Journal of Physical Activity and Health, 2009, 6, 699-707

Adaptation of the System for Observing Physical Activity and Recreation in Communities (SOPARC) to Assess Age Groupings of Children

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Background*:** To better measure physical activity (PA) in outdoor environments, McKenzie and colleagues developed the System for Observing Play and Recreation in Communities (SOPARC). However, previous SOPARC research has focused on adults, seniors, teens and children. One avenue for extending this work is to expand the child age group code to capture important nuances that can influence children's PA and their environments. This study reports on the reliability of a measure designed to account for PA in parks among children in different childhood age groups. ***Methods: Three groups were developed: 0 to 5 years old (Young Children); 6 to 12 (Middle Childhood) and 13 to 18 (Older Children) based on Erikson's stages of child development. Data were obtained by direct observation in 3 neighborhood parks in Raleigh, NC and 20 neighborhood parks in Durham, NC. ***Results*:** Kappa coefficients showed high agreement for all age group, gender, and PA codes. For the 3 assessments, the results show that the 3 age group category exhibit acceptable reliability for measuring PA in parks among children. ***Conclusions*:** The reliability of measuring PA among children by segmenting children by 3 age groups was established. This approach is recommended for future studies of PA among children in parks and other outdoor environments.

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Keywords: direct observation, children, measurement, reliability, parks

Increasing prevalence of childhood obesity and overweight in the U.S. remains a significant public health concern.[1,2] The trends are particularly disturbing because risk factors associated with obesity and overweight carryover to adulthood.[3] Preventive measures to reduce childhood obesity target improving nutrition[4,5] and increasing opportunities for physical activity.[6] Investigations of children's and adolescent physical activity in outdoor environments have increased as studies show that being outdoors is a consistent predictor of children's physical activity[7] and that some elements of outdoor settings where children are active are modifiable and subject to policy change.[8–10] Moreover, several studies have shown that access to parks, playgrounds, and other community resources are associated with increased physical activity among children and adolescents.[11–14]

Measurement of physical activity among children and adolescents (children especially under 10y) is generally challenging because self-report measures of physical activity exhibit questionable validity and reliability activity levels[15,16] and the number of individuals in open environments can change frequently.[17] Accelerometers provide objective assessments of physical activity, but do not capture the ecological context of physical activity behaviors which is important for understanding environmental correlates.[18] Developing and refining tools for measuring children's and adolescent's physical activity are necessary to better understand how environments contribute to physical activity.

Direct observation has emerged as an important approach for measuring physical activity among children.[15] Indeed, a recent important contribution to the active living research field is the System for Observing Physical Activity and Recreation in Communities (SOPARC) developed by McKenzie and colleagues. Several studies have used this measurement system or the System for Observing Play and Leisure among

Youth (SOPLAY) to assess PA in parks.[17–22] The SOPARC provides a systematic protocol for objective measurement of physical activity in community parks. SOPARC consists of periodic momentary scans of individuals and environmental features in predetermined zones or target areas. The system requires trained observers to code individual behavior into one of 3 activity levels (sedentary, walking, and vigorous) during a brief left to right scan of the zone or target area. Separate scans are made for males and females. The SOPARC activity level categories have been validated for K-12 youth with heart rate monitors[23] and by pedometers by prior studies.[24] In addition to activity levels and gender, McKenzie et al coded perceived age (child, teen, adult, senior), ethnicity/race (Latino, Black, White, Other), and setting characteristics (presence of supervision, equipment, and free play vs. organized activity).[17] Interobserver agreement across the various codes were acceptable (98% overall percent agreement). The focus of the current study is the code for perceived age. As noted, increasing prevalence of childhood obesity[1,2] and expanding evidence on the role of parks in contributing to physical activity among children and adolescents[11–13] underscore the necessity of enhancing children and adolescent physical activity measurement strategies.

McKenzie et al noted that one limitation of the current SOPARC protocol was not being able to tie the momentary scans to either race or age.[17] Specifically, they observed that there is a limit to the number of variables observers can record simultaneously during a scan. Data can be tied to race/ethnicity, gender and age. However, it is unfeasible to include all variables at once. As a result, alternative protocols must be employed. For studies focused on children and adolescent activity in parks, one alternative is to attempt to capture different developmental stages within childhood and adolescence and treating adults under the SOPARC contextual codes. Representing different developmental stages in SOPARC is important given the different developmental issues children face. Grouping children and adolescents into 1 age category[21] or 2 (eg, child and teen)[17] can potentially obscure nuances reflective of how different age groups use outdoor environments. The transition from childhood to early adulthood brings about numerous psycho-social, and physiological changes and a marked decline in physical activity.[25]

This study reports an assessment of a measure designed to account for PA in parks among children in different childhood age groups. Three groups were developed: 0 to 5 years old (Young Children); 6 to 12 (Middle Childhood) and 13 to 18 (Older Children). These categories were based on Erikson's stages of child development.[26] The first category (young children) combined Erikson's first 3 stages of psychosocial development (birth to 18 months [trust vs mistrust], 18 months to 3 years [autonomy vs shame/doubt], 4 to 5 years [initiative vs guilt]). The second category (middle childhood) focused on Erikson's fourth stages of psychosocial development (6 to 12 years) the industry vs inferiority stage. The final category (older children) focused on Erikson's fifth stage of psychosocial development (13 to 18)—the identity vs role confusion stage. National surveillance efforts such as the NHANES[2] classifies children based on the following categories (2 to 5 years; 6 to 11 years; 12 to 19 years). Because our measure focuses on children's use of neighborhood parks, age categories tied to Erikson's model seemed appropriate.

Methods

As noted earlier, the SOPARC offers important advantages in measuring PA among children in outdoor settings. This study assesses a modification of the age group code to reflect different developmental stages.

SOPARC Training

Research staff completed 2 days of SOPARC training. Staff spent the morning of the first day learning the background and significance of the study. Staff were introduced to observational measurement techniques, and practiced SOPARC observational techniques in a classroom environment with examples drawn from the SOPARC training video[27] and in a nearby park. To differentiate between children at the 3 developmental stages, the SOPARC age group code was modified. Thus, observation codes accounted for age (young child, middle child, older child), gender, and activity levels (sedentary, walking, and vigorous). The observation codes for different age groups were introduced after research staff were able to recognize and code SOPARC PA levels.

Median height and weight statistics of different child age groups were presented[1] with a particular emphasis on cut off points of different age groups relating to this study.[28] This was followed by a presentation focused on age-related biological and social characteristics to help observers identify age groups of children in parks. The following physical characteristics were highlighted to help observers discern between the 3 different age categories: Presence of adult teeth (particularly in distinguishing between 2 younger age groups); facial hair and pubic development (to identify between 6 to 12 age group and 13 to 18 year old age group); an examination of a child's motor skill development (particularly in distinguishing differences between 2 younger age groups); and finally examining a peer group (if one was present) and making an informed judgment of age. All of these factors were considered in addition to the average height and weight CDC statistics presented.

Fifty-four photographs of children playing were displayed in a PowerPoint presentation followed by a discussion and group assessment on identifying the age category (young, middle, older) of children in the photographs. Staff were encouraged to refer to the CDC data along with identifying features to make an informed judgment about the age of children. Detail on the presentation used in the training or the training is available from the authors.

In the afternoon on day 1, SOPARC training occurred in a local public park. Pairs of observers received additional instruction on the SOPARC protocol with adapted SOPARC coding sheets (see Figure 1). Basemaps of the park were prepared in advance outlining park zones (the observation target area). Pairs of observers walked the area of the park with the basemaps and discussed the boundaries of the zones. Following the SOPARC protocol, each pair of observers collected data on the physical activity of the children, the age category of the child, and the gender of the child, as well as contextual data in each zone (eg, activity code, number of adults, shade, etc.). All observers were debriefed after each round of practice to identify problems or concerns. After the first day of training was completed, minor adjustments to the protocol were made. These included: increasing the number of activity codes, adding an equipment/no equipment code and adding a code related to adult/caregiver present. None of the changes to the protocol related to the age classification.

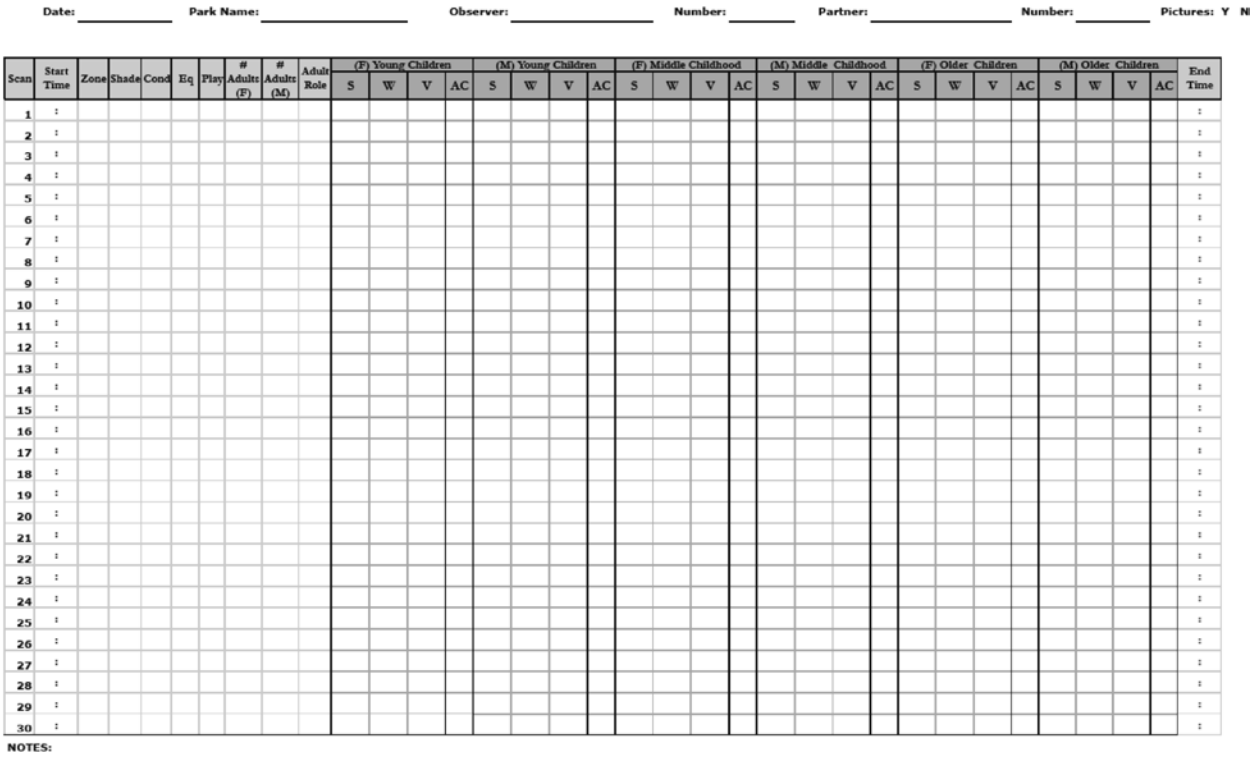
A second day of practice occurred at 2 other parks. The practice parks were chosen because they were similar in size to the study's largest parks with multiple zones. Furthermore each practice park contained facets that observers would encounter in the study parks (eg, ball fields, open spaces, paths, basketball courts, playgrounds with both stand alone play equipment and continuous play structures).

Data Collection

Data for this analysis were obtained from direct observations in 3 neighborhood parks in Raleigh and 20 in Durham, NC (see Table 1 for a detailed list of all parks used in the study). Observers recorded PA in predetermined zones between 10 AM to 2 PM and between 3 PM and 7 PM for 2 separate weeks using SOPARC.[17] Data were collected on 2 randomly selected weekdays and 2 weekend days. The SOPARC observation protocol required observers to conduct the first and last observations in each park in pairs for interobserver agreement assessment. For the present analysis, data from a practice round and Weeks 1, 4, 5, 7, and 8 of the 8-week study are reported.

Data Analysis

All statistical analysis was conducted in Microsoft Excel using the pivot table procedure to generate Kappa statistics (see Appendix 1 for steps). Weighted kappa's were reported to account for the number of observations each team of observers performed. Kappa statistics are reported for agreement by age group and gender by physical activity codes. Kappa statistics across weeks ranged from -0.03 to 1.00, while observer agreement ranged from 89.0 to 100% (see Table 2). The Cohen's kappa statistic is generally considered to be a conservative measure because it considers the degree to which agreement is due to chance.[29] A limitation of the kappa


Date: _____ Park Name: _____ Observer: _____ Number: _____ Partner: _____ Number: _____ Pictures: Y N

Scan	Start Time	Zone	Shade	Cond	Eq	Play	# Adults (F)	# Adults (M)	Adult Role	(F) Young Children				(M) Young Children				(F) Middle Childhood				(M) Middle Childhood				(F) Older Children				(M) Older Children				End Time
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NOTES:

Figure 1 — Modified System for Observing Play and Recreation in Communities (SOPARC) observation form.

Table 1 Description of Study Parks and Activity Zones

Park name	Acreage	Number of zones	Type of zones
Pullen Park (practice)	42.0	6	Playgrounds, picnic shelter, tennis courts, open space, walkway/trail
Jaycee Park (practice)	24.9	9	Playgrounds, baseball field, tennis courts, multipurpose field, picnic shelter, open space, trail, volleyball courts
Laurel Hills (practice)	48.2	9	Playground, basketball courts, picnic areas, soccer fields, baseball fields
Belmont	0.5	1	Playground, picnic shelter, open space
Indian Trail	8.4	7	Playground, picnic shelter, open space, exercise stations, trails
Oval Drive	3.7	7	Playground, picnic shelter, open space, baseball fields, basketball courts, tennis courts, seating area
Crest Street	6.9	9	Playground, trails, open space, baseball fields, basketball courts, picnic shelter
Duke	15.9	11	Playground, trails, open space, baseball fields, soccer field, picnic shelter, outdoor handball courts
Bay-Hargrove	0.9	2	Playground, picnic area
Old North Durham	3.6	4	Playground, open space, soccer field, picnic shelter
Sherwood	15.8	8	Playground, picnic shelter, open space, baseball fields, basketball courts, tennis courts, trails
Burch Avenue	1.0	1	Playground
East End	8.3	14	Playground, sprayground, picnic shelter, open space, baseball fields, basketball courts, tennis courts, trails, swings
East Durham	9.5	7	Playground, picnic shelter, open space, baseball fields, basketball courts, trails
Long Meadow	9.6	11	Playground, picnic shelter, open space, baseball fields, basketball courts, trails, pool/waterslide
Wrightwood	14.0	5	Playground, picnic shelter, open space, baseball fields, seating areas
Lyon	9.8	8	Playground, picnic shelter, open space, baseball fields, seating areas, basketball courts, trails
Forest Hills	45.8	15	Playground, picnic shelter, open space, swimming pool, seating areas, trails, tennis courts
Hillside	14.8	9	Playground, picnic shelter, open space, baseball fields, seating areas, basketball courts, trails, amphitheater, sprayground, swimming pool
Rockwood	10.0	6	Playground, picnic shelter, open space, basketball courts, trails
White Oak	1.2	3	Playground, open space, basketball courts
Trinity	0.7	5	Playground, open space, picnic area, trails
Elmira Avenue	12.1	6	Playground, picnic shelter, open space, baseball fields, basketball courts, tennis courts

statistic is that if there is no variability in the observations, the weighted kappa is unable to yield a meaningful test statistic (see older female vigorous in the training week as an example). Although, percent agreement does not account for agreement due to chance, in those cases it appears that reporting percent agreement would be more appropriate. Thus, percent agreement was also reported. Similar to previous studies this reporting procedure has merit.[29]

Results

A total of 2145 children were observed during the weeks covered by this analysis. Results showed that adequate reliability was observed for PA codes using the 3 age groups (see Table 2). The training week reliability data were collected by 5 teams of observers with 127 paired independent and simultaneous observations. A total of 276 children were observed. Kappas for young, female

Table 2 Cohen's Kappa Coefficients and % Observer Agreement by Age Group, Gender, and PA code

Gender, child age, and activity level	Kappa Coefficients and (% Observer Agreement)					
	Training (127 paired observations)	Week 1 (130 paired observations)	Week 4 (152 paired observations)	Week 5 (117 paired observations)	Week 7 (120 paired observations)	Week8 (75 paired observations)
Female, YC, S	0.67 (93.7)	0.57 (96.2)	0.66 (98.7)	0.56 (94.0)	0.80 (97.5)	0.81 (97.3)
Female, YC, W	0.26 (92.1)	0.38 (95.4)	0.74 (98.7)	0.15 (92.3)	0.59 (98.3)	0.00 (98.7)
Female, YC, V	0.56 (93.7)	0.00 (99.2)	1.00 (100)	−0.01 (98.3)	0.66 (99.2)	0.00 (98.7)
Male, YC, S	0.63 (96.1)	0.39 (97.7)	0.80 (98.7)	0.84 (98.3)	0.79 (98.3)	0.49 (97.3)
Male, YC, W	0.77 (96.1)	0.71 (98.5)	0.80 (98.7)	0.59 (98.3)	0.56 (97.5)	0.66 (98.7)
Male, YC, V	0.65 (96.9)	1.00 (100)	0.80 (99.3)	0.24 (97.4)	0.80 (99.2)	1.00 (100)
Female, MC, S	0.68 (92.9)	0.00 (99.2)	0.66 (97.4)	0.81 (98.3)	0.95 (99.2)	0.87 (98.7)
Female, MC, W	0.44 (89.0)	0.49 (97.7)	0.63 (97.4)	0.66 (98.3)	1.00 (100)	0.00 (98.7)
Female, MC, V	0.49 (91.3)	0.66 (99.2)	0.63 (97.4)	0.00 (98.3)	1.00 (100)	— (100)
Male, MC, S	0.55 (89.0)	1.00 (100)	0.65 (97.4)	0.59 (96.6)	0.75 (96.7)	0.90 (98.7)
Male, MC, W	0.60 (91.3)	— (100)	0.66 (96.7)	0.66 (99.2)	0.87 (98.3)	0.66 (98.7)
Male, MC, V	0.51 (94.5)	0.00 (99.2)	0.93 (99.3)	0.49 (98.3)	0.56 (97.5)	— (100)
Female, OC, S	0.55 (96.9)	— (100)	0.66 (99.3)	0.66 (99.2)	0.66 (99.2)	1.00 (100)
Female, OC, W	0.43 (96.1)	— (100)	0.89 (99.3)	— (100)	1.00 (100)	— (100)
Female, OC, V	— (100)	— (100)	1.00 (100)	— (100)	0.00 (99.2)	— (100)
Male, OC, S	0.68 (94.5)	— (100)	0.50 (99.3)	0.83 (99.2)	0.66 (99.2)	0.00 (98.7)
Male, OC, W	0.66 (93.7)	— (100)	— (100)	0.62 (97.4)	0.66 (99.2)	−0.03 (93.3)
Male, OC, V	0.83 (97.7)	— (100)	0.66 (99.3)	0.80 (99.2)	— (100)	0.00 (98.7)

Abbreviations: YC, young child; MC, middle child; OC, older child; S, sedentary PA; W, walking/moderately active PA; V, vigorous PA.

children were 0.67 for sedentary PA, 0.26 for walking, and 0.56 for vigorous PA. For middle age group females, kappas were 0.68 for sedentary PA, 0.44 for walking, and 0.49 for vigorous. For older female children, kappas were 0.55 for sedentary PA, 0.43 for walking, and no kappa was recorded for vigorous PA. Among young male children, kappas for sedentary PA, walking, and vigorous PA were 0.63, 0.77, 0.65. For middle age group male children, kappas were 0.55 for sedentary PA, 0.60 for walking, and 0.51 vigorous PA. For older age male children, kappas were 0.68 for sedentary PA, 0.66 for walking, and 0.83 vigorous PA.

Week 1 reliability data were collected by 5 teams of observers with 130 paired independent and simultaneous observations. A total of 645 children were observed overall. Kappas for young, female children were 0.57 for sedentary PA, 0.38 for walking, and 0.0 for vigorous PA. For middle age group females, kappas were 0.00 for sedentary PA, 0.49 for walking, and 0.66 for vigorous. No kappas were able to be recorded for older male or female children during this week.

The third set of reliability data (week 4) was collected by 5 teams of observers in 152 paired observations. A total of 284 children were observed overall. Kappa coefficients for young, female children were 0.66, 0.74, and 1.0 for sedentary PA, walking, and vigorous PA respectively. For middle age group female children, kappas were 0.66, 0.63, and 0.63 for sedentary PA, walking, and vigorous PA respectively. For older female children (adolescents), kappas for sedentary, walking and vigorous PA levels were 0.66, 0.89, and 1.0 respectively. For young male children, kappas were 0.80 across sedentary PA, walking, and vigorous PA. For middle male children, kappas were 0.65, 0.66, and 0.93 for sedentary PA, walking, and vigorous PA respectively. Kappas for older male children (adolescents) activity levels were 0.50 (sedentary), unable to report (walking) and 0.66 (vigorous).

Week 5 data are based on 117 paired observations. Three hundred thirty-five children were observed for the overall week. For young females, kappa coefficients were 0.56, 0.15, and -0.01 for sedentary, walking, and vigorous PA. For young males, kappas were 0.84, 0.59, and 0.24 for sedentary, walking, and vigorous PA. For middle age group females, kappas were 0.81, 0.66, and 0.00 for sedentary, walking, and vigorous PA. For middle age group males, kappas were 0.59, 0.66, and 0.49 for sedentary, walking, and vigorous PA. For older female children (adolescents), kappas were 0.66 (sedentary) and unable to report (walking and vigorous). Kappas for older male children (adolescents) activity levels were 0.83 (sedentary), 0.62 (walking) and 0.80 (vigorous).

Week 7 reliability data are based on 120 paired observations. A total of 321 children were observed overall. Kappa coefficients for young female were 0.80, 0.59, and 0.66 for sedentary, walking and vigorous PA respectively. For young male children the coefficients were 0.79, 0.56, and 0.80 for sedentary, walking and vigorous PA. Within the female middle age group, coefficients were 0.95 (sedentary), and 1.0 (walking and vigorous PA). Within the male middle age group, coefficients were 0.75 (sedentary), 0.87 (walking) and 0.56 (vigorous PA). For older female children, kappas were 0.66 (sedentary), 1.00 (walking) and 0.00 (vigorous). Kappas for older male children's activity levels were 0.66 (sedentary and walking), and unable to report (vigorous).

The final set of reliability data (Week 8) is based on 75 paired observations. A total of 284 children were observed overall. Kappas for young female children were 0.81 for sedentary PA, and 0.00 for both walking, and vigorous PA levels. For observations of middle age group female children, kappas were 0.87, 0.00, and unable to report. For older female children, kappas were 1.0 for sedentary and unable to report for walking and vigorous categories. For young male children, kappas ranged were 0.49, 0.66, and 1.00 for the sedentary, walking and vigorous PA categories. For observations of middle age group male children, kappas were 0.90, 0.66, and unable to report across the PA levels. For older males, kappas were 0.00, -0.03, and 0.00.

For these assessments, the results show that the 3 age group category exhibited adequate reliability for measuring PA in parks. Standards for Cohen's Kappa recommend: < 0 = poor agreement, 0 to 0.2 = slight agreement, 0.40 to 0.59 = moderate agreement, 0.60 to 0.79 as substantial, and 0.80 outstanding agreement.[30] However, recent simulations of the behavior of kappa have resulted in alternate interpretations of the kappa statistic. They suggest the following interpretations: < 0 = poor agreement, 0 to 0.2 = fair agreement, 0.20 to 0.45 = moderate agreement, 0.45 to 0.75 = substantial agreement, 0.75 to 1.0 outstanding agreement.[31] Furthermore, interrater agreement appeared to improve over successive weeks. However, the observed kappas are consistent with reliabilities observed in the training data based on larger numbers of children.

Discussion and Conclusions

The prevalence of overweight and obesity among children and adolescents is an important public health concern. Because parks can promote PA among children[11–14] there is a need to develop and refine strategies to assess children and adolescent PA in parks and recreation areas. Observational methods are particularly suited for measuring PA among children in public parks and accounting for environmental contexts related to PA.[15,16] To better understand how environments influence PA among children, alternative methods are needed to reflect different developmental stages of childhood and adolescence. The results of this study showed that the modification of the age code in SOPARC to reflect 3 developmental stages reliably measures PA among children and adolescents in parks.

Several studies have employed the SOPARC or SOPLAY to assess PA in parks[17–22] and report adequate reliabilities. These studies contribute to a growing body of evidence on the ability of direct observation to document the capacity of parks and outdoor settings to contribute to PA. For future studies focusing on children and adolescents in parks and other outdoor environments, we recommend use of 3 age categories. Future studies employing this approach would be better able to inform and evaluate interventions to increase children's PA through parks, playgrounds, and school settings.

Recognition of distinct stages of development holds important implications for physical activity research. Studies have shown that both younger children, and girls in particular, have less freedom and autonomy to play in public spaces compared with older children and boys.[32–34] Research also indicates that adolescence brings about increased independent travel and mobility and less parental supervision affecting young children.[13] Finally, although there are few longitudinal studies showing specific age breakpoints, PA is known to dramatically decline in adolescence[35,36] and participation in youth sports declines significantly during middle school years.[37]

Using measures that reflect differences in age groups can provide more specific and valuable insight into the ways younger children and adolescents differ in their use of public parks, playgrounds, and other play spaces. For example, in their study of children's free play Veitch et al point to the lack of empirical evidence focused on the location and activity of children in outdoor settings.[38,39] Understanding how specific age groups among children use outdoor spaces would inform the design of environments particularly as children's active free play outside of school has not been extensively examined.[39]

Recent longitudinal research examining physical activity behavior of children over a 5-year period showed that vigorous physical activity decreases at specific ages (most notably between 11 to 12 and 15 to 16 years).[36,40] Therefore it appears that examining the physical activity patterns of children within particular age groups is critical particularly in light of the evidence pointing to an increase in physical inactivity during specific years. Learning more about what outdoor environments can stimulate adolescents to be more physically active may provide important insight into designing park environments to increase their LTPA. The delineation between the SOPARC child age group codes reported in this study providing some evidence to facilitate this understanding.

Although incorporating different age classifications within the SOPARC protocol showed promise, several limitations should be mentioned. First, although the age categories were based on Erickson's developmental stages, there was no check on the validity of the age group measure. The high reliabilities show that the observers performed well in consistently discriminating between the 3 categories. However, we do not have evidence on the accuracy of the measures. One suggestion for future studies employing this adapted approach would be for observers to spend time in local schools observing children in different grades of interest. This would allow observers to have more experience identifying different age groups and recognize variation in height and weight among different ethnic/racial populations.[28] Another system could entail a triad of 2 observers and a go-between plus an additional observer-questioner near the target child. Periodic validation checks would be made based on the following protocol: 2 observers notify the go-between of the target child/children just coded for age; the go-between relays which children were assessed to the observer-questioner near the children via walkie-talkie. The observer-questioner could approach the child or an adult caregiver and after briefly explaining why the age datum is needed, gathers the information, which could be later checked against the codes.

A second limitation was low usage for some parks resulting in low numbers of children being observed. This potentially inflates reliabilities in such cases. We were particularly challenged by the low number of older children (13–18yrs). However, this underscores the rationale of our analysis. Refinements in the age group allow researchers to discern which specific age group of children use parks more regularly. Despite these limitations we feel that this study further demonstrates the viability of using SOPARC methodology in assessing physical activity in open outdoor environments. This study's contribution is that it further delineates child age groupings providing a useful addition in assessing the activity environments of children and adolescents.

Acknowledgments

This research was funded by Active Living Research, The Robert Wood Johnson Foundation. The authors would like to thank Ben Hickerson, Timia Thompson, Kashif Norville, Orcun Kepez, Gary Keuber, Kevin Laven, Niambi Hall-Campbell and Bob Massengale for help in conducting this study.

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Appendix

Microsoft Excel was used to generate Kappa's statistics for the independent observations in the Active Living Data. There are 2 major sections in the procedure. The first was preparation of the data in a format required for pivot tables. The second was the customization of the pivot table itself.

Section 1—Data Preparation

An Excel macro was recorded to perform many of the repetitive steps in the data preparation section, as the steps were the same for each set of observations of a given factor.

- Copy the Observer and Observer2 name fields directly in front of the field containing the observation results for Observer.
- Delete all extraneous data fields in the input Active Living Data spreadsheet. Only a small subset of the fields was required for Kappa generation.
- Sort the resulting spreadsheet in ascending order based on the first 3 remaining fields (Park Name, Park Zone, Facility).
- Inspect the sorted spreadsheet and remove all line entries that do not have an adjacent entry with the same Park Name, Park Zone and Facility with reversed Observer and Observer2 entries. This removes all unpaired observations.
- Create 3 new fields (Obs-factor, Obs2-factor, count) immediate after the field containing the observation results for Observer.
- Set Obs-factor equal to the value in the field containing the results for Observer in the same line.
- Set Obs2-factor equal to the value in the field containing the results for Observer in the next line.
- Use "Paste Special" to replace the values in Obs2-factor with just the values in the same field, eliminating the equation that had been in the field.
- Place a "1" in all the cells in the count field.
- Starting with the second line eliminate every second line in the spreadsheet.

Section 2—Pivot Table Generation

- Highlight 6 columns (Observer, Observer2, factor, Obs-factor, Obs2-factor and count).
- Select Data→Pivot Table . . . from the Excel menu and the Pivot table wizard will open.
- From the 2 sets of radio buttons in step 1 select: "Microsoft Excel list or database" and "Pivot Table" and click "Next."
- Click "Next" on step 2 of the wizard without making any changes (the highlighting selected the correct columns).
- Select either "New worksheet" or "Existing worksheet" as appropriate in step 3. All pivot tables for factors in the same family were placed in the same worksheet. Click "finish."
- A new pivot table will be displayed along with the pivot-table factor window.
- Drag Observer from the pivot-table factor window to the vertical column in the pivot table.
- Drag Observer2 from the pivot-table factor window to the horizontal column in the pivot table.
- Drag Obs-factor to the vertical column and make sure it displays to the right of the Observer.
- Drag Obs2-factor to the horizontal column and make sure it displays to the right of Observer2.
- Drag count to the main body of the pivot table.
- The resulting pivot table contains all the diagonal and off-diagonal elements required to generate Kappa for the factor.
- Insert the standard Kappa formula beneath the pivot table using the appropriate cells in the pivot table.