The association between chronic bullying victimization with weight status and body self-image: a cross-national study in 39 countries

Qiguo Lian 1, 2, Qiru Su 3, Ruili Li 4, Frank J Elgar 5, Zhibao Liu 6, Dongpeng Zheng Corresp. 7

1 Key Lab. of Reproduction Regulation of NPFPC, SIPPR, IRD, Fudan University, Shanghai, China
2 School of Public Health, Fudan University, Shanghai, China
3 National Immunization Program, Chinese Center for Disease Control and Prevention, Beijing, China
4 Children Health and Development Department, Capital Institute of Paediatrics, Beijing, China
5 Institute for Health and Social Policy, McGill University, Montreal, Canada
6 Institute for Health Education, Jiangsu Provincial Center for Disease Control and Prevention, Jiangsu, China
7 Huajing Community Health Service Center, Shanghai, China

Corresponding Author: Dongpeng Zheng
Email address: Dongpeng.Zheng@huajing.org.cn

Background: Childhood obesity and school bullying are pervasive public health issues and known to co-occur in adolescents. However, the association between underweight or thinness and chronic bullying victimization is unclear. The current study examined whether chronic bullying victimization is associated with weight status and body self-image.

Methods: A school-based, cross-sectional study in 39 North American and European countries and regions was conducted. A total of 213,595 adolescents aged 11, 13, and 15 years were surveyed in 2009/10. Chronic bullying victimization was identified using the Revised Olweus Bully/Victim Questionnaire. Weight status was determined using self-reported height and weight and the body mass index (BMI), and body self-image was based on perceived weight. We tested associations between underweight and bullying victimization using three-level logistic regression models.

Results: Of the 213,595 adolescents investigated, 11.28% adolescents reported chronic bullying victimization, 14.80% were classified as overweight/obese according to age- and sex-specific BMI criteria, 12.97% were underweight, and 28.36% considered themselves a little bit fat or too fat, 14.57% were too thin. Bullying victimization was less common in older adolescent boys and girls. Weight status was associated with chronic bullying victimization (adjusted OR underweight = 1.10, 95% CI = 1.05-1.16, p = 0.002; adjusted OR overweight = 1.40, 95% CI = 1.32-1.49, p < 0.0001; adjusted OR obese = 1.91, 95% CI = 1.71-2.14, p < 0.0001). Body self-image also related to chronic bullying victimization (adjusted OR too thin = 1.42, 95% CI = 1.36-1.49, p < 0.0001; adjusted OR little bit fat = 1.54, 95% CI = 1.48-1.61, p < 0.0001; adjusted OR too fat = 3.30, 95% CI = 2.96-3.68, p < 0.0001).

Conclusions: Both perceived weight and self-rated overweight are associated with chronic bullying victimization. Both overweight and underweight children are at risk of being chronically bullied.
The association between chronic bullying victimization with weight status and body self-image: a cross-national study in 39 countries

Qiguó Lian ¹,² MD, Qíru Su ³ MD, Ruílí Li ⁴ MD, Frank J Elgar ⁵ Ph.D., Zhiháo Liu ⁶ MD, Dongpēng Zhèng ⁷ MD

¹ Key Lab. of Reproduction Regulation of NPFPC, SIPPR, IRD, Fudan University, Shanghai, China
² School of Public Health, Fudan University, Shanghai, China
³ National Immunization Program, Chinese Center for Disease Control and Prevention, Beijing, China
⁴ Children Health and Development Department, Capital Institute of Paediatrics, Beijing, China
⁵ Institute for Health and Social Policy, McGill University, Montreal, Canada
⁶ Institute for Health Education, Jiangsu Provincial Center for Disease Control and Prevention, Jiangsu, China
⁷ Huajing Community Health Service Center, Xuhui District, Shanghai, China

Correspondence Author:
Dongpeng Zheng
Huajing Community Health Service Center
180 Jianhua Road, Xuhui District, Shanghai, China, 200231
Email: Dongpeng.Zheng@huajing.org.cn
Telephone: 8621-6496-0088
Abstract

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Conclusions: Both perceived weight and self-rated overweight are associated with chronic bullying victimization. Both overweight and underweight children are at risk of being chronically bullied.
Introduction

School bullying is widely considered to be a public health concern for children and adolescents. Bullying victimization has been found to be a common adverse life event in young people worldwide (Anthony et al. 2010; Bowes et al. 2013). According to Dan Olweus, bullying is defined as intentional harmful behavior, carried out repeatedly, against an individual who is unable to defend themselves (Olweus 2013). Based on this definition, the Health Behavior in School-aged Children (HBSC) study found that 45.2% of boys and 35.8% of girls in 40 countries were exposed to bullying (Craig et al. 2009).

The predictors of bullying victimization include individual, family and school factors (Jeong et al. 2013). Children who are overweight/obese, with low self-esteem, come from low socioeconomic households, have few friends and experienced child abuse are more likely to be bullied (Fanti & Henrich 2015; Shetgiri 2013; Tippett & Wolke 2014). Some personal characteristics including internalizing problems (depression, anxiety) could increase the risk for victimization (Shetgiri 2013). Living in a two-parent family with high parental support and positive adult role models can protect against bullying perpetration (Tippett & Wolke 2014). Besides, a positive school climate including adult support and peer support in school predicts within-class reduction of bullying (Gage et al. 2014).

The published evidence shows short- and long-term adverse consequences for the victims of school bullying. Compared to their peers, victims are at higher risk of a wide range of harmful effects, such as loneliness, anxiety, depression and low self-esteem (Ranta et al. 2009; Stapinski et al. 2015). There is an increasing concern about chronic school bullying. Children who suffered more
frequent bullying by peers tend to display worse outcomes. These chronic victims tend to experience more psychotic symptoms later in life as well as more anxiety problems such as agoraphobia, panic disorder, and generalized anxiety(Kochenderfer & Ladd 1996). Compared to occasional victims and non-bullied children, victims of chronic bullying are at elevated risk for maladjustment, which may lead them to bully others or to self-harm(Bowes et al. 2013). Moreover, school bullying can increase the risk for unhealthy behaviors that may lead to weight gain (e.g., increased caloric intake, binge eating, and increased sedentary activities) for individuals who are targeted(Puhl & Luedicke 2012).

Childhood obesity also relates to various chronic health and social problems, including bullying victimization(Puhl & Luedicke 2012). Up to 29% of children experienced bullying linked to their weight status(Puhl & Luedicke 2012). Being overweight or obese is the primary reason that children are bullied at school(Puhl et al. 2011). The evidence shows a positive association between adiposity level and school bullying; that is, in general, children with overweight or obesity are more likely to be victims of bullying than their normal-weight peers(Bacchini et al. 2015; Lumeng et al. 2010). Underweight children were also found to be at increased risk of being bullied occasionally(Wang et al. 2010), however the association between underweight and chronic bullying is still unclear. Aside from weight status, studies also found that self-image, independently of weight status, is associated with peer victimization (Reulbach et al. 2013; Sutter et al. 2015; Zequinão et al. 2017). According to Reulbach et al., bullying perpetration was not associated with body mass index (BMI) derived weight status but associated with perceived self-description of weight(Reulbach et al. 2013). In another study, however, BMI z-score and body
dissatisfaction are both significant predictors of bullying victimization (Sutter et al. 2015).

Against this background, the present study examined the association between chronic bullying victimization and adolescent’s weight status, as determined using the body BMI z-scores, and with body self-image, a subjective indicator of weight status. Also, we computed predicted probabilities of chronic bullying victimization based on weight status and body-image. We hypothesized that the probability of chronic bullying victimization would be lowest in normal weight status group for both BMI and body-image indicators. Specifically, based on literature (Sutter et al. 2015; Zequinão et al. 2017), we assumed that weight status and body-image are independent predictors to chronic bullying victimization, and the associations of victimization with weight status and body-image are consistent across countries.

Materials & Methods

Study design and participants

Data for this study were drawn from the 2009/10 HBSC study, a school-based cross-sectional survey conducted in 39 North American and European countries and regions every four years (Chester et al. 2015; Elgar et al. 2015). The study recruited an international sample (N=213,595) of schoolchildren aged 11, 13 and 15 years using identical sampling methods, which is much larger than required sample size for statistical power 0.8 estimated by retrospective power analysis. The sampling unit was a classroom within schools selected by inverse probability weighting to guarantee that students were equally likely to be sampled. The desired sample size for each age group was 1,500 (750 boys, 750 girls) per country/region. Students anonymously completed the self-administered questionnaires in classroom settings and handed them to teachers or well-trained
assistants.

The study was reviewed and approved by university-based or equivalent review boards. Parental consent procedures depend on school district policy. Once obtained parental consent, students provided their assent to participate.

Measures

Outcome

Chronic bullying victimization

We measured the experiences of bullying victimization using the question: “How often have you been bullied at school in the past couple of months” with options 0=I haven’t been bullied, 1=Once or twice, 2=2 or 3 times a month, 3=About once a week, 4=Several times a week. We recoded items 1 and 2 as non-chronic bullying victimization, items 3 to 5 as chronic bullying victimization. Before the question, there was a definitional statement of bullying adapted from the Revised Olweus Bully/Victim Questionnaire to ensure consistency in responses (Olweus 1994).

Exposures

Perceived weight status

We calculated body mass index (BMI; kg/m²) based on self-reported weight and height, converted the BMI values to exact z-scores, then divided the adolescents into four categories (underweight, normal weight, overweight and obese) according to age- and sex-specific z-scores cut-off points, as recommended by the International Obesity Task Force (Cole et al. 2000; Cole et al. 2007).
Although self-reported weight and height are vulnerable to reporting bias, several studies revealed high correlations between reported and measured BMI in adolescents (Haines et al. 2008; Himes et al. 2005; Paxton et al. 2004).

**Perceived body-image**

To assess body self-image, we asked the participants whether they perceived their body as “Much too thin,” “A bit too thin,” “About right,” “A bit too fat,” or “Much too fat.” For consistency with the classification of weight status, we combined the replies of the first two options (“much too thin” and “a bit too thin”) into “too thin.”

**Confounders**

**Socioeconomic status**

We measured socioeconomic status (SES) of the respondents using the Family Affluence Scale (FAS). The scale is developed by HBSC Methodology Development Group, and comprised of four items: “Does your family own a car, van or trunk?” (No=0, Yes=1, Yes, two or more=2); “Do you have your own bedroom?” (No=0, Yes=1); “During the past 12 months, how many times did you travel away on holiday (vacation) with your family?” (Not at all=0, Once=1, Twice=2, More than twice=3); and “How many computers does your family own?” (None=0, One=1, Two=2 More than two=3). The FAS has been validated as a better proxy of parental SES and is less affected by nonresponse bias than other measures (Currie et al. 2008). We divided the respondents into high (6-9), medium (3-5) and low (0-2) groups according to the total score (range 0-9).
Family structure

We recorded family structure as "traditional" if the participants lived with 'both biological parents', and "non-traditional" if they lived with a 'single mother,' 'single father,' in a 'reconstituted family' or 'other.'

Classmate support

We measured the perceived classmate support using a subscale of three items: “Students in my class(es) enjoy being together,” “Most of the students in my class(es) are kind and helpful” and “Other students accept me as I am.” Participants responded on a Likert scale of five points, from “Strongly agree” to “Strongly disagree.” In this paper, students who agreed or strongly agreed with all the three statements were classified as having positive classmate relationships.

Country-level data

We also collected the country-level data, including GDP per capita and Gini coefficient, on these 39 countries/regions (table 1).

Statistical analysis

We analyzed the data using Stata/SE 14.0. The prevalence estimates were presented separately for each gender. Given these data were hierarchical, with individuals nested within schools, and schools nested within countries, we tested associations of school bullying victimization between weight status and body self-image separately for males and females using three-level logistic regression models with adjustment for potential confounding by age, classmate support, family
structure, and FAS group. We weighted the data to adjust the clustered sampling design of the survey. Odds ratios (ORs) and 95% confidential intervals (CIs) were used to measure the association.

After fitting the logistic models, we computed and plotted the adjusted predicted probability of being chronic bullying victims for weight status and body self-image by variables value using Stata margins and marginsplot commands. Similarly, we estimated the average marginal effects of weight status and body self-image.

**Results**

A total of 213,595 adolescents from 7,468 schools in 39 countries and regions were investigated, of which 105,099 were boys, and 108,496 were girls, accounting for 49.20% and 50.80%, respectively (table 1). In our sample, 22,822 (11.28%) adolescents were identified as having been exposed to chronic bullying victimization. Also, 12.79%, 12.19% and 2.61% of the participants were classified as underweight, overweight and obese according to age- and sex-specific BMI criteria, while 14.57%, 24.85% and 3.51% of the participants considered themselves too thin, a little bit fat and too fat. The Gini coefficient in 2010 ranged from 24.82 to 44.05, with a mean of 31.94. The GDP per capita in 2010 ranged from 2,974 USD to 103,267 USD, and the average value was 35,052 USD.

As illustrated in table 2 and figure 1, we noted that the prevalence of chronic bullying victimization declined in older age groups, and this pattern remained consistent among boys and girls. The prevalence of chronic bullying victimization was lowest among normal weight/about-right
populations and highest among obese/too-fat populations in both sex groups.

Next, we examined the associations between chronic bullying victimization with perceived weight and perceived body-image respectively. The associations of individual-level confounders with exposures and outcome were showed in table s1-s3 the Appendix. We controlled potential confounders at the individual level (sex, age group, SES, classmate support and academic achievement) and the macro level (country wealth and income inequality) and accounted for the multilevel structure of the data. We found that weight status was associated with chronic bullying victimization (adjusted OR_{underweight}=1.10, p=0.002; adjusted OR_{overweight}=1.40, p<0.0001; adjusted OR_{obese}=1.91, p<0.0001) (table 3). The association between body self-image with chronic bullying victimization was similar (adjusted OR_{too thin}=1.42, p<0.0001; adjusted OR_{a little bit fat}=1.54, p<0.0001; adjusted OR_{too fat}=3.30, p<0.0001) (table 4). We also performed gender-specific analyses that revealed there were no gender differences in obesity-related or fat-related chronic bullying victimization (table 3-4). We examined the interactions between weight status, body-image, and victimization, and did not observe positive results (table s4 in the Appendix).

We also computed the post-estimation predictions after fitting logistic models. As shown in figure 2 and table s5 in the Appendix, the estimated probabilities for weight status is 0.108 for underweight, 0.100 for normal weight, 0.131 for overweight and 0.166 for obese, the estimated probabilities were all higher in males than in females. On average, being underweight compared with being normal weight increased the probability of chronic bullying victimization by 0.031(p<0.0001). Being overweight compared with being normal weight increased the probability by 0.032(p<0.0001). Being obese compared with being normal weight increased the probability
by 0.067 (p<0.0001). The estimated probabilities for body self-image were also calculated and displayed in figure 2, and table s6 in the Appendix.

Discussion

This study involving 39 national representative samples of schoolchildren aged 11, 13 and 15 years using identical sampling methods, revealed that both overweight/obese and self-rated overweight were linked to increased risk of being chronic bullied. Furthermore, the study showed adolescents with underweight also had a higher risk of being chronically bullied than normal-weight adolescents, as their overweight/obese peers did. The link between underweight and chronic bullying victimization is a valuable addition to the scientific literature on occasional bullying, which suggests that vulnerable populations include not only adolescents with overweight/obesity (Puhl & Luedicke 2012; Puhl et al. 2011) but also underweight adolescents.

To our knowledge, few studies have tested the association of chronic bullying victimization with both weight status and body self-image using cross-national data. Previous research found that for overweight and obese youth, weight stigmatization translates into pervasive victimization, teasing, and bullying (Puhl & King 2013). While the weight-related bullying may be intuitive, the association between underweight and school bullying may be less clear, although there is a relationship between media influence and drive for thinness (Fernandez & Pritchard 2012). Using the data from a large cross-national epidemiological sample, our results not only provide supporting evidence for the relationship between chronic bullying and overweight/obesity but also reveal the relationship between chronic bullying and underweight, for both boys and girls.

Specifically, the strength of associations (ORs) between chronic bullying victims and weight status
were 1.91, 1.40 and 1.10 for obesity, overweight and underweight, respectively. The marginal 
predicted probabilities of being chronically bullied were 0.17 for obesity, 0.13 for overweight, 
0.11 for underweight, and 0.10 for normal weight. The strength of association between chronic 
bullying and underweight was relatively weaker but still significant.

School bullying focuses on differences, and the differences can be either real or perceived. We 
found similar but stronger relationships between chronic bullying and perceived body self-image. 
Our finding echoes earlier research indicating BMI z-score and physical appearance independently 
predicted the victimization (Bacchini et al. 2017). The research also found that self-concept 
mediated the relationship between BMI z-score and bullying victimization (Bacchini et al. 2017), 
however, we didn’t observe the interactions between perceived weight status and body self-image 
and further research is needed.

In adolescence, especially in females, being taunted about being overweight or obese may 
contribute to the development of eating disorders such as anorexia nervosa, and internalizing 
problems such as suicidal thoughts and depression (Lian et al. 2017). Significant residual obesity 
stigma remains against individuals who have lost weight (Latner et al. 2012). Furthermore, our 
results also indicate that adolescents with “too thin” body self-image are still vulnerable to chronic 
bullying (Wang et al. 2010). These findings further our understanding of the weight-related 
bullying and can help develop targeted preventative strategies to stop or lessen school bullying. 
Programs for bullying prevention should not overlook psychosocial and cultural interventions, 
which can help adolescents cope with their weight status better (Wilson et al. 2013).

Our study focuses on a particularly vulnerable group of bullied children: those who experienced
chronic bullying victimization in school. In our sample from 39 countries, 11.28% of the children suffered chronic bullying, while the prevalence rose to 24% in a long-term study followed children from kindergarten through Grade 12 in the U.S. (Ladd et al. 2017). This inconsistency in prevalence is partly due to an age difference between samples (Ladd et al. 2017), the age-range was narrow in our study but broad in the U.S. study.

On average, the current study revealed an apparent gradual decline in reported chronic bullying with older age groups, for both boys and girls. The trend is observable in other large studies (Ladd et al. 2017; Olweus 1994; Rigby & Smith 2011; Wang et al. 2009). Bullying is more frequent in early grade school, rather than in middle school and high school as popular media depicted (Ladd et al. 2017). This age-related decline in school bullying could be explained in part by two hypotheses: 1) the number of older pupils with opportunities to bully decreases with age; 2) potential victims (usually younger students) are getting more socially skilled (Smith et al. 1999). The hypotheses indicate that modified playgrounds with increased opportunities for risk and challenge (Farmer et al. 2017), and early skill training when younger students start school (Smith et al. 1999) could help lessen school bullying.

**Strengths and Limitations**

Strengths of the current study include a sizeable cross-national sample, standardized questionnaire, and the ability to perform subgroup analyses on the effects of chronic bullying on groups of underweight and too thin individuals. This study uniquely examined the associations between chronic bullying victimization and weight status defined by BMI and body-image. An important limitation of the present study is the cross-sectional nature of the data, which does not allow us to
make causal interpretations. The relation between weight status and chronic bullying victimization is dynamic. Actual and perceived weight can serve as both a cause and a consequence of being bullied (Wilson et al. 2013). Therefore, longitudinal studies are needed to clarify the relationship.

Another limitation was that BMI calculations in our study were based on self-reported data from the participants. Evidence supported the high correlation between self-reported and measured BMI in adolescents (Himes et al. 2005; Paxton et al. 2004). However, misclassification of some overweight and obese cases was likely (Elgar et al. 2005). Also, self-reported BMI overestimated the prevalence of underweight in adolescents (Yngve et al. 2008). Third, our study only investigated the general bullying in all forms and did not cover specific types of bullying such as physical, verbal, relational and cyberbullying. Compared with underweight adolescents, peers with overweight or obesity are targets of different kinds of bullying (Wang et al. 2010). Longitudinal studies with more comprehensive data on bullying and weight status are needed to investigate this more closely. Fourth, some of the important confounders including race/ethnicity and child abuse were not included in the analysis because using a secondary data, which could potentially confound the association of bullying victimization with perceived weight status and body self-image.

Conclusions

In conclusion, our findings have shown that both overweight and self-rated overweight relate to chronic bullying victimization in adolescents. Also, adolescents with underweight and perceived themselves as thin are both at higher risk of being chronically bullied than normal-weight peers. Our study suggests that underweight adolescents need the same attention as their peers with overweight or obesity do in the fight against school bullying.
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References

Anthony BJ, Wessler SL, and Sebian JK. 2010. Commentary: Guiding a Public Health Approach to Bullying. *Journal of Pediatric Psychology* 35:1113-1115. 10.1093/jpepsy/jsq083

Bacchini D, Licenziati MR, Affuso G, Garrasi A, Corciulo N, Driul D, Tanas R, Fiumani PM, Di Pietro E, Pesce S, Crino A, Maltoni G, Iughetti L, Sartorio A, Deiana M, Lombardi F, and Valerio G. 2017. The Interplay among BMI z-Score, Peer Victimization, and Self-Concept in Outpatient Children and Adolescents with Overweight or Obesity. *Child Obes* 13:242-249. 10.1089/chi.2016.0139

Bacchini D, Licenziati MR, Garrasi A, Corciulo N, Driul D, Tanas R, Fiumani PM, Di Pietro E, Pesce S, Crino A, Maltoni G, Iughetti L, Sartorio A, Deiana M, Lombardi F, and Valerio G. 2015. Bullying and Victimization in Overweight and Obese Outpatient Children and Adolescents: An Italian Multicentric Study. *PLoS ONE* 10:e0142715. 10.1371/journal.pone.0142715

Bowes L, Maughan B, Ball H, Shakoor S, Ouellet-Morin I, Caspi A, Moffitt TE, and Arseneault L. 2013. Chronic bullying victimization across school transitions: The role of genetic and environmental influences. *Development and psychopathology* 25:10.1017/S0954579412001095. 10.1017/S0954579412001095

Chester KL, Callaghan M, Cosma A, Donnelly P, Craig W, Walsh S, and Molcho M. 2015. Cross-national time trends in bullying victimization in 33 countries among children aged 11, 13 and 15 from 2002 to 2010. *European Journal of Public Health* 25:61-64. 10.1093/eurpub/ckv029

Cole TJ, Bellizzi MC, Flegal KM, and Dietz WH. 2000. Establishing a standard definition for child overweight and obesity worldwide: international survey. *Bmj* 320:1240-1243.

Cole TJ, Flegal KM, Nicholls D, and Jackson AA. 2007. Body mass index cut offs to define thinness in children and adolescents: international survey. *Bmj* 335:194. 10.1136/bmj.39238.399444.55

Craig W, Harel-Fisch Y, Fogel-Grinvald H, Dostaler S, Hetland J, Simons-Morton B, Molcho M, de Mato MG, Overpeck M, Due P, Pickett W, Violence H, Injuries Prevention Focus G, and Group HBW. 2009. A cross-national profile of bullying and victimization among adolescents in 40 countries. *Int J Public Health* 54:216-224. 10.1007/s00038-009-5413-9

Currie C, Molcho M, Boyce W, Holstein B, Torsheim T, and Richter M. 2008. Researching health inequalities in adolescents: The development of the Health Behaviour in School-Aged Children (HBSC) Family Affluence Scale. *Social Science & Medicine* 66:1429-1436. http://dx.doi.org/10.1016/j.socscimed.2007.11.024
Elgar FJ, Pfortner TK, Moor I, De Clercq B, Stevens GW, and Currie C. 2015. Socioeconomic inequalities in adolescent health 2002-2010: a time-series analysis of 34 countries participating in the Health Behaviour in School-aged Children study. *Lancet* 385:2088-2095. 10.1016/s0140-6736(14)61460-4

Elgar FJ, Roberts C, Tudor-Smith C, and Moore L. 2005. Validity of self-reported height and weight and predictors of bias in adolescents. *J Adolesc Health* 37:371-375. 10.1016/j.jadohealth.2004.07.014

Fanti KA, and Henrich CC. 2015. Effects of Self-Esteem and Narcissism on Bullying and Victimization During Early Adolescence. *The Journal of Early Adolescence* 35:5-29. 10.1177/0272431613519498

Farmer VL, Williams SM, Mann JI, Schofield G, McPhee JC, and Taylor RW. 2017. Change of School Playground Environment on Bullying: A Randomized Controlled Trial. *Pediatrics*. 10.1542/peds.2016-3072

Fernandez S, and Pritchard M. 2012. Relationships between self-esteem, media influence and drive for thinness. *Eating Behaviors* 13:321-325. [http://dx.doi.org/10.1016/j.eatbeh.2012.05.004](http://dx.doi.org/10.1016/j.eatbeh.2012.05.004)

Gage NA, Prykanowski DA, and Larson A. 2014. School climate and bullying victimization: A latent class growth model analysis. *School Psychology Quarterly* 29:256-271. 10.1037/spq0000064

Haines J, Neumark-Sztainer D, Hannan PJ, van den Berg P, and Eisenberg ME. 2008. Longitudinal and secular trends in weight-related teasing during adolescence. *Obesity (Silver Spring)* 16 Suppl 2:S18-23. 10.1038/oby.2008.447

Himes JH, Hannan P, Wall M, and Neumark-Sztainer D. 2005. Factors associated with errors in self-reports of stature, weight, and body mass index in Minnesota adolescents. *Ann Epidemiol* 15:272-278. 10.1016/j.annepidem.2004.08.010

Jeong S, Kwak D-H, Moon B, and San Miguel C. 2013. Predicting School Bullying Victimization: Focusing on Individual and School Environmental/Security Factors. *Journal of Criminology* 2013:13. 10.1155/2013/401301

Kochenderfer BJ, and Ladd GW. 1996. Peer victimization: cause or consequence of school maladjustment? *Child Dev* 67:1305-1317.

Ladd GW, Ettekal I, and Kochenderfer-Ladd B. 2017. Peer Victimization Trajectories From Kindergarten Through High School: Differential Pathways for Children’s School Engagement and Achievement?

Latner JD, Ebneter DS, and O’Brien KS. 2012. Residual Obesity Stigma: An Experimental Investigation of Bias Against Obese and Lean Targets Differing in Weight-Loss History. *Obesity* 20:2035-2038. 10.1038/oby.2012.55

Lian Q, Zuo X, Mao Y, Luo S, Zhang S, Tu X, Lou C, and Zhou W. 2017. Anorexia nervosa, depression and suicidal thoughts among Chinese adolescents: a national school-based cross-sectional study. *Environmental Health and Preventive Medicine* 22:30. 10.1186/s12199-017-0639-2

Lumeng JC, Forrest P, Appugliese DP, Kaciroti N, Corwyn RF, and Bradley RH. 2010. Weight status as a predictor of being bullied in third through sixth grades. *Pediatrics* 125:e1301-1307. 10.1542/peds.2009-0774

Olweus D. 1994. Bullying at School: Basic Facts and Effects of a School Based Intervention Program. *Journal of Child Psychology and Psychiatry* 35:1171-1190. 10.1111/j.1469-7610.1994.tb01229.x

Olweus D. 2013. School bullying: development and some important challenges. *Annu Rev Clin Psychol* 9:751-780. 10.1146/annurev-clinpsy-050212-185516

Paxton RJ, Valois RF, and Drane JW. 2004. Correlates of body mass index, weight goals, and weight-management practices among adolescents. *J Sch Health* 74:136-143.

Puhl RM, and King KM. 2013. Weight discrimination and bullying. *Best Practice & Research Clinical Endocrinology*
Puhl RM, and Luedicke J. 2012. Weight-Based Victimization Among Adolescents in the School Setting: Emotional Reactions and Coping Behaviors. *J Youth Adolesc* 41:27-40. 10.1007/s10964-011-9713-z

Puhl RM, Luedicke J, and Heuer C. 2011. Weight-based victimization toward overweight adolescents: observations and reactions of peers. *J Sch Health* 81:696-703. 10.1111/j.1746-1561.2011.00646.x

Ranta K, Kaltiala-Heino R, Pelkonen M, and Marttunen M. 2009. Associations between peer victimization, self-reported depression and social phobia among adolescents: the role of comorbidity. *J Adolesc* 32:77-93. 10.1016/j.adolescence.2007.11.005

Reulbach U, Ladewig EL, Nixon E, O'Moore M, Williams J, and O'Dowd T. 2013. Weight, body image and bullying in 9-year-old children. *Journal of Paediatrics and Child Health* 49:E288-E293. 10.1111/jpc.12159

Rigby K, and Smith PK. 2011. Is school bullying really on the rise? *Social Psychology of Education* 14:441-455. 10.1007/s12118-011-9158-y

Shetgiri R. 2013. Bullying and Victimization Among Children. *Advances in pediatrics* 60:33-51. 10.1016/j.yapd.2013.04.004

Smith PK, Madsen KC, and Moody JC. 1999. What causes the age decline in reports of being bullied at school? Towards a developmental analysis of risks of being bullied. *Educational Research* 41:267-285. 10.1080/0013188990410303

Stapinski LA, Araya R, Heron J, Montgomery AA, and Stallard P. 2015. Peer victimization during adolescence: concurrent and prospective impact on symptoms of depression and anxiety. *Anxiety Stress Coping* 28:105-120. 10.1080/10615806.2014.962023

Tippett N, and Wolke D. 2014. Socioeconomic status and bullying: a meta-analysis. *Am J Public Health* 104:e48-59. 10.2105/ajph.2014.301960

Wang J, Iannotti RJ, and Luk JW. 2010. Bullying Victimization Among Underweight and Overweight U.S. Youth: Differential Associations for Boys and Girls. *Journal of Adolescent Health* 47:99-101. https://doi.org/10.1016/j.jadohealth.2009.12.007

Wang J, Iannotti RJ, and Nansel TR. 2009. School bullying among adolescents in the United States: physical, verbal, relational, and cyber. *J Adolesc Health* 45:368-375. 10.1016/j.jadohealth.2009.03.021

Wilson ML, Viswanathan B, Rousson V, and Bovet P. 2013. Weight Status, Body Image and Bullying among Adolescents in the Seychelles. *International Journal of Environmental Research and Public Health* 10:1763-1774. 10.3390/ijerph10051763

Yngve A, De Bourdeaudhuij I, Wolf A, Grijbowski A, Brug J, Due P, Ehrenblad B, Elmadfa I, Franchini B, Klepp K-I, Poortvliet E, Rasmussen M, Thorsdottir I, and Perez Rodrigo C. 2008. Differences in prevalence of overweight and stunting in 11-year olds across Europe: The Pro Children Study. *European Journal of Public Health* 18:126-130. 10.1093/eurpub/ckm099

Zequinão MA, de Medeiros P, Rosário HRVd, Pelegrini A, Lopes L, Pereira B, and Cardoso FL. 2017. Association between body dissatisfaction and bullying in children of socioeconomically vulnerable areas. *Porto Biomedical Journal* 2:260-264. https://doi.org/10.1016/j.pbj.2017.04.010
Table 1 (on next page)

Description of study sample (N=213,595)
| Characteristics                          | n(%)     |
|----------------------------------------|----------|
| **Individual level**                   |          |
| Sex                                    |          |
| Male                                   | 105,099(49.20) |
| Female                                 | 108,496(50.80) |
| Age group (years)                      |          |
| 11                                     | 67,924(32.11) |
| 13                                     | 71,975(34.02) |
| 15                                     | 71,652(33.87) |
| Chronic bullying victimization         |          |
| No                                     | 179,581(88.72) |
| Yes                                    | 22,822(11.28) |
| Perceived weight status                |          |
| Underweight                            | 22,227(12.79) |
| Normal weight                          | 125,794(72.41) |
| Overweight                             | 21,176(12.19) |
| Obese                                  | 4,528(2.61) |
| Perceived body-image                   |          |
| Too thin                               | 30,580(14.57) |
| About right                            | 119,737(57.06) |
| A little bit fat                       | 52,157(24.85) |
| Too fat                                | 7,374(3.51) |
| **Country level characteristics**      | Mean(SD) |
| Mean income per person (GDP per capita in USD) | 35,052.34 (21,331.34) |
| Mean income inequality (Gini coefficient) | 31.94(4.70) |
| Countries                              | 39       |
| Schools                                | 7,468    |
Table 2 (on next page)

The prevalence of chronic bullying victimization, by gender
Table 2 The prevalence of chronic bullying victimization, by gender

|                      | Total, n (%) | Male, n (%) | Female, n (%) |
|----------------------|--------------|-------------|---------------|
| **Age group(years)** |              |             |               |
| 11                   | 22,628(11.28)| 12,282(12.51)| 10,346(10.10) |
| 13                   | 8,515(13.25) | 4,506(14.37) | 4,009(12.18)  |
| 15                   | 8,239(12.10) | 4,452(13.42) | 3,787(10.84)  |
| **Perceived weight status** |          |             |               |
| Underweight          | 2,333(11.12) | 1,035(13.34) | 1,298(9.81)   |
| Normal weight        | 11,852(9.90)| 6,475(10.95) | 5,377(8.87)   |
| Overweight           | 2,841(14.09)| 1,738(14.33) | 1,103(13.72)  |
| Obese                | 824(18.95)  | 511(18.98)  | 313(18.91)    |
| **Perceived body-image** |          |             |               |
| Too thin             | 3,736(12.98)| 2,298(13.86) | 1,438(11.78)  |
| About right          | 10,380(9.13)| 6,063(10.29) | 4,317(7.88)   |
| A little bit fat     | 6,614(13.12)| 3,161(15.81) | 3,453(11.34)  |
| Too fat              | 1,790(25.02)| 692(29.57)  | 1,098(22.81)  |
**Table 3 (on next page)**

The association between weight status and chronic bullying victimization, OR (95%CI, p value)
Table 3 The association between weight status and chronic bullying victimization, OR (95%CI, p value)

| Fixed components | Total | Male | Female |
|------------------|-------|------|--------|
| Perceived weight status (base=Normal)* | | | |
| Underweight | 1.10 (1.05-1.16, p=0.002) | 1.16 (1.07-1.27, p=0.002) | 1.07 (1.00-1.13, p=0.047) |
| Overweight | 1.40 (1.32-1.49, p<0.0001) | 1.31 (1.22-1.41, p<0.0001) | 1.56 (1.43-1.70, p<0.0001) |
| Obese | 1.91 (1.71-2.14, p<0.0001) | 1.81 (1.63-2.01, p<0.0001) | 2.09 (1.67-2.61, p<0.0001) |
| Sex (base=Male) | | | |
| Female | 0.77 (0.72-0.83, p<0.0001) | -- | -- |
| Age group (base=11) | | | |
| 13 | 0.85 (0.79-0.91, p<0.0001) | 0.86 (0.80-0.93, p<0.0001) | 0.83 (0.76-0.89, p<0.0001) |
| 15 | 0.54 (0.49-0.59, p<0.0001) | 0.58 (0.52-0.64, p<0.0001) | 0.49 (0.44-0.55, p<0.0001) |
| Classmate support (base=negative) | | | |
| Positive | 0.33 (0.30-0.38, p<0.0001) | 0.35 (0.31-0.40, p<0.0001) | 0.31 (0.27-0.35, p<0.0001) |
| Academic achievement (base=good) | | | |
| Average and below | 1.32 (1.26-1.39, p<0.0001) | 1.22 (1.15-1.29, p<0.0001) | 1.46 (1.37-1.56, p<0.0001) |
| SES (base=low) | | | |
| Medium | 0.83 (0.76-0.90, p<0.0001) | 0.84 (0.75-0.95, p=0.037) | 0.81 (0.74-0.90, p=0.001) |
| High | 0.78 (0.70-0.87, p<0.0001) | 0.78 (0.69-0.90, p=0.004) | 0.77 (0.67-0.87, p=0.001) |
| GDP per capita | 1.00 (1.00-1.00, p=0.7015) | 1.00 (1.00-1.00, p=0.9736) | 1.00 (1.00-1.00, p=0.4887) |
| GINI index | 1.01 (0.98-1.04, p=0.3465) | 1.02 (0.99-1.05, p=0.1706) | 1.00 (0.97-1.04, p=0.7418) |
| Constant | 0.19 (0.07-0.57, p=0.0028) | 0.13 (0.05-0.53, p=0.001) | 0.14 (0.04-0.47, p=0.0015) |
| Random components | | | |
| $\sigma^2$(country) | 0.28 | 0.29 | 0.30 |
| $\sigma^2$(school) | 0.14 | 0.17 | 0.19 |
| ICC(country) | 0.08 | 0.08 | 0.08 |
| ICC(school) | 0.11 | 0.12 | 0.13 |
AIC#  98295  52144  46118
BIC#  98444  52273  46248

ICC=Intraclass correlation. AIC= Akaike’s information criterion. BIC=Bayesian information criterion. # Goodness-of-fit index.

* Odds ratio adjusted for sex, age group, classmate support, academic achievement, SES, GDP per capita and GINI index.
Table 4 (on next page)

The association between body self-image and chronic bullying victimization, OR (95%CI, p value)
| Fixed components                           | Total         | Male          | Female         |
|-------------------------------------------|---------------|---------------|----------------|
| Perceived body-image                      |               |               |                |
| (base=Normal)"                           |               |               |                |
| Too thin                                  | 1.42(1.36-1.49, p<0.0001) | 1.39(1.31-1.47, p<0.0001) | 1.47(1.38-1.57, p<0.0001) |
| A little bit fat                          | 1.54(1.48-1.61, p<0.0001) | 1.60(1.50-1.71, p<0.0001) | 1.50(1.42-1.59, p<0.0001) |
| Too fat                                   | 3.30(2.96-3.68, p<0.0001) | 3.25(2.84-3.72, p<0.0001) | 3.35(2.97-3.78, p<0.0001) |
| Sex(base=Male)                            |               |               |                |
| Female                                    | 0.71(0.66-0.76, p<0.0001) | --            | --             |
| Age group (base=11 years)                 |               |               |                |
| 13 years                                  | 0.82(0.76-0.87, p<0.0001) | 0.84(0.78-0.91, p<0.0001) | 0.78(0.72-0.88, p<0.0001) |
| 15 years                                  | 0.52(0.47-0.57, p<0.0001) | 0.57(0.51-0.63, p<0.0001) | 0.46(0.41-0.52, p<0.0001) |
| Classmate support                         |               |               |                |
| (base=negative)                           |               |               |                |
| Positive                                  | 0.34(0.31-0.38, p<0.0001) | 0.36(0.32-0.40, p<0.0001) | 0.32(0.28-0.36, p<0.0001) |
| Academic achievement                      |               |               |                |
| (base=good)                               |               |               |                |
| Average and below                         | 1.27(1.21-1.34, p<0.0001) | 1.21(1.15-1.28, p<0.0001) | 1.35(1.26-1.43, p<0.0001) |
| SES(base=low)                             |               |               |                |
| Medium                                    | 0.84(0.78-0.91, p<0.0001) | 0.87(0.77-0.98, p<0.0001) | 0.81(0.74-0.88, p<0.0001) |
| High                                      | 0.79(0.72-0.87, p<0.0001) | 0.81(0.71-0.83, p<0.0001) | 0.76(0.68-0.84, p<0.0001) |
| GDP per capita                            | 1.00(1.00-1.00, p<0.0001) | 1.00(1.00-1.00, p<0.0001) | 1.00(1.00-1.00, p<0.0001) |
| GINI index                                | 1.02(0.99-1.05, p=0.1914) | 1.02(1.00-1.05, p<0.0914) | 1.01(0.98-1.05, p<0.4553) |
| Constant                                  | 0.17(0.06-0.51, p<0.0015) | 0.10(0.04-0.28, p<0.0001) | 0.11(0.03-0.34, p<0.0004) |
| Random components                         |               |               |                |
| $\sigma^2$(country)                       | 0.26          | 0.26          | 0.28           |
| $\sigma^2$(school)                        | 0.14          | 0.16          | 0.19           |
| ICC(country)                              | 0.07          | 0.07          | 0.07           |
| ICC(school) | 0.11 | 0.11 | 0.13 |
|------------|------|------|------|
| AIC#       | 119053 | 62574 | 56454 |
| BIC#       | 119206 | 62706 | 56587 |

ICC=Intraclass correlation. AIC= Akaike’s information criterion. BIC=Bayesian information criterion. # Goodness-of-fit index.

* Odds ratio adjusted for sex, age group, classmate support, academic achievement, SES, GDP per capita and GINI index.
Figure 1

The prevalence of chronic bullying victimization by age, weight status and body self-image (n=213,595)
Figure 2

The estimated probabilities for weight status and body self-image