Assessing Physical Activity in Adolescents: Common Activities of Children in 6th - 8th Grades

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Objectives
To provide data for physical activity assessment in practice by describing the leisure time activities of adolescents and determining if the activities and the metabolic equivalents (MET levels) of those activities differ for boys and girls.

Data Sources
The study was conducted in five middle schools in three rural counties in North Carolina. Subjects were 1,211 6th, 7th, and 8th graders aged 11-14 (mean 12.2) years. Half (52.5%) were girls. The sample was 64% white, 24% African-American and 12% other races.

Results
The top five activities of boys were football, basketball, bicycling, running, and baseball; the top five activities of girls were talking, running, walking, bicycling, and dancing. The average MET was 5.3 for boys and 4.3 for girls (p=0.000). By grade levels, 6th graders had an average MET of 4.9 and the MET of 8th graders was 4.5 (p<0.05). Older youth, girls, and children of parents with more education reported significantly more sedentary activities than the other youth.

Implications for Practice
Physical activity is an integral component of overall health. Once activities and activity levels are known, current practices can be augmented or changed to accommodate improved understanding of physical activity. Because an active lifestyle is important in preventing obesity and other chronic conditions and for general health, nurse practitioners (NPs) should

INTRODUCTION

Physical activity is defined as "...any bodily movement produced by skeletal muscles that results in energy expenditure, measured in oxygen used, and calories expended" (Casperson, Powell, & Christenson, 1985, p. 126). Energy expenditure is generally expressed as a function of basal metabolic rate and physical activity, and is derived from amount of work, time period of work, or counts of movement, and converted into kilocalories or metabolic equivalents (METs). Because energy consumed as food and not expended in activity is stored as fat, regular physical activity in childhood is essential in primary prevention of obesity, early onset Type 2 diabetes, and future cardiovascular disease (CVD). Knowledge about adolescents' common activities is essential to allow nurse practitioners (NPs) to integrate effective assessment and promotion of physical activity into practice.

Engaging all people in regular physical activity is a leading objective of *Healthy People 2010* (U.S. Department of Health and Human Services, 2000). Promotion of healthy physical activity and counseling about its importance should be a priority for all health care professionals (Lemley, O'Grady, Rauckhorst, Russell, & Small, 1994; Pate et al., 1995; Sallis & Patrick, 1994; U.S. Department of Health and Human Services, 1996). A modest goal is achieving 30 minutes of physical activity per day for at least 30% of the population; however, that goal is not being met (Lemley et al., 1994; Pate et al., 1995; Sallis & Patrick, 1994; U.S. Department of Health and Human Services, 1996). A consensus report on adolescent physical exercise recommends nearly daily activity as part of the child's everyday routines and engagement in three or more sessions a week of 20 minutes duration at a moderate to vigorous level of exertion (Sallis & Patrick, 1994). About one-quarter of adolescents report no vigorous activity at all, and 19% of high school students report physical activity for only 20 minutes or more during physical education classes (U.S. Department of Health and Human Services, 1996).

REVIEW OF LITERATURE

The number of overweight children and adolescents is on the rise in the United States, with one in five children considered obese (BMI over 95th percentile for children of the same age and gender) and increasing trends in obesity in both children and adults (Dietz, 1998; Dietz & Gortmaker, 2001; Figueroa-Colon, Franklin, Lee, Aldridge, & Alexander, 1997; Goran, 2001; Goran, Reynolds, & Lindquist, 1999). Sedentary behavior is related to obesity in children. Data support the view that children are increasingly seden-

ask adolescents about their common activities and encourage them to continue the more vigorous activities and reduce time spent in sedentary pursuits. Prescriptive physical activity can be included for primary, secondary, or even tertiary prevention, thus crossing all levels of NP practice.

Key Words
Children, adolescents, exercise, health promotion, obesity.

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tary and do not engage in aerobic activity on a regular basis (Andersen, Crespo, Bartlett, Cheskin, & Pratt, 1998; Baranowski, Hooks, Tsong, Cieslik, & Nader, 1987; Gortmaker, Dietz, & Cheung, 1990; Harsha, 1995; Kann et al., 2000; Kimm et al., 2000; Manios, Kafatos, & Codrington, 1999; McMurray et al., 1993). The Third National Health and Nutrition Examination Survey (NHANES III) showed that 20% of U.S. children 8 to 16 years of age do not exercise vigorously more than twice a week (Andersen et al., 1998). In the 1999 Youth Risk Behavior Survey (YRBS), 45% of students nationwide did not participate in physical activities that made them sweat on 3 or more of the 7 days preceding the survey (Kann et al). In the 1991 YRBS less than 50% of 14 to 18 year olds reported engaging in moderate physical activity, with increasingly less activity reported as youth progressed from 9th through 12th grades (Kann et al., 1993).

Researchers have found that gender, socioeconomic status (SES), and possibly race are factors associated with activity levels. In general, boys are more active than girls (Garcia, Pender, Antonakos, & Ronis, 1998), report more participation in team sports, and have higher levels of aerobic fitness than females throughout adolescence (Aaron et al., 1993). These gender differences may already be present in middle school (Craig, Goldberg, & Dietz, 1996; Garcia et al., 1998). However, in children transitioning from elementary to middle school, activity level prior to transition was predictive of activity level following the transition (Garcia et al.). With regard to SES, the data are equivocal, with varying associations found between physical activity and SES (Aaron et al., 1993; Deheeger, Rolland-Cachera, & Fontvieille, 1997; Harrell, Gansky, Bradley, & McMurray, 1997; Kimm et al., 1996; Sallis, Zakarian, Hovell, & Hofstetter, 1996). Race is another factor that may be related to childhood physical activity, but the results of studies in children and adolescents are inconsistent. Investigators have shown that levels of physical activity are higher in white high school students than African-American or Hispanic adolescents, (Aaron et al., 1993; Andersen et al., 1998; Bradley, McMurray, Harrell, & Deng, 2000; Crespo et al., 2001; Heath, Pratt, Warren, & Kann, 1994; Kann et al., 2000; Kann et al., 1993; Myers, Strikmiller, Webber, & Berenson, 1996; Pate, Trost, Levin, & Dowda, 2000) but our study of elementary school children showed opposite results (Harrell et al., 1997). In NHANES III, Mexican-American and non-Hispanic African-American girls (8 through 16 years of age) reported less physical activity than white girls (Andersen et al., 1998; Crespo et al., 2001), while the YRBS data showed 14 to 18 year old Hispanic and black female students reported less physical activity than their counterpart white female students (Kann et al., 2000).

Even though knowledge of the common activities of youth would be very helpful to clinicians and educators, only a few investigators have reported the specific leisure time activities of children. Watching TV is the activity that has been studied most often. Andersen and associates (1998) found in NHANES III that 67% of children 8 to 16 years of age watched at least 2 hours and 26% watched 4 or more hours of TV a day. Highest rates of TV watching were found in boys aged 14-16 years and girls 11-13 years old (Andersen et al.; Crespo et al., 2001). A few other studies report a broader array of activities that indicate boys spend more time in vigorous physical activities than girls (Bradley et al., 2000; Harrell et al., 1997; Heath et al., 1994; Myers et al., 1996). In the 1999 YRBS, 55.1% of high school students reported that they played on sports teams (61.7% of males and 48.5% of females) (Kann et al., 2000).

Although childhood obesity and low levels of activity, with the associated health risks, are of national concern, (Goran et al., 1999) and this concern is reflected in objectives in *Healthy People 2010* (Section 22.7) (U.S. Department of Health and Human Services, 2000), little research has been conducted to determine the factors contributing to inactivity in youth. Evidence is accruing that both patterns of physical activity (Goran et al., 1999; Harsha, 1995; Kelder, Perry, Klepp, & Lytle, 1994; Malina, 1996; Telama, Yang, Laakso, & Viikari, 1997; Twisk, Kemper, & van Mechelen, 2000) and childhood obesity (Dietz & Gortmaker, 2001; Goran et al., 1999; Webber, Wattigney, Srinivasan, & Berenson, 1995) established in childhood and adolescence form patterns in adulthood. Nurse practitioners are effective in health promotion assessment (Alexy, 1985; Burns, 1994; Jessup & Harrell, 1996; Lemley et al., 1994), but in order to understand overall physical activity in

children, it is important to examine the common activities of youth, as they have implications both for their current health and potentially for their adult health. Further, knowing the common activities of adolescents provides important data for NPs interested in preventing obesity and promoting physical activity in this population.

This research describes the leisure time activities of a group of ethnically diverse middle school youth and specifically addresses the following questions: What activities are most frequently reported as the top three activities of 6th, 7th, and 8th graders and do those activities differ for boys and girls? In addition, does the average metabolic equivalent (MET) level (Ainsworth et al., 1993; Ainsworth et al., 2000) of the top three activities differ by grade, gender, race, or SES, and do the MET levels of the most vigorous and most sedentary of the top three activities reported by the subjects differ by grade, gender, race or SES?

METHODS

Setting and Subjects

This research is part of a larger study on Cardiovascular Health in Children and Youth (CHIC II). Subjects were 1,211 6th, 7th, and 8th graders from Cohort 3 of this study with a mean age of 12.2 years from five schools in three rural counties in North Carolina. Parents of all children in these grades were asked for permission for their children to participate, and children also gave their written assent. Exclusion criteria were the presence of chronic diseases such as diabetes or moderate to severe asthma, or learning disabilities, as reported by parents or teachers. Participation rate was 37.5% of all of the 6th, 7th, and 8th graders in the five schools; we were unable to obtain the number who were not eligible to participate. Slightly over half of the subjects (52.5%) were girls. The sample was 64% (n=777) white, 24% (n=291) African-American and 12% (n=143) other races. The demographics of the sample were essentially the same as those of the schools as a whole.

Variables and Instruments

Leisure time activities (LTAs) were assessed using a Physical Activity Checklist of 32 sedentary and non-sedentary activities. The children were asked to identify the three activities that they "usually do the most" (for 15 minutes or more) The activities were coded independently by two exercise physiologists (inter-rater reliability 100%) who assigned each activity a MET level of 2 (very low), 3 (low), 5 (moderate), or 8 (high) (Ainsworth et al., 1993), based on the Compendium of Activities. If a child's most common activity was not in the activity list, instructions were given to write the activity in one of the blank spaces provided and the MET value was determined as described above. The three most commonly reported activities are the focus of this paper.

The Physical Activity Checklist is a frequency checklist of a variety of common physical activities, both sedentary and active. The list is based on the Minnesota Leisure Time Activity Questionnaire for adults (Taylor et al., 1978) and is similar to a tool validated with fourth grade students (Sallis et al., 1993). In an earlier study, Cronbach's alpha was 0.74 and test-retest Spearman rho correlation was 0.70 (Gilmer, Speck, Bradley, Harrell, & Belyea, 1996).

Demographic variables including age, gender, and race were obtained from the youth on the questionnaire. A proxy measure for SES, the highest educational level of the father (or mother, if the father did not respond), was obtained from parental questionnaires. Socioeconomic status was grouped as follows: low = education of sixth grade or less through some high school, but did not graduate; medium = high school graduate or some college or specialized training; and high = college graduate or higher.

Procedures

A multiple assurance institutional review board (IRB) approved all forms and procedures. Informational letters, consent forms and questionnaires were sent to parents of all 6th, 7th, and 8th graders in the schools. Data were collected after obtaining written parental consent and subject assent. Trained research assistants administered questionnaires to the children during a regular school day.

Data Analysis

The percent of children who reported each activity as one of their top three activities is reported overall and by gender, race, grade, and SES. In addition, an activity score for each youth was determined by multiplying MET level by the time spent in one of the top three activities. The activities were assigned one of the 4 MET levels: 2 METs (very low), 3 METs (low), 5 METs (moderate) or 8 METs (high). Three activity-intensity scores were assigned to each individual child: (1) the average (mean) MET level of their top 3 activities, (2) the lowest MET level of the three activities (that is, their most sedentary activity), and (3) the highest MET level of the three activities (i.e., their most vigorous activity). These activity-intensity scores were compared by gender with t-tests and by grade, race and SES with one-way ANOVAs.

RESULTS

Overall, youth reported 84 different LTAs as one of their top three activities. Activities reported by at least 10% of both boys and girls are shown in Table 1. The top five activities of boys were football, basketball, bicycling, running and baseball, while the top five activities of girls were talking, running, walking, bicycling and dancing.

When categorized according to average MET level of the top three activities, there were significant differences by gender and grade (Table 2). Males had an average MET of 5.3, while the females had an average MET of 4.3. When the data were analyzed by grade level, the 6th graders had an average MET level of 4.9, which was significantly different from the 8th graders with an average MET level of 4.5 (p<0.05); there were no significant differences between 6th and 7th, or 7th and 8th graders.

Table 1. Activities Reported by Students as Being 1 of their Top 3 Activities

		Percent Reporting the Activity[1]		
	Estimated	**Overall[2]**	**Girls**	**Boys**
Activity	MET	*N*=1,212	*N*=659	*N*=544
		%	%	%
Running	8	25	25	26
Basketball	8	23	15	32
Bicycling	5	23	20	27
Football	8	18	5	34
Talking	2	18	27	7
Walking	3	18	24	10
Homework	2	14	16	11
Watching TV	2	12	12	13
Dancing	5	10	17	0.2
Reading	2	10	14	6
Soccer	8	10	6	15
Baseball	5	9	2	19
Housework	3	7	10	4
Video Games	3	7	3	12

Activities reported by at least 20% of subjects are shown in bold. [1]Only activities reported by at least 10% of boys or girls are listed [2]nine children did not list gender in questionnaire

Finally, there were no significant differences by race or SES.

Table 3 summarizes the sedentary activities the youth reported. There were no differences by race; however, significant differences were found by gender, grade, and SES. Females reported lower MET activities than males. Eighth graders reported significantly more sedentary activities than both 6th and 7th graders. There was no significant difference between the 6th and 7th graders. Children whose parents had less than a high school education (low SES) reported fewer sedentary activities than those whose parents had a college education or higher (high SES). There were no differences between children from low SES and middle SES families.

When we examined the most vigorous of the top three reported activities, there were no differences by grade, race or SES, but there was a significant difference by gender (Table 4). Males had significantly higher vigorous MET levels than females.

DISCUSSION

The results of our study indicated that, as expected, the boys were more active than the girls. Six of the top ten activities reported by the 6th to 8th grade boys were of moderate to high intensity, that is, a MET of 6 or higher (average was 5.4 METS), whereas only four of the top ten activities were of similar intensity for the girls (average was 4.3 METS). In addition the girls reported a greater number of sedentary activities than the boys.

Table 2. Average MET Levels of Top 3 Activities

	Average MET level			
	Mean	**SD**	***t*-statistic**	***p*-value**
By Gender			11.055	0.000
Male	5.35	1.60		
Female	4.31	1.56		
			F-statistic	*p*-value
By Grade[1]			3.756	0.024
Sixth	4.91	1.60		
Seventh	4.80	1.71		
Eighth	4.59	1.67		
By Race			2.850	0.058
White	4.70	1.57		
African American	4.87	1.84		
Other	5.09	1.73		
By SES			2.971	0.052
Less than high school	4.91	1.78		
High School/some College	4.81	1.65		
College or higher	4.52	1.59		

[1]Statistically significant difference between 6th and 8th graders only (p=0.026 from post hoc test)

Table 3. MET Levels of Most Sedentary of the Top 3 Activities

	Average MET level			
	Mean	**SD**	***t*-statistic**	***p*-value**
By Gender			8.435	0.000
Male	3.48	1.75		
Female	2.70	1.36		
			F-statistic	*p*-value
By Grade[1]			3.756	0.024
Sixth	3.16	1.56		
Seventh	3.14	1.72		
Eighth	2.82	1.49		
By Race			2.766	0.063
White	3.1	1.44		
African American	3.04	1.87		
Other	3.42	1.60		
By SES			5.073	0.006
Less than high school	3.29	1.80		
High School/some college	3.06	1.55		
College or higher	2.78	1.48		

[1]Statistically significant differences between 6th and 8th graders and 7th and 8th graders only (p=0.012 and p=0.029 from post hoc). [2]Statistically significant difference only between those whose parents had less than a high school education and those whose parents had a college education or higher (p=0.007 from post hoc).

Table 4. MET Levels of the Most Vigorous of the Top 3 Activities

	Average MET level			
	Mean	**SD**	***t*-statistic**	***p*-value**
By Gender			8.581	0.000
Male	7.05	1.68		
Female	6.07	2.11		
			F-statistic	*p*-value
By Grade[1]			1.741	0.176
Sixth	6.64	1.87		
Seventh	6.49	2.00		
Eighth	6.38	2.09		
By Race			1.948	0.143
White	6.44	1.96		
African American	6.61	1.09		
Other	6.82	1.79		
By SES			1.256	0.285
Less than high school	6.46	2.01		
High School/some college	6.57	1.98		
College or higher	6.31	2.03		

Previous studies have shown that males participate in activities with higher overall MET levels (Aaron et al., 1993; Kimm et al., 1996; Pate, Heath, Dowda, & Trost, 1996; Trost et al., 1996). Other studies have shown that the activities of boys in high school, such as sports, mechanics, and building, tend to be more active, while the activities of girls are more domestic and sedentary in nature (Anderssen & Wold, 1992; Deheeger et al., 1997; Pate et al., 1996; Pratt, Macera, & Blanton, 1999; Rekers, Sanders, Strauss, Rasbury, & Morey, 1989). Further, our findings are consistent with the findings in the earlier CHIC I study, although conducted with elementary rather than middle school children, where elementary school males were more active than females (average MET level of males=4.8 and females=4.2) (Harrell et al., 1997).

Investigators have previously reported that white adolescents have higher average MET levels than African-Americans or Hispanics (Aaron et al., 1993; Myers et al., 1996; Pivarnik, Taylor, & Cummings, 1998) and African-American females are more sedentary than white females (Heath et al., 1994; Pivarnik et al., 1998). Both the NHANES data (Andersen et al., 1998; Crespo et al., 2001; Pratt et al., 1999) and YRBS data (Kann et al., 2000; Pratt et al., 1999) showed that all girls reported less physical activity than boys, and that Hispanic and African-American girls reported more sedentary activities than non-Hispanic white girls. Additionally, the YRBS data revealed that Hispanic and African-American students reported less sports participation than white students (Pate et al., 2000; Pratt et al., 1999). In the CHIC I study of 3rd and 4th graders, we reported that African-American males engaged in more vigorous activities than white males. In contrast, white females did more vigorous activities than African-American females (Harrell et al., 1997). However, with the present cohort of middle school youth we found no differences in the MET levels between African-American and white youth. It is possible that, because all youth are apparently becoming less active, the differences between ethnic groups are reduced.

Our data indicated that SES was significantly related to participation in sedentary activities, with high SES youth reporting more sedentary activities. The review of literature contained conflicting data regarding SES and activity. Aaron and associates (1993) showed no difference in activity by SES in boys, but an association between higher SES and higher activity in girls. In contrast, we found in our earlier study that higher SES boys reported a greater proportion of sedentary activities than lower SES boys, and that the higher the SES, the more sedentary the children (Harrell et al., 1997). Thus, our findings about SES with middle school youth are similar to our results with elementary aged children.

Limitations

The method of data collection is a limitation of the study. Physical activity in children can be measured in a variety of ways. Some measures are based on direct monitoring, using behavioral observation or mechanical or electronic devices, such as heart rate monitors and pedometers. Another alternative is self-report method, which might include diaries, logs, questionnaires, and recall surveys. Self-report, the method used in this study, is commonly used in large epidemiologic studies for practical and logistic reasons but it is subjective and may not reflect daily routines. Children and adolescents may not remember their actual daily activities, or they may have reported favorite leisure time activities instead of actual activities. Further, self-report is subject to social desirability and reliance on memory. In addition, children may have included responses that they felt to be appropriate to the adults.

Strengths

The strengths of the study are the large sample size (1,211 subjects) and the inclusion of minority populations in the sample. Other strengths are that the children did not know the data collectors, the questions were worded to avoid gender bias, and the activities were alphabetized instead of grouped, which helped eliminate bias and a tendency to circle activities close together.

In summary we found that, among 6th-8th graders, males are generally more active than females. No differences were found by race in terms of MET levels, but there is some evidence suggesting that higher SES children are more sedentary than those of lower SES. More research is needed on the specific activities of children in this age group, especially by race within gender and by SES within gender. In addition, the growing gender gap, with girls becoming increasingly less active with increasing age, needs to be investigated.

IMPLICATIONS FOR PRACTICE

Nurse practitioners play a significant role in health promotion and disease prevention, and promoting a physically active lifestyle is an essential element in primary prevention of many diseases. Physical activity must be assessed and can be prescriptive in primary, secondary, and even tertiary prevention. In addition to indirect measurement of physical fitness, such as weight, height, body mass index, heart rate, blood pressure and skinfold thickness, it is essential for NPs to ask children and adolescents directly about activities or exercise during patient encounters.

Physical activity assessment can be an integral component of assessment. Not only is it important to ask about type of activity, as we report here, but also the frequency and the duration of the activity, which is easier to determine in a clinical setting than in a field study. It is also important to ask about some specific leisure time activities, for some children may not think that hobbies (i.e. dancing), play activities, or household chores can be included as physical activity. One way to do this is to question children about the activities that they enjoy doing, and then encourage them to increase the amount of time they spend in activities with the higher MET levels. Assessment forms can be modified to include physical activity assessment. A checklist of common activities can be used and tailored to the NP's unique population - in the case of adolescents, the common activities found in this study (see Table 1) can be used as a foundation for list development. Understanding that age, gender, and SES can be related to activity levels helps to hone assessment.

Assessment may indicate that the child is meeting activity recommendations, in which case the NP can reinforce healthy choices. If assessment demonstrates low levels of activity or high sedentary activity, the NP and the youth together can determine appropriate and enjoyable activities and make plans for integrating them into a daily routine.

Targeting interventions to increase physical activity in children requires knowledge of current activities. Understanding patterns of physical activity in children and adolescents provides a foundation upon which to develop age- and individual-appropriate interventions that include physical activity. Prescription of physical activity is often underused in practice (Timmerman, Reifsnuder, & Allan, 2000). Barriers to prescription of physical activity include a lack of experts in physical activity who are available to NPs (Timmerman et al., 2000); thus, expansion of collegial relationships is an important practice component. Time is always a barrier in practice. Efficient, but effective, mechanisms to aid assessment and discussion are essential.

Age-appropriate explanation of physical activity, energy expenditure in terms of calories consumed and burned, and the importance of physical activity for health and well-being are essential in patient encounters. Patient hand-outs can emphasize information discussed and serve as reminders regarding the importance of physical activity to health and well-being. Short lists of activities can be generated to aid as "check-off" lists for patients and NPs. These and other tools can be in examination rooms, available for patients to read, as well as available for NPs to use.

Because there is no ICD-code specific to "physical activity," billing of physical activity assessment or related intervention is generally integrated into related individual patient-appropriate codes, such as overweight (278.00 unspecified or 278.01 morbid), which includes general adiposity or family history of obesity; overeating (783.6); or a number of V-codes, such as those related to family history of diabetes type 1 or 2 (V19.0), screening for obesity (V77.8); school exam (V70.3), or family history of coronary artery disease, ischemia, or premature CAD (V17.3). Counseling codes can include dietary (V65.3), exercise (V65.41), or health instruction (V65.49). These V-codes are billable services, with appropriate health record documentation.

Ongoing planning and assessment are important in developing better knowledge about physical activity in children and adolescents. Understanding what children do will provide a more solid base to develop improved methods of assessment, strategies for intervention, and ongoing evaluation. These components of practice will support improved long-term health and contribute to the nation's health overall. Why is it important to encourage physical activity in youth? If we wish to ensure the health of the population in the future, the time to intervene is in childhood and adolescence. Physical activity and exercise patterns are formed in childhood, and continue into adulthood. Physical activity plays a role in preventing obesity, treating obesity, protecting against chronic illnesses and improving cardiovascular health. Only by being aware of childhood activity levels can we start to impact physical fitness and improve cardiovascular health, both now and in the future.

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