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Implementation of a School Nurse-led Intervention for Children With Severe Obesity in New York City Schools

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Abstract

Purpose—The Healthy Options and Physical Activity Program (HOP) is a school nurse-led intervention for children with severe obesity. HOP was developed by experts at the New York City Department of Health and Mental Hygiene and implemented in New York City schools beginning in 2012. The purpose of this study was to evaluate HOP implementation with the goal of informing HOP refinement and potential future HOP dissemination.

Design and Methods—This study entailed a retrospective analysis of secondary data. Analytic methods included descriptive statistics, Wilcoxon rank sum and Chi square tests, and multivariate logistic regression.

Results—During the 2012–2013 school year, 20,518 children were eligible for HOP. Of these, 1054 (5.1%) were enrolled in the program. On average, enrolled children attended one HOP session during the school year. Parent participation was low (3.2% of HOP sessions). Low nurse workload, low school poverty, higher grade level, higher BMI percentile, and chronic illness diagnosis were associated with student enrollment in HOP.

Conclusions—As currently delivered, HOP is not likely to be efficacious. Lessons learned from this evaluation are applicable to future nurse-led obesity interventions.

Practice Implications—Prior to implementing a school nurse-led obesity intervention, nursing workload and available support must be carefully considered. Interventions should be designed to facilitate (and possibly require) parent involvement. Nurses who deliver obesity interventions may require additional training in obesity treatment. With attention to these lessons learned, evidence-based school nurse-led obesity interventions can be developed.

Keywords

Childhood obesity; Nursing; School nursing; School health

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Conflict of Interest

None.

Introduction

Childhood obesity, defined as body mass index (BMI) for age and sex 95th percentile (Ogden, 2010), affects 16.9% of children in the United States (Ogden, Carroll, Lawman, et al., 2016). Nearly 4% of American children meet criteria for severe obesity (Skelton, Cook, Auinger, Klein, & Barlow, 2009), with a BMI for age and sex at the 99th percentile or 120% of the 95th percentile (Flegal et al., 2009; Kelly et al., 2013). In New York City (NYC) schools, 20.7% of students are obese and 5.7% of students are severely obese before the age of 14 years (Day, Konty, Leventer-Roberts, Nonas, & Harris, 2014). In both NYC and nationwide, groups that suffer from health disparities (Villarruel, 2001) such as racial/ethnic minorities (Cunningham, Kramer, & Narayan, 2014; Freedman, Khan, Serdula, Ogden, & Dietz, 2006; Ogden, Carroll, Kit, & Flegal, 2014) and children from low-income households (Boelsen-Robinson, Gearon, & Peeters, 2014; Cunningham et al., 2014; Shrewsbury & Wardle, 2008) are disproportionately affected. Causes of obesity and severe obesity are complex, including individual, family, and community level factors (Davison & Birch, 2001).

Childhood obesity is associated with many negative health consequences (Daniels, 2006); health risks are increased for children with severe obesity (Kelly et al., 2013). Children with severe obesity are more likely to be diagnosed with metabolic syndrome and have higher levels of serum inflammatory markers (Kelly et al., 2013). Severity of cardiovascular disease risk factors (e.g., hypertension, elevated serum triglycerides), non-alcoholic fatty liver disease, and musculoskeletal problems such as knee pain increase with degree of adiposity (Kelly et al., 2013; Li et al., 2016; Skinner, Perrin, Moss, & Skelton, 2015).

Childhood obesity also increases risk for poor psychosocial health. Children with obesity are more likely to have depression and anxiety (Daniels, 2006; Kalarchian & Marcus, 2012). They are also more likely to have negative self-perception and self-worth (Braet, Mervielde, & Vandereycken, 1997), be bullied (Puhl & King, 2013; Puhl & Latner, 2007), be perceived negatively by peers (Zeller, Reiter-Purtill, & Ramey, 2008), and have unhealthy peer relationships (Boneberger et al., 2009). Compared to children with obesity, children with severe obesity have greater social anxiety and depression (Phillips et al., 2012). The health-related quality of life for children with severe obesity is similar to that of children with cancer and is poorer than their peers across all domains (physical, psychosocial, emotional, social, and school functioning) (Schwimmer, Burwinkle, & Varni, 2003).

Nurses working in the school setting may be well suited to implement obesity interventions by assisting with health behavior improvement, weight control, and chronic illness management (Morrison-Sandberg, Kubik, & Johnson, 2011; National Association of School Nurses, 2013; Pbert et al., 2013; Tucker & Lanningham-Foster, 2015). However, school nurses have been only involved in a limited amount of school-based obesity interventions (Pbert et al., 2016; Schroeder, Travers, & Smaldone, 2016). No school nurse-led intervention for children with severe obesity has been previously implemented or evaluated (Schroeder et al., 2016). The first intervention of this type, the Health Options and Physical Activity Program (HOP), was developed by the NYC Department of Health and Mental Hygiene (DOHMH) and implemented in NYC schools beginning in the 2012–2013 school year.

The Healthy Options and Physical Activity Program

HOP is a school nurse-led intervention for children with severe obesity who attend NYC schools. HOP was created by experts at the NYC Department of Health and Mental Hygiene with a focus on the health behaviors targeted in the 5210 Let's Go program: 5 fruits and vegetables, 2 hours or less of sedentary screen time, 1 hour of physical activity, 0 sugar-sweetened beverages (Let's Go!, 2012). HOP also included a fifth behavior of interest, portion control. Let's Go is a community-wide childhood obesity prevention intervention that has demonstrated feasibility (Kessler, Vine, & Rogers, 2015; Polacsek et al., 2009; Rogers & Motyka, 2009), efficacy (Rogers et al., 2013), and sustainability (Polacsek et al., 2014).

Figure 1 illustrates the process of HOP eligibility screening, enrollment, and implementation. Children who meet criteria for severe obesity during annual fitness assessments (New York City Department of Education, 2015) are identified for potential HOP participation. Parents of identified children receive a letter from the school explaining program processes and goals. Although parents have the opportunity to opt out, this option is taken by less than 1% of parents. If parents do not opt out, the child is eligible for HOP enrollment by the school nurse. HOP entails one-on-one meetings between the child and the school nurse. HOP is a low intensity program, requiring at least one session every six months. School nurses may increase the frequency of HOP sessions at their discretion. HOP sessions include counseling with a focus on three components: BMI tracking, goal setting, and education around the 5 targeted health behaviors. There is no structured HOP session curriculum; school nurses tailor session content using a set of resources provided to them during HOP training (e.g., colorful activity sheets, tip sheets for healthy goal setting, list of websites such as ChooseMyPlate.gov (United States Department of Agriculture, 2016) that provide additional tools for developing healthy habits). Referrals to school health physicians or primary care providers are made as needed for management of associated health conditions, such as hypertension or type 2 diabetes. Parents are invited to participate in HOP sessions either in person or via phone. Prior to program implementation in 2012, the DOHMH held a full day HOP training for school nurses. The training included education on HOP components and implementation (e.g., timeline for HOP sessions), as well as biological overview of obesity (e.g., common comorbidities), methods for clinical assessment of a child with obesity (e.g., how to plot BMI percentile), and the psychological/behavior/cultural influences on obesity (e.g., association between obesity and bullying, cultural perceptions of appropriate body size).

Purpose

The purpose of this study was to evaluate implementation of the HOP program in order to guide program refinement and potential further dissemination within the NYC school system. Implementation was evaluated by examining the proportion and characteristics of eligible children who were enrolled in HOP, HOP session frequency and content, and factors associated with student enrollment in the program.

Methods

This study was a retrospective analysis of secondary data. The sample included all kindergarten through fifth grade students attending New York City schools who were identified with severe obesity and thus eligible for HOP. The sample was limited to the 2012–2013 school year, the first year of HOP implementation. The Institutional Review Boards for Columbia University Medical Center, the New York City Department of Health and Mental Hygiene, and the New York City Department of Education approved this study.

This study was guided by the Socio-ecological Model (Davison & Birch, 2001; McLeroy, Bibeau, Steckler, & Glanz, 1988); variables at the individual, family, school, and community levels were examined when evaluating HOP implementation. Data were collected from three sources: student electronic health records, NYC DOHMH Office of School Health records, and New York Center for Economic Opportunity poverty data (NYC Center for Economic Opportunity, 2015). The electronic health record used by NYC school nurses was the primary data source and included details of student demographics, participation in school programs such as HOP, and health indicators including BMI percentile. School nurse workload was measured using a composite metric developed by the NYC DOHMH that incorporated nurse to student ratio and number of children with diabetes, asthma, or requiring medication administration during school hours. For the logistic regression model, the DOHMH metric for school nurse workload was categorized by tertile representing low (<10.8 points), moderate (10.8–16.8 points), and high (16.9–35.6 points) workload. School poverty level, defined as the percent of registered students who receive free/reduced school lunches, was dichotomized as either above the New York State average of 51.7% for kindergarten through sixth grades in public schools or below the average (New York State Kids' Well-being Indicators Clearinghouse, 2016).

Data Analysis

Characteristics of children who were enrolled in HOP were compared to those of eligible children who were not enrolled using descriptive statistics, Wilcoxon rank sum tests, and Chi Square tests. HOP session frequency and content and factors associated with student enrollment were analyzed using descriptive statistics and multivariate logistic regression, respectively. Factors that significantly differed between HOP participants and nonparticipants ($p < 0.05$) or theoretically associated with childhood obesity (Davison & Birch, 2001) were included in the logistic regression model.

Results

During the 2012–2013 school year, 20,518 kindergarten through fifth grade children met criteria for severe obesity and were therefore eligible for HOP. The mean BMI percentile of eligible children was 99.4 ± 0.3 . The majority were male (61.6%) and of Hispanic ethnicity (56.4%). Most received free or reduced price lunch (81.2%) and lived in communities where, on average, 1 of 4 (23.8%) participants lived under the federal poverty level. Almost one third of eligible children (30.5%) had at least one chronic illness; of these, the most common diagnosis was asthma (29.4%, data not shown).

Of the 20,518 children who were eligible for the program, 1054 (5.1%) were enrolled. Sample characteristics by enrollment status are listed in Table 1. Compared to children who were eligible but not enrolled, HOP participants attended schools with a lower poverty level (71.0% versus 74.1%) and lower school nurse workload (13.2 versus 14.6 points), were in higher grades (i.e., 6.9% versus 20.6% in kindergarten) and older (8.3 versus 7.6 years), had a slightly higher BMI percentile (99.5 versus 99.4), and had a higher rate of chronic illness diagnosis (46.0% versus 30.5%) ($p < 0.05$).

Details of HOP implementation are presented in Table 2. The enrollment rate was 5.1%. Most (61.1%) HOP sessions included 1 program component with BMI measurement and tracking occurring most frequently (92.2% of sessions). Health education was included in 44.9% of program sessions; the focus of health education sessions was “5 fruits and vegetables per day” (31%), “0 sugar sweetened beverages” (19%), “1 hour of physical activity” (19%), “2 hours or less of screen time” (16%), and “portion control” (15%). Goal setting and measurement of goal achievement was documented less frequently (18.2% of sessions). Most participants attended 1 HOP session (median 1, mean 2.1 ± 1.6 , range 1–11) during the 2012–2013 school year. Parents attended 3.2% of HOP sessions.

Factors that predicted HOP enrollment are presented in Table 3. Children who attended schools with lower school poverty levels and lower school nurse workload had higher odds of being enrolled in HOP. Children with lower BMI percentile, lacking a comorbid chronic illness, or in a lower grade level (kindergarten to second grade) had lower odds of being enrolled in HOP.

Discussion

This study provides the first formal evaluation of HOP, a nurse-led obesity intervention developed by the NYC DOHMH. Results demonstrate that the program was delivered to 5.1% of eligible children who attended a median of 1 HOP session during the 2012–2013 school year. HOP was delivered with low intensity and session content varied across participants. Parent participation was rare. BMI measurement and tracking was the most frequently delivered program component. Based on this evaluation, it is concluded that HOP should be revised and then pilot tested for feasibility and efficacy; if feasible and efficacious, broader dissemination can be considered.

Parent involvement must be a key component of childhood obesity interventions such as HOP, because family participation is integral to obesity intervention efficacy (Golan & Crow, 2004; Janicke et al., 2014) particularly for young children (Hesketh & Campbell, 2010). Multiple reasons for lack of parent participation may exist; parents may have transportation barriers, lack the ability to take time off from their job, have limited family support, the child may resist, or the parents may simply be uninterested in the program (Brennan, Walkley, & Wilks, 2012; Moore & Bailey, 2013; Sonnevile, La Pelle, Taveras, Gillman, & Prosser, 2009). It is also possible that parents do not see their child's weight as a concern (Lundahl, Kidwell, & Nelson, 2014; Robinson & Sutin, 2016; Trigwell, Watson, Murphy, Stratton, & Cable, 2014). Efforts to engage parents with sensitivity to these barriers are key. For example, nurses could directly reach out to parents of each child eligible for the

program using supportive and culturally-sensitive communication. Contacting parents in person or via phone may be preferable, as contacting parents about their child's eligibility for an obesity intervention by letter can cause confusion or raise concern about privacy and obesity stigma (Moyer, Carbone, Anliker, & Goff, 2014). In addition, scheduling sessions at a time of day when parents can attend, encouraging parent phone participation when in-person attendance at sessions is not possible, or calling parents after sessions to summarize what was discussed could support parent engagement in the program and facilitate reinforcement of health messages in the home setting.

Nurses who implement obesity interventions may benefit from additional training about obesity treatment (Brown, Stride, Psarou, Brewins, & Thompson, 2007; Phillips, Wood, & Kinnnersley, 2014; Steele, 2011). For example, formal training in methods such as motivational interviewing can help nurses to counsel children about sensitive issues such as weight in a supportive and meaningful way (Miller & Rollnick, 2004; Rollnick & Miller, 1995). Motivational interviewing methods tailor education and goal setting to the child's unique needs and readiness to change (Miller & Rollnick, 2004; Rollnick & Miller, 1995). Previous effective clinician-led obesity interventions that focus on the 5-2-1-0 health behaviors have included a motivational interviewing component (Polacsek et al., 2009). Nurses and healthcare providers have been successfully trained in motivational interviewing in classes as short as 9 to 16 hours (Madson, Loignon, & Lane, 2009; Söderlund, Madson, Rubak, & Nilsen, 2011), suggesting that a training could occur during a one day in-service. Additional education in the metabolic consequences of obesity and treatment may also be beneficial, depending upon the nurses' knowledge base and experience prior to program implementation. Training on structured obesity intervention curriculum may also be helpful, because a structured curriculum that includes a comprehensive focus (e.g., inclusion of physical activity and dietary components, focus on attitudinal and environmental change) and is delivered consistently over multiple school years can promote school-based obesity intervention success (Katz, O'Connell, Njike, Yeh, & Nawaz, 2008; Sobol-Goldberg, Rabinowitz, & Gross, 2013).

HOP is unique to school-based obesity interventions in that it included only children with severe obesity, a population with unique needs. However, low intensity interventions are not likely to be efficacious for children with severe obesity. Compared to children with overweight or obesity, lifestyle approaches and standard behavioral interventions have been shown to be less effective; more intensive treatments are recommended to improve both obesity (e.g., BMI percentile) and health metrics (e.g., blood glucose) (Danielsson, Kowalski, Ekblom, & Marcus, 2012; Johnston et al., 2011). Traditionally, interventions for severe obesity have included intensive family-based treatment (sometimes as an inpatient) (Luca et al., 2015; Taylor, Peterson, Garland, & Hastings, 2016; van der Baan-Slootweg, Benninga, Beelen, et al., 2014), bariatric surgery (Nobili et al., 2015; Schmitt et al., 2016; Thakkar & Michalsky, 2015), medication (Boland, Harris, & Harris, 2015), and/or long-term treatment using a chronic care model (Rijks et al., 2015). Therefore, school-based interventions for children with severe obesity must be coupled with more intensive treatment to lead to clinically meaningful decreases in body measures. School-based interventions may be best suited when used as clinical management programs to manage comorbidities, facilitate communication between the medical team and educational team, and support the

child's treatment plan in the school environment. School nurses, with their clinical expertise, may be the ideal leaders for such programs.

It is important to note that school-based interventions face an uphill battle because many children live in environments that present barriers to a healthy body weight (Booth, Pinkston, & Poston, 2005; Lake & Townshend, 2006; Lobstein, Baur, & Uauy, 2004). Factors outside the school setting such as advertising of unhealthy foods (Andreyeva, Kelly, & Harris, 2011), poor neighborhood walkability (Vandegrift & Yoked, 2004), fast food restaurant access (Newman, Howlett, & Burton, 2014), perceived or actual healthy food access (Rundle et al., 2009; Zenk, Mentz, Schulz, Johnson-Lawrence, & Gaines, 2016), and large portion sizes (Pourshahidi, Kerr, McCaffrey, & Livingstone, 2014) impact health, nutrition, physical activity and body weight. Such factors only intensify physiological, hormonal, and metabolic resistance to weight loss (Farias, Cuevas, & Rodriguez, 2011; Müller, Bosy-Westphal, & Heymsfield, 2010). Therefore, school-based obesity interventions can only be expected to have modest effects (Elbel, Corcoran, & Schwartz, 2016); meaningful reduction in obesity rates will require multifaceted societal change (Block & Roberto, 2014; Pbert et al., 2016).

While school-based obesity interventions are widely reported in the literature, the literature base examining nurses' roles in these interventions is much smaller. A recent systematic review and meta-analysis found only 11 published school-based obesity interventions that involve nurses; the interventions were efficacious and led to small but statistically significant decrease in body measures for those enrolled (Schroeder et al., 2016). While intervention characteristics varied, many included counseling and health behavior education (Robbins, Pfeiffer, Maier, Lo, & Wesolek, 2012; Speroni, Earley, & Atherton, 2007; Tucker & Lanningham-Foster, 2015) (similar to HOP); in contrast to HOP, some also included formal parental involvement (Johnston et al., 2013; Melin & Lenner, 2009; Speroni et al., 2007; Wong & Cheng, 2013; Wright, Giger, Norris, & Suro, 2013), an interactive physical activity component (Hawthorne, Shaibi, Gance-Cleveland, & McFall, 2011; Robbins et al., 2012; Speroni et al., 2007; Williams & Warrington, 2011; Wright et al., 2013), or involvement of other school partners (i.e., teachers) (Johnston et al., 2013; Wright et al., 2013). None focused on severe obesity (Schroeder et al., 2016).

The low HOP enrollment rate suggests that future research must investigate how to optimize feasibility of school nurse-led interventions in busy schools. In a future qualitative study, we will explore school nurses' barriers to and facilitators of HOP implementation. Studies that examine barriers to and facilitators of these interventions will be integral to defining the school nurses' role in relation to other school partners. Future research should include both qualitative work to assess the experiences of nurses, school administrators, teachers, children, and parents and rigorous quantitative studies (randomized controlled trials) to assess intervention efficacy.

Implications for Clinical Practice

Being as this study took place in the vibrant “real world” setting of a busy urban school district, it has multiple actionable implications for school nurses. First, feasibility must be carefully considered prior to implementation of a school nurse-led obesity intervention. For

example, how much time does the school nurse have available, what intervention resources will be available to him or her, and how will teachers and school administrators support the intervention? In addition, future school nurse-led interventions should consider using a structured, evidence-based curriculum. Given resource constraints for pilot testing, schools may want to consider implementation of an intervention that has been previously validated. Once an intervention is launched, fidelity should be closely monitored. Poor fidelity to certain intervention components may indicate lack of feasibility within school constraints or need for further nurse training. Parent involvement is also key. Parents should be approached about their child's eligibility for an obesity intervention via phone or in-person (if possible) and nurses should be trained in how to approach parents in a culturally considerate manner without blame. Parents can be empowered to participate by informing them that their involvement plays a key role in intervention effectiveness. Before implementing a school nurse-led obesity intervention, nurses will need to be adequately trained in intervention delivery; this can potentially be done during routine in-services. It may also be helpful for intervention materials and resources to be available throughout the implementation period, such as via the school intranet. The population for the intervention must also be carefully considered. If only a low intensity intervention is feasible, children with severe obesity are not the appropriate population unless the intervention is designed to be part of a comprehensive clinical management program that includes an intensive clinical care component outside the school day. Lastly, it is important to understand the complex interplay of factors that lead to obesity in the home and community environment; interventions that focus only on the school setting are not likely to have large impact on obesity rates. Interventions that involve school, home, and community components are more likely to be effective but require a much greater coordination of resources and efforts.

Limitations

This study has several limitations. First, it is a retrospective analysis using secondary data. Because data come from an electronic health record, variations in data quality and data collection methods exist. However, the electronic health record was the best available source of health and obesity data for children in the NYC Public Schools. Second, HOP is set in a large, diverse, urban, public school system and the findings of this research may not be generalizable to all school settings. In addition, because the data used in this study were not collected for the purpose of examining HOP, other variables that may be important (e.g., HOP session duration) were not available. The data also did not include information about intervention fidelity, including how it may have varied by factors such as level of nurse experience or school size.

Conclusions

In conclusion, school nurses may be able to play a unique role in the implementation of school-based obesity interventions. However, future school nurse-led interventions can build upon lessons demonstrated in the HOP evaluation; parent involvement must be a focus, nurses must be adequately trained, the intervention intensity must be aligned with the target population's needs, and feasibility of implementation must be carefully considered. With careful evidence-based development and thoughtful deployment, school nurse-led obesity

interventions may be able to uniquely contribute to obesity treatment and improved student health.

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Fig. 1.
Summary of HOP enrollment and implementation process.

Table 1

Sample demographics organized by Socio-Ecological Model constructs.

Variable	Eligible, Enrolled <i>N</i> = 1054	Eligible, Not Enrolled <i>N</i> = 19,464	<i>p</i> -Value for Difference
Community Level			
% of individuals living below poverty level in student home community (mean % $\pm$ SD) ^a	23.4 ($\pm$ 6.3)	23.8 ($\pm$ 6.5)	0.06
Institutional Level			
% students/school eligible for free/reduced school lunch (mean $\pm$ SD)	71.0 ($\pm$ 20.1)	74.1 ($\pm$ 18.0)	<0.01
School nurse workload (mean $\pm$ SD) ^b	13.2 ($\pm$ 6.6)	14.6 ($\pm$ 6.4)	<0.01
Interpersonal Level			
Receive free/reduced school lunch (%)	82.6	81.2	0.26
Individual Level			
BMI (mean $\pm$ SD)	29.8 ($\pm$ 4.9)	27.1 ($\pm$ 4.4)	<0.01
BMI percentile (mean $\pm$ SD)	99.5 ($\pm$ 0.3)	99.4 ($\pm$ 0.3)	<0.01
Gender (%)			0.07
Male	58.8	61.6	
Female	41.2	38.4	
Age in years (mean $\pm$ SD)	8.3 ($\pm$ 1.7)	7.6 ($\pm$ 1.8)	<0.01
Grade (%)			<0.01
Kindergarten	6.9	20.6	
First	16.3	20.2	
Second	21.6	18.9	
Third	18.8	15.6	
Fourth	19.2	13.1	
Fifth	17.2	11.5	
Race/ethnicity (%) ^c			0.10
White (Non-Hispanic or Latino)	10.7	9.9	
Black or African American (Non-Hispanic or Latino)	21.5	25.3	
Hispanic or Latino	58.8	56.4	
Other	9.0	8.4	
At least 1 chronic illness (%)	46.0	30.5	<0.01

^aData from the New York Center for Economic Opportunity (NYC Center for Economic Opportunity, 2015).^bComposite metric developed by the New York City Department of Health and Mental Hygiene that accounts for nurse to student ratio and number of children with diabetes, asthma, or requiring medication administration during school hours.^cOther = Asian, Native Hawaiian/Other Pacific Islander, American Indian/Alaskan Native, Multi-racial.

Table 2

HOP implementation.

Variable	
Number of sessions attended per participant (median [range])	1 (1–11)
Number of sessions attended per participant (%)	
1	53.6
2	19.9
3	10.7
4	7.3
5	4.2
6+	4.3
Focus of HOP session, by component	
Health behavior education (%)	44.9
Health behavior education focus (%)	
Fruit/vegetable intake	31
Sugar sweetened beverage intake	19
Physical activity	19
Screen time	16
Portion control	15
BMI measurement and tracking (%)	92.2
Goal setting (%)	18.2
Comprehensiveness of HOP sessions ^a (%)	
Included all components	6.3
Included 2 of 3 components	32.6
Included 1 component	61.1
Parent attendance at HOP sessions (%)	3.2

n = 1054.

^aProgram components include health behavior education, BMI measurement and tracking, and goal setting.

Table 3

Factors associated with enrollment of eligible children in HOP.

Predictor	Odds Ratio	95% CI
Gender		
Male	1.2	1.0, 1.3
Female	1.0	Reference
Grade		
Kindergarten	0.2	0.1, 0.2
First	0.4	0.3, 0.5
Second	0.7	0.5, 0.8
Third	0.8	0.6, 1.0
Fourth	1.0	0.8, 1.2
Fifth	1.0	Reference
Race/ethnicity ^a		
Black or African American (Non-Hispanic or Latino)	0.7	0.4, 1.3
Hispanic or Latino	0.9	0.6, 1.2
Asian/Native Hawaiian/Pacific Islander	1.0	0.8, 1.3
Other/Multi-racial	0.6	0.5, 0.8
White (Non-Hispanic or Latino)	1.0	Reference
Diagnosis of 1 chronic illnesses		
No	0.5	0.5, 0.6
Yes	1.0	Reference
BMI percentile		
99.0–99.5%	0.5	0.4, 0.6
>99.5%	1.0	Reference
% students/school eligible for free/reduced school lunch (mean ± SD)		
Lower than New York state average	1.6	1.3, 1.9
At or higher than New York state average	1.0	Reference
School nurse workload		
Low	2.4	2.0, 2.8
Middle	1.2	1.0, 1.4
High	1.0	Reference
School Borough		
Bronx	1.8	1.3, 2.6
Brooklyn	1.6	1.1, 2.2
Manhattan	1.3	0.9, 2.0
Queens	4.2	2.9, 5.9
Staten Island	1.0	Reference

N = 20,518.