

Owing to the escalating trend in the prevalence of childhood obesity, physical activity (PA) has assumed an increasingly prominent role in childhood disease prevention and health promotion efforts in the United States.<sup>1-6</sup> Evidence-based PA guidelines recommend children engage in 60 or more minutes of enjoyable, developmentally appropriate moderate PA (MPA) to vigorous PA (VPA) involving a variety of activities daily.<sup>7</sup> Currently, more than half of children ages 6-11 do not meet these guidelines.<sup>8,9</sup> The highest patterns of inactivity have been noted among Black and Hispanic children,<sup>8-11</sup> and substantial inverse socioeconomic gradients in childhood PA have also been observed.<sup>10,11</sup> Schools provide an opportune site for addressing PA promotion in children. With children spending a substantial number of their waking hours during the week at school, increased opportunities for PA are needed,

especially considering trends toward decreased frequency of physical education (PE) in schools.<sup>12</sup> Students typically have 2 opportunities to be physically active during school: PE and recess. Evidence supports the necessity for PE and PE's contribution to daily PA.<sup>13</sup> However, due to the infrequency of PE and the need to teach PE content during lessons, it alone cannot provide sufficient activity to meet recommended levels required to achieve health benefits.<sup>14,15</sup> For this reason, recess is an integral part of a comprehensive plan for school-based PA promotion.<sup>16</sup> The Robert Wood Johnson Foundation<sup>17</sup> reports recess offers nearly half of the available opportunity to promote PA among children during the school year (42%), followed by PE (32%) and afterschool programming (26%).<sup>17</sup>

When given an opportunity to be active during recess, most children will willingly engage in meaningful amounts of PA.<sup>18</sup> However, without the ability to choose activities based on personal preferences, children may participate in PA in as little as 20% of their recess time.<sup>19</sup> Therefore, the recess environment should be conducive to children making physically active choices. Evidence related to PA participation as a result of changes in the environment such as playground markings, additional recreational equipment, physical structures, and designated activity zones during recess is inconsistent.<sup>15,20-22</sup> For example, in a study by Stratton and Mullan,<sup>21</sup> playground markings proved effective for increasing MPA and VPA levels in elementary school children during recess.<sup>21</sup> However, Ridgers and colleagues<sup>15</sup> reported that restructuring the recess environment with playground markings and physical structures did not significantly change MPA or VPA during recess. The cause for these discrepancies is not apparent but enhancements to recess environments still represent a sustainable, low cost intervention strategy for promoting PA in youth. More research in this area is clearly warranted.

According to the most recent Guidelines for School and Community Programs to Promote Lifelong Physical Activity Among Young People, schools should provide physical and social environments that encourage and enable safe and enjoyable PA.<sup>23</sup> To accomplish this goal, schools need personnel who are trained and educated with the knowledge and skills needed to effectively promote enjoyable, lifelong PA among youth. Afterschool programs designed to increase PA participation have established the importance of staff training for improving staff commitment and enhancing program fidelity and effectiveness.<sup>24-27</sup> This suggests training recess staff can help to support changed recess environments designed to promote PA (eg, designated activity zones, playground markings, and additional recreational equipment). Studies that have assessed changes in the recess environment also emphasize the importance of informing and encouraging teachers to promote PA during this time.<sup>25</sup> Suggestions have been made to incorporate PA promotion in the training of future teachers to ensure they have a positive

attitude toward PA.<sup>28</sup> To the authors' knowledge, there are no studies that have assessed the effects of educating staff about the importance of the environment and its role in PA participation.

More studies are needed to determine the optimal recess environment necessary to maximize PA participation in youth. In particular, studies are needed to evaluate the combined benefits from changes to the physical and social environments, as well as from training of recess personnel. Therefore, the purpose of this study was to determine the initial effectiveness of an elementary school recess intervention (staff training, recreational equipment, and playground markings) on the amount of MPA and VPA during recess and the school day. It was hypothesized that there would be an increase in both MPA and VPA during recess and the school day as a result of the Ready for Recess intervention.

## METHODS

### Subjects

Subjects were attending either a public elementary school or a parochial elementary school in the Midwest United States. All children in grades 3, 4, and 5 were invited to participate in this study. Children were provided consent forms to give to their parents and asked to return them signed. Of the 136 informed consents that were handed out, 105 were returned. Insufficient data (ie, missing accelerometer data for children who left school early, left recess early, were not attending the school any longer, refused to wear the accelerometer, took the accelerometer home and did not return them for a few days) eliminated an additional 12 from the study, leaving 93 students (public school:  $n = 45$ , 42.2% female, 68.9% White, mean age = 9.6 years, mean body mass index (BMI) = 18.9, free and reduced lunch = 47%; parochial school:  $n = 48$ , 50% female, 89.6% White, mean age = 9.6 years, mean body mass index (BMI) = 18.8, free and reduced lunch = 17%) for data analysis.

### Instruments

All measures were assessed during the 2008/2009 school year. Baseline data were collected during the month of September 2008 (before implementation of the Ready for Recess program) and post-intervention data were collected in April 2009 (at the end of implementation of the Ready for Recess program). These dates were chosen to minimize any impact of weather differences on levels of PA. Outcomes were measured by research team members trained by the principal investigator. The same research team members collected both baseline and post-intervention data.

**Body Mass Index.** Body mass index was assessed by research team members under the supervision of the school nurse. Research team members helped the school nurse take height and weight, while the school nurse conducted additional screenings. Children's weight was collected using a Taylor (Las Cruces, NM) lithium digital scale model number 7004. Children's height was measured using a stadiometer. The height and weight data for each school were entered into the Children's BMI Group Calculator-English version provided by the Centers for Disease Control and Prevention.<sup>29</sup>

**Physical Activity.** Physical activity was measured using ActiGraph accelerometers (ActiGraph GT1M, Pensacola, FL). The ActiGraph is a reliable and valid tool for the measurement of PA in children.<sup>30-32</sup> Children wore the accelerometers consecutively for 1 school week (Monday through Friday) at baseline and post-intervention. Accelerometers were initialized to start at 7:30 AM and end at 4:00 PM on each monitoring day. The accelerometers were set to collect activity counts and step data in 5-second epochs. Children were fitted each morning for the accelerometers and asked to wear them during the entire school day. Accelerometers were taken off at the end of the school day by graduate students. Accelerometers were only removed earlier than the end of the school day if the child left school or refused to wear the accelerometer. Teachers used stopwatches and logs provided by the research team to record the times children participated in physical activities throughout each day. For example, the teachers recorded the time when children left lunch to go to recess, and then recorded the time they returned to their classroom desks. The log was collected from the teachers at the end of the week. Raw data from the accelerometers were downloaded to determine total activity counts and average counts/minute for recess and the school day. Accepted activity count thresholds were used to quantify the duration of time children participated in MPA (2000-2999 counts/minute) or VPA (3000+ counts/minute).<sup>33</sup>

## Procedures

The study was theoretically guided by the ecological model recommended by the Committee on Prevention of Obesity in Children and Youth commissioned by the Congress, the Centers for Disease Control and Prevention (CDC), and the Institute of Medicine (IOM).<sup>34,35</sup> The IOM report recommends schools have a significant role in making the environment more conducive to PA.<sup>35</sup> They also report a decrease in opportunities for PA at school is 1 of the 5 factors in the environment that is a barrier to children getting recommended amounts of PA.<sup>35</sup> Specifically, the Ready for Recess program was adapted from the Active and Healthy Schools Program.<sup>36</sup> Ready for Recess involved the modification and implementation of 1 specific environmental

component of the Active and Healthy Schools program: activity zones.

Ready for Recess was delivered from the end of September 2008 to the end of April 2009. A training session was held by a PhD pedagogist at the beginning of the school year (August 2008) for principals, teachers, and recess staff. The 4-hour training session consisted of a 2-hour presentation providing an overview of youth PA and the process of including activity zones in recess. The final 2 hours entailed hands-on training focusing on activities that could be played with minimal equipment in a variety of spaces and could include many age groups. A question and answer session followed the hands-on training.

Booster sessions were conducted by a research team member 1 week after baseline testing (September 2008) and the intervention began immediately following the booster sessions. The booster sessions served as a refresher and accounted for staff members who were unable to attend the original training session. The relevant Active and Healthy Schools program materials (ie, playground equipment packs and playground activity cards) were given to both schools during the booster session. Activity zone maps outlining activities in each zone were also designed during this session. Activity zone maps were utilized by school staff during recess to keep track of the specific activities occurring each week and to facilitate the activities on the playground. Each map was drawn specific to the playground at each school. For example, the parochial school had a smaller playground space; therefore, the zone map consisted of 5 activity zones. Seven activity zones were created for the public school because of their large playground space. Location of activity zones remained the same during the Ready for Recess program; however, the activities inside the zones changed throughout the program. Each activity took place in a zone that had the necessary equipment or space to play the game safely. For example, 3-ball soccer was an activity played on the soccer field with goals, modified kickball was played in the back top area, and tag games took place in a large open space.

The PE teacher, a recess staff champion, and a research team member planned daily recess activities during biweekly meetings. Activities were only changed when the zones did not attract children (had less population over time). Prior to recess, fifth and sixth grade students placed materials required for activities in the zones. Materials included dry erase zone signs, zone marker cones, and playground equipment. Zone signs and zone markers were set up to inform the children of the activity occurring in each particular zone. Ten to 15 total pieces of equipment were available within each zone so that multiple games of each activity could be played. Children were allowed to switch zones as they wished throughout recess.

**Table 1. Change in Percent Time During Recess and School Day Spent in Moderate and Vigorous Physical Activity (PA) Between Pre-Intervention and Post-Intervention Periods, Averaged Over Days of the Week for Each Child**

Pre-intervention	18.1%	7.2%	4.9%	1.6%
Post-intervention	31.2%	16.8%	9.1%	2.6%
Difference in %	13.1±	9.6±	4.1±	1±
Difference in minutes in an average (23 minutes) recess period	3	2.2		
Difference in minutes in an average (416 minutes) school day				
<b>During Recess (n = 92 children) During School Day (n = 91 children)</b>	<b>Moderate PA</b>	<b>Vigorous PA</b>	<b>Moderate PA</b>	<b>Vigorous PA</b>

At the beginning of the intervention, research team members would assist the PE teachers and recess staff champions with implementation every day of the week. As the school year progressed, and the PE teachers and/or recess staff were able to implement the zones on their own, the research team members would provide assistance (watch staff to make sure they were implementing activity zones, encourage recess staff to play with children, assist with ideas for zones) 1 to 2 times a week. Fidelity was monitored by the research staff during all days of recess to ensure the program was implemented as intended. Activity zones were utilized all school year unless in climate weather prohibited outdoor activity.

During the colder months, the research team members conducted a second booster session. This 30minute session provided information and examples of several classroom-based activities for all grade levels. These activities were based on the Active and Healthy Schools indoor activity cards.<sup>36</sup> Research team members monitored the first 2 indoor recess sessions to provide support and feedback to the recess staff implementing the indoor activity.

## Data Analysis

Paired *t* tests were used to compare the percentage of time spent in MPA and VPA between baseline and post-intervention. These analyses used the average percentage across 5 school days to provide a more stable indicator. Ordinary least squares multiple regressions were estimated to model the effect of intervention, age, sex, race, BMI, and school on minutes spent in MPA and VPA by a child each day during recess. The analyses also controlled for length of recess period, which varied from 10 to 39, with an average of 23 minutes.

A similar analytic strategy was used to examine the effect of intervention on amount of time spent in MPA and VPA. In the regression analyses, length of measurement day was controlled, which varied from 385 to 430, with an average of 416 minutes.

Because of the dependence of observations between pre-and post-intervention periods, robust variance was used to estimate the *p* values associated with the regression coefficients. Regression analyses were performed on cases with information on all covariates. Separate analyses were conducted for each school but findings were similar so that data were combined for the final presentation of results.

## RESULTS

Table 1 shows change in the percentage of the total recess

time spent in MPA and VPA after intervention, averaged over days of the week for each child. Results demonstrated participation in MPA and VPA were significantly higher at posttest for both the recess and school day outcomes. Moderate PA during recess increased from 18.1% to 31.2% of the total recess time, representing a difference of about 3 minutes for a typical 20-minute recess period. Similarly, VPA during recess increased from 7.2% to 16.8%, representing a difference of 2.2 minutes in a recess period.

Table 2 shows the association of intervention with minutes spent in MPA and VPA after adjusting for demographic variables, BMI, and total length of recess or school day. The adjusted effects of the intervention were very similar to the unadjusted findings presented in Table 1. The intervention resulted in an increase of 2.5 (*p* <.001) and 2.2 (*p* <.001) minutes in MPA and VPA, respectively, during recess. This represented an increase of 51.2% (from 4.8 to 7.3 minutes) and 112.2% (from 1.9 to 4.1 minutes) in the adjusted mean of MPA and VPA, respectively. Similarly, the intervention resulted in an increase of 18.7 (*p* <.001) and

4.7 (*p* <.001) minutes in MPA and VPA, respectively, during the school day. This represented an increase of 92.2% (from 20.3 to 39.1 minutes) and 71.6% (6.6 to 11.3 minutes) in the adjusted mean of MPA and VPA, respectively.

Younger children and males were generally more physically active than older children (*p* = .004 for MPA during recess and *p* <.001 for MPA and VPA during school day) and females (*p* <.001 for MPA and VPA during recess, *p* = .009 for MPA during school day, and *p* = .001 for VPA during school day), respectively. Although there was little evidence of a racial difference

Table 2. Regression of Minutes Spent in Moderate or			Covariates	
Intervention (pre-intervention = 0)	2.5 (p <.001)	2.2 (p <.001)	18.7 (p <.001)	4.7 (p <.001)
Age	-0.6 (p = .004)	-0.3 (p = .110)	-3.8 (p <.001)	-1.4 (p <.001)
Sex (male = 0)	-1.6 (p <.001)	-1.3 (p <.001)	-2.8 (p = .009)	-2.0 (p = .001)
Race (non-White = 0)	-1.0 (p = .071)	-0.4 (p = .224)	-3.8 (p = .006)	-1.7 (p = .044)
BMI	-0.1 (p = .033)	-0.0 (p = .711)	0.1 (p = .702)	-0.2 (p = .008)
School	1.2 (p = .004)	0.4 (p = .366)	3.8 (p = .001)	3.3 (p <.001)
Total length of recess in minutes	0.3 (p <.001)	0.2 (p = .509)		
Total length of school day in minutes			0.2 (p <.001)	0.1 (p <.001)

### Vigorous Physical Activity (PA) on Intervention and

Recess (n = 802 children/days) School Day (n = 766 children/days)

Moderate PA Vigorous PA Moderate PA Vigorous PA

in PA during recess (p = .071 for MPA and p = .224 for VPA), non-Whites appeared to be more physically active during the school day (p = .006 for MPA and p = .044 for VPA). There was some evidence that children with higher BMI engaged in less MPA during recess (p = .033) and in less VPA during the school day (p = .008).

## DISCUSSION

The purpose of this study was to determine the initial effectiveness of an elementary school recess intervention on the amount of MPA and VPA during recess and school day. The Ready for Recess intervention was feasible and provides promising evidence that modifying the recess environment through staff training, recreational equipment, and playground markings can increase MPA and VPA during recess and the school day, respectively.

On the basis of this study's findings, implementing staff training, recreational equipment, and playground markings may be viable ways by which to modify the environment to increase MPA and VPA at recess. This is significant for a few reasons. First, beyond PE, recess may be one of the only times during the school day that children have an opportunity to be active and accumulate some of the necessary minutes to meet recommended guidelines of 60 minutes of PA per day.<sup>7</sup> The Ready for Recess intervention helped to improve both MPA and VPA by making the short (less than 20 minutes) recess time more conducive for PA. At a time in which recess is being decreased or eliminated in schools, it is important to use strategies such as trained staff, recreational equipment, and markings so that children want to be active in the short amount of time provided to them. These findings are consistent with findings from Ridgers and colleagues<sup>15</sup> and Vertstraete and colleagues<sup>37</sup> who noted increases in PA after the introduction of equipment or playground markings. Unlike this study, these other studies did not include a staff training component. Others have suggested staff training and staff participation with children on the recess playground may increase youth activity.<sup>28</sup> This pilot was one of the first PA interventions to modify the recess environment with both staff training and recreational equipment.

In addition, this study's findings are significant because training staff and providing recreational equipment and

playground markings are simple, low cost methods for providing opportunities for PA. Schools could collaborate with local universities and health departments for support in training staff, such as paraprofessionals, how to encourage activity during recess. In addition, many schools have recreational equipment with which recess games can be adapted. Schools that do not have equipment may ask their state or local government for recreational equipment through grant processes. Furthermore, staff can be taught how to use minimal or no equipment to increase PA.

Not only were children more physically active during recess, but they were also more active during the school day as a result of this pilot study. This suggests an additive effect in which increasing their PA at recess increased their PA during the rest of the school day. Morgan and colleagues<sup>13</sup> reported an additive (no compensation) relationship between PE and PA in elementary school children. The least, moderate, and most active children accumulated more PA on days in which they had PE as compared to days in which there was no PE. There is little evidence about the compensatory effect that may occur during the school day as a result of a recess intervention. However, the present findings suggest this, and further investigation is warranted.

Another finding of note was a similar increase in PA at both schools, despite 1 being a public school and 1 a private school. Almost 90% of the children at the private school were Caucasian, and 17.5% of the total student body were receiving free and reduced lunch as compared to almost 70% of children at the public school were Caucasian, with 47% of the total student body receiving free and reduced lunch. The Ready for Recess program could be effective at a number of schools regardless of demographics. Training staff about how to most effectively engage children in activity at recess with recreational equipment and playground markings could be practical despite variety among schools. Paraprofessionals, classroom and PE teachers, and school nurses attended the initial trainings. At each school, staff most involved with recess on the playground was different. However, all staff were trained. Therefore, regardless of the type of school or staff member, Ready for Recess could be implemented and could prove feasible.

Although behavioral problems were not assessed in this study, principals did mention they experienced fewer classroom interruptions and less principal disciplinary action. Future research should assess changes in behavioral issues in children as a result of a PA intervention during recess similar to Ready for Recess.

Future study is also necessary to explore the effectiveness of the Ready for Recess intervention compared to control schools. Research examining an intervention effect based on race/ethnicity, gender, and/or BMI compared to control schools would contribute to the literature. In addition, investigators should consider exploring the effectiveness of environmental changes separately (ie, staff training vs recreational equipment, both staff training and recreational equipment vs no intervention). This may help to clarify the most conducive recess environment to provide children an opportunity to choose PA.

Because this study provided evidence for a compensatory effect on PA during the school day when PA at recess is increased, more research in this area is warranted. In addition, further investigation of possible compensatory effects on PA as compared to a control school is warranted. Additionally, determining the mechanism (eg, children are more fidgety after an active recess) that contributes to increased school activity would add to the recess literature.

Finally, although not reported in this study, one of the PE teachers shared with the research team that during PE, he was teaching games for recess specifically from the Active and Healthy Schools materials. The role of the physical educator has been mentioned in other studies but has not been researched.<sup>18</sup> Thus, a better understanding is needed of the role the PE teacher's engagement in teaching children new activities and games has on children's PA during recess.

## Limitations

The major limitation of the study was that the schools were not randomly assigned to a treatment (intervention) and control group. Therefore, although available confounders were controlled, the observed difference in PA cannot be confidently attributed to the intervention. It is important to note Ready for Recess was funded by a local community foundation that requested it be implemented in 2 schools that were interested in the intervention.

## Conclusions

Ready for Recess is a feasible intervention that includes staff training, recreational equipment, and playground markings modifying the environment so that children have an opportunity to choose PA during recess. It includes inexpensive, simple ways to increase PA during recess so that children can accumulate minutes of PA to meet the recommended guidelines. Further research is necessary to determine the effectiveness of Ready for Recess on MPA and VPA in youth compared to a control group.

## IMPLICATIONS FOR SCHOOL HEALTH

Preliminary evidence presented here suggests environments can be altered (through staff training, recreational equipment, and playground markings) to successfully increase PA in elementary school children. This evidence

warrants the following for schools:

(1) Making recess an environment that encourages PA should be part of a school's wellness policy. Recess offers an excellent opportunity for children to accumulate meaningful amounts of PA and should thus be utilized. (2) Hired or trained recess staff should be expected to implement a recess environment conducive to PA. If teachers serve as recess monitors or a school does not have funding to train recess staff separately, a portion of the beginning of the year professional development meetings could be used to train teachers and staff to maximize PA during recess. (3) Integrate recess friendly games into the PE curriculum. The physical educator can assist in improving recess by teaching games and activities children can participate in during recess. These strategies may help to ensure that children are getting more PA during the school day at recess.