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BMI Reporting and Accuracy of Child's Weight Perception

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abstract

OBJECTIVES: To estimate whether school-based body mass index (BMI) reports impacted the accuracy of children's self-reported weight category, for children overall and within subgroups.

METHODS: We analyzed existing data from the Fit Study, a randomized controlled trial of a BMI screening and reporting intervention conducted in California from 2014 to 2017. The sample included 4690 children in 27 schools randomized to receive BMI reports and 4975 children in 27 controls schools that received BMI screening only. To estimate how BMI reporting affected accuracy, we fit multinomial logistic regression models to our data. We calculated average marginal effects, which capture the change in probability that children more accurately reported their weight category because of BMI reporting.

RESULTS: We detected no impact of BMI reporting on children's self-reported weight accuracy. Exploratory subgroup analyses show that for Black children, exposure to 1 round of BMI reporting was associated with a 10.0 percentage point increase in the probability of accurately reporting their weight category (95% confidence interval [CI]: 2.6 to 17.4). Two rounds of reporting were associated with an increase in the probability of accuracy for Asian children (6.6 percentage points; 95% CI: 0.4 to 12.8), 5^{th} graders (11.1 percentage points; 95% CI: 1.6 to 20.5), and those with BMI $<5^{th}$ percentile (17.1 percentage points; 95% CI: 2.7 to 31.6).

CONCLUSIONS: BMI reporting has limited efficacy in increasing children's weight perception accuracy. Although exploratory analyses show that specific subpopulations became more accurate, future prospective studies should be designed to confirm these results.

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Dr Gee conceptualized and designed the study, oversaw the development and execution of the statistical analysis plan, drafted the introduction and results of the study, and developed and revised drafts of the manuscript; Dr Thompson conceptualized and designed the study, conducted the statistical analyses, oversaw the development of the methods section of the study, and developed and revised drafts of the manuscript; Dr Sliwa conceptualized and designed the study, oversaw the development of the study's discussion section, and developed and revised drafts of the manuscript; Dr Madsen conceptualized and designed the study as well as revised drafts of the manuscript; and all authors approved the final manuscript as submitted and agree to be accountable for all aspects of the work.

The data for this study comes from a clinical trial registered with ClinicalTrials.gov, registration number NCT02088086, https://clinicaltrials.gov/ct2/show/NCT02088086. Deidentified individual participant data will not be made available.

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WHAT'S KNOWN ON THIS SUBJECT: Children's perceptions of their weight have been linked to their exercise and weight control behaviors. Inaccurate perceptions can have both positive and negative consequences in the long run.

WHAT THIS STUDY ADDS: We generate new evidence demonstrating that BMI reporting has no effect on the accuracy of children's weight perceptions. Exploratory evidence shows increased accuracy among Black children, Asian children, 5^{th} graders, and those with BMI $<5^{th}$ percentile.

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A complex interplay of factors influences overweight and obesity in children, including children's biological and psychosocial characteristics, alongside broader contexts within which they develop, such as their family, school, community, and society.[1,2] Among these interdependent influences, one potential factor at the individual and psychosocial level is the accuracy of children's perceived weight. Although some of the strongest predictors predisposing children to overweight and obesity have been traced to children's parents, including parental BMI,[3] how accurately children perceive their weight—especially for those with overweight or obesity—can be a potential precursor to changes in their health behaviors and tentatively linked to healthy weight control behaviors.[4,5]

For instance, adolescents who are overweight and accurately perceived their weight are more likely to control their weight by trying to exercise more or eat less.[4] Further, adolescents with overweight or obesity are more likely to try to lose weight if they accurately perceived their weight.[5] On the other hand, inaccurate perceptions, especially overestimation, can be associated with less than ideal outcomes. Girls who overestimate their weight can experience lower physical and emotional functioning as well as lower parental communication and satisfaction with relationships.[6] Weight overestimation can lead to negative outcomes via the internalization of weight-based stigma,[6,7] which can result in inappropriate weight control behaviors.[6] Finally, in the long run, children with normal weight who inaccurately perceive themselves as overweight face an increased probability of having obesity in young adulthood.[7] Yet, inaccurate perceptions can also lead to long run positive consequences, depending on actual weight status and the direction of the misperception. Children with a higher weight status who misperceive themselves as under or normal weight experience lower BMI gains into young adulthood relative to those with accurate perceptions.[8] Finally, perceived weight, irrespective of the accuracy, can matter—for girls, perceptions of being overweight regardless of their actual weight status has been linked to lower health-related quality of life.[6]

Whereas the accuracy of children's weight self-perceptions is difficult to change,[9] school-based BMI screening and reporting wherein letters containing children's BMI status alongside messaging about healthy exercise and eating behaviors are sent home to parents[10,11] could, in theory, enhance accuracy. Providing BMI reports is a person-based intervention, individualized to each child, and is 1 of many school-based obesity prevention strategies that typically incorporate multipronged components, including altering children's eating and physical activity environments within schools alongside family- and community-based strategies.[12] Although BMI reporting has no effect on reducing children's BMI,[11,13] BMI reports could serve as an informational cue that helps children more accurately align their perceived weight status with their actual weight status. Parents, who play an influential role their children's health,[14] may share BMI information with their children who, in turn, internalize this information, thereby leading them to more accurately self-report their BMI category.

In this follow-up study to the Fit Study, a randomized controlled trial of a BMI screening and reporting intervention targeting children in California,[15] we investigate whether BMI reporting influences children's weight perception accuracy. The original study found no effect on BMI[11]; however, whether weight self-perception accuracy was affected is open to further empirical investigation. Further, we conduct exploratory analyses to examine accuracy within subgroups, by children's sex, racial and ethnic backgrounds, grade levels, and BMI categories. We examine effects by the social constructs of race and ethnicity, given a recent body of evidence demonstrating that weight perceptions can differ across racial and ethnic groups with varying degrees of accuracy.[16–18] These differences emerge, in part, from broader structural and societal influences, including socially constructed body image ideals and norms about weight.[19] For particular racial and ethnic groups, if these socially constructed ideals and norms produce less than accurate perceptions, then BMI notifications could heighten awareness of actual weight status, consequently leading to enhanced weight perception accuracy.

METHODS

The Fit Study (fall 2014 to spring 2017) was a cluster randomized clinical trial among California elementary and middle schools that assessed the impact of school-based BMI screening and reporting on student weight status.[11,15] Study details, including findings for the primary outcome analyses and trial protocol, are published elsewhere.[11] The UC Berkeley Committee for the Protection of Human Subjects approved the Fit Study. We use existing data from the study that included children in 27 treatment schools that were randomly assigned to offer screening and reporting (treatment) and 27 schools randomized to offer screening only (control).

The CONSORT flow diagram for the original cluster randomized trial that we leverage data from for this study is reported elsewhere.[11] Figure 1 displays the flow of eligible children with data available for secondary analysis for this study. This eligible sample includes 12 430 children who first entered the study either in fall 2014 or fall 2015 (treatment group: $N = 5892$; control group: $N = 6538$). Of this eligible sample, 2765 children (treatment group: $n = 1202$; control group: $n = 1563$), approximately 22.2%, were excluded because of missing BMI or child weight perception data. Thus, the final sample used in this study included 9665 children. Children excluded from the analysis were more likely to be Black (12% of excluded students were Black versus 6% of children who were included; $P < .001$) or white (17% vs 16%; $P = .04$) and less likely to be Asian (9% vs 16%; $P < .001$).

Children in the final sample were exposed to at least 1 round of BMI screening and reporting (treatment; $n = 4690$) or screening only (control; $n = 4975$). Among the 9665 children, 2795 were exposed to 2 rounds of screening and reporting (treatment; $n = 1434$) or screening only (control; $n = 1361$). Figure 2 displays a timeline depicting the sample of children who were exposed to at least 1 round and 2 rounds.

Intervention and Measures

BMI

Data on children's BMI comes from screenings conducted by school staff (PE teachers for 64% of students, nurses [26%], classroom teachers [7%], and office staff or principals or other adults [3%]) in the spring using research grade equipment[15]; staff height and weight measurements were found to be equivalent to those of trained researchers.[20] Parents of students in the treatment group were sent a BMI report in the fall, approximately 6 months after BMI was measured in spring. Reports were delivered after 6 months because of the time required to receive, process, and report on the data. A sampleBMI report is included in supplemental materials accompanying previously published findings of the Fit Study.[11] Focus groups with diverse groups of California parents informed the reports, which classified children as underweight (BMI $<5^{th}$ percentile); healthy weight (BMI $\geq 5^{th}$ percentile and $<85^{th}$ percentile); at risk for overweight (BMI $\geq 85^{th}$ percentile and $<95^{th}$ percentile), or overweight (BMI $\geq 95^{th}$ percentile for sex and age) per Centers for Disease Control and Prevention standard cut points,[21] but adopted an earlier naming convention to avoid labeling children as potentially having "obesity" given parents' objection to this language.[22]

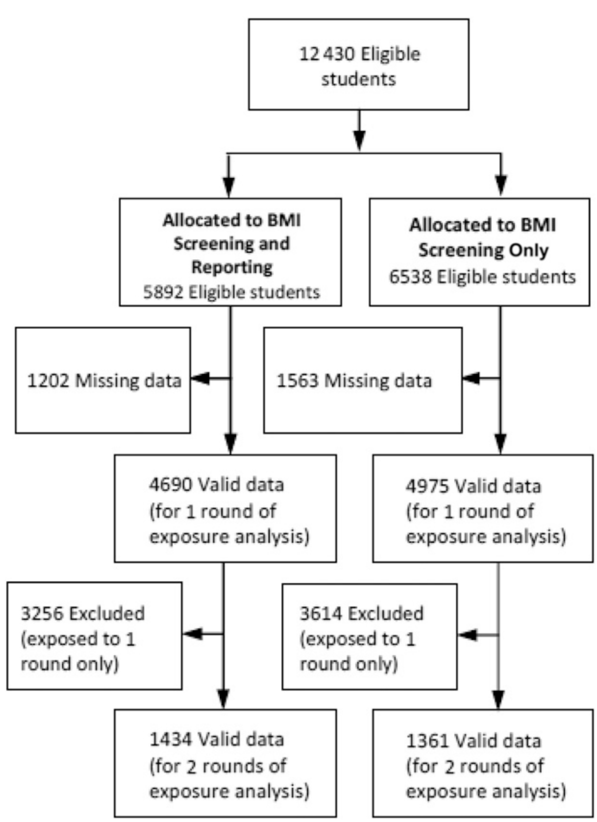

FIGURE 1
Flow diagram of eligible students available for secondary data analysis.

Weight Perception

Data about weight perceptions comes from surveys administered to children in fall, approximately 6 to 9 months after BMI was assessed and 1 to 2 months after parents were sent BMI reports (for treatment students only). Children were asked if they perceived themselves to be very underweight, somewhat underweight, about the right weight, somewhat overweight, or very overweight.[23] "Very underweight" and "somewhat underweight" were collapsed to underweight for this analysis.

Weight Perception Accuracy

Using children's objectively measured BMI from the spring and

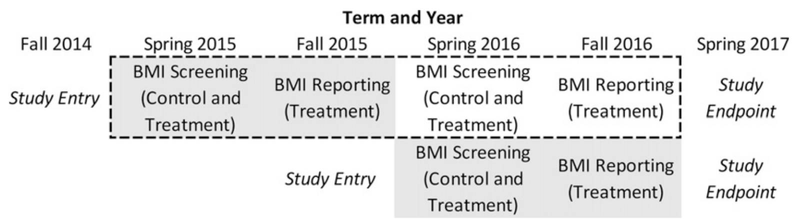

FIGURE 2
Intervention timeline and depiction of the study samples. Boxes in gray represent the sample exposed to at least 1 round of screening (control) or screening and reporting (treatment) ($n = 9665$). The dashed box represents the sample exposed to 2 rounds of screening or screening and reporting ($n = 2795$).

their self-reported weight perception from the fall, we created a 3-category measure to represent the accuracy of their weight perceptions for each study year. Because the BMI and weight perception accuracy categories used slightly different categorical labels, we aligned the BMI measurement categories to the weight perception categories as follows: underweight(BMI) = very underweight or somewhat underweight (weight perception); healthy weight (BMI) = about the right weight (weight perception); at-risk for overweight (BMI) = somewhat overweight (weight perception); and overweight (BMI) = very overweight (weight perception). Children were classified as (A) "underestimated" if their fall weight perception (eg, underweight) was lower than their subsequent spring BMI category (eg, healthy weight); (B) "accurately estimated" if their fall and spring categories matched each other; or (C) "overestimated" if their fall weight perception (eg, very overweight) was higher than their spring BMI category (eg, at-risk for overweight).

Demographics

Schools provided data on parent-reported sex (male or female), race and ethnicity, and grade. Schools collected race and ethnicity information directly from parents during school enrollment and provided it in categories, including Black, Asian, white, or Hispanic. Children whose parents designated another race or ethnicity, or multiple races, were included in an "all other races and ethnicities" category. We used a "declined to state" category if parents declined to provide race or ethnicity data. Finally, we use school-level data on free and reduced-price meal eligibility from the California Department of Education.[24]

Statistical Analysis

To estimate the impact of BMI reporting on students' weight perception accuracy, we fit the following multinomial logistic regression model for child i in school s as follows:

$$ln\left(\frac{P(Accuracy\ \ Category_{is} = m)}{P(Accuracy\ \ Category_{is} = 0)}\right)$$

$$= \alpha_m + \beta_{1m}(Treatment_s) + \sum_{q=0}^{Q} \gamma_{qm} x_{is}$$

Where m indexes the number of accuracy categories minus 1 omitted reference category. We used underestimated as the reference category (= 0). The outcome, $\ln\left(\frac{P(Accuracy\ \ Category_{is} = m)}{P(Accuracy\ \ Category_{is} = 0)}\right)$, is the log odds of being in category m relative to the reference category. γ_{qm} captures the effects of the baseline controls x_{is}, whereas β_{1m} is the effect of the treatment on the outcome. Based on results of this model, we calculated the average marginal effect of BMI reporting on the probability that children accurately estimated their weight category. The average marginal effect is estimated by predicting how each child's probability of being accurate changed if they were in the treatment versus control group, holding all other variables at their observed values, and then averaging over the changes in predicted probabilities. These predicted probabilities are interpreted as the percentage point change in the probability that children accurately reported their weight category. Models included baseline controls for child sex, race and ethnicity, grade level, and school district, as well as school-level proportion of students eligible for free or reduced-price meals. We clustered standard errors by school.

We first fit our model to data on the overall sample. Then, in a series of exploratory analyses, we fit the model stratified by sex, race and ethnicity, grade, and baseline BMI category subgroups. Our analyses by race and ethnicity were based on samples with a reported race or ethnicity; thus, we excluded in those analyses children whose race or ethnicity was unavailable ($n = 24$). We also fit models separately based on whether the sample received 1 or 2 rounds of BMI reporting. For our overall analysis focusing on all sample children, we adopted a standard level of significance ($\alpha = .05$) with which to test the null that there was no impact of BMI reporting on the accuracy of children's weight perceptions. Given the exploratory nature of our subgroup analyses, which typically do not require adjustments for multiple hypothesis testing since the findings are preliminary and used to generate hypotheses rather than confirm them,[25] we also adopted a conventional level of significance ($\alpha = .05$).

RESULTS

Descriptive Statistics

For the sample used to estimate the impact of 1 round of BMI reporting (Table 1), slightly more children at baseline were female (51%) and in middle school grades (6th or 7th) (52%). The majority of children were Hispanic (60%) and had a baseline BMI between the 5th and 85th percentile (56%). Similar demographic patterns existed in the analytic sample used to estimate the impact of 2 rounds of BMI reporting. Of note is that the sample used to estimate 2 rounds versus 1 of reporting had a higher proportion of Asian students (29% vs 16%; $P < .001$) and 6th graders (49% vs 31%; $P < .001$). Finally, by accuracy category, in the sample of treatment and control schools used to estimate the impact of 1 round of reporting, 48% underestimated, 43% accurately estimated, and 9% overestimated their weight.

Table 2 displays the differences between children in the treatment and control schools for the samples used to estimate the impact of 1 and 2 rounds of BMI reporting. Among the sample used to estimate the impact of 1 round, children in treatment schools were more likely to be Asian or white, and less likely to be Black or Hispanic, compared with children in control schools ($P < .001$). Slightly more students in treatment schools were in fourth and slightly fewer were in the 6th grade, compared with children in control schools ($P < .001$). Among the sample used to estimate the impact of 2 rounds, similar differences also existed, with a few notable exceptions. Children in treatment schools were more likely to be healthy weight or overweight ($P = .04$), although there was no

TABLE 1 Baseline Characteristics of Children Participating in the Fit Study (Treatment and Control Groups Pooled Together)

	Analytic Sample for the Impact of 1 Round of BMI Reporting (n = 9665; Baseline Years: Fall 2014 or Fall 2015)	Analytic Sample for the Impact of 2 Rounds of BMI Reporting (n = 2795; Baseline Year: Fall 2014)	P for Difference Between Groups[a]
Sex, n (%)			
Female	4935 (51.1)	1379 (49.3)	.71
Male	4730 (48.9)	1416 (50.7)	.71
Race and ethnicity,[b] n (%)			
Black	573 (5.9)	92 (3.3)	<.001
Asian	1524 (15.8)	800 (28.6)	<.001
Hispanic	5814 (60.2)	1514 (54.2)	<.001
White	1517 (15.7)	315 (11.3)	<.001
All other races and ethnicities	218 (2.2)	69 (2.4)	.51
Declined to state	19 (0.2)	5 (0.2)	.85
School level, n (%)			
Elementary, 3rd–5th	4647 (48.1)	1420 (50.8)	.01
Middle, 6th–8th	5018 (51.9)	1375 (49.2)	.01
Grade level, n (%)			
4th	3222 (33.3)	953 (34.1)	.45
5th	1425 (14.7)	467 (16.7)	.01
6th	2978 (30.8)	1375 (49.2)	<.001
7th	2040 (21.1)	—	—
BMI category, n (%)			
BMI <5th percentile, underweight	303 (3.1)	129 (4.6)	<.001
BMI ≥5th percentile and <85th percentile, healthy weight	5430 (56.2)	1609 (57.6)	.19
BMI ≥85th percentile and <95th percentile, at risk for overweight	1804 (18.7)	524 (18.8)	.92
BMI ≥95th percentile, overweight	2128 (22.0)	533 (19.1)	.001
Accuracy categories, n (%)			
Underestimated	4637 (48.0)	1462 (52.3)	.007
Accurately estimated	4147 (42.9)	1061 (38.0)	.002
Overestimated	881 (9.1)	272 (9.7)	.48

—, Unavailable because 7th graders received only 1 year of BMI reporting.

[a] P values derived from unpaired t tests.

[b] Race and ethnicity information comes from schools who collected parental reported information on race and ethnicity at the time of school enrollment. Children of another race or ethnicity or more than 1 race are included in the "All other races and ethnicities" category.

TABLE 2 Baseline Characteristics of Children Participating in the Fit Study by Treatment (BMI Screening and Reporting) and Control (BMI Screening Only) Status

	Analytic Sample for the Impact of 1 Round of BMI Reporting (n= 9665; Baseline Years: Fall 2014 or Fall 2015)			Analytic Sample for the Impact of 2 Rounds of BMI Reporting (n = 2795; Baseline Year: Fall 2014)		
	Treatment Group: BMI Screening and Reporting (n = 4690)	Control Group: BMI Screening Only (n = 4975)	P^a for Difference Between Treatment and Control	Treatment Group: BMI Screening and Reporting (n = 1434)	Control Group: BMI Screening Only (n = 1361)	P^a for Difference Between Treatment and Control
Sex, n (%)						
Female	2266 (48.3)	2464 (49.5)	.23	700 (48.8)	679 (49.9)	.57
Male	2424 (51.7)	2511 (50.5)	.23	734 (51.2)	682 (50.1)	.57
Race and ethnicity, n (%)						
Black	147 (3.1)	426 (8.6)	<.001	17 (1.2)	75 (5.5)	<.001
Asian	940 (20.0)	584 (11.7)	<.001	525 (36.6)	275 (20.2)	<.001
Hispanic	2659 (56.7)	3155 (63.4)	<.001	692 (48.3)	822 (60.4)	<.001
White	796 (17.0)	721 (14.5)	<.001	152 (10.6)	163 (12.0)	.25
All other races and ethnicities	134 (2.9)	84 (1.7)	<.001	44 (3.0)	25 (1.8)	.04
Declined to state	14 (0.3)	5 (0.1)	.03	4 (0.3)	1 (0.1)	.20
School level, n (%)						
Elementary, 3^{rd}–5^{th}	2388 (50.9)	2259 (45.4)	<.001	768 (53.6)	652 (47.9)	.003
Middle, 6^{th}–8^{th}	2302 (49.1)	2716 (54.6)	<.001	666 (46.4)	709 (52.1)	.003
Grade level, n (%)						
4^{th}	1675 (35.7)	1547 (31.1)	<.001	484 (33.8)	469 (34.5)	.69
5^{th}	713 (15.2)	712 (14.3)	.22	284 (19.8)	183 (13.5)	<.001
6^{th}	1339 (28.6)	1639 (32.9)	<.001	666 (46.4)	709 (52.1)	.003
7^{th}	963 (20.5)	1077 (21.7)	.18	—	—	—
BMI Category, n (%)						
BMI <5^{th} percentile, underweight	169 (3.6)	134 (2.7)	.01	74 (5.2)	55 (4.0)	.16
BMI ≥5^{th} percentile and <85^{th} percentile, healthy weight	2673 (57.0)	2757 (55.4)	.12	853 (59.5)	756 (55.6)	.04
BMI ≥85^{th} percentile and <95^{th} percentile, at risk for overweight	838 (17.9)	966 (19.4)	.06	255 (17.8)	269 (19.8)	.18
BMI ≥95^{th} percentile, overweight	1010 (21.5)	1118 (22.5)	.27	252 (17.6)	281 (20.7)	.04

—, Estimates are unavailable because 7^{th} graders received only 1 year of BMI reporting.

[a] P values derived from t tests.

TABLE 3 Average Marginal Effects of BMI Screening and Reporting on the Accuracy of Children's Self-Reported BMI Category, Overall and by Subgroups

	After Exposure to 1 Round of BMI Reporting[a]			After Exposure to 2 Rounds of BMI Reporting		
	Predicted Probability of Accuracy if in Treatment Group (BMI Screening and Reporting) (95% CI)	Predicted Probability of Accuracy if in Control Group (BMI Screening only) (95% CI)	Average Marginal Effect (Treatment minus Control Difference in Predicted Probabilities) (95% CI)	Predicted Probability of Accuracy if in Treatment Group (BMI Screening and Reporting) (95% CI)	Predicted Probability of Accuracy if in Control Group (BMI Screening only) (95% CI)	Average Marginal Effect (Treatment minus ControlDifference in Predicted Probabilities) (95% CI)
All students	48.1 (47.2 to 49.0)	47.9 (46.8 to 49.0)	0.2 (−1.3 to 1.7)	54.2 (51.3 to 57.1)	50.3 (47.4 to 53.2)	3.9 (−0.7 to 8.5)
Sex						
Female	51.5 (50.1 to 52.9)	51.10 (49.4 to 52.8)	0.4 (−2.0 to 2.8)	57.0 (53.7 to 60.4)	53.7 (50.4 to 58.0)	3.3 (−1.9 to 8.6)
Male	44.9 (43.2 to 46.5)	44.7 (43.3 to 46.1)	0.1 (−2.3 to 2.5)	51.2 (48.2 to 54.2)	47.2 (43.2 to 51.1)	4.0 (−1.4 to 9.5)
Race and ethnicity						
Black	52.8 (46.9 to 58.7)	42.8 (39.9 to 45.8)	10.0** (2.6 to 17.4)	52.9 (39.8 to 66.1)	43.5 (36.7 to 50.3)	9.4 (−9.1 to 27.9)
Asian	53.9 (51.9 to 56.0)	55.4 (52.7 to 58.1)	−1.5 (−5.2 to 2.2)	62.4 (58.6 to 66.1)	55.8 (51.9 to 59.6)	6.6* (0.4 to 12.8)
Hispanic	45.5 (44.3 to 46.7)	44.8 (43.7 to 46.0)	0.6 (−1.1 to 2.4)	49.4 (46.6 to 52.3)	45.2 (41.5 to 49.0)	4.2 (−1.1 to 9.5)
White	51.9 (49.4 to 54.4)	54.0 (50.7 to 57.2)	−2.1 (−6.3 to 2.2)	57.2 (50.0 to 64.3)	59.0 (53.1 to 64.9)	−1.9 (−12.0 to 8.3)
Grade level						
4th	46.2 (44.5 to 47.9)	46.4 (44.8 to 48.1)	−0.2 (−2.6 to 2.1)	51.7 (46.4 to 57.2)	51.1 (46.2 to 56.0)	0.7 (−6.9 to 8.3)
5th	46.5 (43.5 to 49.5)	45.7 (41.6 to 49.9)	0.7 (−4.3 to 5.9)	58.2 (54.7 to 61.7)	47.1 (38.4 to 55.7)	11.1* (1.6 to 20.5)
6th	47.5 (44.5 to 50.6)	50.2 (48.6 to 51.8)	−2.6 (−6.7 to 1.5)	54.4 (50.8 to 58.1)	50.1 (47.2 to 53.0)	4.3 (−1.4 to 10.1)
7th	51.4 (47.7 to 55.1)	49.4 (45.5 to 53.2)	2.0 (−4.4 to 8.5)	—	—	—
BMI category						
BMI <5th percentile, underweight	74.3 (68.8 to 79.8)	65.39 (58.6 to 72.1)	8.9 (−0.5 to 18.1)	88.0 (78.8 to 97.3)	70.9 (62.2 to 79.7)	17.1* (2.7 to 31.6)
BMI ≥5th percentile and <85th percentile, healthy wt	64.8 (63.0 to 66.2)	63.3 (61.8 to 64.9)	1.2 (−1.1 to 3.6)	67.8 (64.7 to 70.9)	63.6 (60.5 to 66.7)	4.2 (−0.7 to 9.1)
BMI ≥85th percentile and <95th percentile, at risk for overweight	33.6 (30.6 to 36.6)	37.5 (35.2 to 39.8)	−3.9 (−7.9 to 0.2)	41.9 (35.8 to 48.0)	42.2 (35.1 to 49.4)	−0.4 (−11.1 to 10.4)
BMI ≥ 95th percentile, overweight	14.7 (12.3 to 17.2)	14.3 (12.1 to 16.4)	0.5 (−3.0 to 3.9)	16.6 (13.3 to 20.0)	12.9 (10.1 to 15.6)	3.8 (−0.8 to 8.4)

—, Children were enrolled in the study through the eighth grade; therefore, treatment group students who were in seventh grade at baseline only received 1 year of BMI reporting. $^{**}P < .01$; $^{*}P < .05$.

[a] Results based on multinomial logistic regression models that were adjusted, when applicable, for district and student-level factors (sex, race and ethnicity, baseline BMI category, grade) and school-level characteristics (proportion of students who qualify for free or reduced-price meals), accounting for clustering by school.

difference in the proportion of white students and fourth graders between treatment and control groups.

Main Results

We found no impact of BMI reporting on children's self-reported accuracy in the overall sample after 1 round (average marginal effect [AME]: 0.2; 95% confidence interval [CI]: −1.3 to 1.7, $P = .82$) or 2 rounds (AME: 3.9; 95% CI: −0.7 to 8.5, $P = .09$) of BMI reporting. Through our exploratory subgroup analyses, we detected statistically significant associations within subgroups by race, grade levels, and BMI categories. As shown in Table 3, for Black children, exposure to 1 round of BMI reporting was related to a 10.0 percentage point (95% CI: 2.6 to 17.4, $P = .008$) increase in accuracy. However, there was no association after exposure to 2 consecutive rounds of BMI reporting, each a year apart (AME: 9.4; 95% CI: −9.1 to 27.9, $P = .32$). On the other hand, for Asian children, exposure to 2 consecutive rounds of BMI reporting was associated with a 6.6 percentage point (95% CI: 0.4 to 12.8, $P = .04$) increase in accuracy. Finally, 5^{th} graders had a higher probability of accurate weight estimation after 2 rounds of BMI reporting (AME: 11.1; 95% CI: 1.6 to 20.5, $P = .02$) as well as those with BMI $<5^{th}$ percentile (AME: 17.1; 95% CI: 2.7 to 31.6, $P = .02$).

DISCUSSION

The accuracy of children's weight perceptions is 1 factor among a set of complex and interdependent influences at the individual, family, community, and societal levels that has been shown to be linked to children's weight control behaviors, particularly among children with overweight or obesity.[4,5,26] In this follow-up study to the Fit Study, a large-scale randomized controlled trial to evaluate BMI measurement and reporting, we found that BMI reporting did not improve the accuracy of children's weight perceptions, including those with overweight or obesity. Our exploratory subgroup analyses show that several subgroups became more accurate in their weight self-perceptions: Black children (after exposure to 1 round of BMI reporting) as well as Asian children, fifth graders, and those with BMI $<5^{th}$ percentile (after exposure to 2 rounds of BMI reporting). Given that these subgroup findings are exploratory, future prospective studies that are theoretically grounded can be designed to confirm these results and to also establish whether accuracy influences their weight and weight-related outcomes. Further, studies that focus on specific racial and ethnic groups can assess whether there is an interplay between BMI notification and socially constructed ideals and norms about weight experienced by certain racial and ethnic groups that helps drive specific groups to have greater perception accuracy. Finally, additional effects that could be further examined include whether the direction of the shift in weight perceptions of children in particular weight categories influence dietary practices. For example, analyses can investigate whether underweight children in fifth grade who believe they were normal weight and became more accurate in their weight perceptions adopt less healthy dietary practices to "bulk up."

Although school-based BMI screening is an important tool for surveillance purposes,[27] BMI screening and reporting have been shown to have no impact on BMI[11,28] and the present results may help elucidate 1 mechanism for why no effects have been found. In theory, weight perception can serve as a potential antecedent to behavioral changes in diet and exercise; yet, without increasing perception accuracy, BMI reporting may not have changed children's behaviors sufficiently enough to lead to lower BMI.

Despite evidence that BMI reporting has no effect on either BMI or weight self-perception accuracy, schools are likely to continue to measure children's BMI and share such information with parents. Given this, the CDC promotes safeguards to ensure that notifications are nonstigmatizing, actionable, and accessible, both in terms of reading level and language.[29] Notifications should also be designed in the context of cultural norms and values.[30] Lastly, given concerns about widening existing health disparities over the course of the coronavirus disease 2019 pandemic, including increases to BMI percentile,[31–33] schools and districts that already conduct BMI measurement programs may find it valuable to continue collecting height and weight data to better understand how coronavirus disease 2019 disrupted childhood obesity prevalence.

Limitations

These results are specific to California schools in the Fit Study and may not hold in other state contexts. Additionally, our subgroup findings are exploratory rather than confirmatory and because of multiple hypothesis testing, these findings are subject to an inflated Type I error rate. Also, students were surveyed 6 to 9 months after they participated in BMI assessment, and we assumed that their measured BMI category remained stable between the assessment and survey. Finally, those receiving 1 versus 2 rounds of BMI reporting represent different subsamples that are demographically distinct. Notably, a higher proportion of Asian children received 2 rounds (29%) versus 1 (16%), and a lower proportion of Black and Hispanic children received 2 rounds versus 1 (3% versus 6% and 54% versus 60%, respectively). These differences limit our ability to directly compare the efficacy of 1 versus 2 rounds of BMI reporting within the same group of children.

CONCLUSIONS

In this follow-up study to the Fit Study, we found that BMI reporting did not improve the accuracy of children's perceived weight status, a finding that offers additional insight into why BMI reports sent home to parents, as a behavior change strategy, may have had no impact on children's BMI. Despite the lack of impact on both BMI and the accuracy of weight self-perceptions, BMI information gathered and reported at the aggregate level can be used to understand patterns and trends in overweight and obesity and to also help target interventions to schools who can most benefit from evidence-based[34] multipronged approaches.

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