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PCD Collection: Evaluation of New York City's Regulations on Nutrition, Physical Activity, and Screen Time in Licensed Group Child Care Centers

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EVALUATION OF NEW YORK CITY'S REGULATIONS ON NUTRITION, PHYSICAL ACTIVITY, AND SCREEN TIME IN LICENSED GROUP CHILD CARE CENTERS

Rationale for New York City's Regulations on Nutrition, Physical Activity, and Screen Time in Early Child Care Centers

Cathy Nonas, MS, RD; Lynn D. Silver, MD, MPH; Laura Kettel Khan, PhD; Laura Leviton, PhD

Neighborhood Disparities in Prevalence of Childhood Obesity Among Low-Income Children Before and After Implementation of New York City Child Care Regulations

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Measurement of Compliance With New York City's Regulations on Beverages, Physical Activity, and Screen Time in Early Child Care Centers

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Training and Technical Assistance for Compliance With Beverage and Physical Activity Components of New York City's Regulations for Early Child Care Centers

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Evaluation Design of New York City's Regulations on Nutrition, Physical Activity, and Screen Time in Early Child Care Centers

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Compliance With New York City's Beverage Regulations and Beverage Consumption Among Children in Early Child Care Centers

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Relationship Between Child Care Centers' Compliance With Physical Activity Regulations and Children's Physical Activity, New York City, 2010

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Insights and Implications for Health Departments From the Evaluation of New York City's Regulations on Nutrition, Physical Activity, and Screen Time in Child Care Centers

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SPECIAL TOPIC

Rationale for New York City's Regulations on Nutrition, Physical Activity, and Screen Time in Early Child Care Centers

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Abstract

Childhood obesity is associated with health risks in childhood, and it increases the risk of adult obesity, which is associated with many chronic diseases. Therefore, implementing policies that may prevent obesity at young ages is important. In 2007, the New York City Department of Health and Mental Hygiene implemented new regulations for early childhood centers to increase physical activity, limit screen time, and provide healthful beverage offerings (ie, restrict sugar-sweetened beverages for all children, restrict whole milk for those older than 2 years, restrict juice to beverages that are 100% juice and limit serving of juice to only 6 ounces per day, and make water available and accessible at all times). This article explains why these amendments to the Health Code were created, how information about these changes was disseminated, and what training programs were used to help ensure implementation, particularly in high-need neighborhoods.

Background: Why Act to Reduce Obesity in Early Childhood

In 2006, childhood obesity in the United States had reached record levels, even among children as young as 2 to 4 years (1,2). A New York City (NYC) Department of Health and Mental Hygiene (DOHMH) study of 16,000 children in NYC Head Start early childhood centers found that 27% of children were obese and 16% were overweight, or 4 of 10 preschoolers were at potentially harmful weights (3). It was clear that child obesity was associated with risk factors such as type 2 diabetes, high blood pressure, and nonalcoholic fatty liver disease among others (4) and that to address this issue public health interventions needed to begin when children are very young.

Health departments are required by law to protect and promote the health of their constituents. In the United States, 25% of all children aged 0 to 4 years are in a center-based child care program (5). There are approximately 2,000 such public and private group child care centers in NYC, caring for roughly 120,000 children aged 0 to 5 years. Unlike boards of health in other cities, the NYC Board of Health has long-held independent regulatory authority over group child care centers; therefore, it made sense for the DOHMH to prioritize early childhood settings for its initial obesity prevention interventions.

The DOHMH's Bureau of Child Care has a team of inspectors and early childhood educators who examine each center at least annually and provide support to ensure compliance with applicable regulations. Until 2006, the Health Code included only general provisions relating to play and wholesome food that had been unenforced for some time. In 2006, the DOHMH proposed to the NYC Board of Health an amendment to Article 47 of the City's Health Code to establish requirements for healthful beverages, strengthen requirements for physical activity, and limit television screen time provided to children. The proposal was introduced at the NYC Board of Health public hearing in March 2006, in conjunction with additional tuberculosis screening requirements at early child care centers. A public comment period was opened for 30 days after which an open hearing was held in April 2006. The proposal was uncontroversial. Only 4 parties commented, 3 who were supportive and 1 who raised the concern that the regulation could indirectly sanction television use. The final proposal was approved in June 2006 and became effective January 1, 2007. The new regulations were shaped by relevant national recommendations and guidelines. Some states had made changes in nutritional standards (6), but to our knowledge, this implementation of regulations was

the first time a local regulatory authority addressed obesity in the early child care environment. Because these regulations applied to the entire population of city-licensed, group-based, early child care centers, these regulations have a broad reach. They also constituted a potentially low cost and sustainable approach to changing environments.

The articles in this issue of *Preventing Chronic Disease* present the results of an evaluation of the 2007 NYC group child care regulations conducted in 2010 by ICF International with funding from the Robert Wood Johnson Foundation and technical assistance from the Centers for Disease Control and Prevention (CDC), the NYC DOHMH, and New York University. As we seek to understand best practices for reducing childhood obesity and improving children's health, several questions arise in relation to the NYC experience: were these regulations feasible to implement, are they effective at increasing physical activity or improving nutrition, and can they be replicated. This evaluation of the NYC regulations is a first step in better understanding best practices for child care centers. This introduction to the collection of manuscripts will seek to describe the content of and rationale for the regulations in NYC, and their evaluation will be discussed in the accompanying manuscripts (7–13).

The Regulations and Their Rationale in 2006

Nutrition

The regulation changes clarified requirements relating to beverages, with specific provisions including the following: 1) beverages with added sweeteners, whether artificial or natural, shall not be provided to children; 2) juice shall only be provided to children aged 8 months or older and shall not be provided in a bottle, only 100% juice shall be permitted, and children shall receive no more than 6 ounces per day; 3) when milk is provided, children aged 2 years or older shall be served milk with only 1% or less milk fat, unless milk with a higher fat content is medically required for an individual child, as documented by the child's medical provider; and 4) water shall be made available and shall be easily accessible to children throughout the day, including at meals (Box).

Box. Health code amendment to require healthy beverages, increase physical activity, and limit television viewing, New York City, 2007

Physical Activity

- Aged 1–3 years: 60 minutes of physical activity per day.
- Aged 3 years or older: 60 minutes, including 30 minutes of guided and structured physical activity.

Television Viewing

- Younger than 2 years: restricted.
- Aged 2 years or older: 60 minutes or less per day.
- Only educational programs or programs that actively engage child movement (ask Early Childhood Consultants for ideas!)

Nutrition/Beverages

- No beverages with any added sweeteners, whether artificial or natural, shall be served.
  - Only 100% fruit juice is allowed — check Nutrition Facts Label.
  - No more than 6 ounces per day is allowed.
  - Juice shall only be provided to children 8 months or older and should not be provided in a bottle.
- Milk:
  - Only unsweetened/unflavored 1% or nonfat milk for children aged 2 or older is allowed. Milk substitutes (such as soymilk) must be unflavored and unsweetened.
  - Only unsweetened/unflavored whole milk for children ages 12 months to younger than age 2 is allowed.
- Water must be made available and easily accessible to children throughout the day (recommendation: directly on the table at meals and snacks).

By 2006, enough epidemiologic data identified sugary drink consumption as a factor in the obesity epidemic that ensuring that children do not consume these products routinely was considered a priority (14). There was also interest in acting early to reduce exposure to sweetened beverages; because infants have a preference for sweet taste, consuming sweetened beverages at an early age may perpetuate that preference throughout life (15). Sugar-sweetened beverages are energy dense and mostly nutrient poor, adding more calories and often unneeded nutrients to a child's dietary intake. Since 2006, the body of literature on this issue has grown and the evidence base strengthened (16,17).

The fruit juice restriction was established because even among children aged 2 to 4 years, 100% fruit juice contributes roughly 100 calories to a daily diet (17,18). These beverage standards were consistent with recommendations from the American Academy of Pediatrics (19), as well as the 2005 Dietary Guidelines for Americans (20).

When the regulations were passed, there were no federal requirements in child feeding programs about the type of milk to be served. However, both the Dietary Guidelines for Americans and the American Heart Association with support from the American Academy of Pediatrics recommended low-fat or nonfat milk rather than whole milk for children older than 2 years. Since 2006, both the Special Supplemental Nutrition program for Women, Infants, and Children (WIC) (21) and the Child and Adult Care Food Program changed their requirements to serve low-fat milk for children older than 2 years (22). Additionally, restrictions on trans fat took effect in 2007, and a Mayoral Executive Order on standards for food purchased and served by all NYC agencies (including city-funded group child care centers under the Health Department's jurisdiction) took effect in 2008. These food standards contained limits for sodium, an increase in fruits and vegetables, and an increase in fiber, as well as a restriction on added sugar and a reduction in fat. Many similar recommendations are supported by the Institute of Medicine (23,24).

Water, particularly tap water in NYC, is a low-cost, healthful way to keep children hydrated. The intent of the regulation requiring access to tap water was to accustom children to drinking it at an early age. The Healthy Hunger-Free Kids Act of 2010 also now requires that clean water be easily available in school (25), and studies have shown its potential for weight gain prevention (26). Therefore, a regulation that water be available and accessible at all times during the day in early child care centers seemed a simple and fundamental public health measure.

Screen time

The updated regulations on screen time stated that

> . . . television, video and other visual recordings shall not be used with children under two years of age. For children ages two and older, viewing of no more than 60 minutes per day of educational programs or programming that actively engages child movement. Children attending less than a full day program shall be limited to a proportionate amount of such viewing.

Television viewing is positively associated with an increase in body mass index (BMI). Evidence cited when the regulation was put into effect included the following: among children in the longitudinal Framingham Children's Study those who watched the most television had the greatest increase in body fat from aged 4 to 11 years (27). A study of 3- to 4-year-olds found that the length of time spent in television viewing predicted BMI over 3 years and that this factor became an even stronger predictor over time (28). Evidence from the Institute of Medicine also indicated that food and beverage marketing targeted to children aged 12 years or younger led them to request and consume high-calorie, low-nutrient products (29).

Reducing television and screen exposure was a tenet of many health messages from such organizations as the Anthem Blue Cross/Blue Shield partnerships with Maine (30). However, most public health messages such as the 5-2-1-0 campaign (www.letsgo.org) call for 5 fruits and vegetables, no more than 2 hours per day of recreational screen time, 1 hour of physical activity, and 0 sugar-sweetened beverages per day. Since that interval includes time at home, it was felt that 60 minutes of screen time per full day at a child care center was a reasonable limit, and screen time content was restricted to educational programing or programming that promoted movement. Early childhood specialists from the Bureau of Child Care were available to specify appropriate programming.

Physical activity

The Article 47 amendments established minimum standards for physical activity in early childhood. Specifically, full-day centers are required to provide children 12 months or older with 60 minutes of physical activity per day. For children aged 3 years or older, 30 of the 60 minutes each day must be structured. Evidence on the benefits of increased physical activity for young children was limited in 2006, although there were some studies on its effects on adiposity (31); there was much evidence on its importance for older children and adults (32), and it was believed that this activity level would be a precursor to healthful behaviors as children age. The proposed regulations cited the 2001 National Association for Sport and Physical Education recommendations that toddlers and preschoolers participate in at least 60 minutes of physical activity per day (33) and that young children not be sedentary for more than 60 minutes at a time except when sleeping. Therefore, establishing these minimum requirements for physical activity was in line with existing recommendations.

The new regulations had a clear statement that no matter how small the space or bad the weather physical activity had to programmed for the children, indoors or out. However, it was also clear that to help centers overcome some of the barriers to weather and space, substantial support and training would be needed. There were other reasons why physical activity training might be required: many NYC centers not only lacked space, but they lacked equipment; some staff members may not like to be physically active; staff members who are overweight or obese or have physical disabilities may find it difficult to perform certain activit-

ies; and studies indicate that children in high-poverty neighborhoods are less likely to have access to physical activity than other children (34).

Implementing the Regulations

The Bureau of Child Care communicated the changes in regulations to child care centers through 3 channels. First, in late 2006, the Bureau invited all center directors to 1 of 5 public meetings organized in each of the 5 boroughs of New York City. Second, letters were sent to all centers about the new regulations in March 2007. Third, sanitarians and early childhood education consultants who annually visit the centers attended trainings about the regulations and were given directives to ensure that the center directors were aware of these changes. The early childhood education consultants are charged with supporting the centers' education curriculum. The sanitarians are charged with documenting whether the centers are in compliance with all the regulations in the NYC Health Code. In 3 particularly high-poverty neighborhoods, additional on-site technical assistance related to nutrition and physical activity in general and the new regulations specifically was provided to centers from 2006 until 2010. This individualized technical assistance ended after all sites in each of these neighborhoods had been visited on at least 2 occasions each.

In 2006, NYC's City Council funded expansion of a training program for staff in early child care centers to help them implement the new beverage and screen time regulations and the physical activity requirement in their classrooms. Since that time, approximately 14,000 teachers from over 70% of the 1,600 licensed centers that care for children 2 to 5 years of age have been trained. Manuals and play equipment were provided to centers that sent staff for training. At the time of this evaluation, most teachers had been trained through a program called Sports, Play, and Active Recreation for Kids! (SPARK!), part of Sportime, Inc (www.sparkpe.org/about-us/sportime/). The program had been edited to meet NYC needs for small space use. After this evaluation was complete, because of contractual issues, the DOHMH created its own physical activity curriculum called Move-To-Improve for Early Childhood, developed by DOHMH staff specifically for small spaces typical of NYC centers. The curriculum is publicly available at www.nyc.gov/html/doh/downloads/pdf/cdp/cdp-pan-staff-early-child-intro.pdf.

Why a Regulatory Approach

One alternative to a regulatory approach is intensive education of and outreach to staff at child care centers. However, NYC, like many other jurisdictions, has large numbers of facilities and limited staff and funding. Although intensive technical assistance and outreach may have been effective in changing practices without regulation, the necessary resources to reach 2,000 facilities rapidly were simply not feasible without funding from outside sources.

In contrast, policy approaches, such as those used in NYC, can affect a large number of people and be instituted at a low cost for the population they reach. It would be naïve to assume that simply writing a regulation alone would automatically result in high levels of compliance with those policies. Effective communication of requirements, some level of technical support and training, and consistent enforcement are needed for most policies to be optimally successful.

Policy and program approaches also are not either–or. One could think of obesity policies as layers: each layer inches closer to better health and raises the tenor of the work. For example, in the case of reversing tobacco use, it has taken many layered policies — including smoke-free air in more places, taxation, hard-hitting media campaigns, and cessation support — over a decade to successively reduce the prevalence (35). In the field of obesity prevention, in 2006 whole milk was still part of school, early child care centers, WIC, and other places where children spent their time. Only 6 years later, because of multiple changes in the federal and city regulations, low-fat and skim are the norm for NYC children older than 2 years. It is likely that reversing the childhood obesity epidemic will similarly require layering of multiple policy, system, and environmental changes to bring levels down to those of past decades.

We hope that colleagues from other jurisdictions, operators of early childhood services, and national policy makers will find this evaluation useful in their efforts to design and implement programs and policies to address childhood obesity for their communities.

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ORIGINAL RESEARCH

Neighborhood Disparities in Prevalence of Childhood Obesity Among Low-Income Children Before and After Implementation of New York City Child Care Regulations

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PEER REVIEWED

Abstract

Introduction
New York City Article 47 regulations, implemented in 2007, require licensed child care centers to improve the nutrition, physical activity, and television-viewing behaviors of enrolled children. To supplement an evaluation of the Article 47 regulations, we conducted an exploratory ecologic study to examine changes in childhood obesity prevalence among low-income preschool children enrolled in the Nutrition Program for Women, Infants, and Children (WIC) in New York City neighborhoods with or without a district public health office. We conducted the study 3 years before (from 2004 through 2006) and after (from 2008 through 2010) the implementation of the regulations in 2007.

Methods
We used an ecologic, time-trend analysis to compare 3-year cumulative obesity prevalence among WIC-enrolled preschool children during 2004 to 2006 and 2008 to 2010. Outcome data were obtained from the New York State component of the Centers for Disease Control and Prevention's Pediatric Nutrition Surveillance System.

Results
Early childhood obesity prevalence declined in all study neighborhoods from 2004–2006 to 2008–2010. The greatest decline occurred in Manhattan high-risk neighborhoods where obesity prevalence decreased from 18.6% in 2004–2006 to 15.3% in 2008–2010. The results showed a narrowing of the gap in obesity prevalence between high-risk and low-risk neighborhoods in Manhattan and the Bronx, but not in Brooklyn.

Conclusion
The reductions in early childhood obesity prevalence in some high-risk and low-risk neighborhoods in New York City suggest that progress was made in reducing health disparities during the years just before and after implementation of the 2007 regulations. Future research should consider the built environment and markers of differential exposure to known interventions and policies related to childhood obesity prevention.

Introduction

Following decades of rising prevalence of obesity among children in the United States, evidence suggests that the trend may be subsiding (1–4). Although childhood obesity has begun to stabilize in New York City, disparities in the burden of obesity and related chronic disease persist (4,5). The causes of childhood obesity are complex; therefore, for prevention efforts to succeed, strategies need to be implemented at multiple levels involving both environmental and policy changes (6,7). Furthermore, involvement at the local public health level is necessary for programs and policies to have population-wide impact (8).

As part of New York City's efforts to promote health equity and reduce neighborhood health disparities, the New York City Department of Health and Mental Hygiene established a District Public Health Office (DPHO) in the neighborhood that had the highest rates of illness and death in 2002 in each of 3 New York City boroughs: Manhattan, Brooklyn, and the Bronx. DPHOs work with community partners to plan and implement health promotion initiatives in the catchment areas of their respective high-risk neighborhoods. To prevent childhood obesity, personnel in child care centers in DPHO catchment areas receive additional training and technical assistance for promoting physical activity and healthy nutrition than do child care centers in non-DPHO neighborhoods. The additional training and technical assistance provided by DPHOs would be expected to enhance the implementation of various initiatives to prevent childhood obesity in the 3 DPHO high-risk neighborhoods. Key childhood obesity prevention initiatives implemented after the DPHOs were established include the 2006 revisions to Article 47 of the New York City Health Code and the Eat Well Play Hard in Child Care Settings initiative, which was launched by the New York State Department of Health at child care centers participating in the federally funded Child and Adult Care Food Program. Both initiatives sought to improve the nutrition, physical activity, and television-viewing behaviors of children enrolled in licensed child care centers.

Many children, especially low-income children, attend nonlicensed child care or have home day care providers; these children are also likely to be enrolled in public health nutrition programs such as WIC. Indeed, more than half (52.0%) of children sampled from child care centers in low-income neighborhoods for the 2-part ICF International (ICF) evaluation of New York City Article 47 child care regulations, which is described elsewhere (9) in this issue of *Preventing Chronic Disease*, were also enrolled in WIC (9). No population-wide data source is available at the local level for monitoring changes in obesity among preschool-aged children. Data from WIC are a reliable source of information on measured weight and height of enrolled low-income, preschool children (10). Accordingly, to supplement the ICF evaluation, we used New York State WIC data from the Centers for Disease Control and Prevention's (CDC's) Pediatric Nutrition Surveillance System (PedNSS) 1) to conduct an exploratory ecologic study of changes in obesity prevalence and 2) to compare disparities in obesity prevalence between preschool children enrolled in WIC in DPHO (ie, high-risk) areas and preschool children in non-DPHO (ie, low-risk) neighborhoods 3 years before (2004–2006) and 3 years after (2008–2010) the initial response to the new child care regulations in 2007.

Methods

We used an ecologic, time-trend analysis to compare trends in early childhood obesity prevalence between 2004–2006 and 2008–2010 in New York City high-risk neighborhoods located in and around DPHO areas (11). Child care centers in the DPHO neighborhoods were oversampled in the ICF evaluation to study compliance with the regulations by child care centers in predominantly low-income neighborhoods. Data for calculating obesity prevalence and racial/ethnic distributions were obtained from the New York State component of CDC's PedNSS, for 2004–2006 (n = 148,785) and 2008–2010 (n = 170,091).

The CDC PedNSS monitored height and weight of all preschool children enrolled in WIC in New York State during the study time frame. Clinic- and county-specific data were captured to assess obesity trends in the New York City pediatric WIC population. On average, children were assessed twice a year by the WIC program; to measure height and weight, trained staff used a standard protocol (3) or obtained the data from medical referral records. Each child's age, sex, race/ethnicity, household size, and income were reported by the child's parent or caregiver. For this study, race/ethnicity was categorized as non-Hispanic black, non-Hispanic white, Hispanic, or other; the "other" group is small and consists of numerous racial/ethnic categories, including South Asian, East Asian, Native American, and Pacific Islander. Household income was converted to a ratio of income-to-federal-poverty level based on household size by using annual federal poverty guidelines for 2004 or 2010 (12). Data were collected at the clinic level, aggregated at the state level, and submitted to CDC for analysis. Weight, height, and age data were used to calculate body mass index (BMI) (weight [kg]/height [m^2]). For children aged 2 to younger than 5 years, obesity is defined as BMI for age at or below the 95th percentile on the basis of the 2000 CDC sex-specific growth charts (13). One record per child per year was randomly selected to estimate annual obesity prevalence. Weight and height data were excluded if data were missing, miscoded, or biologically implausible (13,14).

Only New York City PedNSS records for children aged from 3 through 4 years were included in the study sample to ensure comparability with preschool-aged children included in the New York City child care evaluation. Data for 2007 were excluded because that was the year the New York City child care regulations were implemented.

To maximize the comparability of New York State PedNSS data with data from child care centers included in the New York City evaluation, WIC clinics in the 5 boroughs were mapped with ArcView, Version 10.0 (Environmental Systems Research Institute,

Inc) against child care centers included in the evaluation and compared visually. Because of the relatively small number of child care centers in the boroughs of Queens and Staten Island included in the New York City evaluation, our analysis was restricted to study centers in and surrounding the DPHO areas of the Bronx, Brooklyn, and Manhattan boroughs, hereafter referred to as "high-risk neighborhoods." WIC clinics located outside the DPHO-catchment areas and in the rest of each borough constituted the "low-risk neighborhoods." These study areas were defined to be consistent with definitions used for New York City's efforts to reduce health disparities in areas that were deemed to be high-need.

To assess possible demographic shifts in the WIC-enrolled children across the study areas, 2004 and 2010 New York City PedNSS racial/ethnic distributions were compared by using absolute percentage changes. For the purposes of this study, race/ethnicity was used as a marker of differential exposure to obesogenic social factors (15). We did not standardize obesity prevalence for race/ethnicity because we did not have estimates of obesity prevalence by race/ethnicity for individual New York City WIC clinics. Data on the household income of WIC-enrolled children were used to calculate the mean poverty ratio in 2004 and 2010 for each of the borough-specific high-risk neighborhoods and their corresponding low-risk neighborhoods. Similarly, 3-year obesity prevalence estimates before 2007 (2004–2006) and after 2007 (2008–2010) were computed for borough-specific high-risk and low-risk neighborhoods, and the significance of changes in 3-year obesity prevalence was assessed by using χ^2 tests. Trends in childhood obesity prevalence were assessed by using a log-linear model in PROC REG, SAS version 9.3 (SAS Institute, Inc).

Results

The figure displays the spatial distribution of WIC clinics included in our study along with child care centers targeted for the ICF evaluation of Article 47 regulations. The figure also shows the high-risk neighborhoods served by a DPHO and shows adjacent low-risk neighborhoods located outside the DPHO catchment areas in the boroughs of Manhattan, Brooklyn, and the Bronx. In addition to showing the target areas for DPHO activities and initiatives (ie, high-risk neighborhoods), the map also shows the clustering of WIC sites and low-income child care centers across all 3 study areas. The high-risk study areas include 46 of the 86 WIC clinics in New York City (53%). In 2004, 84% of WIC participants in the high-risk neighborhoods in our study area (n = 32,710) were Hispanic (52%) or non-Hispanic black (32.0%). The proportions of the 2 subgroups changed little in the high-risk neighborhoods in 2010. In contrast, in the low-risk areas, non-Hispanic black and Hispanic children together constituted approximately half of WIC-enrolled children in 2004 (51%) and 2010 (49%). Among high-risk neighborhoods, the largest absolute change in racial/ethnic composition from 2004 through 2010 occurred in the Bronx where the proportion of WIC-enrolled Hispanic children increased by 4.9 percentage points, while the proportion of children in the "other" category decreased by 5.4 percentage points (Table 1). A slight increase in the proportion of non-Hispanic black children was observed in the Manhattan high-risk neighborhoods (2.2%) along with a small decline in the proportion of children in the "other" category (2.9%). Among the low-risk neighborhoods, the largest changes in racial/ethnic composition occurred in Brooklyn where the proportions of WIC-enrolled non-Hispanic white and non-Hispanic black children both decreased by 4.8% percentage points while the proportion of children in the "other" category increased by 6.3%. In both 2004 and 2010, the household income of WIC-enrolled children in high-risk neighborhoods tended to be a lower proportion of the federal poverty level than that of their WIC-enrolled counterparts in low-risk neighborhoods (Table 1). On average, WIC-enrolled children in high-risk neighborhoods in 2004 lived in households with incomes at approximately 79% of the federal poverty level compared with 88% of those in low-risk neighborhoods. This pattern was unchanged in 2010. Comparisons of the mean poverty ratio between 2004 and 2010 in both high- and low-risk neighborhoods showed a general decline, with the largest decreases observed in Brooklyn (high-risk neighborhoods, −0.29; low-risk neighborhoods, −0.24) and the smallest in the Bronx (high-risk neighborhoods, −0.13; low-risk neighborhoods,−0.04).

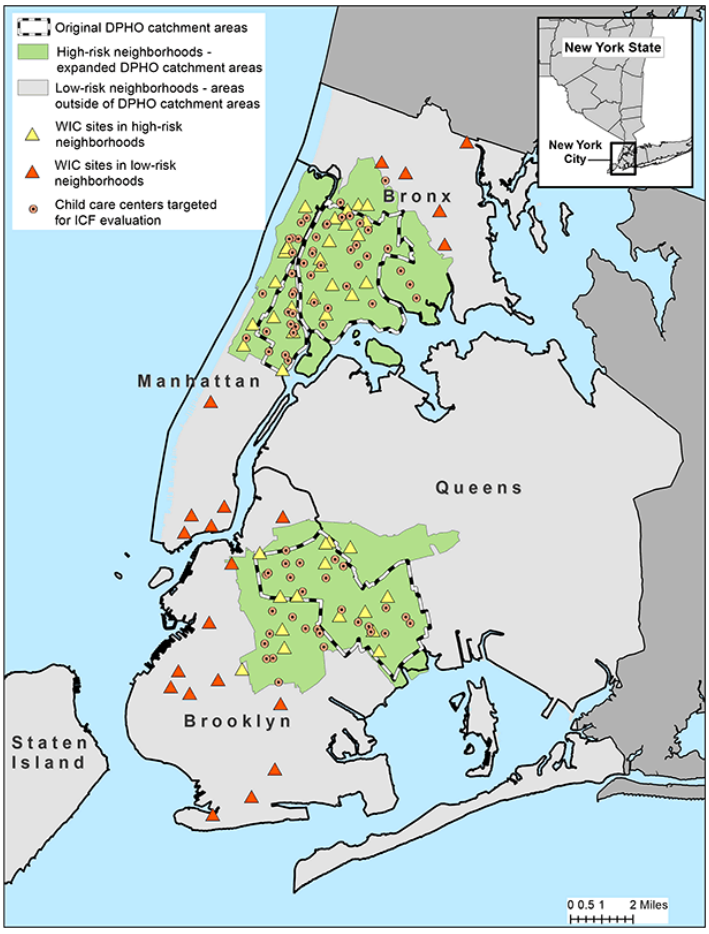

Figure. Child care centers and Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) clinics in high-risk and low-risk neighborhoods of Manhattan, Brooklyn, and the Bronx. Solid and dotted lines indicate the boundaries of the New York City District Public Health Offices (DPHO) located in Central and East Harlem in Manhattan, North and Central Brooklyn, and the South Bronx.

The 3-year prevalence of childhood obesity among 3- and 4-year old children enrolled in WIC during 2004–2006 and 2008–2010 was consistently higher in high-risk neighborhoods than in low-risk neighborhoods (Table 2). The highest prevalence among both high-risk and low-risk neighborhoods was in the Bronx. Childhood obesity prevalence declined in all study neighborhoods. Changes were significant in all areas except in Manhattan low-risk neighborhoods. The greatest decline occurred in Manhattan high-risk neighborhoods where childhood obesity prevalence decreased from 18.6% during 2004–2006 to 15.3% during 2008–2010 ($P < .001$). This decline led to a substantial narrowing of the Manhattan gap in childhood obesity prevalence between high-risk and low-risk neighborhoods. In the Bronx, childhood obesity prevalence in high-risk neighborhoods declined from 19.1% in 2004–2006 to 17.1% in 2008–2010 ($P < .001$) and reached parity with that of the Bronx low-risk neighborhood during 2004–2006 (17.4%) leading to a slight narrowing of the gap. A similar narrowing of the gap was not observed in Brooklyn.

The average annual percentage change in prevalence of obesity in high-risk neighborhoods from 2004 through 2010 was −2.6% ($P = .007$) compared with −1.6% ($P = .082$) in low-risk neighborhoods. The highest annual percentage change occurred in the Manhattan high-risk neighborhood (−4.7%; $P < .001$), followed by that in the Bronx high-risk neighborhood (−2.6%, $P = .005$). No significant trends were observed in the Brooklyn high-risk neighborhood or in any of the 3 low-risk neighborhoods (data not shown).

Discussion

The results of this study show that 3-year obesity prevalence among 3- and 4-year old children enrolled in WIC in high-risk and low-risk neighborhoods in the Bronx, Brooklyn, and Manhattan declined from 2004–2006 to 2008–2010. The declines were greatest in high-risk neighborhoods of the Bronx and Manhattan, with average annual percentage changes that ranged from −4.7% in Manhattan to −2.6% in the Bronx. The findings suggest a narrowing of the gap in early childhood obesity prevalence between high-risk and low-risk neighborhoods in Manhattan and the Bronx, but not in Brooklyn where race/ethnicity shifts in low-risk neighborhoods were substantial. The observed narrowing of the gap between 3-year obesity prevalence in high-risk neighborhoods in Manhattan and the Bronx during 2008–2010 suggests that some progress is being made in addressing health disparities consistent with the mission of the New York City DPHOs.

The observed declines in 3-year obesity prevalence in the study neighborhoods from 2004–2006 to 2008–2010 are consistent with secular trends that show that obesity among preschool and school-aged children has plateaued (1,2), and with reports of declines in childhood obesity in different parts of the United States (3,4,16,17). The relationship of these findings to compliance with the Article 47 regulations by child care centers in the ICF New York City evaluation is unknown but may point to the importance of more intensive assistance in these areas of the city. Compliance with Article 47 of the New York City Health Code was expected in all city neighborhoods. It is likely that multiple factors influenced the decline in obesity rates.

This study shows that geographic variation in childhood obesity is significant within New York City neighborhoods. Evidence of neighborhood-level variation in childhood obesity prevalence in a large city such as New York City underscores the importance of

identifying and monitoring modifiable aspects of the built and social environments when designing and implementing interventions and policies to support the maintenance of healthy lifestyles (18).

Because this study did not include measures of the built environment, it is not possible to comment on the extent to which the observed differences in 3-year obesity prevalence over time could be explained by within-neighborhood changes in socio-environmental characteristics. However, a previous analysis of census and New York City Community Health Survey data shows that more affluent neighborhoods in New York City tend to have more resources that support maintenance of physical activity and healthy eating behavior (18). Most importantly, that same analysis showed that prevalence of adult obesity was higher in less-resourced, low-income communities than in more affluent neighborhoods (18).

Beyond the built environment, however, possible explanations for the observed differences in childhood obesity prevalence among the study neighborhoods range from sociodemographic characteristics of the populations enrolled in WIC to differences in implementation of population-wide obesity prevention policies. In this study, racial/ethnic composition and income-to-poverty ratio were used to assess changes in the sociodemographic characteristics of the study neighborhoods. If the observed declines in 3-year obesity prevalence were largely explained by changes in the racial/ethnic composition of the study neighborhoods, it would be reasonable to expect that proportions of Hispanic and non-Hispanic black children, who are known to be at higher risk for obesity than non-Hispanic white children in the United States (1,3,4,19), would be significantly lower in 2010 than in 2004. However, a careful review of the racial/ethnic composition data shows that the proportions of these 2 high-risk groups remained fairly stable from 2004 to 2010 across all study neighborhoods. Furthermore, in 2010 WIC-enrolled children in each borough were living with families in greater poverty than were the WIC-enrolled children in 2004 as evidenced by the average decrease in income-to-poverty ratio in each borough. This finding suggests that the observed differences in changes in obesity prevalence cannot be attributed to the changing racial/ethnic or socioeconomic composition of the neighborhoods.

In light of the numerous interventions implemented in New York City during the last decade (4) to address the growing childhood obesity epidemic, including the implementation of child care regulations in Article 47 of the New York City Health Code in 2007, the results of this study suggest that citywide policies may be working in concert with state and local initiatives to change the food and physical activity environments for low-income, preschool children. Because data for this study came from WIC-enrolled, low-income children, the observed geographic variation in childhood obesity prevalence trends also raises the possibility that families with WIC-enrolled children are better able to adopt and maintain some healthy lifestyles promoted by the WIC program, such as healthy eating, physical activity, and reduced screen time (20) in some neighborhoods than in others (21).

This study examined childhood obesity prevalence trends at a subcity level over time. Previous studies of preschool-aged children compared trends at the state (2) or city (19,22) level but not at the neighborhood level. The use of 3-year prevalence proportions instead of annual prevalence proportions ensured that comparisons were made by using more stable numerators (ie, counts of WIC-enrolled obese 3- and 4-year old children) and denominators (ie, counts of all 3- and 4-year-old children enrolled in WIC) across all study neighborhoods during the 2004–2006 and 2008–2010.

Our study has several limitations. Like all ecologic study designs, the findings of this hypothesis-generating study cannot be used to draw causal inferences at the individual level. Second, we had no information on the national origin or length of time in the United States of WIC participants; therefore, it was not possible to assess whether changes in the makeup of racial/ethnic subpopulations contributed to changes in obesity prevalence across the study areas. Furthermore, we cannot rule out the effect of more children who are not at risk of obesity enrolling in WIC as a result of the economic downturn that occurred in New York City and nationwide during 2008–2010. Finally, the scope and reach of health promotion activities in DPHO areas are known to have expanded during the study period; however, we were not able to assess the extent to which this expansion may vary across the DPHO areas or may explain the observed neighborhood disparities in childhood obesity prevalence trends.

Although work still remains to eliminate these health disparities (particularly in the South Bronx where obesity prevalence during both 2004–2006 and 2008–2010 was approximately twice the *Healthy People 2020* (23) target of 9.6% for early childhood), evidence of declines in childhood obesity among children enrolled in WIC in all study areas and a narrowing of the gap between high-risk and low-risk neighborhoods in Manhattan and the Bronx is encouraging. New York State and New York City have been proactive and innovative in childhood obesity prevention with statewide and citywide initiatives focused on improving age-appropriate physical activity and access to affordable healthy foods in early child care and WIC settings (4,22). Future research

should include measures of the built environment and individual exposure to known interventions and policies to prevent childhood obesity, including exposure to child care, and should incorporate multilevel regression modeling to fully understand factors associated with childhood obesity prevalence trends in New York City neighborhoods.

Acknowledgments

The evaluation of the New York City Department of Health and Mental Hygiene's regulations for beverages, physical activity, and screen time for children aged 3 years or older in licensed, group child care centers was funded by grant no. 65425 from the Robert Wood Johnson Foundation (RWJF) to the CDC Foundation. Technical assistance was provided by CDC's National Center for Chronic Disease Prevention and Health Promotion's Division of Nutrition, Physical Activity, and Obesity. ICF International was the lead contractor for the study in conjunction with the New York City Department of Health and Mental Hygiene (DHMH). Beth Dixon was a consultant on the project. We thank Laura Leviton, RWJF; Tamara Dumanovsky, New York City DHMH; and Julia Ruben and David Cotton, ICF International for their support and contributions to the study. The findings and conclusions of this paper are those of the authors and do not necessarily reflect the official views of CDC.

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Tables

Table 1. Characteristics of Children Aged 3 to 4 Years (N = 110,773) Residing in High- and Low-Risk Neighborhoods in Manhattan, Brooklyn, and the Bronx and Enrolled in the Special Supplemental Nutrition Program for Women, Infants, and Children, New York City, 2004–2010

	High-Risk Neighborhoods[a]				Low-Risk Neighborhoods[b]			
	2004 n = 34,079	2010 n = 40,701			2004 n = 15,536	2010 n = 20,457		
Characteristic	n (%)	n (%)	Difference[c]	*P* Value	n (%)	n (%)	Difference[c]	*P* Value
The Bronx								
Non-Hispanic black	2,814 (24.0)	3,643 (24.9)	0.9	<.001	1,255 (36.3)	1,719 (35.4)	−0.9	.051
Non-Hispanic white	146 (1.2)	138 (0.9)	−0.3		136 (3.9)	207 (4.3)	0.4	
Hispanic	7,702 (65.8)	10,367 (70.7)	4.9		1,674 (48.4)	2,282 (47.0)	−1.4	
Other	1,043 (8.9)	510 (3.5)	−5.4		395 (11.4)	648 (13.3)	1.9	
Poverty ratio[d], mean (SD)	0.74 (0.52)	0.61 (0.45)	−0.1	<.001	0.81 (0.56)	0.77 (0.55)	−0.04	.004
Brooklyn								
Non-Hispanic black	6,388 (45.7)	7,517 (43.9)	−1.8	.059	1,550 (15.0)	1,586 (10.2)	−4.8	<.001
Non-Hispanic white	2,924 (20.9)	3,509 (20.5)	−0.4		4,131 (39.9)	5,462 (35.1)	−4.8	
Hispanic	3,817 (27.3)	4,696 (29.0)	1.7		2,799 (27.0)	3,880 (24.9)	−2.1	
Other	836 (6.0)	1,111 (6.5)	0.5		1,867 (18.0)	3,499 (24.3)	6.3	
Poverty ratio[d], mean (SD)	0.90 (0.50)	0.61 (0.43)	−0.29	<.001	0.93 (0.47)	0.69 (0.40)	−0.24	<.001
Manhattan								
Non-Hispanic black	1,344 (19.0)	1,517 (21.2)	2.2	<.001	225 (7.3)	251 (8.5)	1.2	.008
Non-Hispanic white	39 (0.6)	143 (2.0)	1.4		27 (0.9)	54 (1.8)	0.9	
Hispanic	5,324 (75.4)	5,350 (74.7)	−0.7		1,129 (36.7)	1,091 (37.0)	0.3	
Other	353 (5.0)	149 (2.1)	−2.9		1,696 (55.1)	1,556 (52.7)	−2.4	
Poverty ratio[d], mean (SD)	0.74 (0.49)	0.63 (0.44)	−0.11	<.001	0.87 (0.50)	0.69 (0.40)	−0.18	<.001

Abbreviation: SD, standard deviation.

[a] High-risk neighborhoods are the areas in or adjacent to the District Public Health Office areas of the Bronx, Brooklyn, and Manhattan boroughs.

[b] Low-risk neighborhoods are the areas in each borough outside the District Public Health Office catchment area.

[c] Values are percentages unless otherwise indicated. Percentages may not total 100 because of rounding.

[d] Poverty ratio is ratio of income to federal poverty level computed by income and household size using annual the US Department of Health and Human Services's Federal Poverty Guidelines for 2004 (24) or 2010 (25).

Table 2. Prevalence of Obesity Among 3- and 4-Year-Old Children Enrolled in the Special Supplemental Nutrition Program for Women, Infants, and Children in High-Risk Versus Low-Risk Study Neighborhoods in Manhattan, Brooklyn, or the Bronx Before (2004–2006) and After (2008–2010) Implementation of New York City Day Care Policies.

Borough	High-Risk Neighborhoods			*P* Value	Low-Risk Neighborhoods			*P* Value
	2004–2006	2008–2010	Change		2004–2006	2008–2010	Change	
Bronx	19.1	17.1	–2.0	<.001	17.4	16.1	–1.3	.008
Brooklyn	15.7	14.8	–0.9	<.001	13.6	12.8	–0.8	.004
Manhattan	18.6	15.3	–3.3	<.001	12.0	11.5	–0.5	.302

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ORIGINAL RESEARCH

Measurement of Compliance With New York City's Regulations on Beverages, Physical Activity, and Screen Time in Early Child Care Centers

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PEER REVIEWED

Abstract

Introduction
Policy interventions designed to change the nutrition environment and increase physical activity in child care centers are becoming more common, but an understanding of the implementation of these interventions is yet to be developed. The objective of this study was to explore the extent and consistency of compliance with a policy intervention designed to promote nutrition and physical activity among licensed child care centers in New York City.

Methods
We used a multimethod cross-sectional approach and 2 independent components of data collection (Center Evaluation Component and Classroom Evaluation Component). The methods were designed to evaluate the impact of regulations on beverages served, physical activity, and screen time at child care centers. We calculated compliance scores for each evaluation component and each regulation and percentage agreement between compliance in the center and classroom components.

Results
Compliance with certain requirements of the beverage regulations was high and fairly consistent between components, whereas compliance with the physical activity regulation varied according to the data collection component. Compliance with the regulation on amount and content of screen time was high and consistent.

Conclusion
Compliance with the physical activity regulation may be a more fluid, day-to-day issue, whereas compliance with the regulations on beverages and television viewing may be easier to control at the center level. Multiple indicators over multiple time points may provide a more complete picture of compliance — especially in the assessment of compliance with physical activity policies.

Introduction

About 24% of American children aged 0 to 4 years are enrolled in center-based child care and another 14% are cared for by a nonrelative adult (1). Thus, nearly 40% of young children spend most of their day being cared for by nonparent adults and are exposed to food and physical environments that are determined by their caregivers. The child care environment, including healthy nutrition and adequate physical activity, is an important factor in the health, well-being, and weight of young children. Many researchers and policy makers have suggested that health behavior patterns are established early in life, making the child care environment an essential element in national efforts to reduce childhood obesity and promote healthy behaviors even among the very young (2–4).

Policy can play a key role in regulating healthy child care environments; although research in this area is growing, increased evaluation of the effectiveness of such policies is needed (4,5). Once a policy is passed, there remain many ways in which the intended benefits of the policy may be compromised when it is implemented in real-world settings. It is critical to understand whether child care centers are able to comply with such policies.

This study examined group child care centers in New York City to assess whether and how well these centers comply with regulations, in place since 2007, intended to improve child nutrition, increase physical activity, and reduce noneducational screen time. New York City monitors compliance with regulations for licensed group child care centers using periodic (generally annual) site visits by city sanitarians; the assessment of compliance is basic, and the implications of poor compliance is an initial citation and a possible loss of license. To date, no center has lost its license because of the beverage, physical activity, and screen time regulations. Thus, our study sought to use a more comprehensive approach to assess compliance. Our approach, which measured compliance in different ways and in an applied research context, offered unique opportunities to investigate variability in compliance. Although recent research has shown relative validity of self-report and observational measures of child care nutrition and physical activity environments, additional evaluation is needed to identify reliable methods of assessing implementation of policies and regulations in real-world contexts (6).

Methods

This evaluation used a multimethod cross-sectional approach and data collected from licensed group child care centers in New York City at 2 time points. This approach was designed to measure the level of compliance with regulations in centers and classrooms, the level of agreement in compliance between centers and classrooms, the factors that affect compliance, and the behavioral outcomes associated with different levels of compliance (eg, physical activity). Details on sampling and data collection are available in Breck et al (7), but they are explained briefly below.

Sample

The sample was limited to centers serving low-income communities, defined by census tracts with 40% or more of families with incomes at or below 200% of the federal poverty level. The sampling frame included 300 of the 311 centers in District Public Health Office (DPHO) catchment areas (low-income, high-morbidity areas where increased levels of public health services are delivered). Ten centers in DPHO catchment areas were excluded because they were not in low-income census tracts; another center was excluded because it was in a census tract with fewer than 100 residents. An additional 350 centers in non-DPHO neighborhoods were included in the sampling frame. These centers were selected from among 549 centers in low-income non-DPHO census tracts in high-poverty zip codes. The goal was to obtain participation of 200 centers (approximately 12% of the licensed centers in New York City). To account for projected nonparticipation, centers were oversampled by 30% to create a sample of 260 centers by randomly sampling 130 DPHO centers and 130 non-DPHO centers. Selected centers were screened for participation eligibility (26 centers did not meet the eligibility criteria and were excluded from participation during recruitment). Of the 234 centers remaining, 58 refused and 176 agreed to participate in the evaluation. Most centers were located in the Bronx, Brooklyn, or Manhattan. Of the 176 centers that agreed to participate in the center component of the study, 110 (62.5%) also agreed to participate in the classroom component.

Data collection

The study consisted of 2 data collections (the Center Evaluation Component and the Classroom Evaluation Component). The center component, conducted in fall 2009, focused on center-level data and included in-person interviews with each center's director, 2 randomly selected teachers, and if applicable, a food service staff member. An observation of each center's facilities, including kitchens and food items in pantries and refrigerators, was also conducted by trained site visitors. The classroom component, conducted in spring 2010, focused on classroom-level data and included observation of staff and child behaviors in the selected classroom during a 2-day site visit. The classroom was randomly selected by the data collectors if the center had more than 1 classroom. Trained data collectors observed all beverages and meals served and consumed, physical activity offered, screen time offered, and other characteristics in 1 classroom of children aged 3 or 4 years. They also collected data on physical activity via accelerometer (8). We measured compliance with 9 regulations and used the following data collection tools: in the center component, we used a site inventory, a food-service survey, a teacher survey, and a director survey; in the classroom component, we used a nutrition observation form, a mealtime observation form, and a general observation form (Table 1).

The evaluation was not originally designed to compare or validate measures of compliance with the regulations. Originally, the center component was designed to assess compliance at each center through the use of staff report and limited observation; the classroom component was designed to assess compliance-associated outcomes among children in selected classrooms. The center component was designed to be similar to regulatory compliance

assessments typically conducted annually by government representatives. However, the classroom component was designed to use more resource-intensive methods — direct observation over a longer period of time — than those typically used for regulatory compliance assessments. The classroom component is less likely to be used for assessment of regulatory compliance in practice, but it could be used by center administrators to monitor their center's compliance.

Descriptive statistics were used to calculate compliance scores (as percentages) in both evaluation components. To explore the consistency of compliance with the regulations between the 2 components, we calculated the percentage of agreement between the components among the sample of 110 centers that had data from both components. All analyses were performed using SPSS version 19.0 for Windows (IBM Corp).

Although the purpose of the 2 data collections was not to compare or contrast the results of the 2 data collection methods used for assessing compliance, the results allowed our study team to document differences in compliance assessed by different methods. By examining differences in compliance measured by the 2 methods, our study elucidates strategies that can be applied to enforce these or similar regulations as well as implications for policy enforcement research.

Results

In the center component, most child care centers were classified as compliant with the regulations on the type of milk to be served to children (80.0%), type of juice to be served (69.1%), the restriction on sugar-sweetened beverages (78.9%), water availability (89.1%), provision of at least 30 minutes of structured physical activity time (78.5%), total physical activity time of at least 60 minutes in a full day (87.2%), amount of television time permitted (100%), and provision of educational-only screen time (84.4%) (Table 2).

Most centers in the classroom component were classified as compliant with type of milk served (90.0%), type of juice served (84.5%), restriction on sugar-sweetened beverages (84.4%), amount of television time permitted (86.1%), and provision of educational-only television time (89.0%). However, a smaller percentage of centers was classified as compliant in the classroom component with the amount of juice given to children (67.3%), water availability (55.5%), amount of structured physical activity offered (30.0%), and total amount of physical activity offered (34.9%).

Compliance varied between components (Table 2). The percentage of centers that were classified as compliant in both the center and classroom components ranged from 21.5% (for structured physical activity) to 86.1% (for television time). We found a high percentage of agreement between center and classroom component compliance for milk (82.7%), sugar-sweetened beverages (70.6%), television time (86.1%), and provision of educational-only television programming (77.1%). In contrast, we found a low percentage of agreement between center and classroom component compliance for total physical activity time offered (38.5%) and structured physical activity time offered (34.6%).

Discussion

Using different methods of assessment at 2 time points, we found high levels of reported and observed compliance with most regulation requirements. The percentage of centers that were classified as compliant in both components ranged from 21.5% (for structured physical activity) to 86.1% (for television time). Especially for television and milk, consistency between components was fairly high; centers that were classified as compliant in the center component were likely to be compliant in the classroom component about 4 to 6 months later. We hypothesize that the difference in compliance is because implementation of these requirements are easy to control at the center level, whereas the provision of physical activity is more sensitive to daily fluctuations, individual classroom factors (eg, variations among teachers or children), or other factors that make consistency of compliance more difficult to achieve. Kakietek et al (9) examined the factors that contributed to center compliance in this evaluation.

Each component of this evaluation used different data collection methods, and data were collected at 2 different times (about 4 to 6 months apart). The center component used self-reports and site observations, whereas the classroom component used a 2-day classroom observation in 1 randomly selected classroom. Although this evaluation was not intended to validate methods for assessing compliance with the regulations, it does shed light on the strengths and weaknesses of various methods of assessing regulatory compliance. For some policies, levels of compliance may vary across time; each day, a center and its staff must act to achieve compliance, and compliance with all regulation requirements may not always be achieved on any given day. Understanding compliance as a daily event might help to explain some of the variations found day to day and between center and classroom components.

For several regulation requirements, we found inconsistent compliance between the center and classroom components. One possible explanation for the inconsistency is that compliance with the regulations may have changed between the first and second data collections. Center component site visits were conducted in fall 2009, and the classroom component was conducted in spring 2010. Although the center staff members were not informed of the results of the center component, during the intervening time, changes in staff, facility, or other factors may have influenced the center's implementation of the regulations.

A second possible explanation for the inconsistency in compliance is that data collected in the center component from teachers, directors, and food service staff members were self-reported inaccurately. This inaccuracy could have been caused by social desirability bias, inconsistent implementation within each center (eg, certain classrooms were compliant and others were not), or lack of knowledge among respondents about the practices or the policy or both. For example, although directors may have believed they served only 100% juice, they may have been unclear about the definition of 100% juice and unknowingly served juice drinks. Although the city provides training for center staff on the 100% juice policy, we do not know and did not assess in this study the extent to which the training results in comprehensive knowledge among center staff. The greatest difference in compliance between components was related to the provision of physical activity opportunities. Respondents in the center component may have wanted to provide the most socially desirable response: that they typically provide the required amount of physical activity opportunities. This explanation would account for the higher proportion of teachers who reported compliance in the center component than the proportion of teachers observed in the classroom component.

A third possible explanation for the inconsistency in compliance is measurement error. Although data collection tools were adapted from other studies where possible, our interview questions or observation tools may have incorrectly classified the center environment or staff behavior. Finally, differences in compliance between the center and classroom components may have resulted from atypical events on the days that data collectors visited the centers. In this scenario, data collected on an atypical day could result in higher or lower levels of compliance compared with data collected on a typical day.

The centers in our study were in low-income, urban neighborhoods; thus, generalizing our findings to other settings is cautioned. Given the resources involved in complying with these and similar regulations, higher-income neighborhoods could demonstrate higher levels of compliance than the centers participating in our study. However, comparisons of compliance assessed by the 2 different components used in our study may have applications for those monitoring compliance and those conducting applied research.

Another limitation of the study sample in both components is the potential for nonrandom bias in the rate of refusal to participate. Although centers included in the center component sample were selected randomly from a sampling frame, about 25% refused to participate in the center component, and about 38% of the centers who participated in the center component opted not to participate in the classroom component. Centers that took part in the classroom component were significantly more likely than centers that took part only in the center component to participate in the Child and Adult Care Food Program, be part of a larger parent agency, have dedicated food service staff, be in DPHO areas, and participate in training programs provided by the health department. Our data on refusal rates and characteristics of centers that refused to participate suggest that centers with poor compliance with the regulations were less likely to participate in the classroom component than centers with better compliance.

Although our evaluation was not designed to inform the enforcement of regulations, our methods may shed light on one of the practical difficulties of enforcing these regulations through the traditional means of an annual site visit by an inspector: the inability of inspectors to monitor compliance every day. Our study demonstrated on 2 separate occasions (1 additional observation per year than an inspector would make to each facility) that compliance with all components of the regulations varies over time and the method of assessing compliance may be especially important for physical activity requirements. We found a much lower level of compliance with the physical activity requirements when we used observation rather than director and teacher self-report. This lower level of compliance suggests that the policy's intended benefit is less likely to be achieved. Policy makers may want to consider not only the content of such policies but also the mechanisms for ensuring compliance over time. For some policies, changes to the methods and frequency of compliance checks, penalties for noncompliance, and training and support may be needed to strengthen implementation.

Recent literature (6) suggests that self-reported survey responses, interviews, and observation are highly correlated for similar studies. Our study builds on that idea by combining multiple data sources to represent not only compliance for a single classroom at a single point in time but also center-wide compliance. Although our evaluation was not designed to validate measures of compliance, our methods can inform future research and evaluation. First, numerous measures could be used to assess compliance (eg, logs, other observational tools), although all methods have

strengths and weaknesses. The measures used in our study were designed to capture data on classroom-level and center-level compliance at 2 time points to examine relationships between compliance and child-level outcomes (8). Second, researchers who are interested in validating compliance metrics would want to design studies explicitly focused on validation using multiple methods of assessment over time to draw more robust conclusions about the validity of individual methods. Although we could not verify which method was most reliable or valid, our findings suggest that observational methods may be a more conservative estimate of daily compliance with physical activity regulations. A study contrasting the use of logs to collect teacher-reported data on physical activity and the use of a third party to observe physical activity offerings would aid in identifying the most reliable, valid, and cost-efficient means of assessing compliance in group child care facilities.

Acknowledgments

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Tables

Table 1. Measures of Compliance for Center and Classroom Components for the Evaluation of New York City Regulations on Beverages, Physical Activity, and Screen Time for Group Early Child Care Centers (N = 110)

Regulation Component	Center Component (Fall 2009) Definition of Compliance by Source[a]	Classroom Component (Spring 2010) Definition of Compliance by Source
Serve only milk with 1% or less fat to children aged 2 years or older	Site inventory (n = 110): No milk with >1% fat was found in the center refrigerator.	Nutrition observation form: Data collector observed only unflavored milk with ≤1% fat served, or the center did not serve any milk.[b]
Provide only 100% fruit juice	Site inventory (n = 110): No <100% fruit juice was found in the refrigerator or on the shelf.	Nutrition observation form: Data collector observed only 100% fruit juice being served.
Serve no more than 6 oz of 100% fruit juice per day	Not measured.	Mealtime observation form[c]: Data collector recorded no more than 6 oz of 100% fruit juice was served to observed children (up to 6 children observed per center).
Do not serve beverages with added sweeteners, whether artificial or natural	Site inventory (n = 76): No beverages with added sweeteners were found in the refrigerator or on the shelf.	Nutrition observation form: Data collector observed no sugar-sweetened beverages served (including sweetened or flavored milk).
	Food service survey (n = 33): In an average week, staff reported never serving beverages with added sweeteners (eg, sodas, sports drinks, flavored or sweetened milk, Kool-Aid, Sunny Delight, Hawaiian Punch, lemonade, fruit drinks, *aguas frescas*, sweet tea) to the children.	
Make water available and accessible throughout the day, including at meals	Teacher survey (n = 105): In an average week, teaching staff reported making drinking water available to children all the time.[d]	General observation form: Data collector observed that drinking water was visible and accessible.
	Food service survey (n = 5): In an average week, food service staff reported making drinking water available to children all the time.	
Provide at least 30 min of structured physical activity per day	Teacher survey (n = 105): Teaching staff reported that children spend at least 30 total minutes per day in structured physical activity or movement time. "Structured" was defined as "teacher-led or teacher guided."	General observation form: Data collector logged the start and stop times of all structured physical activity offerings. The difference between the start and stop time was used to calculate the amount of time for each structured physical activity event. Compliance was indicated when the summed time of all structured physical activity events was ≥30 min per day.
	Director survey (n = 2): Center director reported that children spend at least 30 total minutes per day in structured physical activity or movement time. "Structured" was defined as "teacher-led or teacher guided."[e]	
Provide at least 60 min of total of physical activity per day, structured and	Teacher survey (n = 107): Teaching staff reported that children spend a combined total of at least 60 minutes per day of structured physical activity or	General observation form: Data collector logged the start and stop times of all unstructured physical activity offerings. The difference between the start and stop time was used to

[a] The first source listed is the primary source used to assess compliance status. When the primary source was not available, another source was used.
[b] Flavored or sweetened milk was considered a sugar-sweetened beverage.
[c] Mealtime observation form was used for mealtime observation of up to 6 children during 2 days, and the nutrition observation form was used for observation of food and beverage service (not consumption) in the classroom.
[d] Multiple teachers were asked this survey item, and the least compliant teacher response determined final compliance status; ie, if any teacher reported making drinking water available to children less than all the time, the center was deemed noncompliant.
[e] Half-day centers (n = 11) were deemed compliant when a respondent reported at least 15 minutes of structured physical activity or movement time.
[f] Multiple teachers were asked this survey item, and the least compliant teacher response determined final compliance status; ie, if any teacher reported that children spend less than 60 minutes in combined structured and unstructured physical activity, the center was deemed noncompliant.
[g] Half-day centers (n = 11) were deemed compliant when a respondent reported at least 30 minutes of structured physical activity or movement time.
[h] Programs that actively engage children in movement were not assessed in this study.

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Table 1. Measures of Compliance for Center and Classroom Components for the Evaluation of New York City Regulations on Beverages, Physical Activity, and Screen Time for Group Early Child Care Centers (N = 110)

Regulation Component	Center Component (Fall 2009) Definition of Compliance by Source[a]	Classroom Component (Spring 2010) Definition of Compliance by Source
unstructured combined	movement time or unstructured or free play. "Unstructured" was defined as "times when the children are up and physically active, but the activity is not led by a teacher."[f]	calculate the amount of time for each unstructured physical activity event. Compliance was indicated when the summed time of all structured and unstructured physical activity events was ≥60 min per day.
	Director survey (n = 2): Center director reported that children spend a combined total of at least 60 min per day of structured physical activity or movement time or unstructured or free play. "Unstructured" was defined as "times when the children are up and physically active, but the activity is not led by a teacher."[g]	
Limit screen time to no more than 60 min per day	Teacher survey (n = 106): Teaching staff reported that in an average day, the children spend ≤60 min watching television or videos.	General observation form: Data collector recorded whether television was viewed or video/computer game playing was observed and for how many minutes each was observed. Compliance was indicated when the summed time of all television viewing and video/computer game playing was ≤60 min.
	Director survey (n = 2): Center director reported that in an average day, the children spend ≤60 min watching television or videos.	
Limit screen time viewing to educational programs or programs that actively engage child in movement[h]	Teacher survey (n = 107): Teaching staff reported that the children do not ever watch television shows or videos that are not for educational purposes.	General observation form: Data collector recorded that both the television and video/computer game viewing were for educational purposes only.
	Director survey (n = 2): Center director reported that the children do not ever watch television shows or videos that are not for educational purposes.	

[a] The first source listed is the primary source used to assess compliance status. When the primary source was not available, another source was used.
[b] Flavored or sweetened milk was considered a sugar-sweetened beverage.
[c] Mealtime observation form was used for mealtime observation of up to 6 children during 2 days, and the nutrition observation form was used for observation of food and beverage service (not consumption) in the classroom.
[d] Multiple teachers were asked this survey item, and the least compliant teacher response determined final compliance status; ie, if any teacher reported making drinking water available to children less than all the time, the center was deemed noncompliant.
[e] Half-day centers (n = 11) were deemed compliant when a respondent reported at least 15 minutes of structured physical activity or movement time.
[f] Multiple teachers were asked this survey item, and the least compliant teacher response determined final compliance status; ie, if any teacher reported that children spend less than 60 minutes in combined structured and unstructured physical activity, the center was deemed noncompliant.
[g] Half-day centers (n = 11) were deemed compliant when a respondent reported at least 30 minutes of structured physical activity or movement time.
[h] Programs that actively engage children in movement were not assessed in this study.

Table 2. Agreement Between Center and Classroom Component Compliance From the Evaluation of New York City Regulations on Beverages, Physical Activity, and Screen Time for Group Early Child Care Centers (N = 110)[a]

Regulation Component	Classroom Component Noncompliant, No. (%)	Classroom Component Compliant, No. (%)	Total, No. (%)	Agreement[b], No. (%)
1% Milk only				
Center component noncompliant	7 (6.4)	15 (13.6)	22 (20.0)	
Center component compliant	4 (3.4)	84 (76.4)	88 (80.0)	91 (82.7)
Total	11 (10.0)	99 (90.0)	110 (100.0)	
100% Juice only				
Center component noncompliant	3 (2.7)	31 (28.2)	34 (30.9)	
Center component compliant	14 (12.7)	62 (56.4)	76 (69.1)	65 (59.1)
Total	17 (15.5)	93 (84.5)	110 (100.0)	
Maximum of 6 oz of juice per day				
Center component noncompliant	10 (9.1)	24 (21.8)	34 (30.9)	
Center component compliant	26 (23.6)	50 (45.5)	76 (69.1)	60 (54.5)
Total	36 (32.7)	74 (67.3)	110 (100.0)	
No sugar-sweetened beverages (n = 109)				
Center component noncompliant	4 (3.7)	19 (17.4)	23 (21.1)	
Center component compliant	13 (11.9)	73 (67.0)	86 (78.9)	77 (70.6)
Total	17 (15.6)	92 (84.4)	109 (100.0)	
Water availability				
Center component noncompliant	8 (7.3)	4 (3.6)	12 (10.9)	
Center component compliant	41 (37.3)	57 (51.8)	98 (89.1)	65 (59.1)
Total	49 (44.5)	61 (55.5)	110 (100.0)	
Structured physical activity (n = 107)				
Center component noncompliant	14 (13.1)	9 (8.4)	23 (21.5)	
Center component compliant	61 (57.0)	23 (21.5)	84 (78.5)	37 (34.6)
Total	75 (70.0)	32 (30.0)	107 (100.0)	
Total physical activity (n = 109)				
Center component noncompliant	9 (8.3)	5 (4.6)	14 (12.9)	
Center component compliant	62 (56.9)	33 (30.3)	95 (87.2)	42 (38.5)
Total	71 (65.1)	38 (34.9)	109 (100.0)	
Television time (n = 108)				
Center component noncompliant	0	0	0	
Center component compliant	15 (13.9)	93 (86.1)	108 (100)	93 (86.1)

[a] Unless otherwise indicated, the number of centers providing data was 110; data for constructing compliance scores for some regulations were missing for some centers.

[b] Percentage agreement was calculated by 1) adding together the number of centers that were compliant in the center component and the classroom component and the number of centers that were noncompliant in both components for a given regulation, and then 2) dividing the sum by the number of centers that provided data for both components.

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Table 2. Agreement Between Center and Classroom Component Compliance From the Evaluation of New York City Regulations on Beverages, Physical Activity, and Screen Time for Group Early Child Care Centers (N = 110)[a]

Regulation Component	Classroom Component Noncompliant, No. (%)	Classroom Component Compliant, No. (%)	Total, No. (%)	Agreement[b], No. (%)
Total	15 (13.9)	93 (86.1)	108 (100.0)	
Television content (n = 109)				
Center component noncompliant	2 (1.8)	15 (13.8)	17 (15.6)	84 (77.1)
Center component compliant	10 (9.2)	82 (75.2)	92 (84.4)	
Total	12 (11.0)	97 (89.0)	109 (100.0)	

[a] Unless otherwise indicated, the number of centers providing data was 110; data for constructing compliance scores for some regulations were missing for some centers.

[b] Percentage agreement was calculated by 1) adding together the number of centers that were compliant in the center component and the classroom component and the number of centers that were noncompliant in both components for a given regulation, and then 2) dividing the sum by the number of centers that provided data for both components.

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ORIGINAL RESEARCH

Training and Technical Assistance for Compliance With Beverage and Physical Activity Components of New York City's Regulations for Early Child Care Centers

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PEER REVIEWED

Abstract

Introduction
In 2006, the New York City Department of Health and Mental Hygiene (DOHMH) passed regulations for child care centers that established standards for beverages provided to children and set a minimum amount of time for daily physical activity. DOHMH offered several types of training and technical assistance to support compliance with the regulations. This article analyzes the association between training and technical assistance provided and compliance with the regulations in a sample of 174 group child care centers.

Methods
Compliance was measured by using a site inventory of beverages stored on premises and a survey of centers' teachers regarding the amount of physical activity provided. Training and technical assistance measures were based on the DOHMH records of training and technical assistance provided to the centers in the sample and on a survey of center directors. Ordinal logistic regression was used to assess the association between training and technical assistance measures and compliance with the regulations.

Results
Measures of training related to physical activity the center received: the number of staff members who participated in Sport, Play and Active Recreation for Kids (SPARK) and other training programs in which a center participated were associated with better compliance with the physical activity regulations. Neither training nor technical assistance were associated with compliance with the regulations related to beverages.

Conclusion
Increased compliance with regulations pertaining to physical activity was not related to compliance with beverage regulations. Future trainings should be targeted to the specific regulation requirements to increase compliance.

Introduction

The obesity epidemic among children is a substantial public health concern in the United States (1). Environment and policy change interventions in child care settings are a promising way of responding to this epidemic (2–4). Policy interventions for obesity prevention often target children in settings such as schools and early child care and education centers, places where children spend large amounts of time (5,6). State and local health departments, identified as key partners in supporting community-based obesity prevention, often provide training and technical assistance to improve centers' ability to comply with such regulations (7). The emerging consensus that policy changes are an important public health tool for addressing childhood obesity makes it necessary to examine the factors that facilitate the implementation of and compliance with policy-based interventions. This article analyzes the association between the New York City Department of Health and Mental Hygiene (DOHMH) regulations governing beverages and physical activity in group child care centers and

training programs and technical assistance offered by the DOHMH to support and increase compliance with the regulations.

The New York City regulations, adapted in 2006, set standards for beverages served and strengthen requirements for physical activity offered. Child care centers are required to serve only milk with 1% or less fat to children aged 2 years or older; provide only 100% fruit juice in servings of no more than 6 ounces per day; make water available and accessible throughout the day, including at meals; and they are prohibited from serving beverages with added sweeteners. Child care centers are also required to provide at least 60 minutes of physical activity a day. At least 30 minutes of the total physical activity provided must be structured (ie, teacher-led).

To support adherence to these regulations and to encourage healthy habits in early childhood, the DOHMH provided nutrition- and physical activity-related training programs and technical assistance to licensed group child care centers. The training programs — including Sport, Play and Active Recreation for Kids (SPARK), Eat Well, Play Hard (EWPH), and the EWPH Training of Teachers (TOTs) — were designed and implemented to ensure that all child care centers were given the resources and guidance necessary to improve staff knowledge related to nutrition and classroom physical activity and help increase compliance with the regulations. SPARK training sessions reviewed and discussed the new beverage, physical activity, and screen time regulations in addition to the physical activity curriculum; EWPH and TOTs did not.

The key research hypothesis tested here is that training and technical assistance are associated with better compliance. Analyses presented are part of the larger multi-method evaluation that also examines the impact of compliance on child-level outcomes such as physical activity and beverage consumption (8,9).

Methods

Participants

This cross-sectional study focused on the 1,654 early child care and education centers licensed by the New York City DOHMH Bureau of Child Care. To support child care centers in underserved communities, DOHMH maintains Department of Public Health Offices (DPHOs) that provide technical assistance and other services to child care centers in DPHO catchment areas. Although nearly all (301 of 311) of the child care centers in DPHO catchment areas were in areas with high levels of poverty (census tracts with 40% or more of families with incomes at 200% of the federal poverty line or below), only about 41% (549 of 1,343) of the non-DPHO centers were in neighborhoods with high poverty levels. To ensure comparability between DPHO and non-DPHO centers, only centers in low income, non-DPHO areas were included in the sampling frame. The final sampling frame included 301 of the 311 child care centers in DPHO neighborhoods and 350 child care centers in 9 non-DPHO neighborhoods. Of these, 260 centers were randomly sampled (130 in DPHO neighborhoods and 130 in non-DPHO neighborhoods). Ten percent (26) of the centers were ineligible for the study because they had an insufficient number of children (fewer than 10), had no children in the target age group (3 or 4 years), enrolled only special needs children, were closing or had already closed, or were unreachable. Of the 234 eligible centers, 58 (25%) refused to participate. At the end of the sample selection, data was collected in 176 centers. Complete data was available for 174 centers (92 in a DHPO area and 82 outside) (Figure).

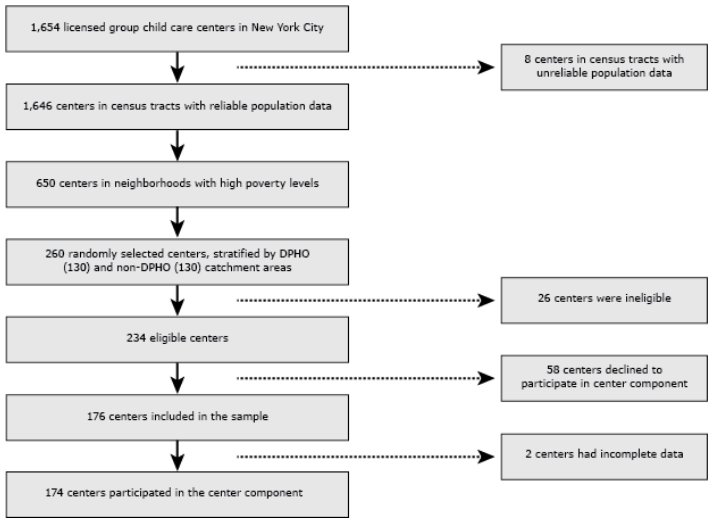

Figure. Sample Flow of Participants in New York City Child Care Centers (n = 174), 2010.

Training and technical assistance offered by DOHMH

The DOHMH offered full-day training sessions for child care center staff on a modified SPARK Early Childhood curriculum to ensure that center staff had the skills to provide 30 minutes of structured physical activity daily. Participants learned how to lead students through structured activities for small classroom spaces and received a manual and equipment necessary for physical activity lessons demonstrated in the training. In response to demand from trained child care center staff, the DOHMH offered a second full-day SPARK training for staff who had participated in the first training.

Centers located in the DPHO catchment areas that target low-income neighborhoods were all provided additional on-site training that focused on that center's specific issues with compliance related to nutrition and physical activity in general and specifically to the new regulations. This individualized technical assistance ended after all centers had been visited on at least 2 occasions regardless of their compliance.

The DOHMH also offered the EWPH program to provide information about healthy eating habits to children, staff, and parents. Unlike SPARK, EWPH was not designed to assist centers in complying with the regulations and did not address the regulations specifically; instead, EWPH reinforced concepts related to nutrition and physical activity that complemented the regulations. Centers participating in EWPH received 8 classroom lessons led by dietitians that focused on the importance of nutrition, portion size, and family meals; lessons on role modeling and healthy eating for staff; and lessons for parents on how to make nutritious and inexpensive meals at home. Centers that participated in EWPH workshops were eligible to participate in the TOTs program, which trained staff members to implement the EWPH nutrition curriculum at their center.

Centers included in the evaluation also reported participation in other training programs not offered by the DOHMH. These trainings included, but were not limited to, Administration for Children's Services (ACS) and Child and Adult Care Feeding Program (CACFP) workshops on nutrition and physical activity, I am Moving, I am Learning, Go! Healthy, and other programs.

Measures

Data collection was conducted by using site inventories and in-person interviews with child care center directors, teachers, and food service staff. The site inventory included items related to availability of and access to play space, availability of water, and types of beverages served, including milk and juice. The interviews collected information on the amount of physical activity provided to children, and other center characteristics. Survey items were adapted from existing validated instruments designed for similar populations (10). Instruments are available on request. Data on training (including SPARK, EWPH, and TOTs) and technical assistance the centers had received were obtained from DOHMH records.

Independent variables: training and technical assistance

Data on a center's participation in training was captured through director interviews and the DOHMH's records. Directors were asked whether their center had participated in SPARK and EWPH and whether the director had attended a SPARK training. The DOHMH provided information on the number of staff members from each center who participated in the EWPH or TOTs trainings and the 2 SPARK training sessions. The DOHMH provided the number of staff from each center who participated in the first and second SPARK training sessions during the 12 months before the evaluation. For each center, those numbers were used as the measure of staff participating in SPARK training.

Center directors were also asked about participation in other nutrition and physical activity training programs. Because supplemental technical assistance was provided by the DOHMH to all centers within the 3 DPHO catchment areas, center location served as an indicator for the additional technical assistance provided by the department in the regression models.

Dependent variables: assessing compliance

Measures of compliance with the regulations related to juice, milk, and sugar-sweetened beverages (SSBs) were based on data collected through the site inventory, while compliance with the regulations related to the availability of water and physical activity were based on self-report of center staff. For each specific beverage regulation, centers were considered compliant if the site inventory found only milk with 1% or less fat, only 100% fruit juice, and no beverages with added sweeteners. For regulations concerning water, centers were considered compliant if center staff reported that water was available to children throughout the day. For each physical activity regulation, centers were considered compliant if center staff reported that children received at least 30 total minutes of structured physical activity per day and at least 60 minutes of total physical activity. Two additive scores were constructed, one for compliance with beverage regulations and another for compliance with physical activity. The beverage score ranged from 0 (did not comply with any of the 4 beverage regulation components) to 4 (complied with all 4 beverage-related regulations components). The physical activity score ranged from 0 (did not comply with either of the 2 components on physical activity) to 2 (complied with both components on physical activity).

Analysis

Multivariate ordinal logistic regression models were used to examine the association between compliance and training and technical assistance. Control variables included in the models captured aspects of center size: average classroom size (average number of students per classroom) and student–teacher ratio; infrastructure: presence or absence of indoor and outdoor play spaces (captured through the site inventory); staffing: presence of dedicated food staff and teaching staff turnover; participation in federal programs related to nutrition or physical activity: CACFP and Head Start;

and proxy measures of the director's leadership: director's tenure (number of years at the center) and educational attainment. These variables were significantly associated with compliance in bivariate analysis. Variables related to nutrition (eg, presence of dedicated food service staff, participation in EWPH) were included only in the model of beverage compliance; variables pertaining to physical activity (eg, presence of outdoor physical activity facilities, participation in SPARK) were included only in the model of physical activity compliance.

Data on compliance with the 100% juice regulation were not available for one center and data on compliance with the SSB regulation were not available for 2 centers. The final sample used in the multivariate models included 174 of the 176 centers. All analyses were conducted using STATA version 9 (StataCorp).

Results

We found that 92 centers (52.9%) were located in DPHO technical assistance areas (Table 1). A total of 151 centers (86.8%) participated in SPARK; directors in 93 centers (46.5%) were trained as part of the program. In an average center, 9 teachers participated in the first SPARK training and 1 teacher participated in the follow-up (second) training. A total of 38 (21.8%) centers participated in one training related to physical activity other than SPARK, and 3 centers (1.7%) participated in 2 such trainings. A total of 53 centers (30.5%) participated in EWPH. On average, 0.5 teachers per center participated in EWPH TOT. A total of 93 (53.4%) centers participated in one training related to nutrition other than EWPH, and 15 centers (8.6%) participated in 2 such programs. A total of 98 centers (56.3%) participated in Head Start and 48 (27.6%) in CACFP. A total of 105 (60.3%) center directors served in that position for more than 5 years and 147 (84.5%) had a graduate degree. A total of 154 centers (88.5%) had dedicated food service staff, 61 (35.1%) had indoor physical activity facilities, 126 (72.4%) had private outdoor facilities for physical activity, and 30 (17.25) had access to shared outdoor facilities (eg, park) for physical activity. An average center was open for 10 hours during the day, had about 6 students per teacher, and had a teaching staff turnover ratio of 0.1.

We calculated the number and percentage of centers in the sample that reported compliance with individual regulation components (Table 2). Compliance with components of regulations on beverages and physical activity ranged from 63.4% to 86.4%.

Results of the regression models for beverages and physical activity (Table 3) show that no training or technical assistance indicators were associated with compliance. Participation in CACFP and center's operating hours were significantly associated with compliance. Centers that participated in CACFP had 3.5 times higher odds of compliance with an additional beverage-related regulation than centers that did not participate in the CACFP program (AOR 3.47, 95% confidence interval [CI], 1.39–8.66). Each additional hour a center was open was associated with a 28% decrease in the odds of being in compliance with an additional beverage regulation (AOR 0.72, 95% CI, 0.54–0.97).

In the physical activity model (Table 3), 2 indicators of physical activity training, but not technical assistance, were associated with compliance: 1) the number of teachers who participated in the first SPARK training and 2) the number of physical activity training programs other than SPARK in which a center participated. Each additional teacher who participated in the first SPARK training was associated with an increase of about 9% in the odds of compliance with an additional regulation (AOR 1.09; 95% CI, 1.01–1.17). Each additional physical activity training program other than SPARK was associated with a 3.6 times increase in the odds of compliance with an additional regulation pertaining to physical activity (AOR 3.57; 95% CI, 1.28–10.01).

In the physical activity model, an increase of one child in the average classroom size for children aged 3 or 4 was associated with a decrease of about 13% in the odds that the center would comply with an additional physical activity regulation (AOR, 0.87; 95% CI, 0.76–0.98). Also, each additional hour the center reported being open was associated with a percent decrease of about 41% in the odds that the center would comply with an additional regulation (AOR, 0.60; 95% CI, 0.39–0.92). An increase of 1 in the teaching staff turnover ratio was associated with a 90% decrease in the odds that the center would comply with an additional regulation (AOR, 0.11; 95% CI, 0.02–0.53). Centers that had their own outdoor facilities for physical activity had almost 3.6 times higher odds of compliance with an additional physical activity regulation than centers that did not have such facilities (AOR 3.67, 95% CI 1.47–9.13).

Discussion

Few empirical studies have systematically assessed compliance with regulations concerning nutrition and physical activity in child care settings. Recent assessments of compliance with nutrition and physical activity regulations among child care centers in Delaware found that 86% of child care centers were compliant with statewide recommendations (not regulations) regarding unstructured physical activity and 78% compliant with the recommendations concerning structured physical activity (11). These findings are consistent with ours: 77.5% of centers were compliant with the regulations regarding structured physical activity and 85.5% of centers were compliant with the regulation concerning total phys-

ical activity. An assessment of compliance with regulations related to nutrition conducted in Delaware found that 88.3% of the centers were compliant with state regulations concerning the types of juice served (12). Our study showed that only 63% of centers were compliant with the regulations concerning juice. This difference may reflect actual differences in compliance, or it may be that the Delaware compliance measure (which was based on self-report) was inflated because of social desirability bias. Observed compliance with regulations concerning water (86.4%) is consistent with other evaluations conducted in Delaware (12) and Connecticut (13): 82.1% and 84%, respectively.

We are not aware of any studies that examined directly the effects of training and technical assistance to improve compliance with regulations concerning nutrition and physical activity in child care settings in the United States. One recent study examined the effect of training on child care staff's knowledge of regulations concerning nutrition, physical activity, and screen time (14). However, it did not address the extent to which the training was associated with improved compliance. Our evaluation supports the potential effect of training and technical assistance programs on a center's compliance with the New York City regulations. Both the number of staff who participated in SPARK and the number of training programs related to physical activity other than SPARK in which a center participated were significantly and positively associated with physical activity regulation compliance. Overall, the results suggest that training sessions such as those offered by the DOHMH may offer child care center staff concrete tools and methods to improve the implementation of physical activity regulations and thereby improve physical activity compliance, but training and technical assistance is less important for beverage regulation compliance.

The lack of association between the second SPARK training and compliance with the regulations suggests that the first training, which provided teachers with basic skills to lead physical activity sessions in their centers, was sufficient to support compliance.

The difference in the associations for physical activity and beverage-related training and technical assistance may have resulted from different ways that physical activity and beverages offered at a center can be influenced and improved through training programs. Simple knowledge of what beverages should be served is insufficient to improve compliance. Some researchers suggest that high prices of healthy foods and beverages may present a barrier to providing them in health care settings (15).

Our analysis showed that factors such as classroom size, operating hours, and teaching staff turnover were associated with regulatory compliance. Consistent with the previous findings, our analysis showed that participation in CACFP was associated with better compliance with regulations related to nutrition (12) and that compliance with regulations related to physical activity was associated with the presence of physical activity facilities at the center (11).

One limitation of this evaluation is that it is based on a cross-sectional design and cannot accurately delineate the direction of the causal linkages between compliance and training and technical assistance. Centers that were dedicated to high standards in nutrition and physical activity and complied with the regulations may have been more likely to participate in training and technical assistance programs than less dedicated and compliant centers. Another limitation is that measures of compliance with regulations on physical activity and water were based on self-report, which might have introduced social desirability bias and may have inflated our estimates. We minimized the effects of measurement bias due to self-report by using, where possible, measures based on site inventories and observational data. The evaluation was also limited by being conducted in group child care centers in low-income communities in New York City. Although the study's setting may limit generalizability, it does give some indication as to how urban child care centers in resource-poor communities may respond to regulations related to nutrition and physical activity.

Our findings have important implications for other jurisdictions considering similar regulations. First, they suggest that training programs can increase compliance with regulations pertaining to physical activity but not to beverages. Therefore, jurisdictions adopting new policies may consider providing training focused on physical activity. Second, numerous center characteristics such as large classroom size, high teaching staff turnover, and center open for long hours are negatively associated with compliance. Training to improve compliance may help offset the effect of those characteristics. Consequently, local health departments may want to focus their training on large centers with high staff turnover (including repeating training for new staff), large classroom size, and centers with long hours of service. Finally, because training appears to have less influence on compliance for beverages, tools such as a simple checklist of which beverages are and are not acceptable may be adequate.

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Tables

Table 1. Training and Technical Assistance to Improve Nutrition and Physical Activity in 174 New York City Child Care Centers, 2010

Categorical Variables	N (%)
Center located in the DPHO area[a]	
Yes	92 (52.9)
No	82 (47.1)
Center participated in SPARK[b]	
Yes	151 (86.8)
No	23 (13.2)
Center participated in EWPH[c]	
Yes	53 (30.5)
No	121 (69.5)
Director reported participation in SPARK[d]	
Yes	93 (46.5)
No	81 (53.5)
No. of physical activity–related trainings other than SPARK and EWPH in which the center participated	
0	133 (76.4)
1	38 (21.8)
2	3 (1.7)
No. of nutrition-related trainings other than SPARK[b] and EWPH[c] in which the center participated	
0	66 (37.9)
1	93 (53.4)
2	15 (8.6)
Continuous variables, mean (SD)	
No. of teachers trained in the 1st SPARK[b] workshop	8.6 (9.0)
No. of teachers trained in the 2nd SPARK[b] workshop	1.2 (3.6)
No. of teachers who participated in TOTs[e]	0.5 (2.4)

[a] DPHO (District Public Health Offices) is a program of the New York City DOHMH that targets resources to high-need neighborhoods in the South Bronx, East and Central Harlem, and North and Central Brooklyn. These centers all received 2 individualized on-site technical assistance sessions.
[b] SPARK (Sport, Play and Active Recreation for Kids) is a physical activity training program that New York City Department of Health and Mental Hygiene (DOHMH) provides free of charge to licensed child care centers.
[c] EWPH (Eat Well Play Hard) is a childhood obesity-prevention initiative of the New York State Department of Health. The EWPH intervention is a 6-week training program provided free of charge by DOHMH to child care centers where at least 50% of the enrolled students are eligible for free or reduced-price meals.
[d] Coded 1 if the director reported she or he participated in the SPARK training and 0 otherwise.
[e] TOTS (Training of Teachers) is a DOHMH technical assistance program that provides child care center staff the skills necessary to lead the EWPH nutrition and physical activity curriculum in their classrooms.
[f] Head Start is a comprehensive developmental program for preschool-aged children and their families who earn a household income below the federal income poverty threshold and is administered by the Administration for Children and Families, US Department of Health and Human Services.
[g] CACFP (Child and Adult Care Food Program) is administered by the US Department of Agriculture through federal grants to state health departments to provide nutritious meals and snacks to low-income individuals.
[h] Presence or absence of variables coded 1 if the appropriate staff or facilities are present and 0 otherwise.
[i] Number of new staff hired during the 12 months preceding the study divided by the total number of staff.

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Table 1. Training and Technical Assistance to Improve Nutrition and Physical Activity in 174 New York City Child Care Centers, 2010

Categorical Variables	N (%)
Continuous variables, n (%)	
Center participates in Head Start[f]	
Yes	98 (56.3)
No	76 (43.7)
Center participates in CACFP[g]	
Yes	48 (27.6)
No	126 (72.4)
Center is part of a larger agency	
Yes	69 (39.7)
No	105 (60.3)
Director's tenure (years at the center)	
1–3 years	46 (26.5)
3–5 years	23 (13.2)
More than 5 years	105 (60.3)
Director's educational attainment	
No bachelor's degree	8 (4.6)
Bachelor's degree	19 (10.9)
Graduate degree	147 (84.5)
Center has dedicated food service staff[h]	
Yes	154 (88.5)
No	20 (11.5)
Center has indoor physical activity facilities[h]	
Yes	61 (35.1)
No	113 (64.9)
Center has private outdoor physical activity facilities[h]	

[a] DPHO (District Public Health Offices) is a program of the New York City DOHMH that targets resources to high-need neighborhoods in the South Bronx, East and Central Harlem, and North and Central Brooklyn. These centers all received 2 individualized on-site technical assistance sessions.
[b] SPARK (Sport, Play and Active Recreation for Kids) is a physical activity training program that New York City Department of Health and Mental Hygiene (DOHMH) provides free of charge to licensed child care centers.
[c] EWPH (Eat Well Play Hard) is a childhood obesity-prevention initiative of the New York State Department of Health. The EWPH intervention is a 6-week training program provided free of charge by DOHMH to child care centers where at least 50% of the enrolled students are eligible for free or reduced-price meals.
[d] Coded 1 if the director reported she or he participated in the SPARK training and 0 otherwise.
[e] TOTS (Training of Teachers) is a DOHMH technical assistance program that provides child care center staff the skills necessary to lead the EWPH nutrition and physical activity curriculum in their classrooms.
[f] Head Start is a comprehensive developmental program for preschool-aged children and their families who earn a household income below the federal income poverty threshold and is administered by the Administration for Children and Families, US Department of Health and Human Services.
[g] CACFP (Child and Adult Care Food Program) is administered by the US Department of Agriculture through federal grants to state health departments to provide nutritious meals and snacks to low-income individuals.
[h] Presence or absence of variables coded 1 if the appropriate staff or facilities are present and 0 otherwise.
[i] Number of new staff hired during the 12 months preceding the study divided by the total number of staff.

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Table 1. Training and Technical Assistance to Improve Nutrition and Physical Activity in 174 New York City Child Care Centers, 2010

Categorical Variables	N (%)
Yes	126 (72.4)
No	48 (27.6)
Center has shared outdoor physical activity facilities[h]	
Yes	30 (17.2)
No	144 (82.8)
Continuous variables, mean (SD)	
Average classroom size (children aged 3–4 y)	6.7 (3.1)
No. of hours of service	10 (1.2)
Student-teacher ratio	5.7 (3.0)
Teaching staff turnover ratio[i]	0.1 (0.2)

[a] DPHO (District Public Health Offices) is a program of the New York City DOHMH that targets resources to high-need neighborhoods in the South Bronx, East and Central Harlem, and North and Central Brooklyn. These centers all received 2 individualized on-site technical assistance sessions.
[b] SPARK (Sport, Play and Active Recreation for Kids) is a physical activity training program that New York City Department of Health and Mental Hygiene (DOHMH) provides free of charge to licensed child care centers.
[c] EWPH (Eat Well Play Hard) is a childhood obesity-prevention initiative of the New York State Department of Health. The EWPH intervention is a 6-week training program provided free of charge by DOHMH to child care centers where at least 50% of the enrolled students are eligible for free or reduced-price meals.
[d] Coded 1 if the director reported she or he participated in the SPARK training and 0 otherwise.
[e] TOTS (Training of Teachers) is a DOHMH technical assistance program that provides child care center staff the skills necessary to lead the EWPH nutrition and physical activity curriculum in their classrooms.
[f] Head Start is a comprehensive developmental program for preschool-aged children and their families who earn a household income below the federal income poverty threshold and is administered by the Administration for Children and Families, US Department of Health and Human Services.
[g] CACFP (Child and Adult Care Food Program) is administered by the US Department of Agriculture through federal grants to state health departments to provide nutritious meals and snacks to low-income individuals.
[h] Presence or absence of variables coded 1 if the appropriate staff or facilities are present and 0 otherwise.
[i] Number of new staff hired during the 12 months preceding the study divided by the total number of staff.

Table 2. Compliance With Beverage and Physical Activity Regulations, New York City Child Care Centers (n = 174), 2010

Regulation	Centers That Comply, n (%)
Beverages served	
Milk that is served has a 1% fat content or less	133 (75.6)
Only 100% juice is served	111 (63.4)
Beverages with added sweeteners are not provided	142 (81.6)
Water is readily available to children throughout the day, including meal times	152 (86.4)
Beverage compliance score[a] (range: 0–4)	
Noncompliance, 0	1 (0.6)
1	12 (6.9)
2	30 (17.3)
3	57 (32.9)
Total compliance, 4	73 (42.3)
Physical activity offered	
Children are offered at least 30 min of structured physical activity a day	134 (77.5)
Children are offered at least 60 min of physical activity a day	148 (85.5)
Physical activity compliance score[b] (range: 0–2)	
Noncompliance, 0	20 (11.6)
Compliance with 1 regulation, 1	24 (13.9)
Total compliance, 2	129 (74.5)

[a] Beverage score ranged from 0 (centers that served milk with more than 1% fat, provided juice drinks that were not 100% fruit juice, provided sugar-sweetened beverages, and did not make water readily available) to 4 (centers that served only milk with 1% or less fat, 100% fruit juice, did not provide sugar-sweetened beverages, and made water readily available).
[b] Physical activity score ranged from 0 (centers that reported offering fewer than 30 min of structured physical activity and fewer than 60 min of total physical activity a day) to 2 (centers that reported offering children 30 or more minutes of structured physical activity and 60 or more minutes of total physical activity a day).

Table 3. Association Between Compliance with Beverage and Physical Activity Regulations and Training and Technical Assistance Based on Estimates of Ordinal Logistical Regression Models, New York City Child Care Centers (n = 174), 2010

	Model 1	Model 2
	Beverage Compliance Score	Physical Activity Compliance Score
Center Characteristics	AOR (95% CI)	AOR (95% CI)
Center participates in Head Start[a]	1.49 (0.67–3.34)	0.35 (0.12–1.02)
Center participates in CACFP[b]	3.47 (1.39–8.66)	0.93 (0.30–2.90)
Center is part of a larger agency	0.81 (0.43–1.53)	0.68 (0.30–1.57)
Average classroom size[c]	1.03 (0.95–1.13)	0.87 (0.76–0.98)
No. of hours the center is opened during the day	0.72 (0.54–0.97)	0.60 (0.39–0.92)
Student–teacher ratio: 5.7[d]	0.91 (0.82–1.01)	1.05 (0.90–1.21)
Teaching staff turnover ratio: 0.1[e]	0.35 (0.10–1.27)	0.11 (0.02–0.53)
Director's tenure (number of years at the center)		
3–5 years	1.03 (0.34–3.08)	0.64 (0.16–2.56)
More than 5 years	0.51 (0.25–1.02)	1.21 (0.48–3.05)
Director's educational attainment		
No bachelor's degree	0.45 (0.11–1.88)	0.68 (0.12–3.82)
Bachelor's degree	0.60 (0.24–1.53)	0.74 (0.19–2.81)
Center has dedicated food service staff[f]	1.34 (0.46–3.89)	—
Center has indoor physical activity facilities[f]	—	0.69 (0.28–1.69)
Center has private outdoor physical activity facilities[f]	—	3.67 (1.47–9.13)
Center has shared outdoor physical activity facilities[f]	—	1.04 (0.33–3.27)
Center is in the DPHO area[g]/DPHO technical assistance	0.79 (0.39–1.61)	1.33 (0.50–3.50)
Center participated in SPARK[h]	—	0.71 (0.21–2.44)
Center participated in EWPH[i]	1.33 (0.58–3.03)	0.45 (0.15–1.36)

Abbreviations: AOR, adjusted odds ratio; CI, confidence interval; —, not applicable; CACFP, Child and Adult Care Food Program; DPHO, Department of Public Health Office; EWPH, Eat Well Play Hard; SPARK, Sport, Play and Active Recreation for Kids; TOTs, Training of Teachers.

[a] Head Start is a comprehensive developmental program for preschool-aged children and their families who earn household income below the federal income poverty threshold administered by the Administration for Children and Families within the US Department of Health and Human Services.

[b] CACFP is a program of the US Department of Agriculture that administers federal grants to state health departments to provide nutritious meals and snacks to low-income individuals.

[c] Average number of students per classroom.

[d] Number of students in the center divided by the no. of teachers in the center.

[e] Number of new staff hired during the 12 months preceding the study divided by the total no. of staff.

[f] Presence or absence variables: coded 1 if the appropriate staff or facilities were present and 0 otherwise.

[g] DPHO is a program of the New York City DOHMH that targets resources to high need neighborhoods in the South Bronx, East and Central Harlem, and North and Central Brooklyn. These centers received 2 individualized on-site technical assistance sessions.

[h] SPARK is a physical activity training program New York City DOHMH provides free of charge to licensed child care centers.

[i] EWPH is a childhood obesity initiative of the New York State Department of Health. EWPH intervention involves a 6-week training program provided free of charge by the New York City Department of Health and Mental Hygiene to child care centers where at least 50% of the enrolled students are eligible for free or reduced-price meals.

[j] Coded 1 if the director reported she or he participated in the SPARK training and 0 otherwise.

[k] TOTS is a New York City DOHMH technical assistance program that provides child care center staff the skills necessary to lead the EWPH nutrition and physical activity curriculum in their classrooms.

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Table 3. Association Between Compliance with Beverage and Physical Activity Regulations and Training and Technical Assistance Based on Estimates of Ordinal Logistical Regression Models, New York City Child Care Centers (n = 174), 2010

	Model 1	Model 2
	Beverage Compliance Score	Physical Activity Compliance Score
Center Characteristics	AOR (95% CI)	AOR (95% CI)
Director reported participation in SPARK[j]	—	2.27 (0.96–5.37)
No. of physical activity–related trainings other than SPARK[h] and EWPH[i] in which the center participated	—	3.57 (1.28–10.01)
No. of nutrition-related trainings other than SPARK[h] and EWPH[i] in which the center participated	1.43 (0.86–2.37)	—
No. of teachers trained in the first SPARK[h] workshop	—	1.09 (1.01–1.17)
No. of teachers trained in the 2nd SPARK[h] workshop	—	1.13 (0.82–1.55)
No. of teachers who participated in TOTs[k]	1.23 (0.94–1.63)	1.07 (0.86–1.33)
P value (χ^2)	<.001	.004
Pseudo R^2	0.124	0.169

Abbreviations: AOR, adjusted odds ratio; CI, confidence interval; —, not applicable; CACFP, Child and Adult Care Food Program; DPHO, Department of Public Health Office; EWPH, Eat Well Play Hard; SPARK, Sport, Play and Active Recreation for Kids; TOTs, Training of Teachers.

[a] Head Start is a comprehensive developmental program for preschool-aged children and their families who earn household income below the federal income poverty threshold administered by the Administration for Children and Families within the US Department of Health and Human Services.

[b] CACFP is a program of the US Department of Agriculture that administers federal grants to state health departments to provide nutritious meals and snacks to low-income individuals.

[c] Average number of students per classroom.

[d] Number of students in the center divided by the no. of teachers in the center.

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SPECIAL TOPIC

Evaluation Design of New York City's Regulations on Nutrition, Physical Activity, and Screen Time in Early Child Care Centers

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Abstract

This article describes the multi-method cross-sectional design used to evaluate New York City Department of Health and Mental Hygiene's regulations of nutrition, physical activity, and screen time for children aged 3 years or older in licensed group child care centers. The Center Evaluation Component collected data from a stratified random sample of 176 licensed group child care centers in New York City. Compliance with the regulations was measured through a review of center records, a facility inventory, and interviews of center directors, lead teachers, and food service staff. The Classroom Evaluation Component included an observational and biometric study of a sample of approximately 1,400 children aged 3 or 4 years attending 110 child care centers and was designed to complement the center component at the classroom and child level. The study methodology detailed in this paper may aid researchers in designing policy evaluation studies that can inform other jurisdictions considering similar policies.

Introduction

In March 2006, the New York City Department of Health and Mental Hygiene (DOHMH) published a report on the prevalence of obesity among young children who attended Head Start programs in New York City (1). In response, the New York City Board of Health adopted revisions to Article 47 of the New York City Health Code governing licensed group child care centers in an effort to reduce early childhood obesity (2) (Box). Beginning January 1, 2007, centers were required to comply with the new regulations that restrict provided beverages, set minimum amounts for physical activity, and limit television viewing. We describe the multi-method approach developed and implemented to evaluate New York City's regulations of beverages served, physical activity, and screen viewing in group child care centers. This article provides a detailed description of the evaluation design and methods. The results of this evaluation are presented in the multiple manuscripts included in this special collection (3–6).

Box. Child Care Regulations in Article 47 of the New York City Health Code

- Children cannot be served beverages with added sweeteners.
- Children can only be served juice that is 100% juice, and no more than 6 oz per day and only served to children 8 months old or older.
- Children 2 years old or older can only be served milk that is 1% milk fat or less.

- Children must have water available and easily accessible throughout the day.
- Children 1 to 3 years old must have at least 60 minutes of physical activity every day.
- Children 3 years old or older must have at least 60 minutes of physical activity every day, 30 minutes of it guided and structured.
- Children younger than 2 years old are not permitted to watch television.
- Children 2 years old or older are allowed a maximum of 60 minutes of television viewing per day (restricted to educational programs or those that engage child movement).

The multi-method approach to evaluate New York City's licensed group child care centers regulations involved 2 components. The first evaluation component (Center Evaluation Component) was designed to evaluate whether compliance was associated with center and staff characteristics. The second evaluation component (Classroom Evaluation Component) was designed to evaluate whether compliance was associated with staff and children's behavior. Institutional review boards of DOHMH and ICF International reviewed and approved all components of the evaluation. We present 1) the sampling methods and sample characteristics for the center and the classroom components of the study, 2) the instruments and data collection methods for the center component, and 3) the instruments and data collection methods for the classroom component.

Sample Selection

The sampling universe included all 1,656 DOHMH-licensed group child care facilities. Three District Public Health Offices (DPHOs) include catchment areas (ie, geographic areas within New York City that have high risk factor and disease burden and therefore increased need for public health services) that consist of low-income, high-risk neighborhoods, specifically East and Central Harlem, the South Bronx, and East and Central Brooklyn. It was thought that centers in these low-income neighborhoods might have the greatest challenge in complying with the new regulations, and they are eligible for training and technical assistance from the DPHO at no cost. To account for the differences in technical assistance received, the sample was stratified according to DPHO status (ie, whether centers were in a DPHO neighborhood or not).

Of the 1,656 licensed group child care facilities in New York City, 311 were in DPHO neighborhoods. Although 97% (301 out of 311) of the DPHO centers were in census tracts with 40% or more of families with incomes at 200% of the federal poverty threshold or below, only about 41% (549 out of 1,345) of the non-DPHO centers were in neighborhoods with such high poverty levels. To ensure comparability of DPHO and non-DPHO centers, only centers from high-poverty areas were randomly included in the sampling frame (300 in DPHO and 350 in non-DPHO catchment areas). The final center component sample consisted of a random sample of 130 centers in DPHO and 130 centers in non-DPHO catchment areas (Figure).

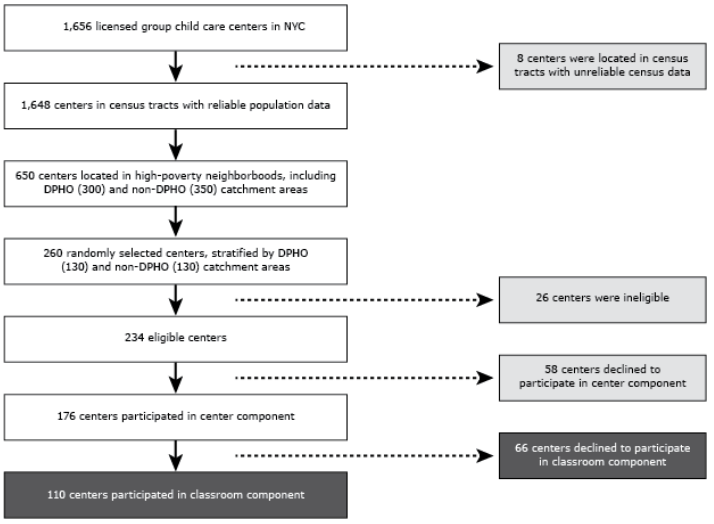

Figure. Selection of New York City (NYC) licensed group child care centers for Center Evaluation Component (fall 2009) and Classroom Evaluation Component (spring 2010) selected through a stratified sampling approach. Abbreviation: DPHO, District Public Health Office.

Center eligibility was based on 4 criteria: 1) had a classroom of at least ten 3- to 4-year-old children, 2) had at least 2 teachers of 3- to 4-year-old classrooms, 3) did not exclusively serve children with special needs, and 4) was not closing or had not already closed. Twenty-six centers were excluded because they did not meet these criteria, and an additional 58 centers elected not to participate.

The center component was completed in 176 child care centers (93 in DPHO and 83 in non-DPHO catchment areas). Most centers were in the Bronx, Brooklyn, or Manhattan, supporting the DOHMH's interest in examining how the additional training and technical assistance provided affected a center's capacity to comply with the regulations (Table 1). The 176 group child care centers that participated in the center component were all invited to

participate in the classroom component; 110 centers agreed to participate (65 in DPHO and 45 in non-DPHO catchment areas). Each center for the center component received a $100 gift card to an educational resource retailer. Each of the classroom component centers received another $100 gift card, and classroom teachers received a $25 American Express gift card.

Although the focus of the study was 3- to 4-year-old children (94% of final sample), because the age of children within a classroom varied, our analysis included children 2 to 6 years of age (n = 1,427). Validated accelerometer cut points only exist for children older than 3 years old, therefore we excluded children less than 2 years 10 months of age (n = 29 aged 34–36 months). We also excluded children who were more than 6 years of age (n = 1). Most (92%) of the children were Hispanic or non-Hispanic black (Table 2).

Center Evaluation Component — Staff Interviews and Site Inventory

The center component of the evaluation involved interviewing staff and conducting a site inventory. Center-level compliance with the regulations was assessed through a review of center records, the site inventory, and in-person interviews with center directors, teachers, and food service staff. DOHMH staff and sanitarians were interviewed on training, technical assistance, and enforcement of the regulations. Standardized, written data collection protocols were developed. In addition, DOHMH provided center-level data regarding dates of participation in DOHMH-provided physical activity and nutrition training programs, such as Sports, Play, and Recreation for Kids! (SPARK!), Eat Well Play Hard (EWPH), and EWPH Training of Teachers. These training programs are described in detail in Nonas et al (3) in this issue.

Instruments

The center component interview instruments were designed to assess center level compliance and the degree to which center staff members were familiar with the regulations. In addition, the instruments were designed to identify barriers to compliance with the regulations and the effect that DOHMH training had on staff awareness of the regulations. Teachers selected for participation were identified by center directors. Interview instruments were designed for each type of staff position and adapted from existing instruments (7,8). The site inventory recorded the types of beverages present in food storage and preparation areas, location and number of televisions, the availability of indoor and outdoor play space, and characteristics of the center's neighborhood that could facilitate physical activity, such as access to safe places to play (eg, a neighborhood park). Table 3 lists background resources and evaluation instruments developed for each evaluation component. The center component instruments were pilot tested by project team members at 2 child care centers and revised in advance of data collector training. The results of these pilot tests are not included in analyses.

Data collection

For the center component, 10 data collectors were trained in October 2009. This training focused on the purpose and methods of the evaluation, interview surveys, use of the SPSS Data Collection Interviewer Desktop, Version 5.50.000.5009 (IBM, Inc), and a supervised site visit. The center component data collection occurred from October 2009 to January 2010.

In January and February 2010, ten in-depth semistructured telephone interviews to provide context were completed with DOHMH staff members who enforce regulations and oversee various training programs but were not part of the evaluation team. Results of the center component are reported by Lessard et al (4) and Kakietek et al (5) in this issue.

Classroom Evaluation Component — Classroom and Child Direct Observation

The classroom component was an observational and biometric study of a subsample of the centers participating in the center component to determine whether compliance was associated with staff and child behavior. Classroom-level compliance with the regulations and child behavior was assessed through observation of beverages served, access to water throughout the day, and physical activity opportunities offered as well as documentation of center characteristics that support physical activity opportunities. Child-level outcomes were examined by using observed beverages consumed during meals and snacks and intensity and duration of physical activity measured by accelerometry. The classroom serving children aged 3 to 4 years was selected for the Classroom Evaluation Component. If a center had more than 1 classroom serving children aged 3 to 4 years, one of these classrooms was randomly selected for participation in the study.

Instruments and measurement

The classroom component included 2 days of classroom-level and child-level observation of foods and beverages provided and physical activity opportunities offered to children between 8 AM and 5 PM. Child-level measures included amounts of foods and bever-

ages served and consumed, child's height in centimeters and body weight in kilograms, and amount and intensity of physical activity each child achieved via accelerometry. Demographic information was collected by using a Child Information Form; data collected included date of birth, sex, race/ethnicity, and start date at the center.

A General Observation Form was created to record the episodes and context of physical activity, staff behavior related to foods provided and physical activity, children's access to water, and classroom staff participation in training. This instrument was adapted from forms used by DOHMH to verify compliance by their sanitarians and from other validated instruments (9–12). An Accelerometry Form was used to record the time the accelerometer (Actigraph GT3X) was placed on and removed from the child, and the child's height and body weight were recorded on the General Observation Form (9,13,14). The Nutrition Observation Form was used to record food and beverage components of every meal and snack, including service style and preparation. This instrument was used to record staff behavior, such as providing second servings without the child asking, encouraging the child to try new foods, and drinking or eating less healthful foods in front of the children. The Mealtime Observation Form was used to collect information on all food and beverages served to and consumed by the children. The dietary observation instruments were adapted from existing literature on dietary assessment (12,15–17).

The classroom component instruments and protocols were pilot-tested at 1 randomly selected, eligible group child care center and revised. The results of these pilot tests were not included in the evaluation results.

Data collection

Twenty data collectors were trained over a 5-day period that included classroom-based training and site visits. Two-day site visits were conducted between April and June 2010.

On arrival at the centers, data collectors measured height and weight for each child who had parental consent to participate. Height was measured in centimeters by using a portable stadiometer (Seca 213) and weight was measured in pounds by using a portable scale (Seca Clara 803). Each child was measured twice, and the data were recorded to ensure accuracy on the first day of data collection. Anthropometric measurements were averaged and a SAS program (SAS Institute, Inc) developed by the Centers for Disease Control and Prevention (CDC) was used to calculate BMI *z* scores. Children wore the GT3X Actigraph accelerometers for the duration of the 2-day observation period. Some children had 1 day of accelerometry data because they either refused to wear the accelerometer on the first or second day or did not attend the child care center on the second day of data collection.

Using the nutrition observation form, data collectors recorded all food served in the classroom over the 2 days. During a typical day, meals often included breakfast or morning snack, lunch, and afternoon snack. Three unique children were randomly selected per day. These children did not have to have parental consent to be observed. This resulted in a total of 6 unique child dietary records per center. Results of the classroom component are reported in Kakietek et al (5) and Stephens et al (6) in this issue.

Discussion

This evaluation is the first to measure compliance with beverage and physical activity regulations in a large sample of New York City child care centers in low-income neighborhoods. The data collected using this multi-method approach resulted in the creation of compliance scores for each center for the center and the classroom components, the calculation of a consistency of compliance score based on data from both the center and classroom components, and an analysis of the factors that are associated with compliance. By using mixed methods, we triangulated center-level and child-level data sources and conducted a multi-level assessment of the association between consistency of implementation of the New York City regulations and child behavior.

Limitations

A limitation of this evaluation is the absence of pre-intervention center-level and child-level data. The use of a post cross-sectional evaluation design limits our ability to assess whether the adoption of the new regulations spurred child care centers in New York City to improve their policies and practices regarding beverages, physical activity, and screen time. Also, even though the center component and the classroom component were conducted within a close time period, they were not conducted simultaneously, so it cannot be assumed that the regulation was being implemented the same way. Another potential limitation is that compliance measures were partially based on self-reported data (eg, the staff interviews), which are subject to recall bias and social desirability in responses. In addition, it is possible that the teachers surveyed in the center component were not the same teachers observed or interviewed in the classroom component, leading to a potentially large intra-center variation.

It is also possible that the study sample was biased because of nonrandom refusal to participate. Although centers included in the center component sample were selected randomly from a sampling frame, about one-quarter of the eligible sampled centers (58 out of 234) refused to participate. Similarly, 66 centers that participated in the center component of the study opted to not participate in the classroom component. When compared with centers that participated in the center component only, centers that participated in the classroom component reported significantly more of the following: participation in CACFP, being a part of a larger parent agency, having a dedicated food service staff, being in DPHO areas, and participating in DOHMH training programs such as SPARK! and EWPH. It was possible that centers with poor compliance with the regulations were less likely to participate than centers with better compliance.

Strengths

Despite the limitations noted above, this study has numerous unique strengths. At the time of this evaluation, New York City was one of the only major municipalities to have strong regulations for beverages, physical activity, and screen time at licensed group child care centers. As a result, this study design was constructed specifically for the New York City regulatory and training environment. DOHMH staff members with intimate knowledge of the history and intensity of training and technical assistance provided to the centers before and after implementation of the regulations were involved in the study design. Additionally, the study sample focused on low-income neighborhoods that could have more difficulty than high-income neighborhoods in implementing the regulations.

Conclusions

The unique design of this evaluation contributes to the field both through findings and evaluation of practice. Although the results of this evaluation are limited to New York City's metropolitan, urban, low-income communities, these results have potential importance for communities across the nation. The original purpose of the 2 data collection methods for assessing regulation compliance was not to compare or contrast the results for assessing compliance, but the resulting data identified important differences in measuring levels of compliance when using different methods. Practitioners and researchers alike can benefit from understanding the differences (4). Furthermore, the use of accelerometry in the assessment of physical activity fills a gap in the field's knowledge of intensity of activity among children younger than 6 years old, for which there are no federal recommendations. Additional analyses of these data have the potential to add to the knowledge of the type and intensity of children's physical activities in structured and unstructured play.

Our use of multiple data collection methods to examine regulatory compliance in group child care environments contributes to the evaluation field because there are few studies systematically examining compliance and there is increasing demand for methods to assess policy implementation. This evaluation not only documented the extent of compliance by using a variety of methods but also identified factors that may affect a center's ability to comply. To further contribute to the field, future research might examine topics such as inter-rater reliability of observations of environment and child behavior and, in particular, the validity of using self-report data compared with direct observation data on compliance with nutrition and physical activity regulations. Finally, we hope the methods outlined here will provide guidance for future evaluations that build on this work.

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

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Tables

Table 1. New York City Child Care Center Sample Characteristics, Fall 2009 and Spring 2010

Sample Characteristics	Center Component, n = 176	Classroom Component, n = 110
Borough, n (%)		
Bronx	43 (24.4)	35 (31.8)
Brooklyn	75 (42.6)	40 (36.4)
Manhattan	44 (25.0)	28 (25.5)
Queens	13 (7.4)	7 (6.4)
Staten Island	1 (0.6)	0
Capacity, n (%)		
Head Start[a]	48 (27.2)	34 (30.9)
CACFP[b]	144 (81.8)	97 (88.2)
Center part of a larger agency (not part of ACS[c] or Head Start)	69 (39.2)	50 (45.4)
Director's tenure, n (%)		
Less than 3 years	46 (26.1)	28 (25.5)
3–5 years	23 (13.1)	17 (15.4)
More than 5 years	107 (60.8)	65 (59.1)
Director's educational attainment, n (%)		
No bachelor's degree	8 (4.5)	5 (4.5)
Bachelor's degree	19 (10.8)	12 (10.9)
Graduate or professional degree	149 (84.7)	93 (84.6)
Indoor physical activity facilities	61 (34.7)	38 (34.5)
Outdoor physical activity facilities, n (%)		
Private	127 (72.2)	79 (71.9)
Shared	32 (18.2)	21 (19.1)
Training and technical assistance, n (%)		
Located in a DPHO[d] catchment area	93 (52.8)	65 (59.1)

Abbreviations: CACFP, Child and Adult Care Feeding Program; ACS, Administration for Children's Services; DPHO, District Public Health Office; SPARK!, Sports, Play, and Recreation for Kids!; EWPH, Eat Well Play Hard; TOT, Training of Teachers; DOHMH, New York City Department of Health and Mental Hygiene.

[a] Head Start is a comprehensive developmental program of the Administration for Children and Families within the US Department for Health and Human Services for preschool-aged children and their families whose household income is below the federal income poverty threshold.

[b] CACFP is a program of the US Department of Agriculture that administers federal grants to state health departments to provide nutritious meals and snacks to low-income individuals.

[c] ACS is New York City government's child welfare agency.

[d] DPHOs are a program of the DOHMH that target resources to high-need neighborhoods in the South Bronx, East and Central Harlem, and East and Central Brooklyn.

[e] SPARK! is a physical activity training program that DOHMH provides free of charge to licensed group child care centers.

[f] EWPH is a childhood obesity initiative of the New York State Department of Health. EWPH intervention involves a 6-week training program provided free of charge by the DOHMH to child care centers where at least 50% of the enrolled students are eligible for free or reduced-price meals.

[g] TOT is a DOHMH technical assistance program that provides child care center staff the skills necessary to lead the EWPH nutrition and physical activity curriculum in their classrooms

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Table 1. New York City Child Care Center Sample Characteristics, Fall 2009 and Spring 2010

Sample Characteristics	Center Component, n = 176	Classroom Component, n = 110
SPARK![e] participant	153 (86.9)	102 (92.7)
EWPH[f] participant	54 (30.7)	44 (40.0)
TOT[g] participant	19 (10.8)	15 (13.6)
Director trained for SPARK!	93 (52.8)	66 (60.0)
Center characteristics, mean (standard deviation)		
Average classroom size (3- to 4-year-olds)	16.1 (3.9)	16.5 (3.5)
No. of hours centers were open	10.0 (1.2)	10.0 (1.0)
Food service staff per center	2.0 (1.4)	2.3 (1.3)
Student-teacher ratio	5.7 (3.0)	5.8 (3.0)
Teaching staff that terminated employment compared with total teaching staff (eg, turnover ratio per center, 2008–2009)	0.13 (0.2)	0.09 (0.15)
Training and technical assistance, mean (standard deviation)		
No. of physical activity–related training programs other than SPARK! and EWPH	0.3 (0.5)	0.24 (0.47)
No. of nutrition-related training programs other than SPARK! and EWPH	0.7 (0.6)	0.78 (0.63)
Teachers trained in first SPARK! workshop	8.7 (9.1)	10.1 (9.8)
Teachers trained in second SPARK! workshop	1.2 (3.6)	1.1 (3.98)
Teachers trained in TOTs	0.5 (2.4)	0.5 (2.4)

Abbreviations: CACFP, Child and Adult Care Feeding Program; ACS, Administration for Children's Services; DPHO, District Public Health Office; SPARK!, Sports, Play, and Recreation for Kids!; EWPH, Eat Well Play Hard; TOT, Training of Teachers; DOHMH, New York City Department of Health and Mental Hygiene.

[a] Head Start is a comprehensive developmental program of the Administration for Children and Families within the US Department for Health and Human Services for preschool-aged children and their families whose household income is below the federal income poverty threshold.

[b] CACFP is a program of the US Department of Agriculture that administers federal grants to state health departments to provide nutritious meals and snacks to low-income individuals.

[c] ACS is New York City government's child welfare agency.

[d] DPHOs are a program of the DOHMH that target resources to high-need neighborhoods in the South Bronx, East and Central Harlem, and East and Central Brooklyn.

[e] SPARK! is a physical activity training program that DOHMH provides free of charge to licensed group child care centers.

[f] EWPH is a childhood obesity initiative of the New York State Department of Health. EWPH intervention involves a 6-week training program provided free of charge by the DOHMH to child care centers where at least 50% of the enrolled students are eligible for free or reduced-price meals.

[g] TOT is a DOHMH technical assistance program that provides child care center staff the skills necessary to lead the EWPH nutrition and physical activity curriculum in their classrooms

Table 2. New York City Child Care Child Participant Characteristics, Spring 2010 Classroom Component (N = 1,427)

Characteristic	n (%)
Age, y	
2	32 (2.2)
3	871 (61.0)
4	467 (32.7)
5	57 (4.0)
Race/ethnicity	
Hispanic or Latino	632 (44.3)
White	14 (1.0)
Black or African American	669 (46.9)
American Indian	2 (0.1)
Asian	34 (2.4)
Not Hispanic or Latino (other race)	63 (4.4)
Missing	13 (0.9)
Sex	
Female	754 (52.8)
Male	672 (47.1)
Missing	1 (0.1)
Weight status[a]	
Underweight	68 (4.8)
Healthy weight	924 (64.8)
Overweight	214 (15.0)
Obese	210 (14.7)
Missing	11 (0.8)

[a] Weight status categories are determined by body mass index (BMI, kg/m^2) *z* score. Underweight: BMI <5th percentile; healthy weight: BMI 5th percentile to <85th percentile; overweight: BMI 85th percentile to <95th percentile; obese: BMI ≥95th percentile.

Table 3. Overview of New York City Child Care Evaluation Data Collection Instruments and Resources

Instrument/Data Source	Purpose/Content/Strengths and Weakness of Data Source	Unit of Analysis
Center Evaluation Component		
DOHMH administrative data	Primarily used for sampling stratification (center address and location relative to DPHO catchment areas), and indicators of center participation in DOHMH training programs. Low data collection cost and burden.	Center
DOHMH staff interviews	Provide context for the setting in which the beverage and physical activity regulations are implemented by interviewing staff responsible for providing child care center training and/or enforcing regulations. Low data collection cost and burden.	Context
Director, teacher and food service staff interviews	Respondents' knowledge of and reported compliance with New York City's regulations for beverages, physical activity, and screen time at child care centers. Moderate data collection cost and burden on center staff and time required.	Center
Site inventory	Beverages present in the child care center food storage and preparation areas and the centers' physical activity environment. Low data collection cost and burden.	Center
Classroom Evaluation Component		
Child information form	Director reported child birth dates, sex, race/ethnicity, start date in the center, and number of days per week and number of hours per day attending the day care. Moderate data collection cost and burden on center staff and time required.	Center
General observation form	Episodes, context, and environment of physical activity in selected classroom. High data collection cost and time required.	Classroom
Child accelerometry form	Height and weight and accelerometer start and stop times for children in selected classroom. High data collection cost and time required.	Child
Nutrition observation form	Components of every meal and snack provided to children in selected classroom. High data collection cost and time required.	Classroom
Mealtime observation form	Quantity of meal and snack items served to and consumed by observed children in selected classroom. High data collection cost and time required.	Child

Abbreviations: DOHMH, New York City Department of Health and Mental Hygiene; DPHO, District Public Health Office.

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ORIGINAL RESEARCH

Compliance With New York City's Beverage Regulations and Beverage Consumption Among Children in Early Child Care Centers

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PEER REVIEWED

Abstract

Introduction
This article examines the association between the New York City regulations on beverages served in child care centers and beverage consumption among enrolled children. The regulations include requirements related to beverages served to children throughout the day.

Methods
Beverage consumption data were collected on 636 children enrolled in 106 group child care centers in New York City. Data on compliance with the regulations were collected through direct observation, interviews with center staff, and a site inventory. Logistic regression for rare events was used to test associations between compliance with the regulations and beverage consumption.

Results
Compliance with the regulations was associated with lower odds of children consuming milk with more than 1% fat content and sugar-sweetened beverages during meals and snacks. There was not a significant relationship between compliance with the regulations and children's consumption of water.

Conclusion
The findings suggest a strong, direct relationship between what a center serves and what a child consumes, particularly regarding consumption of higher-fat milk and sugar-sweetened beverages. Therefore, policies governing the types of beverages served in child care centers may increase children's consumption of more healthful beverages and reduce the consumption of less healthful ones.

Introduction

Beverage consumption is a key factor in caloric intake that contributes to childhood obesity. Consumption of sugar-sweetened beverages (SSBs) such as sodas and fruit juice drinks with added sugar is associated with increased energy intake, overweight, and obesity in children (1–5). Although some research suggests that consumption of SSBs has decreased in the general population (5), most studies report that consumption of SSBs among children is increasing (6–8). Studies on milk consumption show varying effects on body mass index among children (9–13); however, the association between milk fat content and increased caloric intake has contributed to national guidelines supporting the consumption of low-fat and nonfat milk (14).

Child care centers have been identified as key settings to address childhood obesity (15,16). In response to evidence supporting the need for interventions in child care settings, in 2006 the New York City Department of Health and Mental Hygiene (DOHMH) modified regulations governing group child care centers. The modifications (amendments to Article 47 of the New York City Health Code) took effect in January 2007 and provided standards for what centers should offer in terms of beverages, physical activity, and screen time. The beverage-related regulations specify that 1) SSBs should not be provided to children, 2) milk served to children aged

2 or older should have a fat content of 1% or less, and 3) water must be readily available to children throughout the day.

This article contributes to the literature on policy interventions for obesity prevention by assessing the association between compliance with the New York City regulations and beverage consumption in children aged 3 or 4 years enrolled in a child care center in New York City.

Methods

This evaluation involved a multimethod study design with 2 distinct data collection activities referred to as Center Evaluation Component and Class Evaluation Component (17). Center component data collection (October 2009–January 2010) focused on center-level measures. Class component data collection (April 2010–June 2010) focused on classroom- and child-level measures. Information on compliance collected in center and class components was intended to be complementary, and the study was not designed to compare compliance across methods.

Study sample

The study population included the 1,654 child care centers licensed by the DOHMH Bureau of Child Care. Centers located in DOHMH District Public Health Offices (DPHO) catchment areas receive technical assistance and support services from the DOMH. Although most (301 of 311) of the DPHO catchment area child care centers were located in areas with high levels of poverty (census tracts with 40% or more of families with incomes at 200% of the federal poverty line or below), only 41% (549 of 1,343) of the non-DPHO centers were located in neighborhoods with high poverty levels. To ensure comparability between DPHO and non-DPHO centers, only centers in low-income, non-DPHO areas were included in the sampling frame. The final sampling frame included all 311 in DHPO neighborhoods and all 350 child care centers in 9 comparable low-income non-DPHO neighborhoods. Of the 260 centers randomly sampled, 26 (10%) were ineligible because they had an insufficient number of children (fewer than 10), had no children in the target age group (3- and 4-year-olds), enrolled only special-needs children, were closing or had already closed, or were unreachable. Of the 234 eligible centers, 58 (25%) refused to participate; 176 (75%) agreed to participate in the center component, and 110 (62.5%) agreed to participate in the class component. Complete beverage consumption data was collected on 636 children enrolled in 106 centers participating in the class component (17). Information on 24 children was missing for some meals in 4 centers. The centers were located in Manhattan, Bronx, Brooklyn, Queens, and Staten Island.

Data collection

Center component data were collected during 2 site visits of 4 hours each. Data collection activities included computer-assisted, in-person interviews with child care center directors, teachers, and food service staff. Interviews documented center demographics, knowledge of the regulations, physical activity offered, food and beverages served, and training and technical assistance received. Data collectors also completed a structured site inventory to document child care center facilities and the beverages stored in kitchens or pantries. Data on training and technical assistance were provided by the New York City DOHMH.

Class component data were collected during 2-day site visits (approximately 8 hours per day during 2 consecutive days) in 1 randomly selected classroom per center of children aged primarily 3 or 4 years. Data collection included structured documentation of classroom activities, the types of foods and beverages served, staff characteristics and behavior, and child characteristics and behavior. Each day, 3 children in the classroom (for a total of 6 children per center) were randomly selected for observation of the amounts of foods and beverages served and consumed during meal and snack times. Data collectors reviewed the original beverage packaging (such as milk cartons, bottles, or juice boxes) and recorded all beverages served and consumed during the day. Data collection instruments were developed for this evaluation on the basis of existing validated instruments (18–21). Clearance was obtained from the ICF International institutional review board.

Measures

Compliance with New York City regulations. Separate measures of compliance were constructed for each of the 3 components of the beverage regulations: milk, SSBs, and water. For each beverage type, compliance was measured by using a dichotomous indicator coded 1 if the center was compliant with the regulation on that beverage both at the center level (center component) and at the classroom level (class component) and 0 otherwise (compliant at the center level but not at the classroom level, compliant at the classroom level but not compliant at the center level, not compliant at either level).

In the center component, compliance with beverage regulations was determined by using data from the inventory of the child care center facilities. A center was coded compliant with the milk regulation if the center kitchen facilities contained only milk with 1% milk fat or less. A center was coded as compliant on the SSB regu-

lation if beverages with added sweeteners (including artificial sweeteners) were not found in the center's kitchen facilities. A center was considered compliant with the water regulation if teaching staff consistently reported that water was available to children throughout the day.

In the class component, compliance with beverage regulations was determined by classroom observation of the types of beverages served to children during meals and snacks. A center was considered compliant with regulation on milk if no milk with more 1% fat was served to any of the children with any meal or snack during the day. A center was considered compliant with the regulation on SSBs if no SSBs were served to any child with any meal or snack during the day. Finally, a center was considered compliant with the regulation on water if it had drinking water visible (eg, in pitchers or bottles) or a water fountain in the classroom or in a nearby hallway.

Beverage consumption. Consumption of milk with more than 1% fat, consumption of SSBs, and consumption of water were coded by using dichotomous indicators of whether a child consumed the beverage type (milk with more than 1% fat, SSB, water) at any meal during the day. Milk consumption was coded 1 if a child consumed milk with more than 1% fat with any meal or snack during the day in child care and 0 otherwise. SSB consumption was coded 1 if a child consumed an SSB with any meal or snack during the day in child care and 0 otherwise. Water consumption was coded 1 if a child consumed water with any meal or snack during the day in child care and 0 otherwise.

Control variables. Variables theorized to affect beverage consumption were considered as control variables; if these variables exhibited a significant bivariate relationship with the dependent variable of interest, they were included in the multivariate models. The following center-level variables were included in the analysis: center's participation in 1) Child and Adult Care Food Program (CACFP) and 2) Head Start; 3) location inside or outside a DPHO catchment area; 4) average classroom size; 5) number of hours of operation per day; 6) student–teacher ratio; 7) annual teaching staff turnover rate; 8) participation in Eat Well Play Hard (EWPH); 9) the number of staff trained in EWPH Training of Trainers (TOTs); and 10) the number of TOTs-trained staff in the classroom of observation. The number of meals the observed child consumed during the day of observation was included to account for increased likelihood of consuming any beverage, including those prohibited by the regulations, by children who had more meals during the day compared with those who had fewer meals (eg, refused to have some of the meals provided by the center).

Analysis

Multiple regression analysis was used to assess the association between compliance and beverage consumption while controlling for potential confounding factors. Because most children did not consume prohibited beverages, the distribution of the dependent variables was skewed toward 0. To correct for potential bias and inefficiency of the logistic regression resulting from a zero-inflated sample, logistic regression for rare events was used (22). All analyses were conducted using Stata 11 (StataCorp LP).

As a robustness check, we re-estimated all models using logistic regression with robust standard errors, which corrects for inefficiency of the estimates due to clustering (23,24). The results obtained by using logistic regression with robust standard errors were virtually the same as the results obtained by using rare event logistic regression.

Results

An average center in the sample had about 16 children per classroom and 6 children per teacher and was open for about 10 hours per day. An average center participated in one training related to nutrition other than EWPH. In an average center and in an average classroom, fewer than 1 teacher participated in TOTs (Table 1). Most (59.3%) centers were located in the DPHO catchment area; 87.7% participated in CACFP, 68.9% participated in Head Start, and 39.6% participated in EWPH (Table 1).

Overall, the level of compliance with the regulations in the centers was high (Table 2). Most centers (75.5%) complied with the milk regulation, and 67% of the centers did not serve SSBs. Water was available to children in 52.8% of the centers. All centers in the sample provided meals to children. The number of centers where children consumed beverages brought from home varied by meal type and day of observation. Most centers (92 centers, 83.6%) did not allow any food from home. Only 2 centers (1.9%) allowed foods from home for all eating occasions. The other 16 allowed it at some eating occasions.

Most children in the sample did not consume beverages prohibited by the regulations: 90% did not consume milk with more than 1% fat, and 86.8% did not consume SSBs (Table 2). Only 27% of the children consumed water with meals or snacks.

Logistic regression analyses showed that compliance with regulations was associated with lower likelihood that a child consumed milk with more than 1% fat content or SSBs. Compliance was not associated with the likelihood of the child consuming water during meals or snacks (Table 3).

Milk (Model 1). Children in centers that were compliant with the milk regulation had 97% lower odds of consuming milk with more than 1% fat with any meal or snack than children in centers that were not compliant (adjusted odds ratio [AOR], 0.03; 95% CI, 0.01–0.09). Children in centers that participated in CACFP and in a greater number of training programs (beyond EWPH) were less likely to consume milk with more than 1% fat than children in centers that did not participate in the program (Table 3). Longer operating hours, center's participation in EWPH, and greater number of meals and snacks were associated with greater likelihood that the child consumed milk with more than 1% fat. The indicator of center's participation in Head Start was dropped from the regression model because none of the children in centers that participated in Head Start consumed milk with more than 1% fat.

Sugar-sweetened beverages (Model 2). Children in centers compliant with the SSB regulation had 86% lower odds of consuming SSBs with any meal or snack than children in centers that were not compliant (AOR, 0.14; 95% CI, 0.07–0.26). Center's participation in CACFP and Head Start, the higher number of nutrition-related training programs other than EWPH, and larger classroom size were associated with lower likelihood that the child consumed SSBs (Table 3). A greater number of meals or snacks the child had during the day and center's participation in EWPH were associated with a higher likelihood that SSBs were consumed with a meal or a snack.

Water (Model 3): Compliance with the water regulation was not associated with the likelihood of the child consuming water with a meal or a snack during the day (AOR, 0.70; 95% CI, 0.46–1.08). Factors associated with higher likelihood that the child consumed water with a meal or a snack were center's participation in Head Start, location in a DHPO area, longer operating hours, greater teaching staff turnover, and greater number of meals and snacks during the day (Table 3). In contrast, center's participation in CACFP was associated with lower likelihood that the child consumed water with a meal or a snack.

Discussion

The literature on beverage consumption in child care settings focuses either on the assessments of nutritional content and quality of foods and beverages consumed in child care, often comparing them with national guidelines and standards (25–28) or on reviews comparing regulations in different jurisdictions (29,30). This evaluation bridges the gap between those 2 strands of research and directly examines the link between regulations and consumption. Studies have reported the effectiveness of regulatory approaches in school-aged children (31,32). Ours is the first study to examine the association of these types of interventions on children's beverage consumption in child care centers in the United States.

Our findings show a strong association between center compliance with the New York City regulations and the types of beverages children consumed. Children in centers compliant with the regulations were less likely to consume SSBs and milk with more than 1% fat content than children in noncompliant centers. The results are encouraging and suggest that regulations prohibiting unhealthful beverages have the potential to limit consumption of these beverages among children in child care settings.

Our evaluation found that relatively few centers served unhealthful beverages (23.6% served milk with more than 1% fat, and 33.0% served SSBs). Because we wanted to create as restrictive a measure of compliance as possible, our measure may underreport compliance with the milk regulation. Specifically, we considered a center noncompliant with the regulation when milk with more 1% fat was found in the kitchen facilities. In centers serving children younger than 2 years, milk with more than 1% fat may have been stored on their premises but it was not served to children older than 2.

The degree to which less healthful beverages are served in child care settings varies. A recent study of child care centers in North Carolina found that 8% of the centers in the study sample served SSBs but as many as 50% served whole milk to children aged 3 to 5 (26). Studies conducted in New York City (29) and Georgia (33) found that water was available to children in about 50% and 55% of the centers, respectively, which is consistent with our findings (48%).

We did not find a significant association between compliance with the water regulation and the likelihood that the child consumed water with meals or snacks. Data collection on consumption of beverages was conducted only during meals and snacks, whereas the New York City regulations aimed at increasing the consumption of water throughout the day including meal and snack times. Because of the intensive and intrusive nature of data collection during 8 hours in a classroom, we focused on observation of consumption at meal times.

Despite that limitation, our findings are similar to those reported in the literature. A study of Connecticut child care centers found that despite policies promoting the availability and accessibility of water in child care centers and the availability of water in most classrooms, children were not prompted to drink water or the wa-

ter was accessible only to adults (34). These data suggest that education and support on water consumption may be needed to facilitate greater compliance with regulations.

Consistent with the literature, participation in CACFP and Head Start was associated with improved beverage-related outcomes (35,36). Participation in Head Start was associated with lower odds that children consumed SSBs and greater odds that a child consumed water with any meal or snack. Furthermore, in centers participating in Head Start, none of the children consumed milk with more than 1% fat. Participation in CACFP was associated with lower odds that children consumed SSBs, but, unlike participation in Head Start, it was also associated with lower odds that the child consumed water with any meal or snack. This finding is consistent with the requirements of the 2 programs: Head Start guidelines encourage water consumption and, before 2011, CACFP guidelines encouraged the provision of low-fat milk at all mealtimes and recommended that water not be placed on the table during meal times for children aged 3 to 5 years (the CACFP policy was revised in 2011 and allows for water on the table during meals) (37,38).

One limitation of our study is the use of a cross-sectional design that does not establish cause between the adoption of the regulations and child-level outcomes. However, we did find an association between compliance with the types and frequency of beverages that children consumed. We are not aware of any systematic assessment of the consumption of SSBs, milk, or water in child care centers in New York City before the adoption of the regulation and cannot assess, even indirectly, any differences in day care center consumption after the introduction of the regulations. Another limitation of the study is that the data related to compliance with the New York City regulations at the center level is, in part, based on staff self-reports. To minimize the measurement bias, when possible, we used site inventories to capture center-level compliance. Furthermore, we captured classroom-level compliance through direct observations. Combining data from both sources strengthens the robustness of our compliance measure.

This study considered only beverages consumed during the child care center day and excluded beverages consumed in the home. As much as 70% of sugar-sweetened beverages may be consumed in the home (38). Nevertheless, within the limitations of the study setting, our findings highlight the potential effectiveness of policy interventions in child care centers and illustrate the need for further exploration of the relationship between regulations and consumption of less healthful beverages.

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Tables

Table 1. Characteristics of 106 Child Care Centers, New York City, 2010

Variable	Value
Continuous, mean (SD)	
Average classroom size, no. of children, range, 7–27	16.5 (3.5)
Operating hours, hours/day, range, 6.75–13.5	10.0 (1.0)
Student–teacher ratio, range, 0.30–22	5.8 (3.0)
Teaching staff turnover, range, 0–0.80	0.08 (0.13)
No. of nutrition-related training programs other than Eat Well Play Hard in which the center participated, range, 0–2[a]	0.77 (0.62)
No. of staff in the center who participated in Training of Teachers, range, 0–23[b]	0.55 (2.41)
No. of staff in the classroom who participated in Training of Teachers, range, 0–3[b]	0.66 (0.93)
No. of meals the child had during the day of observation, range, 2–4	3.05 (0.35)
Categorical, no. (%)	
Center was in a District Public Health Office[c] catchment area	63 (59.3)
Center participated in Child and Adult Care Food Program[d]	93 (87.7)
Center participated in Head Start[e]	73 (68.9)
Center participated in Eat Well Play Hard[a]	42 (39.6)

[a] Eat Well Play Hard is a technical assistance program of the New York City Department of Health and Mental Hygiene that teaches staff and children about nutrition and physical activity.
[b] Eat Well Play Hard Training of Teachers is a technical assistance program of the New York City Department of Health and Mental Hygiene that teaches child care center staff how to lead the Eat Well Play Hard nutrition and physical activity curriculum in their classrooms.
[c] District Public Health Offices are a program of the New York City Department of Health and Mental Hygiene that target resources to high-need neighborhoods in the South Bronx, East and Central Harlem, and North and Central Brooklyn. These centers all received 2 sessions of individualized on-site technical assistance. Only 97 centers were counted.
[d] The Child and Adult Care Food Program is a program of the United States Department of Agriculture that administers federal grants to state health departments to provide nutritious meals and snacks to low-income individuals.
[e] Head Start is a comprehensive developmental program for preschool aged children and their families who earn household income below the federal income poverty threshold administered by the Administration for Children and Families within the United States Department of Health and Human Services.

Table 2. Compliance[a] With the New York City Regulation on Milk, SSBs, and Water and Beverage Consumption[b] in 636 Children in 106 Child Care Centers, New York City, 2010

Measure	No. (%)
Compliance with New York City regulations (n = 106)	
Milk served to children 2 years and older should have a fat content of 1% or less	
Compliant	80 (76.4)
Not compliant	26 (24.5)
SSBs should not be provided to children (n = 106)	
Compliant	70 (66.7)
Not compliant	36 (33.3)
Water must be readily available to children throughout the day (n = 106)	
Compliant	56 (51.8)
Not compliant	50 (41.2)
Beverage consumption (n = 636)	
Child consumed milk with more than 1% fat	
No	576 (90.6)
Yes	60 (9.4)
Child consumed SSBs	
No	552 (86.8)
Yes	84 (13.2)
Child consumed water	
No	464 (72.9)
Yes	172 (27.0)

Abbreviation: SSBs, sugar-sweetened beverages.
[a] See Methods section for a description of measures of compliance.

Table 3. Logistic Regression for Rare Events Models of the Association Between Compliance With New York City Regulations and Beverage Consumption[a], Children in 106 Child Care Centers, New York City, 2010

Variable	OR (95% CI)		
	Model 1: Milk (N = 636)	Model 2: SSBs (N = 636)	Model 3: Water (N = 636)
Compliance[a]	0.03 (0.01–0.09)	0.14 (0.07–0.26)	0.70 (0.46–1.08)
Child and Adult Care Food Program[b]	0.42 (0.18–0.94)	0.41 (0.20–0.83)	0.22 (0.12–0.40)
Head Start[c]	Dropped	0.18 (0.07–0.43)	2.75 (1.74–4.34)
Center in a District Public Health Office catchment area[d]	1.43 (0.62–3.31)	0.90 (0.42–1.93)	1.68 (1.01–2.79)
Average classroom size[e]	1.04 (0.94–1.14)	0.81 (0.74–0.87)	0.93 (0.87–1.00)
Operating hours[e]	4.27 (2.64–6.89)	1.39 (0.96–1.99)	1.30 (1.03–1.65)
Student–teacher ratio[e]	0.92 (0.81–1.06)	0.95 (0.84–1.07)	0.95 (0.89–1.03)
Teaching staff turnover[e]	0.16 (0.01–1.66)	0.16 (0.02–1.12)	4.89 (1.11–21.47)
Center participated in Eat Well Play Hard[f]	4.54 (1.89–10.9)	2.44 (1.08–5.49)	1.33 (0.80–2.22)
No. of nutrition-related training programs other than Eat Well Play Hard[f] in which the center participated	0.42 (0.24–0.72)	0.28 (0.14–0.55)	1.26 (0.92–1.72)
No. of staff in the center who participated in Training of Teachers[g]	1.00 (0.77–1.30)	0.67 (0.44–1.02)	1.04 (0.96–1.12)
No. of staff in the classroom who participated in Training of Teachers[g]	0.38 (0.14–1.05)	0.99 (0.62–1.56)	0.95 (0.73–1.24)
No. of meals the child had during the day of observation	5.97 (2.17–16.38)	2.85 (1.36–5.95)	3.62 (2.13–6.14)

Abbreviations: SSBs, sugar-sweetened beverages; OR, odds ratio; 95% CI, 95% confidence interval.

[a] Noncompliant at center level, classroom level, or both levels is the reference category. See Methods for a description of measures of compliance.

[b] The Child and Adult Care Food Program is a program of the United States Department of Agriculture that administers federal grants to state health departments to provide nutritious meals and snacks to low-income individuals.

[c] Head Start is a comprehensive developmental program for preschool-aged children and their families who earn household income below the federal income poverty threshold administered by the Administration for Children and Families in the Department of Health and Human Services (HHS). This variable was dropped from the model because none of the Head Start centers were noncompliant.

[d] District Public Health Offices are a program of the New York City Department of Health and Mental Hygiene that target resources to high-need neighborhoods in the South Bronx, East and Central Harlem, and North and Central Brooklyn. These centers all received 2 sessions of individualized on-site technical assistance.

[e] All continuous variables in the model are mean-centered.

[f] Eat Well Play Hard is a technical assistance program of the New York City Department of Health and Mental Hygiene that teaches staff and children about nutrition and physical activity.

[g] Eat Well Play Hard Training of Teachers is a technical assistance program of the New York City Department of Health and Mental Hygiene that teaches child care center staff how to lead Eat Well Play Hard nutrition and physical activity curriculum in their classrooms.

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ORIGINAL RESEARCH

Relationship Between Child Care Centers' Compliance With Physical Activity Regulations and Children's Physical Activity, New York City, 2010

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PEER REVIEWED

Abstract

Introduction
Physical activity may protect against overweight and obesity among preschoolers, and the policies and characteristics of group child care centers influence the physical activity levels of children who attend them. We examined whether children in New York City group child care centers that are compliant with the city's regulations on child physical activity engage in more activity than children in centers who do not comply.

Methods
A sample of 1,352 children (mean age, 3.39 years) served by 110 group child care centers in low-income neighborhoods participated. Children's anthropometric data were collected and accelerometers were used to measure duration and intensity of physical activity. Multilevel generalized linear regression modeling techniques were used to assess the effect of center- and child-level factors on child-level physical activity.

Results
Centers' compliance with the regulation of obtaining at least 60 minutes of total physical activity per day was positively associated with children's levels of moderate to vigorous physical activity (MVPA); compliance with the regulation of obtaining at least 30 minutes of structured activity was not associated with increased levels of MVPA. Children in centers with a dedicated outdoor play space available also spent more time in MVPA. Boys spent more time in MVPA than girls, and non-Hispanic black children spent more time in MVPA than Hispanic children.

Conclusion
To increase children's level of MVPA in child care, both time and type of activity should be considered. Further examination of the role of play space availability and its effect on opportunities for engaging in physical activity is needed.

Introduction

As a result of rising childhood obesity rates, public health practitioners have examined the effects of environmental and policy change interventions to promote childhood physical activity (PA) (1–5). Previous findings indicate that preschool-aged children engage in low levels of vigorous activity and spend large amounts of time inactive (3,6). Evidence from longitudinal and cross-sectional studies suggests that PA protects against overweight and obesity among preschoolers and that policies and characteristics of group child care centers influence PA levels of children who attend them (7–10). Child care policies provide a promising strategy to address children's PA and potential obesity (11–13).

In 2007, New York City's (NYC's) Department of Health and Mental Hygiene (DOHMH) implemented modified regulations governing group child care centers, establishing minimum standards for PA, beverage consumption, and television viewing for children (14). The PA-related regulations require centers to schedule at least 60 minutes of total PA per day and at least 30 minutes of structured PA per day for students in full-day classrooms. NYC DOHMH also provided PA trainings and associated technical assistance (ie, Sports, Play and Active Recreation for Kids [SPARK] and Eat Well Play Hard Training of Teachers [TOTs] curricula) (15,16). This article addresses how compliance with requirements to offer at least 30 minutes of structured PA and at least 60 minutes of total PA each day is associated with children's moderate to vigorous PA (MVPA).

Methods

The evaluation used a multicomponent design. A center evaluation component assessed center-level compliance with regulations and organizational characteristics associated with compliance. A classroom evaluation component assessed classroom-level compliance with regulations during a 2-day period and child-level PA using accelerometers. In this issue of *Preventing Chronic Disease* (*PCD*), Breck et al present a full description of the methods (17). Institutional review boards at ICF International and NYC DOHMH approved the study protocol.

Center selection

From among the 1,654 early child care and education centers licensed by NYC DOHMH Bureau of Child Care, a random sample of 176 eligible centers agreed to participate in the center evaluation component (fall 2009). We limited the sample to centers serving low-income communities, defined by census tracts with 40% or more of families with incomes at 200% of the federal poverty line or below and stratified by location in District Public Health Office (DPHO) catchment areas. A sample of 110 of the 176 centers participated in the classroom evaluation component (spring 2010). These 110 centers represented 63% of the invited random, stratified sample. We randomly selected 1 classroom of preschoolers per participating center for 2 days of observation.

As part of the classroom component, data collectors documented variables related to classroom compliance through observation (eg, beverages teachers served, structured and unstructured PA offered, screen time offered). Although we originally did not propose to compare or contrast results of the center and classroom methods for assessing compliance, the resulting data allowed us an opportunity to examine whether and how strongly these different compliance measures related to our outcomes of interest. Also in this issue of *PCD*, Lessard et al discuss the definitions of compliance and each element's data source (18). Briefly, the center component assessed compliance at the center level using staff report (ie, teacher or director reported that children spent at least 30 total minutes per day in structured PA and a combined total of at least 60 total minutes per day in structured and unstructured PA). The classroom component assessed compliance with the regulations using direct observation of PA offerings in selected classrooms (ie, data collectors observed all structured and unstructured PA events offered to determine if amounts totaled at least 30 minutes of structured PA and at least 60 minutes for all structured and unstructured PA).

Participants

Eligible participants included 1,465 children from the 110 participating centers. The resulting sample included 1,352 children who participated in accelerometry data collection and had complete data. Our analysis excluded children aged younger than 2 years, 10 months or older than 5 years, 11 months or those with missing date-of-birth information (n = 38). The analysis also excluded children who experienced malfunctions of accelerometer equipment (n = 72) or an error in assignment of the accelerometers worn during the 2-day observation period (n = 3). Approximately one-fifth of children (21.7%) wore accelerometers for only 1 day; they were included in the sample. A comparison of children included with those excluded showed that the only significant difference was that excluded children were slightly younger (included: mean, 3.39 y; excluded: mean, 3.27 y).

Data collection and analysis methods

Data on children's heights and weights were collected to assess body mass index (BMI), and accelerometers measured duration and intensity of PA. Children wore accelerometers only while in the child care center. Before arrival on the first day of data collection, data collectors recalibrated accelerometers to record a 15-second epoch. Because of an error in recalibration, 140 children wore accelerometers set to a 1-minute epoch rather than a 15-second epoch. These children were included in the sample, and the analyses were adjusted for their inclusion.

On the first day of observation, data collectors placed an accelerometer (ActiGraph GT3X) on each participating child. We calculated accelerometer wear times using the recorded times at which belts were put on and taken off children, and adjusted for likely nonwear time (defined below). Procedures were repeated the second day with the same accelerometer used both days (except for those children who wore accelerometers only 1 day). The accelerometers were to be worn on both days of classroom data collection. Although 1 to 2 days of accelerometry data are below the

number of days recommended to provide reliable estimates of PA, the procedure needed to be brief, as it was administered with 3-year-olds in actual day care centers during normal operation.

Accelerometry data were processed using an Excel macro program developed by Stewart Trost and used with his permission (S. Trost, personal communication). Cut points developed for preschool-aged children by Pate and colleagues (19) were used to determine how much time each child engaged in different levels of PA. Because children wore accelerometers for varying lengths of time, we calculated minutes per hour of wear time to standardize data across children. For children who wore accelerometers both days, we calculated minutes of wear time per hour for each day separately and then averaged across both days.

According to the Institute of Medicine's Early Childhood Obesity Prevention Policies, toddlers and preschool-aged children should be provided opportunities for 15 minutes of light, moderate, and vigorous PA per hour while in care (20). To be consistent with Institute of Medicine recommendations, we analyzed MVPA among the children participating in this study. The calculated PA levels included sedentary (eg, sitting), light (eg, slow walking), moderate (eg, fast walking, skipping), and vigorous (eg, running). Accelerometry data were classified as follows: sedentary PA (<100 average counts/minute), light PA (≥100 and <1,680 average counts/minute), moderate PA (≥1,680 and <3,368 average counts/minute), vigorous PA (≥3,368 average counts/minute). Thus, MVPA included periods with total average counts greater than or equal to 1,680. Periods with consecutive zero counts lasting 60 minutes or longer were defined as nonwear time and were excluded from total wear time.

Calculation of compliance with PA regulations

Centers' compliance scores were calculated using procedures described in this issue of *PCD* by Lessard et al (18). Categories of compliance were as follows: 1) compliant with center and classroom components, 2) compliant with center component but not classroom component, 3) compliant with classroom component but not center component, and 4) compliant with neither component. In these analyses, we included 2 binary indicators: 1) consistently compliant with the regulation of at least 30 minutes of structured PA per day in both center and classroom components, and 2) consistently compliant with the regulation of at least 60 minutes of total PA per day in both center and classroom components.

Variables and analysis approach

To account for clustering of children within centers, we used 2 hierarchical linear models that consisted of 2-level generalized linear regressions assessing effects of center- and child-level factors on child-level PA. Covariates from both center and classroom components were examined for multicollinearity. Only the indicators of compliance with the regulations for structured PA and total PA exhibited evidence of collinearity. We then examined bivariate relationships among variables theorized to have effects on PA. Variables with significant bivariate relationships were included in the final models. Given their collinearity, the 2 compliance variables were included in separate models. All other covariates were included in both models. All analyses were conducted using Stata version 11 (StataCorp LP).

All continuous covariates were grand-mean centered to facilitate interpretation of intercepts as mean minutes per hour spent in MVPA when covariates were held at referent or grand-mean values. Center-level covariates included Child and Adult Care Food Program (CACFP), Head Start, and NYC DPHO status; mean classroom size; operating hours; student:teacher ratio; teacher turnover; and indicators of staff PA training (ie, SPARK and TOT) and play space availability (ie, dedicated outdoor, shared outdoor, or indoor). Child-level covariates included age, sex, race/ethnicity, and BMI. As noted, because of a recalibration error, 140 accelerometers had a 1-minute epoch setting. The potential effect of this difference was accounted for by including an indicator of epoch setting (1 = 1-minute, 0 = 15-second) in the models.

Results

PA levels of children

Boys spent significantly more time in MVPA than girls (Table 1). Levels of MVPA did not differ significantly for other child-level characteristics.

The number of centers considered compliant varied by evaluation component. For the regulation of at least 30 minutes of structured PA, 84 of 107 centers with complete data (78.5%) complied using the center component, and 32 of 107 centers with complete data (29.9%) complied using the classroom component. For the regulation of at least 60 minutes of total PA, 95 of 109 centers with complete data (87.2%) complied using the center component, and 28 of 109 centers with complete data (25.7%) complied using the classroom component. Across components, 23 of 107 centers with complete data (21.5%) consistently complied (ie, complied with using both evaluation components) with the structured PA regulation, and 33 of 109 centers with complete data (30.3%) consistently complied with the total PA regulation.

Children's levels of PA varied by centers' compliance with PA regulations (Table 2). Children in centers consistently compliant with both center and classroom components spent more time in MVPA than children in centers not consistently compliant. Centers did not differ in amount of time children spent in MVPA by compliance with the regulation for at least 30 minutes of structured PA.

Relationships among compliance, covariates, and PA levels

Table 3 presents results for compliance with the regulation for 30 minutes of structured PA per day; Table 4 presents results for compliance with the regulation for 60 minutes of total PA per day. For the first model, the intra-class correlation (ICC) was 0.161; for the second model, the ICC was 0.169. These findings indicate that in both models, more than 15% of the total variation in MVPA was attributable to the center level (ie, variation among centers in children's MVPA).

On average, children spent between 4 and 5 minutes per hour in MVPA. At the center level, amount of time spent in MVPA was not associated with consistent compliance with the regulation for 30 minutes of structured PA per day (Table 3). However, amount of time spent in MVPA was significantly associated with consistent compliance with the regulation for 60 minutes of total PA per day. Children attending centers consistently compliant with this regulation spent nearly 1 minute longer per hour in MVPA than those attending centers that were not consistently compliant with this regulation (Table 4).

Among other center-level covariates, results for both models were similar. Only availability of dedicated outdoor play space was significantly associated with MVPA. Children attending centers with dedicated outdoor play spaces spent nearly 1 minute more per hour in MVPA than those attending centers that did not have dedicated outdoor play spaces (Tables 3 and 4).

At the child level, results for the models were similar. Male children spent more time in MVPA than girls (reference category), and children who were non-Hispanic black spent more time in MVPA than those who were Hispanic (reference category). A 1-minute accelerometer epoch had no significant effect on amount of time spent in MVPA, supporting inclusion of these data in the models (Tables 3 and 4). (Results of models for light PA and sedentary PA [not presented] are available upon request from the corresponding author.)

Discussion

We examined how compliance with NYC's regulations on PA related to amount of time children in group child care centers engage in MVPA. Although previous studies have analyzed state policies for PA in child care centers (11–13), few have examined the effect of compliance with the policies on children's PA. In our study, children's levels of MVPA were associated with implementation of regulations requiring at least 60 minutes of total PA per day in group child care centers. However, compliance with the regulation for at least 30 minutes of structured PA per day was not associated with amount of time spent in MVPA.

The findings regarding compliance suggest that regulations for 60 minutes of total PA are related to increased time spent in MVPA among this age group in child care settings, consistent with previous findings indicating that supportive environments promote MVPA (9). Centers varied in the proportions of structured and unstructured PA comprising the 60 minutes of total PA offered. Anecdotally, data collectors observing PA offerings noted that structured PA activities often involved children engaging in less movement (eg, moving or jumping in place) than did unstructured PA activities (eg, running in an outdoor play space). This finding is consistent with several previous studies that found unstructured play to be associated with more MVPA (3,10,22,23). To be compliant with the regulation for 60 minutes of total PA, staff in group child care centers who want to engage children in more MVPA per day may find it beneficial to offer more time in unstructured PA. This offering would be in addition to 30 minutes of structured PA and would be similar to Let's Move! Child Care's recommendation that centers should offer 60 to 120 minutes of PA per day (23). Unlike findings from previous studies (9), we found no evidence that providing teachers with trainings on implementation of quality PA opportunities in the classroom was associated with time spent in MVPA. That compliance with regulations for amount of time offered for structured PA was not significantly associated with MVPA does not necessarily imply that policies should promote only unstructured PA, but policy makers should consider these findings in determining targeted levels of PA and types of activities offered to promote PA.

Children attending centers with a dedicated outdoor play space spent significantly more time in MVPA, suggesting that time spent

in outdoor play may promote MVPA. More research is needed to understand the pathways. Lessard et al report in this issue of *PCD* that centers with a dedicated outdoor play space were more likely to comply with implementing the center component (18). The potential importance of a center's access to dedicated outdoor play space for complying with regulations and for promoting children's MVPA is noteworthy. Centers should consider offering outdoor PA opportunities as well as types of play equipment and play space environment when implementing PA policy (9,10,13).

Limitations

Because the evaluation began after NYC child care regulations were implemented, it was not feasible to conduct a study that tested causal hypotheses or to conduct pre–post analyses. The cross-sectional study design used multiple methods of data collection, however, and used multivariate, multilevel statistical models to strengthen our ability to isolate center-level contribution of regulation compliance to child-level outcomes while controlling for relevant covariates.

Study methods relied on both observational data collection and self-report, each of which has potential biases (eg, for observation: inaccurate or inconsistent classification, potential variation in activities/outcomes outside the period of observation; for self-report: inaccurate recall, social desirability). Training of data collectors and piloting of data collection procedures were used to refine the data collectors' skills and comfort to reliably document observational data; still, the possibility existed for imprecise, inaccurate, or incomplete observations and inaccurate or more socially desirable survey responses.

The issue of recalibration errors for accelerometers of a small number of children was another limitation. To account for this, statistical analyses included epoch setting as a covariate. Results suggested the error had no significant effect on our findings. Additionally, the use of a 1- to 2-day period to collect accelerometry data was a limitation, because this time frame is below the number of days recommended to provide reliable estimates of physical activity. Estimates of MVPA therefore may be less reliable in this study than in others that used a longer data collection period. However, although we used a brief observation period, we contend this is acceptable given the limitations of the setting of the research and age of participants.

Finally, although efforts were made to recruit all child care centers that met study inclusion criteria, some centers declined participation. Centers that declined participation in the classroom component were less likely to have been compliant in the center component. Therefore, the findings may not be generalizable to all NYC child care centers. Given our focus on recruiting centers serving low-income areas, our findings are more likely generalizable to such centers and the children they serve.

Implications

Our findings have implications for NYC DOHMH regarding its regulations and for other jurisdictions contemplating similar PA standards. Policy makers may consider that similar centers also may struggle to comply with regulation targets for time in PA.

Compliance with NYC's PA regulations had mixed associations with children's PA. Compliance with the structured PA regulation was not associated with increased MVPA, while compliance with the total PA regulation (structured and unstructured) was associated with increased MVPA. Policy makers may consider recommendations for both unstructured and structured PA to promote increases in children's MVPA while in child care. Environmental infrastructure factors were associated with higher levels of physical activity; presence of a dedicated outdoor play space was strongly associated with an increase in time spent in MVPA. As policy makers contemplate the levels of PA deemed appropriate for children in group child care, they may consider the kinds of PA mandated and the influence of certain environmental factors on PA levels. Given that presence of shared and indoor play spaces was not associated with increased amounts of MVPA while presence of dedicated outdoor play spaces was, lack of outdoor play spaces may create potential barriers to engaging in PA. Further examination of the role of play space availability in promoting PA in child care centers would inform the nuances of the relationship. Although we provide cross-sectional evidence of the association of regulations and child-level PA behaviors, longitudinal research is needed to establish causal connections of regulations for group child care centers to children's health outcomes.

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Tables

Table 1. Mean Minutes Per Hour for Child-Level Moderate to Vigorous Physical Activity (MVPA) Among Children in New York City Group Child Care Centers, 2010

Characteristic	MVPA, Mean (Standard Deviation)
Age, y (n = 1,352)	
2	5.20 (2.08)
3	6.14 (3.52)
4	6.26 (3.57)
5	6.22 (3.33)
Sex (n = 1,351)	
Male	6.67 (3.82)
Female	5.70 (3.12)[a]
Body mass index (n = 1,352)	
Underweight	6.00 (3.21)
Normal	6.10 (3.51)
Overweight	6.08 (3.31)
Obese[b]	6.65 (3.67)

[a] $P < .001$.
[b] Based on guidelines of the National Heart, Lung, and Blood Institute (21).

Table 2. Children's Mean Minutes Per Hour of Moderate to Vigorous Physical Activity (MVPA), by Child Care Center Compliance, New York City, 2010

Structured Physical Activity Regulation, Duration of MVPA	Not Compliant With Center Component or Classroom Component	Compliant With Center Component	Compliant With Classroom Component	Compliant With Center and Classroom Components
	Mean (Standard Deviation)			
	n = 162	n = 729	n = 124	n = 301
30 Minutes	6.29 (3.76)	6.17 (3.32)	5.64 (3.76)	6.42 (3.68)
	n = 128	n = 744	n = 65	n = 403
60 Minutes[a]	5.22 (3.07)	6.02 (3.28)	6.25 (3.84)	6.72 (3.89)

[a] $P < .001$.

Table 3. Minutes Per Hour of MVPA Among Children in Group Child Care Centers, by Compliance With 30 Minutes of Structured PA, New York City, 2010

Variable	β	SE
Level 2 — Center-Level Variables (n = 103)		
Consistently compliant with 30 minutes of structured activity	−0.089	0.39
Center characteristics		
CACFP[a]	−0.51	0.54
Head Start[b]	0.25	0.40
DPHO[c] area/technical assistance	0.51	0.32
Average classroom size	0.05	0.05
Daily operating hours (total)	−0.10	0.19
Student:teacher ratio	−0.06	0.06
Teacher turnover rate	0.91	1.30
Training		
Center participated in SPARK[d]	−0.11	0.73
No. of physical activity trainings other than SPARK	−0.62	0.35
No. of center staff trained in 1st SPARK	0.00	0.02
No. of center staff trained in 2nd SPARK	−0.01	0.05
No. of center staff trained in TOT[e]	0.06	0.08
No. of classroom staff trained in SPARK	0.24	0.16
No. of classroom staff trained in TOT	0.04	0.19
Infrastructure		
Indoor play space	0.08	0.36
Outdoor play space	0.92[f]	0.36
Shared outdoor play space	0.08	0.42
Level 1 — Child-Level Variables (n = 1,278)		
Age	0.09	0.18
Male	1.05[g]	0.19
Race[h]		

Abbreviation: MVPA, moderate to vigorous physical activity.

[a] The Child and Adult Care Food Program (CACFP) is a program of the US Department of Agriculture that administers federal grants to state health departments to provide nutritious meals and snacks to low-income people.

[b] Head Start is a comprehensive developmental program for preschool-aged children and their families who earn a household income below the federal income poverty threshold administered by the Administration for Children and Families in the US Department of Health and Human Services.

[c] District Public Health Offices (DHPO) is a program of the New York City Department of Health and Mental Hygiene (NYC DOHMH), which targets resources to high-need neighborhoods in the South Bronx, East and Central Harlem, and North and Central Brooklyn. These centers all received 2 individualized on-site technical assistance sessions.

[d] Sports, Play and Active Recreation for Kids (SPARK) is a physical activity training program that NYC DOHMH provides free of charge to licensed child care centers.

[e] Eat Well Play Hard Training of Teachers (TOT) is a NYC DOHMH technical assistance program that provides child care center staff the skills necessary to lead Eat Well Play Hard nutrition and physical activity curriculum in their classrooms.

[f] $P = .01$

[g] $P < .001$.

[h] Hispanic ethnicity served as the reference category.

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Table 3. Minutes Per Hour of MVPA Among Children in Group Child Care Centers, by Compliance With 30 Minutes of Structured PA, New York City, 2010

Variable	β	SE
Non-Hispanic black	0.61[f]	0.24
Other (including white)	−0.27	0.40
Body mass index (*z* score)	0.12	0.08
1-min epoch	−0.20	0.54
Constant	4.50[g]	0.94

Abbreviation: MVPA, moderate to vigorous physical activity.
[a] The Child and Adult Care Food Program (CACFP) is a program of the US Department of Agriculture that administers federal grants to state health departments to provide nutritious meals and snacks to low-income people.
[b] Head Start is a comprehensive developmental program for preschool-aged children and their families who earn a household income below the federal income poverty threshold administered by the Administration for Children and Families in the US Department of Health and Human Services.
[c] District Public Health Offices (DHPO) is a program of the New York City Department of Health and Mental Hygiene (NYC DOHMH), which targets resources to high-need neighborhoods in the South Bronx, East and Central Harlem, and North and Central Brooklyn. These centers all received 2 individualized on-site technical assistance sessions.
[d] Sports, Play and Active Recreation for Kids (SPARK) is a physical activity training program that NYC DOHMH provides free of charge to licensed child care centers.
[e] Eat Well Play Hard Training of Teachers (TOT) is a NYC DOHMH technical assistance program that provides child care center staff the skills necessary to lead Eat Well Play Hard nutrition and physical activity curriculum in their classrooms.
[f] $P = .01$
[g] $P < .001$.
[h] Hispanic ethnicity served as the reference category.

Table 4. Minutes Per Hour of MVPA Among Children in Group Child Care Centers, by Compliance With 60 Minutes of Total PA, New York City, 2010

Variable	β	SE
Level 2 — Center-Level Variables (n = 103)		
Consistently compliant with 60 minutes of total activity	0.94[a]	0.33
Center characteristics		
CACFP[b]	−0.93	0.53
Head Start[c]	0.43	0.39
DPHO[d] area/technical assistance	0.54	0.32
Average classroom size	0.08	0.05
Daily operating hours (total)	−0.12	0.19
Student:teacher ratio	−0.08	0.06
Teacher turnover rate	1.27	1.27
Training		
Center participated in SPARK[e]	−0.43	0.68
No. of physical activity trainings other than SPARK	−0.62	0.34
No. of center staff trained in 1st SPARK	0.01	0.02
No. of center staff trained in 2nd SPARK	0	0.05
No. of center staff trained in TOT[f]	0.08	0.08
No. of classroom staff trained in SPARK	0.25	0.16
No. of classroom staff trained in TOT	0.13	0.18
Infrastructure		
Indoor play space	−0.04	0.35
Outdoor play space	0.73[g]	0.36
Shared outdoor play space	0.15	0.40
Level 1 — Child-Level Covariates (n = 1,278)		
Age	0.08	0.18
Male	1.02[h]	0.18

Abbreviations: MVPA, moderate to vigorous physical activity; SE, standard error.
[a] $P = .005$.
[b] The Child and Adult Care Food Program (CACFP) is a program of the US Department of Agriculture that administers federal grants to state health departments to provide nutritious meals and snacks to low-income people.
[c] Head Start is a comprehensive developmental program for preschool-aged children and their families who earn a household income below the federal income poverty threshold administered by the Administration for Children and Families in the US Department of Health and Human Services.
[d] District Public Health Offices (DHPO) is a program of the New York City Department of Health and Mental Hygiene (NYC DOHMH) which targets resources to high-need neighborhoods in the South Bronx, East and Central Harlem, and North and Central Brooklyn. These centers all received 2 individualized on-site technical assistance sessions.
[e] Sports, Play and Active Recreation for Kids (SPARK) is a physical activity training program that NYC DOHMH provides free of charge to licensed child care centers.
[f] Eat Well Play Hard Training of Teachers (TOT) is a NYC DOHMH technical assistance program that provides child care center staff the skills necessary to lead Eat Well Play Hard nutrition and physical activity curriculum in their classrooms.
[g] $P = .04$.
[h] $P < .001$.
[i] Hispanic ethnicity served as the reference category.
[j] $P = .01$.

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Table 4. Minutes Per Hour of MVPA Among Children in Group Child Care Centers, by Compliance With 60 Minutes of Total PA, New York City, 2010

Variable	β	SE
Race[i]		
Non-Hispanic black	0.60[j]	0.24
Other (including white)	−0.15	0.39
Body mass index (*z* score)	0.12	0.07
1-min epoch	−0.08	0.51
Constant	4.83[h]	0.90

Abbreviations: MVPA, moderate to vigorous physical activity; SE, standard error.
[a] $P = .005$.
[b] The Child and Adult Care Food Program (CACFP) is a program of the US Department of Agriculture that administers federal grants to state health departments to provide nutritious meals and snacks to low-income people.
[c] Head Start is a comprehensive developmental program for preschool-aged children and their families who earn a household income below the federal income poverty threshold administered by the Administration for Children and Families in the US Department of Health and Human Services.
[d] District Public Health Offices (DHPO) is a program of the New York City Department of Health and Mental Hygiene (NYC DOHMH) which targets resources to high-need neighborhoods in the South Bronx, East and Central Harlem, and North and Central Brooklyn. These centers all received 2 individualized on-site technical assistance sessions.
[e] Sports, Play and Active Recreation for Kids (SPARK) is a physical activity training program that NYC DOHMH provides free of charge to licensed child care centers.
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[g] $P = .04$.
[h] $P < .001$.
[i] Hispanic ethnicity served as the reference category.
[j] $P = .01$.

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SPECIAL TOPIC

Insights and Implications for Health Departments From the Evaluation of New York City's Regulations on Nutrition, Physical Activity, and Screen Time in Child Care Centers

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Abstract

In 2006, the New York City Department of Health and Mental Hygiene, seeking to address the epidemic of childhood obesity, issued new regulations on beverages, physical activity, and screen time in group child care centers. An evaluation was conducted to identify characteristics of New York City child care centers that have implemented these regulations and to examine how varying degrees of implementation affected children's behaviors. This article discusses results of this evaluation and how findings can be useful for other public health agencies. Knowing the characteristics of centers that are more likely to comply can help other jurisdictions identify centers that may need additional support and training. Results indicated that compliance may improve when rules established by governing agencies, national standards, and local regulatory bodies are complementary or additive. Therefore, the establishment of clear standards for obesity prevention for child care providers can be a significant public health achievement.

Background

In 2006, New York City, seeking to address factors contributing to rising rates of childhood obesity, promulgated health code regulations for group child care centers on beverages, physical activity, and screen time. Although the regulations were grounded in scientific evidence, until now, no large-scale assessment of the effect of such regulations has been conducted.

It is interesting to examine the regulations, approved in 2006 and executed in 2007, from the vantage point of 2014. Much has changed. Since 2007, new Institute of Medicine guidelines were released that advocate similar guidelines for early child care centers (1). The federal Child and Adult Care Food Program (CACFP), in which 86% of the centers in our evaluation participated, adopted guidelines similar to the New York City regulations in 2009 (2). And *Caring for Our Children*, the 3rd edition of child care standards, released in 2010 by the American Academy of Pediatrics, the American Public Health Association, and the National Resource Center for Health and Safety in Child Care and Early Education (3), reduced the amount of juice per day to be given and recommended 1% or skim milk for children aged 2 years or older. This redundancy, in which a policy that is shown or expected to change behavior is reinforced by another, may be particularly important in health policy. Although one policy may help to improve health, greater consistency among the policies of regulators, payors, and expert bodies that affect the same population may have synergistic effects.

The articles in this collection present the findings of the multimethod evaluation of the impact of the 2006 regulations. The first data collection in late 2009 included 176 child care centers, and the second data collection included 110 of the original centers 6 months later. The centers were located in high-poverty neighborhoods in all 5 boroughs of the city. Most of the children were Hispanic or non-Hispanic black, aged 3 or 4 years. The first data collection (the Center Component) was for an evaluation at the center level and included interviews with the staff and direct observa-

tion of center-level characteristics, such as whether there was physical activity in the classroom curriculum plan or low-fat milk in the refrigerator. The second data collection (the Class Component) was for an evaluation at the classroom and child level and included direct observation of the classroom staff and child behavior, such as whether children drank water or were physically active for 60 minutes each day. A detailed description of the design and methods can be found elsewhere (3).

Optimizing Compliance

The articles in this collection show both the difficulties and ease with which centers complied with various components of the change in health code regulations. These data are important for developing strategies to optimize compliance. Although some centers had more difficulty with compliance than others, this evaluation demonstrated that most centers were able to comply with most of the changes in the regulation, suggesting that a public policy to change nutrition and physical activity through regulation can be implemented. Additionally, the data will help us identify the types of centers that should be targeted for training and technical assistance. For example, a center that lacks dedicated outdoor space may be challenged by the physical activity regulation, but by training staff in implementing an in-classroom physical activity curriculum, compliance may be improved.

Insights From the Use of Various Methods

For policy assessment, both process and outcome evaluations are beneficial. First, we needed to assess whether center administrators and staff were aware of the new policy. Next, we needed to assess whether the centers were complying with and implementing the regulations. And finally, we needed to know if the implemented policy had the desired effect on staff and child behavior. Increased physical activity and improved nutrition, regardless of whether they ultimately affect rates of obesity, are positive health outcomes in and of themselves because they improve other aspects of health, such as cardiovascular health.

As part of the center component of the evaluation, trained data collectors interviewed staff to assess knowledge and self-reported compliance with the regulations (3). The data collected suggested that the Department of Health and Mental Hygiene (DOHMH) did a good job of disseminating information about the regulations and that center staff considered themselves to be highly compliant, self-reporting ranges of compliance with the regulations from 69% for type of juice served to 100% for television time permitted and 87% for physical activity time required (4).

In addition to examining compliance through self-report in the center component, we examined compliance more objectively through observation in the class component. We found that staff self-reports and class observation were similar for screen time and most beverage regulations but varied significantly for other items, particularly physical activity. Through direct observation, most centers were found to comply with the regulation on serving 100% juice (84.5%) and permitting 60 or fewer minutes of television time (89%). Only 26% of observed centers offered 60 minutes of physical activity per day — although it should be noted that among centers that did not meet physical activity requirements, many came close.

Observation is expensive and time intensive. Data collectors had to be trained on how to observe classrooms and child behaviors and understand the nuances, including how to accurately record portions and methods of food preparation and describe structured and unstructured activity. One rationale for observation may be simply to know how closely a center's compliance compares with the staff's perception of compliance. Our observations indicated some surprising results, such as incomplete compliance with the provision of water and use of only 100% juice, 2 regulations that may be considered easy to implement. Direct observation, therefore, can detect important details for understanding the full depth of compliance and the impact of these regulations on children.

The Importance of Child Care Center Characteristics

Most of the child care centers in our evaluation qualified for and participated in CACFP, a federal program supervised by states to reimburse the cost of meals and snacks to centers that provide food to low-income residents. Many centers did not have dedicated outdoor space or extra indoor play space, and all families of the children enrolled in the centers studied were eligible for food stamps.

When considering whether a regulation can be implemented, child care center characteristics are important. Fewer hours of operation per day, a lower student-to-teacher ratio, greater stability of staff tenure, and a better-educated staff were all associated with compliance. Longer hours and higher staff turnover were associated with lower compliance, whereas participation in CACFP or Head Start enhanced compliance with several regulations. Lower compliance rates may be due to the lack of technical assistance, guidance, or regular reminders typically provided by CACFP and Head Start.

Identifying center characteristics associated with noncompliance can help health departments or other agencies better target resources for training and technical assistance. Our evaluation sug-

gests the importance of directing resources to centers that are not part of Head Start and do not participate in CACFP but are located in low-income neighborhoods.

Lessons Learned About Compliance With Each Regulation

Water

The 2006 New York City regulations state that "water should be available and easily accessible to children throughout the day, including at meals." Eighty six percent of centers reported compliance with the water regulation in the center component (when compliance was assessed through self-report during staff interviews), and 56% of centers were compliant in the class component (when compliance was assessed through direct observation in the classroom). The difference in compliance may indicate that the wording of a regulation is open to interpretation. Words such as "available and easily accessible" may not be specific enough. For example, is a water fountain down the hall available and easily accessible? Breck et al (3) reported that centers in which water was available "down the hall" had lower water-consumption scores than centers in which water was available at the food table. The concepts of availability and accessibility are open to too much interpretation and are perhaps confounded by CACFP guidelines, which express concern that water not displace milk at meals. The lack of clarity has led to confusion in some centers. So what did we learn? That the regulation on water was not written in more specific terms created difficulty in evaluating compliance: the researchers and the centers may have interpreted the regulations differently. If the regulation had stated distinctly that water must be in a pitcher or prepoured in cups or centrally located and at the food table, the terms of compliance would have been clearer to the centers and easier to measure for the researchers. Jurisdictions in which regulations are written in more concrete terms could clarify this issue. Furthermore, standards (eg, CACFP standards) that may be perceived as not aligned with the New York City regulations may have led to reduced compliance in some centers.

100% Juice

The evaluation of compliance with the juice regulation was divided into 2 parts. First, if the beverage examined was not 100% juice, it was counted as a sugar-sweetened beverage and therefore found noncompliant with the juice requirement. Second, if the portion of juice was more than 6 ounces, then the center was recorded as noncompliant with the regulated portion size. Some centers were confused about whether a beverage qualified as 100% juice, suggesting the need for more nutrition education, especially in reading food and beverage labels. For example, some centers mistakenly equated the labels "100% vitamin C" with "100% juice." During observation, 67% of centers were compliant for serving size. This finding brought to light the mealtime practice of "free pour": teaching a child to pour his or her own drink. In centers where free pour was a learning tool, compliance with the 6-ounce juice serving per day may have been lower, but we did not evaluate the effect of free pour. Again, compliance with this regulation may have been greater had it been written with greater clarity. For example, the policy could have stated "Label must say 100% juice, and no more than 6 ounces should be prepoured into cups once per day. Centers that practice 'free pour' should not use juice as an allowable free-pour beverage."

Sugar-sweetened beverages

The level of compliance with the restriction on sugar-sweetened beverages was high, particularly for centers that were also compliant with the 100% juice requirement. In both the center and class components of the evaluation, 80% to 85% of centers were compliant. Some noncompliance may be explained by our categorizing non-100% juices as sugar-sweetened beverages and the confusion in some centers about identification of 100% juice. Therefore, more education on reading beverage labels and on what constitutes a sugar-sweetened beverage may be necessary to increase compliance.

Milk

Compliance with the regulation on low-fat milk for children older than 2 years was on average 90% for all centers in both the center and class components of the evaluation, but the likelihood of compliance was particularly high for Head Start centers (odds ratio, 2.85 for Head Start centers vs other centers.). There may be better understanding of different types of milk than of sugar-sweetened beverages or 100% juice. The high rate of compliance indicates the potential impact that local regulations have on compliance when they are reinforced by governing agencies and programs such as CACFP, the US Department of Agriculture, and the Special Supplemental Nutrition Program for Women, Infants, and Children.

Screen time

The level of compliance with the regulation on screen time — 60 or fewer minutes per day for children aged 2 to5 years — was high in both the center and class components of the evaluation, as was adherence to the regulation that requires television programming to be either educational programming or programming that actively engages children in movement. Minutes of screen time did not predict sedentary activity among children. Because compli-

ance with the screen time regulation was high, it may be feasible to align the regulation more closely with recent recommendations of only 30 minutes per week of educational screen time (5).

Physical activity

The physical activity regulation requires children aged 12 months or older to participate in 60 minutes of physical activity per day, regardless of weather; for children aged 3 years or older, 30 minutes of that time must be structured. The level of compliance with the number of minutes of physical activity was much lower when evaluated through direct observation than by self-report. In the center component, 77% of center staff interviewed reported they met the 30 minutes of structured activity, and 86% reported they met the 60 minutes of total physical activity. In the class component, when minutes of physical activity were observed, 30% were compliant with the 30-minute requirement for structured activity and 26% reached the 60-minute requirement.

There are many reasons why the physical activity requirement is challenging to implement. Early child care centers in dense, urban settings like New York City often lack adequate space for physical activity or may have safety concerns on the playground (6,7). Additionally, structured physical activity requires that teachers demonstrate and participate in the activities. Because more than one-third of adults are sedentary (8), some teachers in child care centers may find a physical activity requirement challenging (9).

What are the characteristics that influence a center's ability to comply with the physical activity requirement? More hours of operation and more children per class were inversely associated with compliance, suggesting that centers with long operating hours and large classroom sizes may need additional support to facilitate compliance. Dedicated outdoor space was associated with higher levels of moderate-to-vigorous activity when measured by accelerometer; this finding has been reported elsewhere (10–12). Compliant centers also used curriculum plans more often than noncompliant centers, totaling minutes of physical activity well beyond the requirement: approximately 50 minutes for structured activity, and more than 95 minutes for total physical activity.

It should be noted, though, that even in centers not complying fully with the physical activity requirement, children were physically active. On both days of observation, noncompliant centers provided approximately 15 minutes of the 30 minutes of structured activity required and approximately 40 of the 60 minutes of total physical activity required. These encouraging results suggest that with some assistance, these centers could achieve full compliance. Further evaluations might consider incorporating an additional measure such as duration of activity.

Staff training was significantly associated with meeting the physical activity requirements. Each additional teacher who participated in a 1-day SPARK! Early Childhood training (a curriculum for in-classroom physical activity) increased the likelihood of compliance by about 9%. Additional physical activity-related training (beyond SPARK!) further increased a center's likelihood of compliance. However, training is expensive and may not be financially feasible because of ever-shrinking budgets. One possible strategy is to allocate training funds to centers most in need — for example, centers that lack dedicated outdoor space.

DOHMH has district public health offices in 3 communities that have exceptionally high poverty rates and high rates of chronic disease. Centers in these 3 communities received additional on-site technical assistance in implementing the physical activity requirements. Trainers visited each center multiple times, watching how teachers implemented the activities, helping teachers improve their technique, and ensuring that centers had sufficient equipment. Interestingly, post-training technical assistance seemed to have little additional effect. Again, an important consideration in policy design is how best to invest financial and staff resources. Allocations of money for training and other technical assistance may be helpful, but methods should be piloted and evaluated to increase the likelihood of success.

Although training clearly increased the likelihood of compliance, enacting a policy in the absence of training resources may still be beneficial. Setting clear standards to improve nutrition and increase physical activity in early child care centers will likely lead to change, however incremental. Better equipped centers will more easily comply, but even those facing challenges will likely strive to comply.

Conclusion

The changes in the New York City health code to improve nutrition, increase physical activity and reduce screen time were largely implemented by the city's early child care centers, although some centers were better able to fully comply than others. Other jurisdictions should consider setting standards in early child care to help improve the health of young children.

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