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Validation of Interviewer-Assisted Recall for Measuring Minutes of Moderate-to-Vigorous Physical Activity in Elementary School Children, Grades 3 and 5

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INTRODUCTION

In recent decades, childhood obesity rates have soared in the U.S.¹ Consequently, the influence of the school environment on children's physical activity (PA) and dietary behaviors has come under intense scrutiny.² Many school-based interventions have attempted to increase PA and improve dietary intake of children,³ often with mixed or unclear results. Efforts to evaluate such interventions require valid measures of children's PA and dietary intake during the school day, but many existing measures have limited utility in the school setting. For example, direct observation can be used to measure both PA and dietary intake, but it involves a heavy staff burden and high cost.⁴ Accelerometry estimates of PA have been shown to be a valid measure of PA,⁵ but it provides no information on specific types of activity (including resistance training and bone-loading activities recommended for children in PA guidelines⁶) or the context in which the activity occurs. Surveys, in which children self-report their PA and dietary intake, can be used in school settings; however, the validity of existing survey instruments is limited and acceptable only for children over age 10.⁷

Studies of obesity prevention approaches in the school environment require good measures of both PA and dietary intake. One measurement tool that holds promise for assessing both behaviors in children, the interviewer-administered recall, typically performs better than self-report questionnaires.⁸ However, little is known about the best way to conduct interviewer-administered recalls for school-based studies. For example, should interviews be focused on PA and dietary intake separately or measure them simultaneously in an integrated manner as one study did in children ages 7–15 years⁹ and a pilot study did in 3rd- and 5th-grade children?¹⁰ The combining of PA and dietary intake into a single interview could reduce time spent in data collection for both subjects and researchers. In addition, this study

explored whether a shorter or longer retention interval (i.e. elapsed time between events to be reported and the interview) was appropriate for elementary school children and explored if there are developmental differences in recall ability. Thus the purpose of this study was to assess the ability of an interviewer-administered recall to measure moderate-to-vigorous physical activity (MVPA) in 3rd- and 5th-grade children who were asked to recall only their PA or both their PA and dietary intake, using either a short retention interval (same-day recall in the afternoon) or a long retention interval (previous-day recall in the morning). We hypothesized no differences between the two interview contents, two retention intervals, two grades, and two genders.

METHODS

Study procedures were approved by the University of South Carolina's Institutional Review Board.

Study Design and Participants

Recruitment occurred in 21 3rd grade classes and 21 5th grade classes in August and early September, 2010 at four public elementary schools in Columbia, SC. Of the 877 children invited to participate, the parents of 513 (58.5%) provided written informed consent. Children provided written assent. Race, ethnicity, and gender distributions of the 877 children invited were similar to the 513 participating children.

The study utilized a cross-sectional design. Training and practice data collection occurred in mid-September through October, 2010. Data were collected from November, 2010 through February, 2011. Consented children were randomly selected and asked to wear an accelerometer for a day at school, and/or were observed eating school-provided breakfast and lunch on the same day at school. From the pool of consented children who wore accelerometers and/or were observed, interviews occurred with randomly selected children until a total of 144 children were interviewed. Assignment to group was random with the constraint that data collection continue until each of the three groups had 48 children with 24 per retention interval (Same Day Afternoon [SDA]; Previous Day Morning [PDM]), and within retention interval, 12 per grade with 6 boys and 6 girls per grade.¹¹ (Sample size calculations had suggested that data from 144 children, with 48 per group, would provide adequate power for the aims of the study.¹¹) The 48 children in the first group were interviewed once each about PA that occurred at school on the day the accelerometer was worn; this was the PA Only group. The 48 children in the second group were interviewed once each about both PA and dietary intake that occurred at school on the day the accelerometer was worn and school meals were observed; this was the PA & Diet group. The 48 children in the third group were interviewed once each about dietary intake at school for the day when school meals were observed; this was the Diet Only group. Because the current article's purpose concerned MVPA, interviews by the 48 children in the Diet Only group were not analyzed. (Results concerning dietary recall accuracy are provided elsewhere.¹¹) Thus, this article concerns the 96 children assigned to the two PA interviews (PA Only; PA & Diet) crossed with the two retention intervals (SDA; PDM). Each of these four combinations (hereafter referred to as PA Only-SDA; PA Only-PDM; PA & Diet-SDA;

PA & Diet–PDM) had equal numbers of 3rd and 5th graders and boys and girls (8 subgroups with 12 children in each). Neither school staff nor children knew in advance which children would be interviewed, whether a child would be interviewed about PA only or PA & Diet, the day on which an interview would occur, or the retention interval (SDA; PDM) to be used in an interview. To allow for random selection for interviews, more children were consented than were needed, and more children wore accelerometers than were needed.

Accelerometry

Children wore an ActiGraph accelerometer (Model GT3X, The ActiGraph, LLC; Pensacola, FL) for one day while in school. The monitors were placed on the children in the school cafeteria prior to eating breakfast and worn until the end of the school day. Monitors were initialized to save data in 1-minute intervals. Children wore the monitor on an elastic belt on their right hip (anterior to the iliac crest). ActiGraph files were summarized for MVPA, calculated using age-specific cut points for a threshold of 4 METs.^{12,13} Sixty minutes of consecutive zero values were considered non-wear time. Minutes per day of MVPA was the primary variable derived from the accelerometry data (MVPA-accelerometer).

Interview Protocols

Four written multiple-phase interview protocols, modeled on the Nutrition Data System for Research (NDSR) protocol (Nutrition Coordinating Center, University of Minnesota, Minneapolis, MN), were developed for the four combinations of interview content and retention interval. A chronological format was used during the interview protocol rather than a free recall format, based on results from a qualitative study of interview-administered PA recalls by children.¹⁴ Prompts concerning PA information were also incorporated into the interview to improve detail about how long the PA occurred and the intensity, based on a pilot study.¹⁰ Interviewers participated in training that included role playing and practice interviews with research staff and children. Following training, three interviewers conducted interviews in private locations at children's schools either after lunch (Monday – Friday, for SDA) or after breakfast (Tuesday – Friday, for PDM). Interviewers used paper forms to note information reported by children. Each interview was audio recorded and transcribed. For quality control, a non-interviewing researcher reviewed both the audio recording and the typed transcript of each interview. Quality control assessment indicated that interviews with eight children failed to abide by the specific protocol (e.g., interviewer failed to ask question[s] as indicated in the protocol for an event [PA; intake] reported by child). Interviews with another five children had inadequate accelerometer data. Interviews with these 13 children were excluded from further analyses, and replaced with interviews by another 13 children.

PA Interviews

Each interview included three phases. In Phase One, the interviewer led the child through the target day by asking questions, including: After you got to school this/yesterday morning, what was the first time you were physically active, moving around, or exercising? What time was that? What moving around did you do? What was the next time at school today/yesterday that you moved around? In Phase Two, the interviewer obtained details about each of the times the child reported being physically active, in chronological order,

including the intensity or pace (fast, medium, slow) and duration. In Phase Three, in chronological order, the interviewer reviewed and confirmed details with the child. The wording of prompts concerning PA was based on results from the qualitative and pilot studies with children.^{10,14} For the PA & Diet interviews, interviewers asked PA and diet questions together. Diet questions asked about items consumed while in the classroom, cafeteria or somewhere else while at school.

PA interview data were scored to estimate minutes of MVPA per day using the following rules: Reported activities were considered to be of at least moderate intensity when children reported a medium or fast pace. All minutes reported for PA at a medium or fast pace were summed to create the MVPA-interview variable. Activities reported as slow pace and activities for which pace was not reported were not included in the MVPA estimate. When duration was not reported in minutes for a particular activity, that activity was not included in the MVPA estimate. When ranges of minutes spent in an activity were reported, the lower end was used. Finally, PA reported as part of a transition period (changing classes, going to the bathroom/lunch/other classroom, etc.) was excluded. Only activities reported during periods when children were wearing an accelerometer were included in these analyses.

Data Analysis

Descriptive statistics were calculated by participant characteristic and MVPA from interviews and accelerometry. Spearman correlations were calculated between MVPA-interview and MVPA-accelerometer for the overall sample and for subgroups. Partial correlations were calculated to control for the effects of age, gender, and retention interval (SDA; PDM). All analyses were conducted in SAS (Version 9.3) and statistical significance was set at 0.05.

RESULTS

Demographic characteristics of the children are presented in Table 1. Data were available for 95 of the 96 children because during analyses, it was discovered that the accelerometer worn by a 3rd-grade girl in the PA & Diet–SDA subgroup had malfunctioned and recorded less than 1 hour of data. Almost three-fourths of the participants were African-American, half were boys, and about half were in 3rd grade.

Physical activity data from interview and accelerometer are presented in Table 2. Overall, children reported an average of 27.3 minutes of MVPA (MVPA-interview) and the accelerometers recorded an average of 23.5 minutes of MVPA (MVPA-accelerometer). MVPA-interview and MVPA-accelerometer data by subgroups for interview content, retention interval and grade are also presented. The only significant difference in the subgroups was between 3rd and 5th grade, with 3rd graders having higher MVPA-accelerometer than 5th graders.

Also presented in Table 2 are the results of the correlational analyses. Overall, the Spearman correlation between MVPA-interview and MVPA-accelerometer was significant ($r=0.23$, $P=.02$). Weak, but significant Spearman correlations were found when the data were divided by content for the PA Only group ($r=0.34$, $P=.02$), when divided by retention interval for PDM

($r=0.33$, $P=.02$), and when divided by grade for 5th graders ($r=0.38$, $P=.01$). Partial correlations were also run for the total group, and by interview content, retention interval and grade to adjust for the other factors, and results varied only slightly from the Spearman correlations. As shown in Table 3, subgroup Spearman correlations between MVPA-interview and MVPA-accelerometer showed the strongest correlation ($r=0.77$, $P=.003$) for 5th graders for the previous day morning, PA Only condition (PA Only–PDM).

DISCUSSION

The major finding of this study was that MVPA measured by interview was significantly positively associated with MVPA ($r=0.34$, $P=.02$) measured by accelerometry when the interview focused only on PA. This indicates that the recall interview method is a promising approach to assessing children's MVPA during the school day. However, when children were asked to recall both PA and diet, MVPA-interview and MVPA-accelerometer were not significantly associated ($r=0.12$, $P=.40$). Very few studies have attempted to measure both PA and diet during the same interview. Moore and colleagues⁹ used a computer program to measure PA and diet simultaneously in 7- to 15-year old children. For comparisons, children wore accelerometers and completed a 24 h multiple pass dietary recall. There was good agreement for both dietary and PA behaviors. Children underestimated their MVPA, while in the current study, children slightly overestimated their MVPA as compared to accelerometry. The variability of the two MVPA measures was very similar in the Moore et al.⁹ study, while in the current study the variability of MVPA-interview was more than twice as high as MVPA-accelerometer. Differences between Moore et al. and the current study include that, on average, the children were older in the Moore et al.⁹ study and the time period assessed was the entire previous day.

In the current study, older children recalled their MVPA more accurately than younger children. Similar findings have been reported by others.^{15,16} Using a 1-day recall instrument in 5th graders, correlations with accelerometer data were 0.28 to 0.60, while using a 1-day activity checklist correlations were between -0.22 and 0.33 in 4th graders.¹⁶ Simons-Morton et al.¹⁵ used an interview-administered PA self-report and compared to data from heart rate monitors. They found age differences in correlation with 0.50 – 0.57 in 3rd graders and 0.72 in 5th graders. In part these differences could be explained by cognitive development as 5th graders generally have greater ability to recall PA than 3rd graders.^{7,17}

In the current study, we found a significant association between MVPA-accelerometer and MVPA-interview for the previous day recall (PDM) but not for the same day recall (SDA). This finding is counter-intuitive. Logistical complications (e.g., late lunch followed by physical education class) placed constraints on conducting SDA interviews on certain days at a certain school. However, there was no difference between SDA and PDM groups in the amount of time that accelerometers were worn (average of 6.00 ± 0.0 hours by children with SDA interviews and 6.00 ± 0.002 hours by children with PDM interviews).

Strengths of this study include the use of an objective measure of MVPA and the use of scripted interview protocols administered by trained interviewers. The sample was limited in that it included children in only 2 grades and three-fourths were African American; also, the

study assessed PA only during the school day. Budgetary constraints precluded the ability to include children's weight status in the study design. The results of this study suggest that children can recall their PA behavior accurately in an interview setting when they are asked to recall PA only. Additional research is needed to confirm these findings and to examine further the effects of interview condition, gender, grade and retention interval on children's PA recall accuracy. Also the reliability and validity of these methods should be tested in longitudinal studies.

IMPLICATIONS FOR REASEARCH AND PRACTICE

Correlational results from this validation study suggest that children can self-report PA accurately in an interviewer-administered interview when recalling PA only and when PA is assessed as MVPA minutes. Research needs to address children's accuracy for recalling specific types of PA, pace, duration, and time frame (e.g., soccer, fast pace, 10 minutes, 9:30 to 9:40am). Such research could have important implications for future studies that need accurate but less expensive approaches than accelerometry to assess PA in school settings and for interventions.

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References

1. Ogden CL, Carroll MD, Kit BK, Flegal KM. Prevalence of obesity and trends in body mass index among US children and adolescents, 1999–2010. *JAMA*. 2012; 307:483–490. [PubMed: 22253364]
2. Williams AJ, Henley WE, Williams CA, Hurst AJ, Logan S, Wyatt KM. Systematic review and meta-analysis of the association between childhood overweight and obesity and primary school diet and physical activity policies. *Int J Behav Nutr Phy Act*. 2013; 10:101.
3. Sobol-Goldberg S, Rabinowitz J, Gross R. School-based obesity prevention programs: A meta-analysis of randomized controlled trials. *Obesity (Silver Spring)*. 2013; 21:2422–2428. [PubMed: 23794226]
4. McKenzie TL, Sallis JF, Nader PR, et al. BEACHES: An observational system for assessing children's eating and physical activity behaviors and associated events. *J Appl Behav Anal*. 1991; 24(1):141–151. [PubMed: 2055797]
5. Sirard J, Pate RR. Physical activity assessment in children and adolescents. *Sports Med*. 2001; 31(6):439–454. [PubMed: 11394563]
6. U.S. Department of Health and Human Services. [Last accessed November 25, 2015] 2008 physical activity guidelines for Americans. Available at: www.health.gov/paguidelines/
7. Sallis JF, Buono MJ, Roby J, Micale FG, Nelson JA. Seven-day recall and other physical activity self-reports in children and adolescents. *Med Sci Sports Exerc*. 1993; 25:99–108. [PubMed: 8423762]
8. McKenna J, Foster LJ, Page A. Exploring recall of physical activity in young people using qualitative interviewing. *Ped Exerc Sci*. 2004; 16:5–14.
9. Moore HJ, Ells LJ, McLure SA, et al. The development and evaluation of a novel computer program to assess previous-day dietary and physical activity behaviours in school children: the synchronised Nutrition and Activity Program (SNAP). *B J Nutr*. 2008; 99:266–1274.

10. Baxter SD, Hitchcock DB, Guinn CH, et al. A pilot study of the effects of interview content, retention interval, and grade on accuracy of dietary information from children. *J Nutr Educ Behav.* 2013; 45:368–373. [PubMed: 23562487]
11. Baxter SD, Hitchcock DB, Guinn CH, et al. A validation study concerning the effects of interview content, retention interval, and grade on children's recall accuracy for dietary intake and/or physical activity. *J Acad Nutr Diet.* 2014; 114:1902–1914. [PubMed: 24767807]
12. Freedson P, Pober D, Janz K. Calibration of accelerometer output for children. *Med Sci Sports Exerc.* 2005; 37:S523–S530. [PubMed: 16294115]
13. Troiano RP, Berrigan D, Dodd KW, Masse LC, Tilert T, McDowell M. Physical activity in the United States measured by accelerometer. *Med Sci Sports Exerc.* 2008; 40:181–188. [PubMed: 18091006]
14. Wilson DK, Baxter SD, Guinn C, Pate RR, McIver K. A qualitative study of interview-administered physical activity recalls by children. *J Phys Act Health.* 2013; 10:833–849. [PubMed: 23072783]
15. Simons-Morton BG, Taylor WC, Wei Huang I. Validity of the physical activity interview and Caltrac with preadolescent children. *Res Q Exerc Sport.* 1994; 65:84–88. [PubMed: 8184216]
16. Sallis JF, Strikmiller PK, Harsha DW, et al. Validation of interviewer- and self-administered physical activity checklists for fifth grade students. *Med Sci Sports Exerc.* 1996; 28:840–851. [PubMed: 8832538]
17. Flavell JH. Cognitive development: Children's knowledge about the mind. *Annu Rev Psychol.* 1999; 50:21–45. [PubMed: 10074674]

Table 1

Characteristics of Study Participants (n = 95)

Characteristic	Total n=95	Grade 3 n=47	Grade 5 n=48
Gender, percent			
Boys	50.53%	51.06%	50.0%
Girls	49.47%	48.94%	50.0%
Age, mean $\pm$ sd	9.78 $\pm$ 1.11	8.71 $\pm$ 0.33	10.81 $\pm$ 0.32
Race, percent			
African American	72.63%	62.50%	82.98%
Hispanic	10.53%	12.55%	8.51%
White	13.68%	20.83%	6.38%
Other	3.15%	4.17%	2.13%
Hours of accelerometer wear, mean $\pm$ sd	6.00 $\pm$ 0.002	6.00 $\pm$ 0.002	6.00 $\pm$ 0
Retention interval - percent same day afternoon (SDA)	49.47%	51.06%	48.9%

Table 2
Moderate to Vigorous Physical Activity (MVPA) Measured by Interview and Accelerometry

	n	MVPA-Interview min/d mean ± sd	P value ^a	MVPA-Accelerometer min/d mean ± sd	P value ^b	Spearman correlation (P value)	Partial correlation (P value)
Total	95	27.34 ± 24.96		23.47 ± 12.76		0.23 (.02)	0.25 (.02) ^c
Gender			.47		.22		
Boys	48	29.19 ± 20.95		25.08 ± 11.56		0.25 (.09)	0.30 (.05) ^d
Girls	47	25.46 ± 28.59		21.83 ± 13.81		0.16 (.29)	0.06 (.69) ^d
Interview content			.56		.12		
Physical activity only	48	28.82 ± 28.48		21.44 ± 13.08		0.34 (.02)	0.28 (.06) ^e
Physical activity & diet	47	25.83 ± 20.97		25.55 ± 12.21		0.12 (.40)	0.12 (.43) ^e
Retention interval			.28		.43		
Same day afternoon (SDA)	47	24.52 ± 25.18		24.53 ± 13.75		0.17 (.26)	0.18 (.26) ^f
Previous day morning (PDM)	48	30.10 ± 24.70		22.44 ± 11.77		0.33 (.02)	0.34 (.02) ^f
Grade			.66		<.01		
Third	47	28.50 ± 28.02		27.32 ± 11.74		0.07 (.62)	0.09 (.55) ^g
Fifth	48	26.21 ± 21.80		19.71 ± 12.71		0.38 (.01)	0.29 (.05) ^g

^aGroup difference for interview MVPA, P<.05 is considered significant

^bGroup difference for accelerometer MVPA, P<.05 is considered significant

^cAdjusted for gender, grade, interview content, and retention interval

^dAdjusted for grade, interview content, and retention interval

^eAdjusted for gender, grade, and retention interval

^fAdjusted for gender, grade, and interview content

^gAdjusted for gender, interview content, and retention interval

Table 3

Spearman Correlations for Grade by Retention Interval by Interview Content Subgroups

Subgroup	n	MVPA ^a -interview	Min/d mean $\pm$ sd	MVPA-accelerometer	Min/d mean $\pm$ sd	Spearman correlation (<i>P</i> value)
Third grade, PDM ^b and PA Only ^c	12	27.50 $\pm$ 20.31		19.42 $\pm$ 7.43		0.25 (.44)
Fifth grade, PDM and PA Only	12	35.00 $\pm$ 30.57		21.67 $\pm$ 15.7		0.77 (.003)
Third grade, SDA ^d and PA Only	12	30.63 $\pm$ 41.92		26.67 $\pm$ 13.51		-0.06 (.86)
Fifth grade, SDA and PA Only	12	22.17 $\pm$ 16.34		18.00 $\pm$ 14.17		0.42 (.17)
Third grade, PDM and PA & Diet ^e	12	32.92 $\pm$ 28.82		31.75 $\pm$ 10.58		0.10 (.76)
Fifth grade, PDM and PA & Diet	12	25.00 $\pm$ 18.93		16.92 $\pm$ 6.35		-0.20 (.52)
Third grade, SDA and PA & Diet	11	22.45 $\pm$ 15.53		31.81 $\pm$ 11.32		-0.19 (.57)
Fifth grade, SDA and PA & Diet	12	22.67 $\pm$ 18.79		22.25 $\pm$ 13.44		0.16 (.62)

^aMVPA: moderate to vigorous physical activity^bPDM: previous-day recall obtained in the morning^cPA Only: physical activity only interview content^dSDA: same-day recall obtained in the afternoon^ePA & Diet: physical activity and dietary intake integrated interview content