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Overweight Misperception among Adolescents in the United States

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The purpose of this study was to examine the discrepancies between perceived and reported overweight status among U.S. adolescents (n > 70,000), and to identify factors contributing to such discrepancies. We used the YRBSS data (years 2001–2009) and found statistically significant, gender and race specific discrepancies between perceived and reported overweight status. Factors such as BMI, school performance, and being sexually active are additional predictors of overweight misperception. The findings suggest that evidence based strategies should be employed to help adolescents establish correct weight perception. These strategies should also be tailored based on gender, race, and weight perception of target audience.

CHILDHOOD OVERWEIGHT AND obesity have acquired the proportions of a global epidemic. In the United States (US), more than one third of the children and adolescents were overweight or obese in the year 2012 (Ogden, Carroll, Kit, & Flegal, 2014). Childhood obesity has more than doubled in children ages 6–11 (increasing from 7% in 1980 to nearly 18% in 2012) and more than quadrupled in adolescents ages 12–19 (increasing from 5% to nearly 21% in the same period) (Ogden et al., 2014). Childhood obesity causes significant adverse effects on cognitive, social, and psychological development in children and has long-lasting negative impacts on health, employment, and socioeconomic status in adulthood (Eichen, Conner, Daly, & Fauber, 2012; Price, Khubchandani, McKinney, & Braun, 2013; Reilly & Kelly, 2011). The estimated annual direct medical cost for children with excess weight in the United States ranges from $3 billion to $14 billion (Trasande & Chatterjee, 2012).

Correct self-perception of weight status (e.g. being overweight or underweight) is considered to be a strong determinant of nutritional and physical activity habits and weight management among adolescents. Correct self-perception of weight is crucial for weight management and success of behavioral interventions to reduce childhood obesity (Atlantis, Barnes, & Ball, 2007; Brener, Eaton, Lowry, & McManus, 2004; Kuchler & Variyam, 2003; Maximova et al., 2008). However, self-perceived weight status is not necessarily consistent with either measured or self-reported weight status among adolescents, which results in body image distortion (BID) (Brener et al., 2004; Liechty, 2010). The direction of BID can take two forms. Adolescents may not perceive themselves as overweight when they really are or normal weight adolescents could have a faulty perception of being overweight. In both forms, health risk factors are likely to be prevalent. Overweight adolescents who do not identify themselves as being overweight may make diet and physical activity choices that do not reflect healthy behaviors. In contrast, normal-weight adolescents who perceive themselves as overweight may be at a high risk of adopting dangerous and health compromising weight-loss methods (Eichen et al., 2012; Thorlton, Park, & Hughes,

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2013; Wang, Liang, & Chen, 2009; Zullig, Ubbes, Pyle, & Valois, 2006). The direction and magnitude of BID varies by socio-demographic background factors such as gender, race, ethnicity, and adolescents' reported weight status (Brener et al., 2004; Puhl & Latner, 2007; Ricciardelli & McCabe, 2001; Viner et al., 2006). Thus, the purpose of this study was to examine the discrepancies between perceived and reported overweight status among both overweight/obese and normal-weight U.S. adolescents and the factors contributing to such discrepancies.

The increasing prevalence of misperception of body weight is globally pervasive. Studies of different population subgroups from several countries with varying rates of overweight or obesity have reported misperceptions of body weight. Youth in the United States have also been assessed for body weight misperceptions (Edwards, Pettingell, & Borowsky, 2010; Marques-Vidal, Melich-Cerveira, Marcelino, & Paccaud, 2011; Salcedo, Gutierrez-Fisac, Guallar-Castillon, & Rodriguez-Artalejo, 2010; Thorlton et al., 2013; Wardle, Haase, & Steptoe, 2005; Zullig et al., 2006). However, despite its importance in weight management and control among adolescents, the literature on self-perception of weight status using nationally representative data is limited in exploring the potential factors that explain BID.

Methods

Participants

For this study, the Youth Risk Behavior Survey (YRBSS) data collected by the Centers for Disease Control and Prevention (CDC) on a biennial basis was utilized. The YRBSS is a nationally representative sample of 9th-grade through 12th-grade students in both public and private schools in the United States. Detailed description of the sampling methods for YRBSS can be found in the sample description section of the Data User's Guide for each survey year (Centers for Disease Control and Prevention, 2013). To ensure consistency of outcome variables and predictor variables the YRBSS data for 2001, 2003, 2005, 2007, and 2009 were used. For the given years, YRBSS questionnaires were similar for estimation of self-reported weight status and other variables of interest (e.g. the earlier waves of the YRBSS data lack BMI information or other important variables like average GPA). This study incorporates sampling weights in all analyses.

Measures

The YRBSS students reported their height and weight without shoes on. The "SAS Program for the 2000 CDC Growth Charts" was used to calculate the BMI percentile by age and gender (Centers for Disease Control and Prevention, 2011). Students were classified as overweight if their self-reported BMI was at or above the 85th percentile for their age and gender. The respondents were also asked to describe their weight using a 5-point Likert-type scale (very underweight, slightly underweight, about the right weight, slightly overweight, and very overweight). Perceived weight status was used to classify adolescents as 'overweight' if they chose one of the last two options and 'non-overweight' if they chose one of the first three options.

Other variables included age, gender, race/ethnicity (black, Hispanic, and white), school grade (9th–12th grade), geographical region (census regions), average GPA of the past school year (mostly A's, mostly B's, Mostly C's, and Mostly D's and F's), and risk behavior variables. The risk behavior variables indicated whether the student felt sad or hopeless almost every day for two or more weeks in a row in the past 12 months such that he or she stopped doing some usual activities (*Depression*); whether the student either attempted or tried suicide at least once (*Suicide*) or, had alcoholic beverages at least once for more than five days (*Drink*). Additionally, students were asked if they drove a vehicle when they had been drinking alcohol or rode in a vehicle driven by someone who had been drinking alcohol in the past 30 days (*DUI*). Other behaviors were whether the student ever smoked cigarettes/tobacco (*Smoke*), used marijuana (*Marijuana*), or had sexual intercourse (*Sex*).

To assess the impact of overweight misperception on weight-loss efforts, three weight-loss intention variables were created indicating whether a respondent tried to lose weight (*Weight Loss Tried*) and whether he/she specifically did so through eating less food and fewer calories (*Weight Loss by Diet*) or exercise (*Weight Loss by Exercise*) during the past 30 days. Two unhealthy weight-loss methods were used in the analysis: going without eating for at least 24 hours, i.e., fasting (*Weight Loss by Fasting*) and taking diet pills, powders, or liquids or laxatives without a doctor's advice (*Weight Loss by Medication*). These two extreme weight-loss methods are associated with severe medical complications, psychiatric disorders, depression, and suicide (Katzman, 2005; Liechty, 2010; Stice, 2002; Thorlton et al., 2013). For the purpose of this study, overweight misperception was classified into two groups: the false positive (*FP*) perceptions group and the false negative (*FN*) perceptions group, as they have different implications for weight-loss efforts. Students in the (FP) group believed that they were overweight even if they were not, while students in the (FN) group believed that they were normal weight even when they were overweight based on self-reported height and weight.

Data analysis

The statistical analyses include an examination of weight misperceptions and factors contributing to misperceptions. STATA 12 was used for statistical analyses. The sampling weights for pooled cross-sectional data were adjusted. Descriptive statistics (frequencies, means, and standard deviations) were used to describe the students' demographic characteristics and risk behaviors. Logistic models were

employed to examine factors contributing to overweight misperceptions separately by gender, race, and self-reported overweight status. Differences between groups were considered statistically significant at $p < 0.05$.

Results

Characteristics of Students

Most of the students were Whites (47.3%) and females (50.8%). Hispanics (26.5%) and Blacks (21.2%) formed the other two major groups of participants. The majority of the students were older than 16 years of age (68%) and in 11th or 12th grade (50.5%). In relation to average GPA of the past school year, the majority of the students reported having mostly A's or mostly B's (61.4%). Students also reported on depressive symptoms, sexual activity, attempted suicide, and other risk factors (see Table 1).

Table 1 Characteristics of Student Participants (YRBSS 2001–2009).

Item	N(%)
Gender	
Males	35,866(49.2)
Females	36,959(50.8)
Race/Ethnicity	
Whites	34045(47.3)
Blacks	15,292(21.2)
Hispanic	19,066(26.5)
Others	3581(5)
Age	
≤14 years	6858(9.3)
15 years	16,557(22.7)
16 years	18,733(25.7)
17 years	19,017(26.1)
18 years	11,655(16.1)
Grade	
9th grade	17,928(24.7)
10th grade	18,032(24.8)
11th grade	18,471(25.3)
12th grade	18,303(25.2)
GPA	
Mostly A's	15,658(23.2)
Mostly B's	25,751(38.2)
Mostly C's	19,958(29.6)
Mostly D's and F's	6070(9.0)
Self-reported depression*	21,172(29.3)
Attempted suicide**	10,871(16.2)
Ever had sexual intercourse	34,400(51.5)
Binge Drinking in the past 30 days	18,658(26.2)
Ever had cigarettes (smoked)	40,515(56.6)
Ever used marijuana	29,766(41.4)
Riding under influence***	24,639(34.2)

N = 72825, Total number of student participants.
* if the respondent felt sad or hopeless almost every day for two or more weeks in a row in the past 12 months; ** if the respondent either attempted or tried suicide at least once in the last 12 months; *** if the respondent either drove a car or other vehicle when he or she had been drinking alcohol or rode in a car or other vehicle driven by someone who had been drinking alcohol at least once in the past 30 days.

Self-Reported Weight Perception and Weight Loss Measures

Students were asked to rate their weight and a majority of the students perceived that they were "about the right weight" (55.9%). Less than one third (29.4%) perceived themselves as overweight. BMI for all students was computed based on self-reported height and weight and average BMI for the entire population was derived ($M \pm SE = 23.52 \pm 4.85$). Based on self-reported BMI, Hispanic and Black students in the study sample were more likely to be classified as overweight than white students. In addition, male students (32.1%) in this study were more likely to be classified as overweight based on BMI compared to female students (24.2%) (Table 2). A plurality of the students in the study sample had tried losing weight (45%). Students were also asked to describe the weight loss methods they had tried. Weight loss by exercise (60%) and weight loss by dieting (41.3%) were the two most common methods of trying to lose weight.

Discrepancies Between Perceived and Reported Overweight Status

Overall, the self-perceived overweight prevalence (35.4%) was higher than reported overweight prevalence (24.2%) for the female students the study sample. In contrast, male students exhibited the opposite pattern (23.7% vs. 32%). As shown in columns (1–6) of Table 3, such gender-specific discrepancies hold for subsamples by age, racial background, school grade, school performance, and risk behaviors, with an exception for black females. The self-perceived overweight prevalence (30.9%) was lower than the reported overweight prevalence (37.5%) for black females. As it relates to correct weight perceptions, non-overweight adolescents were more likely to have correct weight perceptions than their overweight counterparts (83.83% and 65.79%, respectively).

Females in this study had a higher false positive rate compared to the males, whereas males had a higher false negative rate than did the females (Table 3). More than one fifth (22.34%) of non-overweight females falsely perceived themselves as overweight, but less than one tenth (6.97%) of males did so. In contrast, a plurality (41.27%) of overweight males in the study sample falsely perceived themselves as non-overweight, while this number was halved for the female students (21.85%). The statistically significant and gender-specific overweight misperceptions were consistent in the study sample for different subsamples by age, race, and

Table 2 Self-Reported Weight Perceptions and Weight Loss Measures of Students.

Weight related variables	N(%)
Perceived weight	
Underweight	10556(14.7)
About the right weight	40,109(55.9)
Slightly overweight	18,135(25.3)
Very overweight	2964(4.1)
Reported prevalence of overweight by gender	
Male	10,712(32.1)
Female	8349(24.2)
Reported prevalence of overweight by race/ethnicity	
White	7,806(24.6)
Black	5,124(36.5)
Hispanic	6,119(34.6)
Weight Loss Attempted	32,389(45.0)
Weight Loss Methods	
Weight Loss by Diet	29535(41.3)
Weight Loss by Exercise	43013(60.0)
Weight Loss by Fasting	8594(12.2)
Weight Loss by Medication	6913(9.7)
BMI (Mean ± SE)	23.52 (±4.85)
Males	23.66(±0.05)
Females	22.79(±0.05)

N = 72825, Total number of student participants.

We create an indicator variable for each of the following weight-loss intentions and weight-loss methods adopted by the respondents during the past 30 day to lose weight or keep from gaining weight: (1) *Weight loss tried* = if the respondent indicated the weight-loss intention tried; (2) *Weight loss by diet* = if through eating less food, fewer calories, or foods low in fat; (3) *Weight loss by exercise* = if through exercise. (4) *Weight loss by fasting* = if the respondent did not eat for 24 hours or more (also called fasting); (5) *Weight loss by medication* = if the respondent took any diet pills, powders, or liquid without a doctor's advice, vomited, or took laxatives.

school grade (column 7 versus 9 for the false positive and column 8 versus 10 for the false negative).

Compared with the rest of the study population, black adolescents had a lower false positive rate and a higher false negative rate for both genders. That is, black adolescents in the study were less likely to believe that they were overweight even if they were. Our analysis also found a strong inverse (negative) relationship between average GPA and the false positive rate (Table 3, columns 7 and 9). That is, non-overweight adolescents with better school grades were less likely to mistakenly perceive themselves as overweight, and overweight students with higher average GPAs were more likely to correctly perceive their overweight status than did those with poor school performances. For both males and females in this study, relative to their counterparts, adolescents with depressive symptoms and prior suicide attempts had a higher false positive rate and a lower false negative rate. Similarly, a higher false positive rate was found among female adolescents who engaged in other risky behaviors such as substance use (*alcohol, tobacco*, and *marijuana*) and driving under the influence (*DUI*) (Table 3).

Overweight misperceptions were a significant indicator of weight-loss intentions and weight-loss efforts (Table 4). Compared to those students who had correct weight perception, non-overweight students who perceived themselves as overweight (false positive perception) had significantly greater intentions to lose weight through dieting (77.8% vs. 43.3%), and/or exercising (81.7% vs. 60.6%), as well as a greater likelihood of engaging in extreme weight-loss methods through fasting (28.2% vs. 11.8%) and/or taking weight-loss medicines without their doctor's advice (22% vs. 8.3%). In contrast, compared with overweight students with correct overweight perceptions, those with false negative perceptions had significantly lower intentions to lose weight. Students who had false positive overweight misperceptions were more likely to try any or all methods for weight loss compared to those students who had correct perceptions of their weight.

Factors Affecting the Direction and Size of Overweight Misperception

Given the significant differences across gender and racial background, logit models were estimated separately for males and females as well as for non-Hispanic blacks, Hispanics, and non-Hispanic whites. Based on the data availability, the following covariates were used: self-reported BMI, age, school grades, average GPA, and a set of risk behavior variables along with the year and region dummies. The marginal effects of covariates on the probability of overweight misperception are summarized in Table 5 for the false positive perceptions and in Table 6 for the false negative perceptions by gender and race. The correct prediction rates, ranged from 70% to 96%, suggesting a good fit for the 12 logistic models.

First, for non-overweight students, the higher their BMI, the more likely they had false positive overweight perceptions. Whereas, an increase in BMI decreased the probability of having a false negative perception. BMI was also a more pronounced predictor of false positive perceptions for females than for male students. However, BMI was a less pronounced predictor for false negative perceptions for females than for male students. The results indicate that BMI had different impacts on overweight misperceptions of students from different demographic backgrounds.

Second, in this study, a higher average GPA was associated with a statistically lower probability of overweight misperceptions for non-overweight male and female students or a higher probability for overweight students except for overweight Hispanic females. The results suggest that students in this study with better school performance were less likely to have incorrect overweight perceptions regardless of their reported overweight status.

Third, in this study, school grades and age had limited significance to overweight misperceptions. School grades were not found to be statistically significantly associated

Table 3 Prevalence of Overweight Status and Overweight Misperception Among U.S. Adolescents (%) [a].

	Overweight Prevalence						Overweight Misperception			
	Female			Male			Female		Male	
	Reported	Perceived	p-value	Reported	Perceived	p-value	False Positive	False Negative	False Positive	False Negative
	(1)	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*	*(7)*	*(8)*	*(9)*	*(10)*
Total	24.22	35.4	<0.01	32.08	23.71	<0.01	22.34	21.85	6.97	41.27
Age = 13 and 14	26.89	33.64	<0.01	35.31	25.52	<0.01	20.19	26.38	7.1	38.96
Age = 15	25.25	33.68	<0.01	33.11	23.83	<0.01	20.84	26.09	6.75	42.76
Age = 16	23.83	35.61	<0.01	31.76	23.76	<0.01	22.47	21.65	6.88	40.7
Age = 17	22.46	36.87	<0.01	31.44	23.49	<0.01	23.75	16.08	7.12	40.78
Age = 18 or older	23.84	37.77	<0.01	29.79	22.48	<0.01	24.26	18.81	7.16	42.23
White	20.18	35.45	<0.01	29.86	23.19	<0.01	23.6	15.57	6.84	38.66
Hispanic	30.21	39.29	<0.01	38.66	29.14	<0.01	23.24	21.68	8.65	38.6
Black	37.58	30.92	<0.01	35.11	17.89	<0.01	11.42	37.59	4.09	57.07
9th grade	26.6	33.42	<0.01	33.4	24.05	<0.01	20.56	27.82	6.93	41.88
10th grade	23.96	34.86	<0.01	32.45	23.47	<0.01	21.95	23.07	6.76	42.78
11th grade	23.79	36.81	<0.01	31.38	24.03	<0.01	22.95	17.26	7.36	39.51
12th grade	22.08	37.28	<0.01	30.73	23.15	<0.01	24.29	16.64	6.88	40.46
GPA: mostly A's	17.86	29.1	<0.01	24.59	16.75	<0.01	18.62	20.31	5.1	47.39
mostly B's	21.21	31.48	<0.01	29.44	20.51	<0.01	20.15	25.18	6.31	45.02
mostly C's	29.07	40.29	<0.01	37.49	29.51	<0.01	24.55	20.84	8.04	34.36
Mostly D's & F's	42.29	54.3	<0.01	43.46	38.96	<0.01	31.93	15.03	14.02	28.04
Depression = No	22.42	31.85	<0.01	31.56	22.57	<0.01	19.78	24.33	6.31	42.39
Depression = Yes	27.42	41.98	<0.01	34.01	28.08	<0.01	27.41	18.1	9.53	36.97
Suicide = No	22.73	33.74	<0.01	31.61	23.36	<0.01	21.09	21.53	6.7	40.96
Suicide = Yes	28.78	44.17	<0.01	34.19	27.98	<0.01	28.85	18.05	9.76	38.24
Sex = No	24.36	37.22	<0.01	31.59	26.38	<0.01	23.2	17.34	7.5	33.07
Sex = Yes	24.06	34.05	<0.01	32.72	21.31	<0.01	21.38	25.14	6.1	48.23
Alcohol = No	25.06	34.81	<0.01	31.8	24.06	<0.01	21.15	22.28	6.99	39.43
Alcohol = Yes	21.8	37.54	<0.01	32.29	23.07	<0.01	25.76	19.25	6.88	44.76
Smoke = No	21.13	31.8	<0.01	30.47	23.53	<0.01	19.73	21.39	6.82	38.74
Smoke = Yes	26.59	38.22	<0.01	33.36	23.97	<0.01	24.41	21.94	6.98	42.66
Marijuana = No	23.68	34.49	<0.01	31.95	24.5	<0.01	21.23	20.44	7.29	38.88
Marijuana = Yes	25.14	37.04	<0.01	32.05	22.74	<0.01	24.3	23.84	6.47	43.86
DUI = No	24.94	35.07	<0.01	31.94	23.85	<0.01	21.34	21.27	7.04	40.3
DUI = Yes	22.72	36.12	<0.01	32.3	23.28	<0.01	24.3	23.06	6.77	43.17

N = 72825, Total number of student participants.

(1) *Depression* (yes) = if the respondent felt sad or hopeless almost every day for two or more weeks in a row in the past 12 months that he/she stopped doing some usual activities; (2) *Suicide* (yes) = if the respondent either attempted or tried suicide at least once in the last 12 months;

(3) *Sex* (yes) = if the respondent ever had sexual intercourse; (4) *Alcohol* (yes) = if the respondent who was a binge drinker such that he or she had at least one drink of alcohol on more than five days in the past 30 days; (5) *Smoke* (yes) = if the respondent ever had cigarettes;

(6) *Marijuana* (yes) = if the respondent ever used marijuana; (7) *DUI* (yes) = if the respondent either drove a car or other vehicle when he or she had been drinking alcohol or rode in a car or other vehicle driven by someone who had been drinking alcohol at least once in the past 30 days, and zero otherwise.

[a] All-risk behavior variables are dummies and their definitions are given below:

with overweight misperceptions among non-overweight students, but overweight female students in higher grades had lower probabilities of having false negative perceptions. In this study, age was negatively associated with false positive perceptions for non-overweight non-Hispanic male students, but positively associated with false negative perception for overweight Hispanic females and overweight non-Hispanic white and black students.

Among the risk behavior variables, for both genders, relative to their counterparts, adolescents with depressive symptoms or prior suicide attempts had a higher probability of false positive perception for non-overweight non-Hispanic white and Hispanic students. Whereas, students with depressive symptoms or prior suicide attempts had a lower probability of false negative perceptions for white overweight females compared to their counterparts. Furthermore, having sexual experiences was associated with a lower probability of having false positive perceptions and a higher probability of having false negative perceptions. That is, students who had sexual experiences were less likely to

Table 4 Weight-loss Intentions and Unhealthy Weight-loss Methods Among U.S. Adolescents (%) [a].

Weight-loss intentions and weight-loss methods	Female						Male					
	Non-overweight			Overweight			Nonoverweight			Overweight		
	Correct Perception	*False positive*	*p-value*	*Correct Perception*	*False negative*	*p-value*	*Correct Perception*	*False positive*	*p-value*	*Correct Perception*	*False negative*	*p-value*
Weight Loss Tried	42.67	91.54	<0.01	92.15	64.91	<0.01	10.7	70.69	<0.01	78.82	32.85	<0.01
Weight Loss by Diet	43.39	77.8	<0.01	75.62	53.12	<0.01	15.65	53.7	<0.01	58.7	31.06	<0.01
Weight Loss by Exercise	60.61	81.77	<0.01	80.98	68.97	<0.01	40.88	74.42	<0.01	80.3	63.33	<0.01
Weight Loss by Fasting	11.85	28.28	<0.01	23.72	18.3	<0.01	4.72	15.02	<0.01	11.19	8.67	0.002
Weight Loss by Medication	8.31	22.03	<0.01	21.1	11.61	<0.01	3.63	10.73	<0.01	9.79	8.09	0.004

N = 72825, Total number of student participants.

(1) *Weight loss tried* = if the respondent indicated the weight-loss intention tried; (2) *Weight loss by diet* = if through eating less food, fewer calories, or foods low in fat; (3) *Weight loss by exercise* = if through exercise. (4) *Weight loss by fasting* = if the respondent did not eat for 24 hours or more (also called fasting); and (5) *Weight loss by medication* = if the respondent took any diet pills, powders, or liquid without a doctor's advice, vomited, or took laxatives.

[a] We created an indicator variable for each of the following weight-loss intentions and weight-loss methods adopted by the respondents during the past 30 day to lose weight or keep from gaining weight:

perceive themselves as overweight, even for the overweight subsample. Study participants who used substances such as alcohol, cigarettes, and marijuana were not found to be more likely to have misperceptions with an exception of overweight male binge drinkers.

Discussion

This study found large and statistically significant discrepancies between perceived and reported overweight status among a national random sample of U.S. high school students. The direction of the discrepancies was gender specific, i.e. female adolescents had a higher probability of false positive misperceptions and a lower probability of false negative misperceptions than male students. The findings are consistent with the literature as female adolescents have been found to be less satisfied with their body weight and want to be thinner, while male adolescents prefer to increase muscle mass (McCabe & Ricciardelli, 2011). The significant discrepancy in weight misperceptions and its gender-specific direction were consistent for different subsamples by age, race, grade, school performance, and risk factors, with an exception of black females. Black female students may not necessarily perceive being overweight as unhealthy or unattractive which may have contributed to their higher reported overweight prevalence than their self-perceived overweight prevalence (Brener et al., 2004; Edwards et al., 2010; Zullig et al., 2006).

Logistic estimations from this study indicate the following (1) BMI was a strong predictor of overweight misperception, higher the BMI, higher the probability of false positive misperceptions; (2) GPA was inversely associated with false positive misperceptions except for overweight Hispanic females; and (3) school grade, age, and behavioral risk factors except being sexually active had limited significance to overweight misperceptions. The results suggest that weight misperceptions are associated with cognitive ability and could be potentially corrected through educational programs.

The literature on obesity and academic performance among school children mainly focuses on the effect of either reported or measured BMI or overweight status on school performance (Taras & Potts-Datema, 2005). The findings in this study suggest that GPA contributes to correct self-perceptions of overweight among students. However, though it may help non-overweight students to correctly assess their overweight status, it is also likely to make overweight students to be satisfied with their overweight status. Since BMI, school performance, and being sexually active are strong predictors of overweight misperceptions, obesity interventions should make concerted efforts with programs on improving cognitive ability and sexual health. Students who are sexually active or have low cognitive ability are more likely to have overweight misperception and therefore, need more help.

Weight misperceptions are associated with a wide spectrum of problems ranging from eating disorders to depression (Shaw, Ramirez, Trost, Randall, & Stice, 2004; Stice & Bearman, 2001; Thompson & Stice, 2001; Zullig

Table 5 Marginal Effects on Overweight Misperception (false positive) Among Non-overweight Adolescents.

VARIABLES	Female			Male		
	White Coeff (95% CI)	Hispanic Coeff (95% CI)	Black Coeff (95% CI)	White Coeff (95% CI)	Hispanic Coeff (95% CI)	Black Coeff (95% CI)
BMI	0.08**(0.08 - 0.09)	0.09**(0.08 - 0.09)	0.03**(0.02 - 0.04)	0.02**(0.02 - 0.02)	0.03**(0.02 - 0.03)	0.01**(0.00 - 0.01)
Age	−0.01(−0.03 - 0.01)	−0.01(−0.04 - 0.01)	−0.01(−0.03 - 0.01)	−0.01**(−0.02 -0.00)	−0.01(−0.02 - 0.00)	−0.01(−0.02 - 0.00)
Grade						
10th grade	−0.01(−0.04 - 0.02)	0.00(−0.05 - 0.05)	0.02(−0.02 - 0.06)	−0.01(−0.02 - 0.01)	−0.01(−0.04 - 0.01)	0.02(−0.01 - 0.06)
11th grade	−0.01(−0.05 - 0.03)	0.03(−0.03 - 0.10)	0.03(−0.02 - 0.08)	−0.00(−0.02 - 0.01)	−0.01(−0.04 - 0.02)	0.05(−0.02 - 0.12)
12th grade	0.01(−0.05 - 0.06)	0.02(−0.06 - 0.11)	0.04(−0.03 - 0.11)	0.00(−0.02 - 0.03)	−0.02(−0.05 - 0.01)	0.04(−0.04 - 0.12)
GPA						
Mostly As	−0.11**(−0.14 - -0.08)	−0.07**(−0.13 - -0.02)	−0.03(−0.06 - 0.00)	−0.05**(−0.06 - -0.04)	−0.04**(−0.06 - -0.02)	−0.01(−0.03 - 0.01)
Mostly Bs	-0.10**(-0.13 - -0.06)	-0.07*(-0.13 - -0.02)	-0.05**(-0.09 - -0.01)	-0.04**(-0.05 - -0.03)	-0.04**(-0.07 - -0.02)	-0.02(-0.04 - 0.00)
Mostly Cs	−0.08**(−0.11 - -0.05)	−0.05(−0.10 - 0.01)	−0.02(−0.05 - 0.02)	−0.02**(−0.03 - -0.01)	−0.04**(−0.06 - -0.02)	−0.02*(−0.04 - -0.00)
Depression	0.05**(0.03 - 0.07)	0.07**(0.04 - 0.10)	0.02(−0.01 - 0.04)	0.02*(0.00 - 0.03)	0.02(−0.00 - 0.04)	−0.01(−0.02 - 0.01)
Suicide	0.06**(0.03 - 0.09)	0.04(−0.01 - 0.08)	0.00(−0.02 - 0.03)	0.02*(0.00 - 0.03)	0.03(−0.00 - 0.06)	0.03(−0.02 - 0.08)
Sex	−0.04**(−0.07 - -0.02)	−0.05**(−0.08 - -0.01)	−0.05**(−0.08 - -0.02)	−0.01**(−0.02 - -0.01)	−0.02*(−0.04 - -0.00)	−0.02*(−0.04 - -0.00)
Binge Drink	0.00(−0.02 - 0.03)	0.01(−0.03 - 0.05)	0.03(−0.02 - 0.08)	−0.01(−0.02 - 0.00)	0.00(−0.02 - 0.02)	−0.00(−0.02 - 0.02)
Ever Smoke	0.00(−0.02 - 0.02)	0.00(−0.03 - 0.04)	0.01(−0.02 - 0.03)	−0.00(−0.01 - 0.01)	0.01(−0.01 - 0.03)	0.00(−0.01 - 0.01)
Marijuana	0.00(−0.02 - 0.03)	−0.00(−0.04 - 0.03)	−0.01(−0.04 - 0.01)	−0.01(−0.02 - 0.00)	−0.01(−0.03 - 0.01)	−0.00(−0.02 - 0.01)
DUI	0.03*(0.00 - 0.05)	−0.01(−0.04 - 0.02)	−0.01(−0.03 - 0.02)	−0.01*(−0.02 - -0.00)	0.01(−0.01 - 0.03)	0.00(−0.01 - 0.02)
Correct prediction (%)	79.67	77.83	88.84	92.57	91.90	96.01

Note: This table presents the marginal effects of each covariate on the probability of overweight misperception. The marginal effects of regional and year dummies variables are not shown in the table. Robust z-statistics are in parenthesis. Asterisks, ** and *, indicate the 1%, and 5% significance level, respectively.

Table 6 Marginal Effects on Overweight Misperception (false negative) Among Overweight Adolescents.

VARIABLE	Female			Male		
	White	Hispanic	Black	White	Hispanic	Black
BMI	−0.02**(−0.03 - -0.02)	−0.02**(−0.03 - -0.01)	−0.04**(−0.05 - -0.03)	−0.06**(−0.07 - -0.05)	−0.06**(−0.07 - -0.05)	−0.07**(−0.08 - -0.05)
Age	0.01(−0.01 - 0.03)	0.03*(0.00 - 0.07)	0.02(−0.03 - 0.07)	0.07**(0.03 - 0.10)	0.00(−0.05 - 0.05)	0.09**(0.03 - 0.15)
Grade						
10th grade	−0.02(−0.05 - 0.02)	−0.00(−0.06 - 0.06)	−0.08(−0.16 - 0.00)	−0.04(−0.10 - 0.02)	0.06(−0.03 - 0.15)	0.00(−0.13 - 0.14)
11th grade	−0.06**(−0.10 - -0.02)	−0.09**(−0.15 - -0.03)	−0.14**(−0.24 - -0.05)	−0.06(−0.15 - 0.02)	0.07(−0.06 - 0.20)	−0.09(−0.25 - 0.07)
12th grade	−0.06*(−0.11 - -0.01)	−0.13**(−0.20 - -0.07)	−0.15*(−0.28 - -0.03)	−0.12**(−0.21 - -0.03)	0.04(−0.12 - 0.21)	−0.13(−0.33 - 0.07)
GPA						
Mostly As	0.05(−0.02 - 0.12)	0.03(−0.07 - 0.12)	0.11(−0.02 - 0.25)	0.22**(0.12 - 0.32)	0.14*(0.01 - 0.27)	0.13(−0.04 - 0.30)
Mostly Bs	0.05(−0.00 - 0.11)	0.06(−0.02 - 0.14)	0.18**(0.07 - 0.29)	0.22**(0.14 - 0.31)	0.10*(0.00 - 0.20)	0.13(−0.01 - 0.27)
Mostly Cs	0.02(−0.03 - 0.07)	0.05(−0.02 - 0.12)	0.09(−0.02 - 0.20)	0.09*(0.00 - 0.17)	0.06(−0.04 - 0.16)	0.00(−0.14 - 0.14)
Depression	−0.04**(−0.06 - -0.01)	−0.01(−0.06 - 0.03)	−0.03(−0.09 - 0.03)	−0.04(−0.09 - 0.02)	−0.02(−0.08 - 0.05)	−0.06(−0.17 - 0.06)
Suicide	0.00(−0.03 - 0.03)	−0.05(−0.10 - 0.00)	−0.05(−0.13 - 0.03)	−0.03(−0.10 - 0.03)	0.04(−0.05 - 0.13)	−0.08(−0.22 - 0.07)
Sex	0.03(−0.00 - 0.07)	0.09**(0.04 - 0.14)	0.13**(0.06 - 0.19)	0.12**(0.07 - 0.17)	0.10**(0.04 - 0.16)	0.13*(0.02 - 0.24)
Binge Drink	0.00(−0.03 - 0.04)	0.03(−0.03 - 0.09)	−0.05(−0.14 - 0.04)	0.06*(0.00 - 0.11)	0.01(−0.06 - 0.08)	−0.01(−0.12 - 0.11)
Ever Smoke	0.01(−0.02 - 0.05)	−0.03(−0.08 - 0.02)	−0.04(−0.11 - 0.03)	0.03(−0.02 - 0.08)	−0.03(−0.10 - 0.03)	−0.09(−0.19 - 0.02)
Marijuana	0.03(−0.00 - 0.07)	0.03(−0.03 - 0.08)	−0.00(−0.07 - 0.07)	−0.00(−0.05 - 0.04)	0.04(−0.02 - 0.11)	0.01(−0.11 - 0.12)
DUI	−0.01(−0.04 - 0.02)	0.01(−0.03 - 0.06)	0.05(−0.02 - 0.12)	−0.03(−0.08 - 0.01)	−0.02(−0.08 - 0.05)	0.04(−0.07 - 0.14)
Correct prediction (%)	79.67	77.83	88.84	92.57	91.90	96.01

Note: This table presents the marginal effects of each covariate on the probability of overweight misperception. The marginal effects of regional and year dummies variables are not shown in the table. Robust z-statistics are in parenthesis. Asterisks, ** and *, indicate the 1%, and 5% significance level, respectively.

et al., 2006). Adolescence is a transitional period of both physical and psychological development, during which they are actively adapting and forming their own perspectives including weight perceptions. The perception of body weight has been found to be a strong determinant of dietary and nutritional habits, physical activity, and weight management among adolescents (Brener et al., 2004; Liechty, 2010). For example, studies report that the perception of weight status offers a better prediction of childrens' diet and exercise behaviors than their actual weight. Individuals who perceive themselves as non-overweight are less likely to engage in weight-loss behaviors such as dieting and exercising. On the other hand, adolescents who are underweight or normal weight and perceive themselves as overweight are at higher risk for an eating disorder such as anorexia nervosa or potentially harmful weight-loss behaviors such as purging, laxative use, diet pill use, and fasting (Liechty, 2010; Zullig et al., 2006). However, this study has shown that a large proportion of U.S. high school students have developed false positive and false negative perceptions of their weight status. Such inaccurate weight perceptions are harmful to the overall well-being of students.

Having incorrect self-perceptions of weight status could potentially reduce the efficacy of school based anti-obesity intervention programs. For overweight students who fail to recognize their weight problems, motivating them to eat healthy or exercise might become more challenging. For normal-weight adolescents who are obsessed with a slender body, they prefer extreme weight-loss methods with immediate effects rather than improving their eating and exercise habits. There is a considerable need to provide interventions to help adolescents develop accurate perceptions of their body weight or correct their already distorted weight perceptions. Having a correct perception can also help overcome barrier found to constrain physical activity participation among overweight adolescents who have the feeling of "too fat to exercise" or "behavioral incapability" (Pate, Heath, Dowda, & Trost, 1996).

Self-perception of weight status among students can be influenced by the weight status and weight perceptions of people in their immediate environments where school environment is an important part (Maximova et al., 2008). For example, normal-weight students may be obsessed with a thin body, typically because society prizes thin body types, especially among females. Overweight students may feel peer pressure in school to lose weight by engaging in extreme weight-loss methods to gain immediate effects.

Limitations

The results of this study should be viewed in light of several potential limitations. First, the YRBSS does not have information about adolescents' families and friends. Adolescents' self-perceptions of their body weight, their dietary patterns, and exercise habits are likely influenced by their family food environments, parental attitudes and preferences relating to eating and exercise habits, and their friends and peers perceptions and activities. Future research incorporating family and neighborhood environment is warranted. Second, it was not possible to examine the dynamic decisions over time since the YRBSS is repeated cross-section data. Understanding and modeling the inter-period decision making process of adolescents might be a fruitful research area if data is available in the future. Third, the study results may suffer from all the traditional limitations of observational research. Fourth, all the data in the study were self-reported and some participants may have responded in a socially desirable manner. Self-reported weight related variables pose limitations as various studies have indicated the flaws inherent to self-reported measures and the associated problems with reliability and validity. Finally, the students consisted of youths who were in school. Thus, the findings may not be generalizable to all adolescents.

Implications for Practice

While school and community obesity prevention interventions target individuals who are overweight or obese, school personnel and community stakeholders should also place an emphasis on educating normal-weight adolescents with a false positive perception of their weight status due to the ramifications of such perceptions mentioned above.

Based on the findings of this study and a comprehensive review of literature, we suggest potential recommendations for practice. In previous studies, it has been suggested that the Social-Ecological Model and Social Cognitive Theory can be employed to explained overweight misperceptions and associated behaviors in adolescents (Elder et al., 2006; McCabe & Ricciardelli, 2011; Story, Nanney, & Schwartz, 2009; Thorlton et al., 2013). Therefore, school health professionals, pediatric healthcare providers, and parents should keep in mind the multifactorial origin of weight related perceptions in students. These factors could be interpersonal, school social influence, parental beliefs, and peers' attitudes. In this regard, emphasis should be placed on implementation and evaluation of wellness policies and evidence based high quality health and physical education in schools and communities. In addition, schools and communities should promote quality meal programs, increased opportunity for physical activities, and healthy food choices out of school.

Another area of intervention could be periodic assessment of BMI as well as weight perceptions. Although not entirely rid of controversy, screening for BMI and weight perceptions could be a prudent step that school personnel and pediatric care providers could take if followed with adequate referrals for problematic perceptions and behaviors. Currently, many of the states and school districts that require BMI screening do not really emphasize simultaneous education with screening. Screening avenues have considerable potential for educating children and parents on healthy weight, benefits of healthy diets and physical

activity. In addition, screening can potentially help correct misperceptions and motivate parents and children to adopt healthier lifestyles. Parents can also be alerted about at-risk children so that there can be reasonable referrals and follow up with appropriate medical guidance from healthcare practitioners and counseling for facilitation of healthy weight adoption, weight maintenance, and correction of misperceptions (Lenhart, Daly, & Eichen, 2011; Nihiser et al., 2007; Thorlton et al., 2013).

This study provides insights that are meaningful for tailored interventions that could address prevalence of overweight misperceptions, unhealthy weight control practices, and obesity-related morbidity and mortality. For example, females are more likely than males to have weight misperceptions. In addition, within females, racial/ethnic minority females have a greater prevalence of obesity and higher prevalence of being comfortable with an overweight status and not having correct weight perceptions. This indicates that school nurses and pediatric care providers need to employ a variety of evidence based strategies to help students establish correct weight perceptions based on their gender and race/ethnicity. In addition, as shown in this study, pediatric care providers will also have to keep in mind that perceived weight is also associated with risk factors that profile children in different categories (e.g. those who have lower academic performance, those with depressive symptoms, alcohol and tobacco users, or groups that are sexually active). Based on risk factors, race, and gender the needs for health-related services that impact the physical, mental, and social health of students could differ (Lenhart et al., 2011; Nihiser et al., 2007; Shaw et al., 2004; Wang et al., 2009). Future research is needed to better understand the etiology of adolescents' weight perceptions, effects of screening programs, the role and effects of school personnel, effectiveness of referral services for at risk youth, and the means to integrate various methods of communication about body weight with students, parents, and pediatric care providers.

In conclusion, for the overall well-being of adolescents, it becomes urgent now to develop and nurture accurate perceptions of weight status through school-, family-, neighborhood-, or clinic-based interventions. Current prevention and intervention strategies should emphasize promoting healthy dietary habits and physical activities to reduce the prevalence of childhood obesity by fostering correct weight perceptions. Pediatric care providers have been referred to as frontrunners in these prevention efforts against childhood obesity.

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