Evaluation of a Physical Activity Regulation for Child Care in Massachusetts

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Abstract

Objectives: A number of states have enacted regulations to increase physical activity in children attending child care, but most were not evaluated. In 2010, Massachusetts (MA) enacted a new regulation requiring 60 minutes of light, moderate, and vigorous physical activity (LMVPA) for children in child care; we conducted a prospective evaluation. We hypothesized that MA centers would comply with the regulation at follow-up, resulting in increases in children's LMVPA.

Methods: We evaluated compliance with the regulation in MA using Rhode Island (RI) as the comparison. We measured physical activity in a longitudinal sample of 20 centers and cross-sectional samples of 180 children per state three times before and three times after the regulation took effect. We assessed physical activity using the Observation System for Recording Activity in Preschoolers. We conducted difference-in-differences tests to evaluate changes in LMVPA in MA compared with RI from baseline to follow-up.

Results: Children were active for at least 60 minutes of LMVPA in over 80% of centers at baseline and follow-up in MA and RI. Nevertheless, LMVPA increased in both states. In multivariable adjusted regressions, LMVPA increased from baseline to follow-up [MA estimate 38.1 minutes; confidence interval (CI): 28.6, 47.5; $p \leq 0.0001$; and RI estimate 42.7 minutes; CI: 35.2, 50.1; $p \leq 0.0001$]. The average difference-in-differences estimate indicated no difference in MA compared with RI (estimate -4.6 minutes; CI: -16.6, 7.5; $p = 0.46$) since LMVPA increased comparably in both states.

Conclusions: Although LMVPA increased in MA, we observed similar changes in RI. Thus, other factors could have influenced children's physical activity.

Keywords: child care; physical activity; policy; regulation

Introduction

Preschool-aged children are largely inactive in child care.¹⁻⁵ Research shows that children engage in less than the recommended 120 minutes of light, moderate, and vigorous physical activity (LMVPA) daily⁶ and that insufficient physical activity in child care settings may be a missed opportunity.^{7,8} Recommendations put forth by the Institute of Medicine (IOM) in *Early Childhood Obesity Prevention Policies*⁹ suggest that children should be provided with opportunities for 15 minutes per hour of LMVPA daily while in child care. This is equivalent to 120 minutes over an 8-hour day of care. A study of children in South Carolina, however, found that about half of child care centers met this IOM recommendation.⁴

In response, researchers and national organizations have proposed policy-based approaches to increase children's physical activity in child care.⁹⁻¹¹ Child care programs are required by law to meet specific minimum health and safety standards of care unless they are legally exempt from state licensing. In the United States, regulation of child care programs is the responsibility of the individual state, and each has an agency responsible for oversight and enforcement. Cities and other municipalities also have the authority to regulate child care within their jurisdiction, unless preempted by the state. A number of states and cities have enacted new physical activity regulations for child care programs and 4 states and one city currently have regulations specifying a specific amount of physical activity for children daily.¹² Despite this growing interest in establishing such policies, few have been formally evaluated to determine

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whether they increase children's physical activity or bring physical activity levels up to standards.

New York City implemented regulations for licensed group child care centers that required 60 minutes of LMVPA, with 30 minutes of those as structured physical activity each day, and limited screen time to no more than 60 minutes per day.^{13,14} The regulations were implemented in 2007 and researchers conducted a post-only (no baseline) assessment in 2009. Stephens et al.¹³ measured physical activity in a sample of 1352 preschool-aged children from 110 centers and found that 87% of the centers were compliant with the 60-minute physical activity regulation, 86% were compliant with the structured physical activity regulation, and 30% were compliant with the screen time regulation.^{13,14} Additionally, center compliance with the 60-minute physical activity regulation was positively associated with moderate to vigorous physical activity (MVPA) in children.¹³ Compliance with the structured physical activity or the screen time regulation was not associated with children's MVPA.¹³ Delaware also implemented a new physical activity rule requiring 20 minutes of MVPA for every 3 hours of care and less than 1 hour per day of screen time.¹⁵ After the rules took effect, Van Stan et al.¹⁶ assessed changes in provider knowledge before and after a state-sponsored training to facilitate compliance. They found that providers were more knowledgeable about the rules and more providers correctly identified the rules after the training, but they did not measure children's physical activity.¹⁶ While these evaluation studies show promise, one included post-only assessments, the other did not assess physical activity, and neither included a comparison.

Wright et al. aimed to quantify the obesity-related health impact of a multicomponent regulatory intervention for licensed child care programs in the United States.¹⁷ They found that regulatory changes could lead to decreased television viewing, increased minutes of MVPA, and fewer sugar-sweetened beverages consumed by children, resulting in small but meaningful reductions in body mass index (BMI).¹⁷ While large-scale regulatory changes have the potential to improve healthy behaviors in children, additional real-world evaluation studies are needed. The goal of our study was to prospectively evaluate a new statewide regulation in Massachusetts (MA) requiring 60 minutes of physical activity daily for all children in center-based child care, in comparison with Rhode Island (RI), which did not institute such a policy.

Methods

Study Design and Overview

To evaluate consistency with the regulation, we conducted a quasi-experimental study with a two-group repeated measures pretest/posttest design. We compared physical activity before and after the regulation took effect in both MA and in RI, a state not making regulatory changes, for comparison. We hypothesized that MA cen-

ters would show greater increases in children's LMVPA than RI centers pre- vs. postimplementation of the MA regulation. Available funds limited our ability to collect data throughout MA, so we focused on the city of Boston. We selected Providence as the comparison because the geographic location, urban density, and climate are similar to Boston. Both are coastal cities with comparable weather conditions, which helped ensure that temperature and precipitation, which can influence physical activity, were as equivalent as possible. We conducted center assessments in fall 2008, spring 2009, and fall 2009 before the regulation was enacted in 2010. We conducted follow-up assessments in fall 2011, spring 2012, and fall 2012.

Recruitment and Sample

We worked with each state's licensing and administrative agency to generate a list of eligible centers in random order. We invited center directors to participate by mail and followed up with directors by phone until 20 were enrolled per state. Centers were eligible if they were licensed, served children 3–5 years of age, provided full-day care, and were licensed as a child care center and not a family child care home in the state of MA or RI. We observed nine randomly selected children per center at each assessment for a total of 180 children from 20 centers in MA and 180 children from 20 centers in RI across baselines. We conducted a series of cross-sectional observations of children, so we did not necessarily observe the same children at each assessment. We were concerned with attrition as many preschool-aged children leave their child care arrangements or enter kindergarten within a relatively short period of time.¹⁸ Center directors and parents were not aware that we were evaluating a new physical activity regulation. Center directors provided written informed consent to participate. Parents were informed of the study, but did not provide consent since, we did not collect any identifiable information about the children observed in the centers. The Institutional Review Board of Harvard Pilgrim HealthCare approved this study.

Physical Activity Regulation

The new regulation requiring 60 minutes of LMVPA was part of a larger group of health and safety regulations (e.g., tooth brushing, provider training) implemented by the MA Department of Early Education and Care, the child care licensing and administrative agency for the state. The regulation governed both centers and family child care homes—although our study targeted centers only. The regulation was mandatory; centers were required to adhere or face possible financial or administrative penalties if they failed to meet this and other regulations during yearly compliance checks. The new regulation required all full-day child care centers to provide daily at least 60 minutes of physical activity.¹⁹ The regulation took effect in January 2010.

Physical Activity Assessment

At each visit to a center, we assessed physical activity over the course of one full day within each center using the Observation System for Recording Activity in Preschoolers (OSRAP).²⁰ The OSRAP uses a time-sampling procedure for collecting data on physical activity that include intensity, type, location, and context. Previous research reports high correlations in energy expenditure and accelerometer counts across the OSRAP intensity categories.^{21,22} We assessed physical activity in children using the OSRAP rather than, say, accelerometers because the OSRAP allowed us to collect important contextual data such as where (inside vs. outside) and when (unstructured vs. teacher-led activity) children were most active; we reported a summary of these findings elsewhere.²³ Per protocol, we conducted the OSRAP in one classroom of children aged 3–5 years and randomly selected eight children plus one alternate for observation. The protocol allows for observation of fewer children in the classroom; however, all of the centers in our study had at least nine children in care at the time of the observations. We observed one child for 15 seconds before rotating to the next so that we observed each child for two nonconsecutive 4-minute blocks during a 32-minute observation period. We repeated this process over the course of the observation day. If a target child left the classroom or was momentarily out of sight, we observed the alternate. We documented the highest level of physical activity intensity achieved by the target child during each 15-second observation period. We did not observe children while they were eating or napping.

We measured physical activity intensity using the OSRAP 5-point scale of (1) stationary or motionless (sedentary), (2) stationary with movement of limbs or trunk such as sitting still, but moving arms (sedentary), and (3) slow and easy movement such as light walking (light), moderate movement such as fast walking (moderate), and fast movement such as running (vigorous). We calculated the total minutes of LMVPA children engaged in over the course of the day for each center to evaluate consistency with the regulation. Training to conduct the OSRAP included two days of orientation, two days of practice in a center, and a final certification over one day in a center. We required data collectors to achieve 90% agreement with the gold standard trainer to be certified to conduct the OSRAP. Data collectors all held undergraduate or graduate degrees in child development, public health, or a related field and were blinded to the aims of the study.

Other Measures

Directors reported other covariates through questionnaires, including center years of operation, years the director has been employed in the field of child care, and the presence of an indoor or outdoor play area dedicated to the center. Directors also reported participation in the Child and Adult Care Food Program (CACFP), the race and ethnicity of the children in care, and the number of children and the number of income-subsidized children enrolled.

Statistical Analysis

We used linear regression, estimated with generalized estimating equations to assess whether minutes of LMVPA increased from aggregate baseline to aggregate follow-up for children in centers in MA compared with RI. We adjusted regression errors for repeated measures within centers using exchangeable correlation and model-based standard errors. Our outcomes included both total minutes and the standardized minutes per hour of LMVPA to account for centers open for longer vs. shorter lengths of time over the day of observation. We chose to model time with individual binary indicators for assessment period, regulation state, and regulation state interactions to obtain estimations of the difference-in-differences effects of the regulation from baseline to follow-up. We treated the six assessment periods as repeated measures and included a binary indicator for pre or post for each of the three baselines and three follow-ups. The binary indicator effectively pooled the time periods and therefore should be interpreted as an average. We also examined potential changes in sedentary time, MVPA, and light, moderate, and vigorous activity in separate models. We adjusted for covariates identified *a priori* as potential confounders, including number of children enrolled, child race, availability of an indoor and outdoor play area, precipitation and temperature, and total minutes of daily operation for the center. We present linear regression results as parameter estimates of minutes of physical activity, 95% confidence intervals (CI), and two-sided *p*-values. We conducted all analyses using SAS version 9.4 (SAS Institute, Cary, NC) and a significance level of <0.05.

Results

Four of the 20 center directors in MA withdrew from the study before follow-up data collection, citing time constraints, leaving 16 for analyses (80% retention). All 20 centers in RI completed baseline and follow-up assessments. We collected data on 180 children at each baseline and 144 at each follow-up in MA. In RI, we collected data on 180 children at each time point from baseline to follow-up. States differed at baseline by the number of subsidized children enrolled, with a mean [standard deviation (SD)] of 38.0 (33.3) in MA centers compared with 19.3 (36.6) in RI ($p=0.04$) (Table 1). Centers in MA had a mean (SD) number of 27.5 (32.4) white children enrolled vs. 65.8 (30.3) in RI ($p=0.001$). Fewer centers in MA had outdoor play areas than RI (65% compared with 100%, $p=0.008$). Centers in MA did not differ from those in RI in CACFP participation, number of children enrolled, the presence of indoor play space at the center, or any other demographic variables presented in Table 1. We compared demographic data from the 16 centers that provided follow-up data with the four that withdrew after baseline. Centers that completed the study cared for fewer subsidized children [24.9 (35.8) vs. 50.0 (29.9); $p=0.03$] and enrolled a higher percentage of white children (69% vs. 17%; $p=0.002$). However,

Table 1. Characteristics of the Child Care Centers and Center Directors by State

	Massachusetts (n = 20)	Rhode Island (n = 20)
Center characteristics	Mean (SD)	
Center years in operation	19.7 (11.1)	24.5 (21.4)
Number of children enrolled, all ages	60.3 (30.8)	62.1 (38.6)
Number of children enrolled, 3–5 years	34.9 (19.6)	39.6 (24.6)
Number of children receiving subsidy	38.0 (33.3)	19.3 (36.6)
Number of staff members	16.4 (9.1)	14.4 (10.2)
Number of classrooms	5.0 (2.5)	5.0 (3.9)
Race of children		
White	27.5 (32.4)	45.8 (30.3)
Black/African American	27.7 (29.5)	10.9 (13.0)
Asian/Asian American	8.7 (19.1)	4.0 (5.0)
Multiple race/other race	10.5 (11.7)	1.9 (3.5)
Ethnicity of children, Latino/Latina/Hispanic	24.9 (29.8)	15.6 (17.2)
n (%)		
NAEYC accredited	12 (60)	6 (30)
CACFP participation	13 (65)	9 (45)
Outdoor play area at center	13 (65)	20 (100)
Indoor play area at center	13 (65)	9 (45)
Director characteristics	Mean (SD)	
Age in years	45.5 (10.0)	48.1 (11.5)
Years employed in field of child care	20.8 (8.6)	17.8 (10.4)
n (%)		
Education		
High school diploma or Associates degree	6 (30)	2 (10)
College degree	4 (20)	10 (50)
Graduate degree	10 (50)	8 (40)
Sex, female	19 (95)	19 (95)
Race		
White	10 (53)	13 (68)
Black/African American	4 (21)	1 (5)
Multiple race/other race	5 (26)	5 (26)
Ethnicity, Latino/Latina/Hispanic	4 (20)	2 (10)

CACFP, Child and Adult Care Food Program; NAEYC, National Association for the Education of Young Children; SD, standard deviation.

the centers did not differ on other covariates such as outdoor play area, number of staff members, and number of children enrolled.

Among the children we observed, centers in MA provided a combined unadjusted mean (SD) of 90.9 (30.9) minutes of LMVPA at baseline and 130.3 (39.3) at follow-up (Table 2).

Centers in RI provided 84.6 (20.8) minutes at baseline and 128.8 (30.3) at follow-up. Children in MA centers engaged in a low of 20.6 (5.6) minutes of LMVPA minutes per hour at baseline and a high of 27.1 (5.4) at follow-up (Table 2). Similarly, children in RI engaged in a low of 20.6 (5.9) minutes of LMVPA per hour at baseline and a high of 27.6 (4.4) at

Table 2. Unadjusted Mean (Standard Deviation) Minutes of Physical Activity in Massachusetts and Rhode Island^a

Total minutes of physical activity						
	Baseline 1	Baseline 2	Baseline 3	Follow-up 1	Follow-up 2	Follow-up 3
MA	73.5 (21.4)	96.6 (27.4)	103.0 (35.2)	101.7 (31.4)	153.2 (33.1)	137.5 (35.9)
RI	77.8 (22.5)	82.6 (20.9)	93.4 (16.5)	112.9 (30.9)	140.3 (30.9)	132.4 (21.5)
Standardized minutes per hour of physical activity						
	Baseline 1	Baseline 2	Baseline 3	Follow-up 1	Follow-up 2	Follow-up 3
MA	20.6 (5.6)	24.7 (6.7)	26.0 (8.7)	24.0 (5.3)	27.1 (5.4)	27.0 (6.0)
RI	20.6 (5.9)	20.8 (5.4)	23.1 (4.9)	23.3 (4.9)	27.6 (4.4)	24.3 (3.7)

^aSample of 20 centers at baseline and 16 at follow-up in MA; 20 centers at baseline and follow-up in RI.

MA, Massachusetts; RI, Rhode Island.

follow-up. Across the 3 baselines, 80%, 95%, and 90% of centers in MA were already meeting the regulation (Fig. 1). Centers in RI were similar, with 80%, 85%, and 95% of centers providing at least 60 minutes of LMVPA at baseline. At the first follow-up, 88% of MA centers and 90% of RI centers met the regulation. At follow-ups 2 and 3, 100% of centers in both states met the regulation.

All covariates identified *a priori* were significant predictors of at least one sedentary or physical activity outcome; however, outdoor play space was significant in all adjusted models. In multivariable-adjusted regressions, we observed increases in minutes of LMVPA from baseline to follow-up in both states (MA estimate 38.1 minutes; CI:

28.6, 47.5; $p \leq 0.0001$; and RI estimate 42.7 minutes; CI: 35.2, 50.1; $p \leq 0.0001$) (Table 3). The average difference-in-differences estimate indicated no difference in minutes of LMVPA in centers in MA compared with RI from baseline to follow-up (estimate -4.6 minutes; CI: -16.6 , 7.5 ; $p = 0.46$). Thus, MA increased 4.6 minutes less than RI when we compared the baseline to follow-up difference between the two states. These results were driven primarily by increases in light activity in both states (MA estimate 47.5 minutes; CI: 36.3, 58.7; $p \leq 0.0001$; and RI estimate 48.4 minutes; CI: 41.1, 55.7; $p \leq 0.0001$). In MA, but not RI, moderate activity decreased from baseline to follow-up (MA estimate -6.9 minutes; CI: -11.5 , -2.3 ; $p = 0.004$;

Figure 1. Unadjusted mean (standard deviation) minutes of children's light, moderate, and vigorous physical activity in Massachusetts and Rhode Island centers before and after the regulation took effect.

Table 3. Multivariable-Adjusted^a Regression Estimates and 95% Confidence Intervals for Minutes of Physical Activity in Massachusetts Compared with Rhode Island Centers^b

Total minutes	Estimate (95% CI)	p-value
Sedentary		
MA baseline to follow-up	29.1 (20.9, 37.2)	<0.0001
RI baseline to follow-up	26.9 (20.2, 33.5)	<0.0001
MA vs. RI difference in differences	2.2 (−8.3, 12.7)	0.68
Light		
MA baseline to follow-up	47.5 (36.3, 58.7)	<0.0001
RI baseline to follow-up	48.4 (41.1, 55.7)	<0.0001
MA vs. RI difference in differences	−0.9 (−14.1, 12.4)	0.90
Moderate		
MA baseline to follow-up	−6.9 (−11.5, −2.3)	0.004
RI baseline to follow-up	−5.9 (−11.9, 0.2)	0.06
MA vs. RI difference in differences	−1.0 (−8.6, 6.6)	0.80
Vigorous		
MA baseline to follow-up	−2.0 (−6.0, 1.9)	0.32
RI baseline to follow-up	0.1 (−2.9, 3.1)	0.95
MA vs. RI difference in differences	−2.1 (−7.0, 2.8)	0.40
Moderate and vigorous		
MA baseline to follow-up	−9.0 (−15.7, −2.2)	0.009
RI baseline to follow-up	−5.8 (−13.6, 2.1)	0.15
MA vs. RI difference in differences	−3.2 (−13.5, 7.1)	0.54
Light, moderate, and vigorous		
MA baseline to follow-up	38.1 (28.6, 47.5)	<0.0001
RI baseline to follow-up	42.7 (35.2, 50.1)	<0.0001
MA vs. RI difference in differences	−4.6 (−16.6, 7.5)	0.46

^aAdjusted for total number of children enrolled in center; child race; presence of indoor and outdoor play space; and precipitation and temperature on day of observation.

^bSample of 20 centers at baseline and 16 at follow-up in MA; 20 centers at baseline and follow-up in RI.

CI, confidence interval.

and RI estimate −5.9 minutes; CI: −11.9, 0.2; $p=0.06$). Vigorous activity did not change in either state (MA estimate −2.0 minutes; CI: −6.0, 1.9; $p=0.32$; and RI estimate 0.1 minutes; CI: −2.9, 3.1; $p=0.95$). In MA, MVPA decreased significantly in MA [−9.0 (−15.7, −2.2); $p=0.009$], but not RI [−5.8 (−13.6, 2.1); $p=0.15$], although there were no significant differences by state [−3.2 (−13.5, 7.1); $p=0.54$]. Sedentary time increased in both states [MA estimate 29.1 (20.9, 37.2); $p<0.0001$; and RI

estimate 26.9 (20.2, 33.5); $p<0.0001$] with no significant differences between the two states [2.2 (−8.3, 12.7); $p=0.68$]. Results were similar for the minutes per hour analysis (data not shown).

Discussion

In this study, evaluating a new state regulation in MA requiring 60 minutes of LMVPA daily for preschool age children in child care centers, we found that LMVPA in MA centers increased substantially from baseline to follow-up—mainly driven by light activity. However, we saw similar increases in RI. When we examined individual levels of physical activity, we found that sedentary time and light activity increased in both states; changes in MVPA were negligible. These findings are contrary to our hypothesis as we expected LMVPA to increase in MA, but not RI, centers in response to the regulation. Results from our study, however, highlight the importance of including a comparison group. Without data from RI, we might have concluded that MA centers increased the amount of LMVPA provided to children in response to the regulation. Our study design echoes a recent report from the NIH that highlights the value of evaluating natural experiments. The report states that this type of research offers unique opportunities to enrich the evidence base and can offer advantages not provided by other research designs.²⁴

To further increase physical activity in MA, the MA Department of Early Education and Care may consider amending the regulation to specify that the 60 minutes must be MVPA or increase the amount of physical activity to 120 minutes, which would be consistent with the IOM recommendation.⁹ In general, states with specific regulations mandating physical activity vary in the amount of time and level of activity required. A recent review¹² notes three other states with similar regulations. New Mexico requires 60 minutes of physical activity daily for full-day programs,²⁵ which is identical to the MA regulation. In comparison, Alaska mandates at least 20 minutes of vigorous physical activity²⁶ and Delaware requires 20 minutes of MVPA¹⁵ for every three hours the center is open between 7 am and 7 pm. However, no one has evaluated these regulations for their effectiveness in increasing children's physical activity.

Child care programs must provide the opportunity for children to be active for the specific length of time; children may choose to be less active. Simply providing time for active play, however, has been associated with physical activity in children.^{2,5} Other aspects of the child care environment that facilitate children's physical activity include having open areas and outdoor space for active play,^{2,3,13,27} portable and other play equipment,^{5,28} providers trained in physical activity,^{5,27} and providers who encourage children or engage in active play.^{3,27} These could all be additional targets for regulation.

Previous studies have documented the presence of state child care regulations through legal research methods and found wide variation in physical activity regulations.^{12,29,30}

While these reviews provide a description of current regulations, they say little about children's physical activity. Prospective evaluation of newly enacted regulations provides an important opportunity for researchers. For some states, the current political climate may not support regulatory change.^{31–33} However, a handful of states have recently enacted new licensing regulations promoting physical activity in child care.^{12,34} As policy-based approaches to promoting physical activity become more common,³³ researchers can partner with states and other regulatory agencies to evaluate their effectiveness.

Our study has some limitations. Available funds restricted our ability to collect statewide data, so we focused on the city of Boston and included the city of Providence as the comparison. Boston and Providence have similar population densities and comparable weather conditions. We also observed differences by state at baseline, which could have affected results despite including these covariates in the models. There could be some unmeasured confounding that differed by state. The populations of Boston and Providence vary in some important demographic characteristics that could have influenced our findings. In 2010, Providence had a population of 179,154 and a density of 9401 people per square mile.³⁵ Residents were 49.8% white and 16.0% black.³⁵ Boston had a population of 617,595 and a density of 13,841.³⁶ In Boston, 52% of residents were white and 24.1% black.³⁷ Moreover, 28.5% of Providence residents had a college degree in 2010 vs. 43.0% in Boston.³⁸

Additionally, center practices in Boston and Providence may not be reflective of their respective states. For example, physical activity levels of children may be higher in rural areas due to greater availability of outdoor space at the centers. However, we did collect data on the most populated city within each state to make results more comparable. Additionally, while our sample size was somewhat small, we were able to collect data repeatedly before and after the regulation. We observed a general increase in LMVPA over the course of the four-year study period. It is likely that external influences affected our results, since physical activity increased in both states. While there is no indication that a regulation in one state could influence the behavior of a neighboring state, there is evidence of spatial clustering of state regulations.³⁹ It is possible that LMVPA in RI may have increased in response to the MA regulation. However, it is more likely that external forces influenced physical activity in both states. Recent national efforts called for increased physical activity in child care settings. The IOM 2011 report, *Early Childhood Obesity Prevention Policies*,⁹ recommended 120 minutes of LMVPA for children in full-day care. Other initiatives, such as Michelle Obama's *Let's Move!* Child Care campaign,¹¹ aimed to increase physical activity for all children in care.

Another limitation is that available funding limited our ability to collect data on family child care homes, even though they were also required to comply with the new

regulation. We also did not ask centers about their philosophies on physical activity, their interpretation of the regulation, or their current physical activity policies to keep directors blinded to study aims. We did not document teacher/child ratios, even though they may influence children's physical activity. Finally, we did not measure physical activity using a more objective assessment such as accelerometry, which would have eliminated observer error and could have provided detailed information about physical activity levels of individual children.

Conclusion

Physical activity in early childhood is an important public health goal. Recent efforts to increase physical activity through policy-based approaches are largely untested. This study provides insight through a longitudinal evaluation of a new physical activity regulation in MA using RI as the comparison state. Although LMVPA increased substantially in MA, we observed similar changes in RI. This suggests that other factors may be at play beyond the new regulation that could have influenced children's physical activity.

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References

1. Reilly JJ. Low levels of objectively measured physical activity in preschoolers in child care. *Med Sci Sports Exerc* 2010;42:502–507.
2. Tandon PS, Saelens BE, Christakis DA. Active play opportunities at child care. *Pediatrics* 2015;135:e1425–e1431.
3. Henderson KE, Grode GM, O'Connell ML, Schwartz MB. Environmental factors associated with physical activity in childcare centers. *Int J Behav Nutr Phys Act* 2015;12:43.
4. Pate RR, O'Neill JR, Brown WH, et al. Prevalence of compliance with a new physical activity guideline for preschool-age children. *Child Obes* 2015;11:415–420.
5. Bower JK, Hales DP, Tate DF, et al. The childcare environment and children's physical activity. *Am J Prev Med* 2008;34:23–29.
6. National Association for Sport and Physical Education. *Active Start: A Statement of Physical Activity Guidelines for Children Birth to Five Years*. Reston, VA: NASPE. 2011.

7. Beets MW, Bornstein D, Dowda M, Pate RR. Compliance with national guidelines for physical activity in U.S. preschoolers: Measurement and interpretation. *Pediatrics* 2011;127:658–664.
8. Vale S, Silva P, Santos R, et al. Compliance with physical activity guidelines in preschool children. *J Sports Sci* 2010;28:603–608.
9. Institute of Medicine. *Early Childhood Obesity Prevention Policies*. Washington, DC: National Academy of Sciences, 2011.
10. Larson N, Ward DS, Neelon SB, Story M. What role can child-care settings play in obesity prevention? A review of the evidence and call for research efforts. *J Am Diet Assoc* 2011;111:1343–1362.
11. *Let's Move! America's Move to Raise a Healthier Generation of Kids*. Available at www.letsmove.gov/child-care-providers Last accessed March 29, 2016.
12. Duffey KJ, Slining MM, Benjamin Neelon SE. States lack physical activity policies in child care that are consistent with national recommendations. *Child Obes* 2014;10:491–500.
13. Stephens RL, Xu Y, Lesesne CA, et al. Relationship between child care centers' compliance with physical activity regulations and children's physical activity, New York City, 2010. *Prev Chronic Dis* 2014;11:E179.
14. Lessard L, Lesesne C, Kakietek J, et al. Measurement of compliance with New York City's regulations on beverages, physical activity, and screen time in early child care centers. *Prev Chronic Dis* 2014;11:E183.
15. State of Delaware Office of Child Care Licensing, Division of Family Services, Department of Services for Children, Youth and Their Families. Part IV Early Care and Education. 66. Program Goals and Planning. In: *Delacare: Regulations for Early Care and Education and School-Age Centers*. Dover, DE.
16. Van Stan S, Lessard L, Dupont Phillips K. The impact of a statewide training to increase child care providers' knowledge of nutrition and physical activity rules in Delaware. *Child Obes* 2013;9:43–50.
17. Wright DR, Kenney EL, Giles CM, et al. Modeling the cost effectiveness of child care policy changes in the U.S. *Am J Prev Med* 2015;49:135–147.
18. Benjamin Neelon SE, Ostbye T, Hales D, et al. Preventing childhood obesity in early care and education settings: Lessons from two intervention studies. *Child Care Health Dev* 2016;42:351–358.
19. Standards for the licensure or approval of family child care; small group and school age and large group and school age child care programs. In: Massachusetts Department of Early Education and Care (ed), *606 CMR 7.00*. Boston, MA.
20. Brown WH, Pfeiffer KA, McLver KL, et al. Assessing preschool children's physical activity: The observational system for recording physical activity in children-preschool version. *Res Q Exerc Sport* 2006;77:167–176.
21. Fisher A, Reilly JJ, Kelly LA, et al. Fundamental movement skills and habitual physical activity in young children. *Med Sci Sports Exerc* 2005;37:684–688.
22. Kahan D, Nicaise V, Reuben K. Convergent validity of four accelerometer cutpoints with direct observation of preschool children's outdoor physical activity. *Res Q Exerc Sport* 2013;84:59–67.
23. Ball SC, Gillman MW, Mayhew M, et al. Physical activity-related and weather-related practices of child care centers from 2 states. *J Phys Act Health* 2015;12:238–244.
24. Hunter CM, McKinnon RA, Esposito L. News from the NIH: Research to evaluate “natural experiments” related to obesity and diabetes. *Transl Behav Med* 2014;4:127–129.
25. Child Care Licensing: Child Care Centers, Out of School Time Programs, Family Child Care Homes, and Other Early Care and Education Programs. In: New Mexico Children Youth and Families Department (ed), *8.16.2.24 Services and Care of Children in Centers*. Santa Fe, NM.
26. Alaska Department of Health and Social Services. Child care facilities licensing. Title 7. *Health and Social Services. Part 4. Children's Services and Juvenile Justice. Chapter 57. Child Care Facility Licensing*. Juneau, AK.
27. Trost SG, Ward DS, Senso M. Effects of child care policy and environment on physical activity. *Med Sci Sports Exerc* 2010;42:520–525.
28. Broekhuizen K, Scholten AM, de Vries SI. The value of (pre-)school playgrounds for children's physical activity level: A systematic review. *Int J Behav Nutr Phys Act* 2014;11:59.
29. Benjamin SE, Cradock A, Walker EM, et al. Obesity prevention in child care: A review of U.S. state regulations. *BMC Public Health* 2008;8:188.
30. Cradock AL, O'Donnell EM, Benjamin SE, et al. A review of state regulations to promote physical activity and safety on playgrounds in child care centers and family child care homes. *J Phys Act Health* 2010;7 Suppl 1:S108–S119.
31. Boehmer TK, Luke DA, Haire-Joshu DL, et al. Preventing childhood obesity through state policy. Predictors of bill enactment. *Am J Prev Med* 2008;34:333–340.
32. Eyler AA, Nguyen L, Kong J, et al. Patterns and predictors of enactment of state childhood obesity legislation in the United States: 2006–2009. *Am J Public Health* 2012;102:2294–2302.
33. Eyler AA, Budd E, Camberos GJ, et al. State legislation related to increasing physical activity: 2006–2012. *J Phys Act Health* 2016;13:207–213.
34. Slining MM, Neelon SE, Duffey KJ. A review of state regulations to promote infant physical activity in child care. *Int J Behav Nutr Phys Act* 2014;11:139.
35. 2010 State Population estimates by age, sex, race, and Hispanic origin. U.S. Census Bureau. Providence, RI, 2010.
36. *Population and Housing Occupancy Status: 2010–State–County Subdivision, 2010 Census Redistricting Data (Public Law 94–171) Summary File*. United States Census Bureau, 2010, Suitland, MD.
37. 2010 State Population estimates by age, sex, race, and Hispanic origin. U.S. Census Bureau. Boston, MA, 2010.
38. Brookings Metropolitan Policy Program Washington, DC. *Brookings Institution Analysis* 2012.
39. Benjamin Neelon SE, Duncan DT, Burgoine T, et al. Promoting breastfeeding in child care through state regulation. *Matern Child Health J* 2015;19:745–754.

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