so when considering youth culture. For example, adolescence is a high-risk period for developing the onset of depression.[9-11] Not only is depression one of the most common mental health disorders in the population as a whole, but an alarming 20% of adolescents are estimated to meet the lifetime criteria for diagnosis.[12] Although adolescent depression is becoming more prevalent, only a minority of individuals are being treated by mental health professionals.[13] In addition to its effects on daily functioning, depression is also associated with several comorbid risk factors: substance abuse, anxiety, behavior disorders, academic failure, unemployment, disordered eating, and delinquency, all of which greatly influence the lives of adolescents.[12,14,15] Moreover, one longitudinal study showed that anxiety disorders and depression were associated with higher BMI levels among females, a pattern not found in males.[16]

The chronological status of adolescence by itself is not necessarily a risk factor for depression, as research has shown that pubertal status is a better predictor of depressive symptoms than chronological age.[11,17,18] The onset of puberty also marks the time when females become more likely than males to experience depression—a trend that continues throughout the reproductive years[12,17,19-22] and one that is particularly problematic for early maturing girls.[20,21] Although there is debate about why depression becomes more prevalent in females,[19,23,24] there is little doubt that there is a relationship between body image and depression for many adolescents.

Additionally, there is a need to further study mental health disorders in adolescence, as the majority of previous studies used predominately Caucasian samples.[10] Although research has demonstrated that adolescent girls are more likely to develop depression,[9,23,25] studies focusing on racial differences have found little deviance in the prevalence of depression between Caucasian and African American adolescent girls,[10] nor have they demonstrated a greater prevalence of depression in minority populations.[22]

Depression and Body Image

Bodily changes that take place during puberty typically bring boys closer to an idealized body image, whereas the added weight gain often takes girls away from the current idealized thin body image. This additional weight may set the stage for a greater risk of depression and likelihood to partake in disordered eating.[12,21,22,26] This can be an especially heightened risk factor for girls who begin to mature earlier than their peer group.[21] However, one of the problems of previous research with disordered eating and body satisfaction is that the majority of studies focused on middle- to upper-class Caucasian girls.[26]

Another element of adolescent mental health that may not be restricted solely to obese individuals is feelings of poor body image and disordered eating. Allgood-Merten et al.[9] found that self-esteem is affected by body image, and this effect is even greater for girls. Additionally, they suggest body image is a key contributor to depression for girls. However, it is uncertain whether body image is a cause or a consequence of depression.[12]

Interestingly, there appear to be ethnic differences in terms of body image satisfaction. Typically, studies have found that Caucasian girls are at greater risk of being less satisfied with their body image and are more likely to exhibit disordered eating behaviors than African American[10,24] or Hispanic girls.[24] However, this was not the case when Robinson et al.[25] compared Caucasian, Hispanic/Latino, and Asian sixth- and seventh-grade girls' levels of body satisfaction. For all three ethnic groups, ratings of body satisfaction decreased as body fatness increased. Across all ethnic groups, BMI was the strongest independent predictor of increased body dissatisfaction. Ge et al.[24] showed a significant relationship between BMI scores and the perception of being overweight. This perception was found to be associated with lower self-esteem among Caucasian boys and girls and Hispanic girls, as well as to depressed mood among Caucasian boys and girls and Hispanic girls. In terms of an overall effect on different ethnic groups, there was a much stronger association of body image and depressed mood in Caucasian girls than African Americans or Hispanics.

Suicidal Ideation

Over the years, suicide has been increasing at alarming rates[7,22,27,28] and is one of the leading causes of death for adolescents.[7,27] Clinical samples demonstrate that three individual risk factors stand out the most for adolescents attempting suicide: being a Caucasian male, experiencing life stress,[8] and suffering from a psychiatric disorder—particularly depression.[8] However, African American males have exhibited a dramatic increase in suicide over the past two decades.[27]

According to Rubenstein et al.,[8] three levels of contextual variables contribute to

suicidal behavior in adolescents: societal forces (e.g., the closeness of communities), direct stressors (e.g., parental marital status, family conflict, personal relationships), and individual psychology (e.g., having one or more mental health disorders). The authors found a significant relationship between marital status and suicidal behavior, with students in remarried families being at greatest risk, followed by those in separated/divorced families, while those from intact families were the least likely to be suicidal. Finally, the authors found that feelings of depression and levels of stress independently made significant contributions to suicidal behavior.

PURPOSE

The purpose of this study was to assess how BMI is associated with adolescent well-being. Specifically, the study examined some of the consequences of BMI scores as they are associated with anxiety, depression, suicidal ideation, and the use of drugs and alcohol in adolescents and preadolescents. Additionally, the authors examined the association between BMI scores and the following relevant variables: parental employment, biological parents' marital status, age, race, and gender.

METHODS

Data was acquired from adolescent medical charts during 1999–2002 when the researchers were working on a larger study examining the prevalence and risk factors for Type II diabetes in adolescents. In order to gather a random and representative sample, the authors requested that 33% of medical records of adolescents between ages 10 to 19 be randomly selected by staff at eight Midwestern family practice clinics, six of which specialized in pediatric care. The 33% figure was chosen to maximize access to the greatest number of charts that could be reviewed in a timely manner while providing sufficient variability. Researchers recorded various kinds of health information, including the presence of risk factors and mental health diagnoses. A total of 1,033 charts were reviewed (538 females, 481 males, and 14 that did not indicate gender), with ages ranging from 10 to 19 (mean=14.74).

After omitting those for whom a BMI calculation could not be made (due to missing information on gender, height, or weight), a total of 847 cases remained (437 female, 410 male, mean age=14.6). The racial composition of the remaining charts was 63.96% Caucasian, 22.97% African American, 6.61% Hispanic/Latino, 2.1% Asian American, 1.5% Native American, and 2.85% "other." Although the original study purposefully oversampled African American and Native American charts, the racial frequencies remain close to Michigan's 2000 census figures[29]: 78.6% Caucasian, 14.1% African American, 3.3% Hispanic/Latino, 1.8% Asian American, 0.5% Native American, and 0.1% "other."

The value of BMI is obtained by dividing weight in pounds by height in inches squared and multiplying that product by 703 [BMI=(lb/in^2)703]. For children and adolescents age 2–20, BMI scores are then plotted on a gender-specific chart indicating a BMI-for-age percentile that classifies individuals as underweight (≤5th percentile), normal (5th–85th percentile), at risk for overweight (85th–95th percentile), or overweight (≥95th percentile).[30] All information recorded from the medical charts and growth charts regarding height and weight was presumed to have been measured by medical staff prior to entry into the charts, rather than being provided by self report.

For this study, the recorded variables of interest included BMI, anxiety, depression, a history of suicidal ideation, and use/abuse of drugs or alcohol in adolescence. Data was also collected for age, race, gender, parental marital status, and parental employment status. Medical charting of psychosocial data was uneven; thus, every attempt was made to screen for evidence of mental health issues. For example, a child was noted as experiencing depression if his/her chart included language that he/she was depressed, regardless if it was noted in an objective or subjective manner. When the variable was not present in the medical chart, it was categorized as not existing (e.g., no suicidal ideation) or was treated as missing data (e.g., parental marital status).

Analyses focused on the relationship between BMI and each of the other variables. Specifically, the authors sought to understand how being at risk for overweight (between the 85th and 95th percentile in BMI-for-age) or overweight (being above the 95th percentile in BMI-for-age) was related to psychological well-being, as well as with ecological variables that may have an influence on children's weight. For each test of association, we compared adolescents that were classified as being within the normal BMI-for-age range with a collective group of those in the 85th and greater percentile (combining at-risk with overweight categories). We then ran the same analyses separating the at-risk and overweight categories from one another in order to partition out potential differences that may exist between the various categories.

Chi-square tests of association, with an alpha level of .05, were conducted on all of the tests with the partitioned BMI scores, as well as with the collective BMI scores, as compared to race, age, parental marital status, and type of insurance. An alpha level of .05 was also used for the 2 x 2 phi coefficient tests conducted on the tests with collective BMI scores and anxiety, depression, history of suicidal ideation, use of drugs, use of alcohol, gender, and parental employment status. Both types of tests compare the actual frequencies of what was observed in the medical charts to what would be expected if the values had no statistical differences across the BMI categories. The results are then understood as being different from what was expected to occur.

Odds ratios (for the 2 x 2 tables) and Cramer's phi squared (for the chi-squared tests) were used to determine the strength of the significant results. For example, if we found significant results when comparing BMI with coming from a divorced home, we would know that a particular category was more likely to come from a divorced home. Although significant, we need to understand the degree of this statistical difference. For example, if our data were

presented in a 2 x 2 table (comparing the combined category with normal), we would run an odds ratio (Ω) to state how much more likely one category would be to come from a divorced family over the other. This may illustrate an interesting effect such as the combined group being four times as likely to come from a divorced family, which presents a much different picture than if the combined group were merely .05 times more likely to come from a divorced family. Therefore more clarity is given to the degree of statistical difference. If we had compared the three BMI categories separately (chi-squared test) we would utilize the Cramer's phi (ϕ), which ranges from 0 (indicating no association) to 1.0 (indicating a perfect relationship). Although a low Cramer's phi may appear to be unimpressive, it may still show important effects, particularly in medical research.[31]

RESULTS

Each of the non-BMI variables had nonexistent (R=.000) to low (R=.344) correlations, with the exception of the one moderate correlation (R=.482) between alcohol and drug use (see Table 1 for R^2 values and significant relationships). BMI categories were calculated for 847 adolescents: 548 (64.7%) were classified as normal (BMI≤85th percentile for age), 134 (15.8%) were at risk for overweight (between the 85th and 95th percentile), and 165 (19.5%) were overweight (BMI≥95th percentile). These proportions were similar to what was found in the 2006 National Health and Nutrition Examination Survey (NHANES)[1(p1551)] of 12-19-year-olds in 2003–2004 (Table 2).

BMI and Gender

The overall prevalence rates for the current study were similar to the NHANES data.[1(p1552)] There was no significant relationship between gender and BMI with either the combined data (ϕ(1)=.036, *p*=.296) or partitioned BMI values ($\chi^2(2)=1.62$, *p*=.445) (Table 3).

BMI and Race

The overall prevalence rates for the current study were similar to the NHANES data,[1(p1551)] with the exception of the Hispanic/Latino population (Table 2). These results indicated a significant relationship between race and BMI (Table 4). The combined at-risk and overweight values ($\chi^2(5)=16.102$, *p*=.007, ϕ=.152) were more likely to be from the Hispanic/Latino category. Additionally, the partitioned BMI values ($\chi^2(10)=24.979$, *p*=.005, ϕ=.128) showed that Caucasians were more likely to be considered at risk, African Americans and Hispanic/Latinos were more likely to be considered overweight, while those in the "other" category were more likely to be classified as normal.

BMI and Age

There was a significant relationship between age and BMI (Table 5). The combined at-risk and overweight values ($\chi^2(9)=21.217$, *p*=.012, ϕ=.158) showed more 11-, 13-, and 19-year-olds in the normal category and more 16- and 17-year-olds in the 85th percentile and above for BMI-for-age. Additionally, the partitioned BMI values ($\chi^2(18)=32.280$, *p*=.020, ϕ=.138) showed more 11-, 13-, and 19-year-olds in the normal category, more 12-, 15-, and 17-year-olds in the at-risk category, and more 14- and 18-year-olds in the overweight category.

BMI and Dichotomous Variables

There was a significant relationship between depression and BMI. Adolescents from the combined at-risk and overweight category (ϕ(1)=.088, p=.010, Ω=2.20) were more than twice as likely to have depression noted in their medical charts than were adolescents from the normal range (Table 6). Additionally, the partitioned BMI values ($\chi^2(2)=9.961$, *p*=.007, ϕ=.118) showed that those who were overweight had a higher incidence of depression. Although significant, the Cramer's phi indicates a very small association between BMI and depression.

Similar to depression, there was a significant association with the combined at-risk and overweight group (ϕ(1)=.073, *p*=.034, Ω=2.5), who were two-and-a-half times more likely to have incidents of suicidal ideation than the normal category (Table

Table 1. Correlations of Non-BMI Variables Presented as R2 Values

	1.	2.	3.	4.	5.	6.	7.	8.	9.
1. Age	—	—	—	—	—	—	—	—	—
2. Race	.003	—	—	—	—	—	—	—	—
3. Gender	.002	.000	—	—	—	—	—	—	—
4. Depression	.026**	.000	.002	—	—	—	—	—	—
5. Suicidal ideation	.014**	.000	.000	.118**	—	—	—	—	—
6. Anxiety	.000	.000	.001	.000	.006*	—	—	—	—
7. Drug use	.027**	.000	.000	.005*	.008**	.000	—	—	—
8. Alcohol use	.032**	.000	.003	.004	.005*	.000	.232**	—	—
9. Employment status	.001	.003	.003	.002	.010**	.027**	.004	.004	—
10. Parental marital status	.003	.005	.002	.001	.020**	.004	.005	.005	.034

Note: R2 values are interpreted as how much variability within a particular variable can be explained by another. For example, we can attribute 1.4% of the variability in suicidal ideation to age, whereas the other 98.6% is attributable to some other factor(s).
* *p*<.05, ** *p*<.01

Table 2. BMI Prevalence Comparison between Medical Charts and 2003–2004 NHANES[1] Data

	BMI Range	Occurrences in Medical Charts (10-19-year-olds)	NHANES (12-19-year-olds)
All subjects	At risk of overweight and overweight combined	35.3%	34.3%
	Overweight	19.5%	17.4%
All females	At risk of overweight and overweight combined	33.6%	31.7%
	Overweight	17.8%	16.4%
All males	At risk of overweight and overweight combined	37.1%	36.8%
	Overweight	21.2%	18.3%
Caucasian; Non-Hispanic White	At risk of overweight and overweight combined	35.2%	34.7%
	Overweight	18.1%	17.3%
African American; Non-Hispanic Black	At risk of overweight and overweight combined	34.0%	36.5%
	Overweight	22.2%	21.8%
Hispanic/Latino; Non-Hispanic White	At risk of overweight and overweight combined	56.9%	34.3%
	Overweight	34.1%	16.3%

6). However, when the data was partitioned, there was no longer a significant association between suicidal ideation and either the normal, at-risk, or overweight groups ($\chi 2(2)=4.394$, $p=.111$).

There was a significant association between the recorded use of drugs and BMI data (Table 6). The combined at-risk and overweight groups ($\phi(1)=.080$, $p=.020$, $\Omega=2.3$) were 2.3 times more likely to have drug use noted in their medical charts than were adolescents in the normal range. However, the partitioned BMI values only approached significance ($\chi 2(2)=5.781$, $p=.056$), with the overweight group nearly doubling the expected value of drug use.

No significant relationships were found regarding alcohol use in either the combined data ($\phi(1)=.035$, $p=.313$) or partitioned BMI values ($\chi^2(2)=1.083$, $p=.582$), nor between anxiety and either the combined at-risk and overweight ($\phi(1)=.026$, $p=.450$) or partitioned BMI values ($\chi^2(2)=.712$, $p=.700$) (Table 6).

There was notation of at least one employed parent for 604 of the adolescents, while there were 70 records of both parents, or the primary caregiver in divorced/separated families, being unemployed (Table 6). There was a significant association between BMI and the recorded parental employment status. The youths from the combined at-risk and overweight groups ($\phi(1)=.097$, $p=.012$, $\Omega=1.88$) were 1.88 times more likely to come from unemployed homes. Additionally, the partitioned BMI values ($\chi^2(2)=9.801$, $p=.007$, $\phi=.121$) showed that those that were overweight were more likely to come from unemployed families.

BMI and Parental Marital Status

Regarding home life, the parents of the adolescents were married in 424 cases, separated in 16 cases, divorced in 149 cases, never married in 50 cases, and widows/widowers in 6 cases (Table 7); marital status was not reported in 202 (23.8%) cases. There was a significant association between BMI and the recorded parental marital status. The combined at-risk and overweight values ($\chi^2(4)=16.522$, $p=.002$, $\phi=.154$) showed that those in the 85th or greater BMI percentile were more likely to come from separated and divorced homes. Additionally, the partitioned BMI values ($\chi 2(8)=18.823$, $p=.016$, $\phi=.118$) showed that those who were at risk and overweight were more likely to come from separated and divorced families, with overweight youths being more prevalent in never married families.

DISCUSSION

The rates of BMI categories in this study were similar to what was found in the 2006 NHANES of 12-19-year-olds. The present sample consisted of 35.3% of the 10-19-year-olds categorized in the combined at risk of overweight and overweight category, with 19.5% classified as being overweight. Overall, the results show that adolescents who are overweight or at risk for being overweight based on BMI-for-age percentiles are more likely than their peers within the normal category to experience depression or suicidal ideation. These results—connecting being overweight with having a greater prevalence of depression—are not surprising based on the literature regarding body image. If levels of BMI are indicative of how adolescents feel about themselves (as found in Robinson et al.[26]), then these results parallel the controlled studies that found a relationship between body image and depression.[12,24] Not withstanding these implications, it may still be true that some adolescents with higher BMIs may be comfortable with their weight levels. Regardless of whether depression is specifically related to body image or merely to BMI, these results suggest it is prudent to screen more carefully for depression among medical patients who are overweight

Table 3. BMI and Gender

	BMI Range	Occurrences in Medical Charts (10-19-year-olds)
Females (n=437)	At risk	69
	Overweight	78
	At risk of overweight and overweight combined	147
Males (n=410)	At risk	65
	Overweight	87
	At risk of overweight and overweight combined	152

Table 4. BMI and Race

	BMI Range	Occurrences in Medical Charts
Caucasian (n=426)	At risk	73*
	Overweight	77
	At risk of overweight and overweight combined	150
African American (n=153)	At risk	18
	Overweight	34*
	At risk of overweight and overweight combined	52
Hispanic/Latino (n=44)	At risk	10
	Overweight	15*
	At risk of overweight and overweight combined	25*
Native American (n=10)	At risk	1
	Overweight	3
	At risk of overweight and overweight combined	4
Asian American (n=14)	At risk	3
	Overweight	0
	At risk of overweight and overweight combined	3
Other (n=19)	At risk	1
	Overweight	1
	At risk of overweight and overweight combined	2

* $p<.01$

or at-risk for being overweight and to find opportunities to discuss problems related to depression and weight with clients.[32]

Interestingly, the significant association between BMI and suicidal ideation was no longer present when the data was partitioned into more distinct groups, which may be explained by relatively small cell sizes. However, similar to the findings on depression, the results suggest a need to screen for suicidal ideation among adolescent patients who are either at risk for being overweight or overweight.

There was a significant association between the recorded use of drugs and the combined data; this factor approached significance in comparison with the partitioned data. Interpretation of the results related to drug use is complicated due to coding of any drug (e.g., marijuana, heroin, and/or cocaine) as a singular behavior, rather than partitioning specific drugs. In many instances the medical charts did not specify which type of illicit substance was used, and there may be significant differences in motivation for using certain substances, and in consequences of use for individuals from different BMI categories. Nevertheless, for these adolescents, the greater likelihood of using drugs in the combined group may have served as a coping mechanism for their dissatisfaction with their body image, or a defense against external ridicule about their appearance. Alternatively, the increased weight may be a consequence of drug use and a sedentary lifestyle. Additionally, the use of drugs may be viewed as an individual coping mechanism as opposed to the consumption of alcohol, which may be more of a social activity for this age group.

An additional consideration for the lack of significance in the alcohol category could be the result of screening bias by physicians. In our sample of 847 cases, 31 adolescents used drugs (3.7%) and 22 used alcohol (2.6%). Both of these figures are remarkably low compared to national data from 2000, which found that 50% of high school seniors, 41% of 10th-graders, and 22.4% of 8th-graders consumed alcohol that year, while 21.6% of seniors, 23.3% of 10th-graders, and 9.1% of 8th-graders used marijuana.[33] This discrepancy points to a significant need for medical staff to more closely screen for substance abuse during routine patient visits from adolescents. Although the use of substances was greatly underreported, it is still important to note that children who are overweight or at risk for being overweight seem more likely to use some form of non-alcohol drug than children within the normal range.

The literature shows that puberty has a tendency to bring boys closer to an ideal image and girls further from it, making girls more susceptible to eating disorders.[12,21,22,26] After our results found no difference in gender and BMI (see Table 3), we ran an additional 2 x 2 test of association with gender and depression to see whether males and females possibly harbored feelings about their BMI differently. This test failed to produce a significant difference as well, indicating that

males and females do not differ from each other in terms of BMI or depression. This suggests that males may react to their body image in ways very similar to females—a dynamic that has been relatively absent from the literature.

Other significant relationships with BMI included ethnicity, parental marital status, and parental employment. When we consider that being Hispanic/Latino, being African American, having unemployed parents, and having separated, divorced, or never married parents were all significantly associated with being overweight, we can speculate that this association may be related to income. Because single parents and minorities tend to earn less money than other groups, their children may be at greater risk of being overweight due to lost purchasing power and less access to healthier foods. Unfortunately, less expensive foods (e.g., fast food) can be much higher in fats and calories and more easily obtained than more expensive, healthier foods. These at-risk groups may need greater attention regarding nutrition and balanced diet during their medical visits.

Although this study found significant relationships between certain ecological factors and mental health, several methodological limitations need to be considered. Medical records at multiple sites provided inconsistent data; while some offices screened for substance abuse and mental health, others were more informal. Also, there was a great deal of missing data, which should be expected as some patients undoubtedly came in for urgent care or routine needs, such as sports physicals, and it may have been too intrusive to screen for factors such as drug/alcohol usage.

Previous literature has linked depression in adolescents with pubertal status rather than chronological age. However, our study found a significant association between chronological age and BMI. Since the overwhelming majority of medical charts did not mention pubertal status, it is impossible to make inferences between age and puberty, as there may be too great an individual variability with the timing of puberty. Future research should examine the association between the onset of puberty and BMI, peer group, and depression. Children and adolescents who reach puberty earlier than their peers, particularly girls, may be at greater risk for feeling depressed, as their BMI may influence their body image and self image.

Additionally, there is a need to further understand contributing factors to BMI scores in order to ascertain whether some adolescents are at greater risk for being overweight. Future research must also explore the relationship between multiple variables and BMI. Our analyses yielded low levels of explained variance between BMI and the respective variables. This may indicate a need for future controlled studies to examine how multiple ecological variables interact with each other to influence BMI and the consequences of being overweight or at risk for being overweight. Moreover, there is an overwhelming need for future studies to examine the influences on and consequences of BMI categorization between and within

Table 5. BMI and Age

	BMI Range	Occurrences in Medical Charts
10-year-olds (n=43)	At risk	5
	Overweight	7
	At risk of overweight and overweight combined	12
11-year-olds (n=83)	At risk	10
	Overweight	8
	At risk of overweight and overweight combined	18
12-year-olds (n=100)	At risk	20*
	Overweight	15
	At risk of overweight and overweight combined	35
13-year-olds (n=91)	At risk	14
	Overweight	14
	At risk of overweight and overweight combined	28
14-year-olds (n=92)	At risk	15
	Overweight	25*
	At risk of overweight and overweight combined	40
15-year-olds (n=104)	At risk	21*
	Overweight	18
	At risk of overweight and overweight combined	39
16-year-olds (n=87)	At risk	13
	Overweight	25
	At risk of overweight and overweight combined	38*
17-year-olds (n=94)	At risk	20*
	Overweight	22
	At risk of overweight and overweight combined	42*
18-year-olds (n=108)	At risk	11
	Overweight	26*
	At risk of overweight and overweight combined	37
19-year-olds (n=45)	At risk	5
	Overweight	5
	At risk of overweight and overweight combined	10

* $p<.05$

Table 6. BMI and Dichotomous Variables

	BMI Range	Occurrences in Medical Charts	Odds Ratio
Depression (N=847; n present in charts=43; n absent in charts=804)	Normal	20	
	At risk	6	
	Overweight	17**	
	At risk of overweight and overweight combined	23**	2.20
History of suicidal ideation (N=847; n present in charts=21; n absent in charts=826)	Normal	9	
	At risk	6	
	Overweight	6	
	At risk of overweight and overweight combined	12*	2.50
Drugs (N=847; n present in charts=31; n absent in charts=816)	Normal	14	
	At risk	6	
	Overweight	11*	
	At risk of overweight and overweight combined	17*	2.30
Alcohol (N=847; n present in charts=22; n absent in charts=825)	Normal	12	
	At risk	4	
	Overweight	6	
	At risk of overweight and overweight combined	10	1.55
Anxiety (N=847; n present in charts=6; n absent in charts=841)	Normal	3	
	At risk	1	
	Overweight	2	
	At risk of overweight and overweight combined	3	1.84
Parental unemployment (both parents unemployed or the primary caregiver in divorced/separated families) (N=674; n present in charts=70; n absent in charts=604)	Normal	37	
	At risk	11	
	Overweight	22**	
	At risk of overweight and overweight combined	33*	1.88

* $p<.05$, ** $p<.01$

ethnic minority groups, as these populations have been underrepresented in body image/depression research.

TRANSLATION TO HEALTH EDUCATION PRACTICE

The significant associations between BMI and adolescent well-being point to a need for the medical community to attend to the ecological contexts of their young patients, and to support collaboration between the medical and mental health communities. Although the actual amount of time physicians are able to spend with patients is limited, attention to important domains of adolescent life is warranted. For example, although many youths have difficulty with the transition of separation/divorce, parental marital status was not screened for in nearly 25% of our sample. Even when martial status was noted in the charts, there was a great deal of variability as to how recently the question had been asked. Unfortunately, further probing and questioning may require more time than many physicians currently have to allocate to each patient. However, because youths are particularly influenced by factors in their environment, it is essential to inquire about the multiple contexts in which they are involved and to use referral resources as needed. Screening could be facilitated via the use of a brief set of questions (written or verbal) or by an instrument that measures depression.

Screening for risk factors may be especially appropriate for patients whose BMI equals or exceeds the 85th percentile, as they are potentially more vulnerable to mental health risk factors. This study demonstrated that such individuals are more likely to experience anxiety, depression, and suicidal ideation, and to use drugs or alcohol (see odds ratios in Table 6), even if these results did not show a significant difference from a statistical standpoint.

The need to screen for certain risk factors is even more amplified when considering suicidal ideation. Although it is known that

a previous suicide attempt is a primary risk factor for future attempts, it is uncertain how many adolescents actually receive mental health services after an attempt.[8] Ideally, most medical professionals would refer patients who have attempted suicide to therapy; however, they might not be proactively screening for suicidal thoughts prior to a subsequent attempt.

Healthcare providers have significant access to adolescents who may be struggling with weight and depression. This study points to the association between risk factors in adolescents' ecology and well-being. Through careful screening and collaboration, the medical and mental health communities should be able to better identify and serve these adolescents.

Table 7. BMI and Parental Marital Status

	BMI Range	Occurrences in Medical Charts
Married (n=424)	Normal	295
	At risk	63
	Overweight	66
	At risk of overweight and overweight combined	129
Separated (n=16)	Normal	5
	At risk	6*
	Overweight	5*
	At risk of overweight and overweight combined	11**
Divorced (n=149)	Normal	93
	At risk	26*
	Overweight	30*
	At risk of overweight and overweight combined	56**
Never married (n=50)	Normal	31
	At risk	6
	Overweight	13*
	At risk of overweight and overweight combined	19
Widowed (n=6)	Normal	6
	At risk	0
	Overweight	0
	At risk of overweight and overweight combined	0

* $p<.05$, ** $p<.01$

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