

## PEDIATRIC ORIGINAL ARTICLE

## Is obesity associated with reduced health-related quality of life in Latino, black and white children in the community?

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**OBJECTIVE:** Few studies have examined the impact of obesity on health-related quality of life (HRQOL) in non-clinical community samples of children, and methodological limitations have hindered drawing firm conclusions, especially whether the impact is similar across racial/ethnic groups. The present aims were to examine at what levels of non-normal weight, school-aged children experience lower HRQOL and whether this differs among racial/ethnic groups, when controlling for socioeconomic status (SES) differences.

**DESIGN:** Cross-sectional community cohort survey.

**SUBJECTS AND METHODS:** Data are from the Healthy Passages, reporting on 4824 Latino, black and white 5th graders in a population-based survey conducted in three United States metropolitan areas. Children's weight status was classified from measured weight and height into underweight (1%), normal weight (52%), overweight (19%), obese (13%) and extremely obese (14%). Children reported their own HRQOL using the Pediatric Quality of Life Inventory and additional scales addressing global self-worth, physical appearance and body satisfaction. Parents reported children's overall health status.

**RESULTS:** Each increment in higher non-healthy weight class—overweight to obese to extremely obese—was associated with significantly lower scores in more domains of psychosocial HRQOL compared with that in normal weight. However, only extremely obese children reported significantly lower physical HRQOL. Differences among weight classes remained when adjusting for SES and were independent of race/ethnicity. Underweight children generally reported HRQOL that was not significantly different from normal weight children.

**CONCLUSIONS:** Overweight, obese and extremely obese 5th graders on average experience worse HRQOL than normal weight children, especially in psychosocial domains including self-worth and peer relationships, regardless of race/ethnicity. If messages can be conveyed in a sensitive and supportive manner, the desire to improve HRQOL could provide additional motivation for children and their parents in addressing unhealthy weight.

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## INTRODUCTION

The prevalence and severity of obesity in children have increased dramatically in recent decades.<sup>1,2</sup> Among 6–11-year olds, 36% are at least overweight, including 20% who are obese,<sup>3</sup> based on standard classifications.<sup>4</sup> The category of 'extremely obese' (variously defined, but at least  $\geq 97$ th percentile) now applies to about 15% of 6–11 year olds,<sup>3</sup> and has begun to be distinguished from 'obese' for research purposes.<sup>5</sup> Obese children experience a variety of both immediate and long-term physical health consequences;<sup>6</sup> these consequences are generally even more marked for those with extreme obesity.<sup>7</sup> Recent studies have also examined the impact of childhood obesity beyond physical morbidities, reflecting the definition that health is 'a complete state of physical, mental and social well-being, not merely the absence of disease'.<sup>8</sup>

In this vein, the most prevalent and immediate consequence of obesity in childhood may be its impact on health-related quality of life (HRQOL).<sup>9,10</sup> HRQOL is a comprehensive, multidimensional construct encompassing physical and psychosocial well-being.<sup>11</sup> For children, physical HRQOL addresses both the presence of

general ailments and the ability to engage in the physical activities of childhood. Psychosocial HRQOL includes emotional well-being, social integration and role functioning.<sup>12</sup>

Early studies that examined clinical samples with a high prevalence of extreme obesity found them to have a significantly lower HRQOL, comparable to that of children treated for cancer<sup>13</sup> and lower than for children with cystic fibrosis, epilepsy and type 1 diabetes.<sup>14</sup> Systematic reviews have concluded that body mass index (BMI) is inversely associated with HRQOL, but have not identified the non-normal weight categories for which lower HRQOL is present.<sup>9,10</sup> A limitation with these reviews is that they have combined clinical and population sample studies and studies conducted in various countries. Obesity is particularly prevalent in children in the United States, yet, we are aware of only two population sample studies of children there that have examined the association between weight class and HRQOL. One found that lower HRQOL was present in obese but not in overweight children;<sup>15</sup> by contrast, the other found that both overweight and obese children had lower physical HRQOL, in terms of overall

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health status (OHS) and physical limitations, but not in psychosocial domains.<sup>16</sup>

In addition to these inconsistent findings, methodological issues impede generalizing from these studies. For example, child weight class was based on parent report in the former study,<sup>15</sup> rather than on measured weight and height. In the latter study,<sup>16</sup> HRQOL was measured with *ad-hoc* rather than standard scales, making comparisons to other groups of children difficult.<sup>14</sup> This study also included a very broad age range of adolescents (12–20 years of age) without considering possible developmental differences. This limitation also raises the question whether HRQOL is affected by obesity already prior to reaching adolescence.

Therefore, it remains quite unclear whether HRQOL is lower in all categories of non-normal weight status among United States children or whether negative effects are primarily seen in extremely obese children and/or those in treatment for obesity rather than in obese or overweight children.<sup>13</sup> Moreover, little research has addressed the HRQOL of children with very low BMI (for example, <5th percentile), who may be considered underweight. Two United States population studies reported that the HRQOL of underweight youth generally was no different from those with normal weight,<sup>15,16</sup> but the same methodological limitations as noted above constrain drawing firm conclusions.

The distribution of weight differs among racial/ethnic groups, such that among 6–11-year-olds, 23% of Latino and 22% black children are obese, compared with 18% of white children<sup>2,4</sup> in the United States. This disparity is even more marked in the extremely obese category.<sup>1</sup> However, we are aware of only one population study that examined the relationship between the full range of weight classification and HRQOL in a mixed racial/ethnic sample.<sup>16</sup> This study reported an interaction between black vs white race/ethnicity and weight class for only one HRQOL domain, functional limitations. However, this study, as noted previously, included a broad age range of adolescents, measured HRQOL with *ad hoc* rather than standard instruments and excluded Latinos from this analysis.

Consequently, further research is needed to examine racial/ethnic disparities in the association between weight status and HRQOL. Moreover, because children in lower socioeconomic (SES) families have a higher prevalence of obesity<sup>17</sup> and experience disparities across a range of outcomes,<sup>18,19</sup> this association must be examined with appropriate adjustment for SES. Given that obesity has a high prevalence already prior to adolescence,<sup>2</sup> it is important to examine whether any deleterious effects on HRQOL may be present at younger ages.

The aims of our research are thus to examine in a community sample of 5th grade children whether: (1) lower HRQOL is experienced by obese and overweight compared with normal weight children or only among extremely obese children; (2) underweight children experience lower HRQOL compared with normal weight children; (3) the association between weight status and HRQOL remains when adjusting for SES and race/ethnicity and (4) this association is different among black, Latino and white children. We extend the measurement of HRQOL beyond a widely used standard HRQOL instrument also to include measurement of general and body-specific self-perceptions and parent-reported general health status.

## SUBJECTS AND METHODS

### Participants

The Healthy Passages study Wave I provided data for this analysis.<sup>20</sup> The sample frame included 5th graders at public schools with ≥25 students enrolled in regular classrooms in districts in and around Birmingham, AL, Los Angeles County, CA, and Houston, TX. To ensure adequate sample sizes of Latino, non-Latino black and non-Latino white students, we took a random sample of schools with probabilities designed

to provide a balanced sample across these racial/ethnic groups (described elsewhere).<sup>20</sup> Information was disseminated to the 5th grade children in the 118 selected schools (11 532 students) to bring to their parents or caregivers (henceforth, 'parents'). The parents of 6663 agreed to be contacted, and 5147 (77%) of their children participated. Exclusion criteria included not attending a regular academic classroom or having a parent who could not complete interviews in English or Spanish. The 6% who were not identified as being Latino, black or white (see details below) were eliminated from the current analysis, resulting in 4824 in the final sample with the unweighted distribution of 38% Latino, 36% black and 26% white and child age  $M=11.12$  ( $s.d.=0.56$ ). Additional demographics are provided in Table 1.

### Procedures

Following standard procedures approved by the Institutional Review Boards at the participating sites, two trained interviewers met the child and parent at their home, the university or an agreed-upon community location. The parent provided signed informed consent and the child signed assent. The parent could choose whether research material would be presented to her/him in English or Spanish. The interviews were conducted with the child and parent separately in private spaces.

### Measures

All Cronbach's  $\alpha$  reliabilities provided here are for the present sample.

Body mass index calculations were based on weight and standing height obtained according to standard anthropometric protocols<sup>21</sup> by trained interviewers. Height was measured with the participant in bare feet or socks and to the nearest millimeter using a portable stadiometer. Weight was measured to the nearest 0.1 kg using a Tanita electronic digital scale (Tanita Corp. of America, Inc., Arlington Heights, IL, USA). Calibration of the scale was checked regularly. Two independent measurements were taken for each participant; if these differed by ≥0.5 cm for height or ≥0.2 kg for weight, a third measurement was taken. The two measurements of height and of weight closest in agreement were averaged and used to calculate BMI (weight (kg)/height (meters)<sup>2</sup>).

**Table 1.** Sample characteristics

	Raw n	Weighted % <sup>a</sup>
<i>Child's age (years)</i>		
≤10	2113	42
11	2333	50
≥12	342	8
<i>Child's gender</i>		
Female	2446	49
Male	2378	51
<i>Child's race/ethnicity</i>		
Latino	1813	47
Black	1755	30
White	1256	23
<i>Highest education by parent</i>		
<9th grade	677	19
Some high school	537	13
High school graduate	939	21
Some college or 2-year. degree	1272	24
Bachelor degree	760	14
>Bachelor degree	532	9
<i>Child weight classification</i>		
Normal weight	2363	53
Underweight	65	1
Overweight	847	19
Obese	571	13
Extremely obese	620	14

Note:  $n=4824$ . <sup>a</sup>Calculated with weights to reflect sampling design.

Weight class was based on sex-specific distributions of children's BMI by age (months), published by the (United States) Centers for Disease Control and Prevention in 2000<sup>22</sup> and defined as: underweight <5th percentile, normal weight = 5th–84.99th percentile, overweight = 85th–94.99th percentile, obese = 95th–97.99th percentile and extremely obese  $\geq$ 98th percentile (this definition of extremely obese was chosen to retain a reasonable proportion in the obese class).

Health-related quality of life (HRQOL) was measured with the self-report form of the Pediatric Quality of Life Inventory Version 4.0 (PedsQL), a widely used, well-validated measure of children's HRQOL.<sup>23</sup> For example, the PedsQL demonstrated good construct validity when healthy children reported significantly better HRQOL in all domains than their chronically ill peers.<sup>12</sup> The PedsQL provides six scores: subscale scores for physical (8 items,  $\alpha = 0.72$ ), emotional (5 items,  $\alpha = 0.71$ ), social (5 items,  $\alpha = 0.76$ ) and school (5 items,  $\alpha = 0.66$ ) HRQOL as well as a composite psychosocial HRQOL (15 items,  $\alpha = 0.84$ ) score based on the last three subscales, and a total HRQOL (23 items,  $\alpha = 0.87$ ) score based on all items. This hierarchical scale structure has been replicated across racial/ethnic groups.<sup>24</sup> Each item asks how much a certain behavior has been a problem in the past month. Answers are reported on a 5-point scale (0 = never a problem, 4 = almost always a problem), but scale scores are calculated such that a higher score indicates better HRQOL.

This standard HRQOL measure was complemented by measures of self-perception. The global self-worth subscale (six items,  $\alpha = 0.70$ ) of the Self-Perception Profile (SPP) is a measure of general self-perception.<sup>25</sup> Construct validity is supported, for example, by substantial differences in scores between healthy children and children with depression and anxiety problems.<sup>26</sup> For each item, children are asked which of two contrasting descriptions best fits them (for example, 'some kids like the kind of person they are, other kids often wish they were someone else') and how much (sort of true, really true). The physical appearance subscale (six items,  $\alpha = 0.65$ ) of the Self-Perception Profile is commonly used to measure satisfaction with physical appearance.<sup>25</sup> Construct validity is supported, for example, by finding expected differences among normal weight, overweight and obese children.<sup>27</sup> Items ask how well descriptions about physical appearance apply, using the same format as for the global self-worth subscale. Higher scores on both subscales indicate more positive self-perceptions.

Body satisfaction was measured by presenting children with a set of drawings of seven same-sex children representing graduated sizes, from very thin to overweight.<sup>28</sup> Children are asked first which body they think a boy or girl of their age should look like, and next which looks most like them. The absolute difference between the ordered sizes of the two bodies chosen was classified into 0, 1 and 2 or more. To maintain consistency in higher scores representing better outcomes across all measures, this value was subtracted from 2, such that a higher score indicates higher body satisfaction. Studies support this instrument producing a valid measure of body satisfaction,<sup>29</sup> children estimate their body size accurately,<sup>30</sup> and test-retest reliability for children as young as 8 years is high.<sup>31</sup>

Overall health status was reported by the parent using the single item: 'In general, would you say your child's health is...' with a 5-point response scale (0 = poor, 4 = excellent). An association has been demonstrated between parents' perception of children's health status and children's actual health.<sup>32</sup> Findings from the use of this item in child health surveys have

been consistent with theoretical expectations and support its validity as a measure of OHS.<sup>33,34</sup> Herein, a higher score indicates better health status.

Socioeconomic status (SES) was indexed with the participating parent's highest level of education completed, because it is the most stable indicator of SES,<sup>35</sup> and is considered best for use with members of racial/ethnic minority groups, who do not receive the same financial gains for equivalent years of education as do whites.<sup>36,37</sup> Six categories reflected highest education completed (<9th grade to >Bachelor degree).

Additional sociodemographic variables were measured by parent report on standard items. Specifically for race/ethnicity, the parent was asked which one or more of seven racial/ethnic categories describe the child. The child was classified as Latino if so indicated regardless of other racial/ethnic indications. Children not categorized as Latino were classified as black, white or other.

## Data analysis

All analyses were performed using the SPSS Complex Sampling module (IBM Corp., Armonk, NY, USA) with weighted data to adjust for the complex survey design and account for the effects of design and non-response weights, clustering of children within schools and stratification by site, as detailed elsewhere.<sup>19</sup> The distribution of all model residuals adequately conformed to the assumptions for the general linear model, which was applied to each outcome measure as follows: aims 1 and 2 were addressed by specifying an unadjusted model including only the main effect for weight. Aim 3 was examined with an adjusted model including SES and race/ethnicity in addition to weight classification. Aim 4 was examined by adding to this adjusted model all interactions between race/ethnicity and weight class. In addition to considering differences between weight classes in HRQOL in this manner, the linear associations between continuously distributed weight status, indicated by BMI percentile, and each HRQOL measure were explored using the Pearson correlation. Statistical significance in all analyses was set at  $P < 0.05$ .

## RESULTS

The mean BMI for the total sample was 21.11 (s.e. = 0.13) with the following distribution across weight classes: 1% underweight (mean BMI = 13.73), 53% normal weight (mean BMI = 17.54), 19% overweight (mean BMI = 21.61), 13% obese (mean BMI = 26.64) and 14% extremely obese (mean BMI = 30.66).

### Aims 1 and 2: unadjusted associations between weight class and HRQOL

Overweight, obese and extremely obese children reported significantly worse emotional HRQOL, global self-worth, physical appearance and body dissatisfaction compared with normal weight children (Table 2 shows the means and Table 3 shows unadjusted regression analysis in the upper panel). Moreover, parents reported worse OHS for children in these three weight classes. Obese and extremely obese children in addition reported significantly worse total, psychosocial and social HRQOL compared with normal weight children. Only extremely obese children

**Table 2.** Comparison of unadjusted means for HRQOL measures by weight classification

HRQOL Measure (scale range)	Normal weight <sup>a</sup> (n = 2363)	Underweight (n = 65)	Overweight (n = 847)	Obese (n = 571)	Extremely obese (n = 620)
Total HRQOL (0–100)	78.37	76.72 (0.364)	77.18 (0.143)	<b>76.60</b> (0.006)	<b>75.61</b> (<0.001)
Physical HRQOL (0–100)	84.56	84.65 (0.091)	83.52 (0.205)	84.15 (0.491)	<b>82.38</b> (0.003)
Psychosocial HRQOL (0–100)	75.06	72.49 (0.228)	73.79 (0.143)	<b>72.57</b> (0.001)	<b>71.99</b> (<0.001)
Emotional HRQOL (0–100)	70.99	66.47 (0.129)	<b>69.02</b> (0.028)	<b>68.95</b> (0.035)	<b>68.66</b> (0.015)
Social HRQOL (0–100)	79.61	75.76 (0.133)	78.42 (0.325)	<b>75.87</b> (0.001)	<b>73.76</b> (<0.001)
School HRQOL (0–100)	74.59	75.23 (0.767)	73.94 (0.459)	72.90 (0.079)	73.56 (0.234)
Global self-worth (4–24)	19.74	19.83 (0.851)	<b>19.34</b> (0.019)	<b>19.07</b> (0.002)	<b>18.65</b> (<0.001)
Physical appearance (4–24)	18.46	18.56 (0.839)	<b>17.39</b> (<0.001)	<b>16.92</b> (<0.001)	<b>16.42</b> (<0.001)
Body satisfaction (0–2)	1.57	<b>1.31</b> (0.004)	<b>1.46</b> (<0.001)	<b>1.25</b> (<0.001)	<b>0.89</b> (<0.001)
Overall health status (0–4)	2.09	2.06 (0.794)	<b>2.00</b> (0.039)	<b>1.74</b> (<0.001)	<b>1.51</b> (<0.001)

Abbreviation: HRQOL, health-related quality of life. Note: P-values are in parentheses. Values in bold indicate significantly ( $P < 0.05$ ) poorer outcome than normal weight. Higher score indicates better outcome for all measures. <sup>a</sup>Normal weight is the reference category for mean comparisons.

**Table 3.** Unadjusted and adjusted unstandardized regression coefficients for weight class predicting HRQOL measures

Weight class	HRQOL measures <sup>a</sup>									
	Total HRQOL	Physical HRQOL	Psychosocial HRQOL	Emotional HRQOL	Social HRQOL	School HRQOL	Global self worth	Physical appearance	Body satisfaction	Overall health status
	Unadjusted model									
Normal weight <sup>b</sup>	-1.50 (1.81)	-0.01 (1.65)	-2.30 (2.12)	-3.90 (3.06)	-4.10 (2.45)	1.09 (2.07)	0.54 (0.45)	-0.04 (0.50)	-0.35*** (0.10)	-0.03 (0.13)
Underweight	-1.20 (0.80)	-1.10 (0.81)	-1.25 (0.86)	-2.04* (0.90)	-1.24 (1.21)	-0.46 (0.84)	-0.52** (0.18)	-1.03*** (0.16)	-0.11*** (0.03)	-0.09*** (0.04)
Overweight	-1.74** (0.62)	-0.48 (0.58)	-2.41** (0.73)	-1.99* (0.95)	-3.67*** (1.03)	-1.57 (0.94)	-0.78** (0.21)	-1.40*** (0.21)	-0.33*** (0.03)	-0.35*** (0.05)
Extremely obese	-2.80*** (0.65)	-2.25** (0.70)	-3.09*** (0.76)	-2.49* (0.95)	-5.97*** (1.02)	-0.82 (0.85)	-1.31*** (0.21)	-2.11*** (0.22)	-0.69*** (0.04)	-0.58*** (0.06)
	Adjusted (for race/ethnicity and SES) model									
Normal weight <sup>b</sup>	-2.31 (1.80)	-0.86 (1.69)	-3.09 (2.08)	-4.48 (2.91)	-5.02* (2.43)	0.25 (2.07)	0.27 (0.46)	-0.07 (0.48)	-0.36*** (0.10)	-0.07 (0.11)
Underweight	-0.99 (0.82)	-0.95 (0.86)	-1.01 (0.86)	-1.86* (0.91)	-0.91 (1.16)	-0.26 (0.88)	-0.38* (0.17)	-0.98*** (0.15)	-0.11*** (0.03)	-0.03 (0.04)
Overweight	-1.26* (0.60)	0.06 (0.60)	-1.97** (0.70)	-1.45 (0.90)	-3.32** (1.02)	-1.12 (0.94)	-0.60** (0.22)	-1.30*** (0.21)	-0.32*** (0.03)	-0.29*** (0.05)
Obese	-1.97** (0.61)	-1.52* (0.70)	-2.20** (0.73)	-1.65 (0.92)	-5.15*** (1.00)	0.19 (0.85)	-1.00*** (0.21)	-1.93*** (0.21)	-0.66*** (0.04)	-0.44*** (0.05)
Extremely obese	1.77*** (0.31)	1.17** (0.36)	2.08*** (0.32)	1.97*** (0.39)	2.17*** (0.40)	2.12*** (0.39)	0.57*** (0.08)	0.42*** (0.08)	0.04*** (0.01)	0.21*** (0.20)
White <sup>b</sup>	-1.40 (0.92)	-2.64** (0.98)	-0.74 (1.01)	-0.51 (1.34)	-0.37 (1.34)	-1.34 (0.97)	-1.00*** (0.24)	-0.72** (0.24)	-0.06 (0.04)	-0.50*** (0.05)
Latino	-2.15** (0.71)	2.05*** (0.60)	-2.21* (0.86)	-0.94 (1.00)	-2.23* (1.07)	3.46*** (0.97)	0.92*** (0.16)	0.06 (0.21)	-0.05 (0.03)	-0.30*** (0.04)
Black										

Abbreviations: HRQOL, health-related quality of life; SES, socioeconomic status. Note: Values in parentheses are standard errors. \* $P < 0.05$ . \*\* $P < 0.01$ . \*\*\* $P < 0.001$ . <sup>a</sup>Higher score indicates better outcome.

<sup>b</sup>Reference category. <sup>c</sup>Reference value = mean.

reported significantly worse physical HRQOL. Underweight only differed significantly from normal weight children in reporting worse body satisfaction.

**Aim 3: adjusted associations between weight class and HRQOL**

All of the differences reported above between weight classes remained after adjusting for SES and race/ethnicity (see Table 3 showing adjusted regression analysis in the lower panel), with one exception: obese and extremely obese children no longer reported worse emotional HRQOL compared with normal weight children. Although not a focus in this study, Table 3 (bottom panel) also indicates that beyond the contributions from weight class, worse HRQOL is significantly associated with lower SES across all measures, controlling for race/ethnicity. Moreover, black and Latino children had significantly worse HRQOL than white children for five and four of the 10 outcome measures, respectively. At the same time, black children reported significantly better physical and school HRQOL than white children.

**Aim 4: race/ethnic differential associations between weight class and HRQOL**

As only two interactions of 150 tested interactions (involving five weight classes and three racial/ethnic groups for each of 10 outcomes) were statistically significant, they are likely spurious and not reported here.

Linear association between continuous weight status and HRQOL  
 Correlations between BMI percentile and HRQOL measures were all significantly different from zero, yet small in absolute size; only three correlations exceeded  $r = 0.10$ : BMI percentile with physical appearance  $r = 0.17$ , body satisfaction  $r = 0.15$  and OHS  $r = 0.17$ .

**DISCUSSION**

Overweight, obese and extremely obese children in this study experienced significantly worse HRQOL in multiple domains compared with normal weight children. Each sequentially higher non-healthy weight class was associated with significantly worse HRQOL across more domains. Obese and extremely obese children experienced worse HRQOL across a broad range of life domains, including emotional well-being, social relations, self-esteem and perceptions regarding body and appearance. However, only extremely obese children reported significantly lower physical functioning than normal weight children. Overweight children also reported a lower HRQOL than normal weight children, albeit to a lesser extent and in fewer domains. In addition, parents reported their overweight, obese and extremely obese children with worse OHS compared with normal weight children. Functioning in the school domain, at least by child-report, was not related to weight status. Although it is important to keep in mind that findings regarding underweight were based on a small subsample (1%,  $n = 65$ ), underweight children experienced HRQOL in most respects that was not significantly different from that of normal weight children, the exception being greater dissatisfaction with their bodies.

The observed lower HRQOL in obese children remained, except for emotional well-being, when controlling for SES and being non-white, characteristics that are also known to be associated with lower HRQOL.<sup>19,38</sup> Moreover, no significant disparities were found in the association between weight status and HRQOL among the three racial/ethnic groups or along the SES range. This is the first study that demonstrates that the association between obesity and HRQOL exists across the SES spectrum and for the three largest racial/ethnic groups in the United States.

Our findings suggest a pattern where there is lower HRQOL at each higher weight class. Additional domains of HRQOL,

particularly psychosocial domains, appear to be negatively affected as children have an increasingly non-healthy BMI. This is in contrast to previous United States child population studies that had found a more limited association between obesity and HRQOL, either that a lower HRQOL was observed only for the obese and not overweight class<sup>15</sup> or only in physical and not psychosocial domains.<sup>16</sup> Methodological differences between our study and previous United States population studies of obese children<sup>15,16</sup> may partially explain the different findings. Unlike previous studies, our study measured children's weight and height directly, employed standard HRQOL scales and enrolled Latino in addition to black and white children. The HRQOL reported by obese children in the present study is comparable to that reported by children with other chronic diseases.<sup>39</sup>

There are several limitations of this research. As this study examined only 5th graders located in three geographic regions, our findings might not be generalizable. The Latino participants in this study reside primarily in the Houston and Los Angeles areas and therefore primarily represent a heritage from Mexico and other countries in Central America. All but one of the measures of HRQOL was based on child report. Corroborating such self-report with other reports would be valuable.<sup>11</sup> The observational design prevents us from examining causal effects of variation in BMI on HRQOL. It would be informative if HRQOL could be examined in more controlled studies, such as in randomized controlled trials for obese children.

Our findings indicate that children with an unhealthy BMI experience worse HRQOL across multiple life domains already at a quite young age of 10–11 years. These impairments in their experience of life are likely to continue due to the intractability of obesity. These realities underscore the importance of conducting research to find effective ways to address problematic BMI early in life through interventions in at-risk children as well as universal obesity prevention programs. Such efforts, while possibly reducing the risk for physical health consequences in the long run, may well have more immediate effects on the HRQOL of children, including improved emotional well-being, social functioning, self-esteem, physical abilities and satisfaction with appearance. If messages can be conveyed in a sensitive and supportive manner, the desire to improve HRQOL could provide additional motivation for children and their parents in addressing unhealthy weight.

## CONFLICT OF INTEREST

The authors declare no conflict of interest.

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## DISCLAIMER

The findings and conclusions in this report are those of the authors and do not necessarily represent the official position of the CDC.

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