Children's Fitness and Access to Physical Activity Facilities

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Abstract

Introduction: The Medical College of Georgia FitKid project is investigating the effects of an after-school PA program on childhood obesity in a three year study. **Purpose**: To examine whether access (proximity) to PA facilities was related to children's level of fitness and self-reported PA in an East Georgia county. **Methods**: Home addresses from 594 children and PA facilities in the county were geo-coded. Access to PA was defined as the number of facilities within walking distance (0.5 mi). Fitness and self-reported PA were collected during baseline testing. **Results**: 96% students and all 86 PA facilities were geocoded. The average number of facilities within 0.5 and 1 mile from home address were significantly different between white and black students. Access was only moderately correlated to one cardiovascular disease (CVD) risk factor. No significant relationship was found between access to PA and fitness level and CVD risks. **Conclusion**: Access to PA may be influenced by factors other than proximity to facilities. Further study needs to explore other environmental factors that influence children's PA. (funded by NIH-DK63391).

Introduction:

In the last 20 years, an epidemic of obesity in America has emerged (Troiano, Flegal, Kuczmarski, Campbell, & Johnson, 1995). Among children, this trend has led to increases in non-insulin dependent diabetes mellitus (Type 2 diabetes) (Pinhas-Hamiel et al., 1996). The Medical College of Georgia FitKid project is an NIH funded initiative to investigate ways to stop and reverse the trend of obesity in elementary aged youth, and inhibit the development of Type 2 diabetes. Over one-third of American children are overweight (Wang, Ge, & Popkin, 2000), and the development of obesity can lead to increases in cardiovascular risk factors such as high cholesterol, high blood pressure, and increased risk for morbidity. The fast paced American lifestyle leaves families little time to prepare meals, or possibly to supervise children's after school activities. Often times, children fill these hours watching television or playing video games, sedentary activities that limit their instances of moderate and vigorous physical activity (Hancox, Milne, & Poulton, 2004). The availability and consumption of high fat, high calorie foods in this time period completes the "obesogenic" environment (Hill, Wyatt, Reed, & Peters, 2003). Environments that enable sedentary behaviors can lead to the development of overweight and possibly obesity.

Research has shown that children who had the highest levels of physical activity (ages 4-11) had "consistently smaller gains in BMI, triceps, and sum of five skin folds throughout childhood" (Moore et al., 2003). Children who maintain high levels of physical activity through early adolescence should gain less fat and thus protect against the development of the obesity related risk factors. The Surgeon General recommends that children participate in at least 60 minutes of physical activity most days of the week (Jackson et al., 2002). Moderate physical activity includes brisk walking, field games, and other behaviors. Vigorous physical activity sustains a high heart rate over time, and includes activities such as basketball, soccer, hockey, and swimming. Children can benefit from 1-2 hours of moderate-vigorous physical activity a day. Increased fitness and decreased fat acquisition are important to maintaining a healthy cardiovascular system.

An Australian study found that 54% of students, 9-11 years old, watched at least 20 hours of television a week, and 44% of students, 5-8 years (Commission, 2004). According to an American study, viewing time increases as children get older (Vandewater, Shim, & Caplovitz, 2004). Watching television and playing video games supplants the time that children might spend playing outdoors or participating in other physical activities. In a longitudinal study of youth television viewing and adult health, it was found that average weeknight viewing between the ages of 5 and 15 years was associated with higher BMI, lower fitness, and increased total cholesterol (Hancox et al., 2004). The conclusions of this study found that population-attributable fractions indicate that 17% of overweight, 15% of raised serum cholesterol, 15% of poor fitness can be attributed to watching more than 2 hours of television a day (Hancox 2004).

The MCG FitKid project aims to change the after school environment from an obesogenic supportive environment to a “fitogenic” one, an environment that supports and encourages physical activity. Sending a positive message of increasing activity encourages students to build lifestyle skills that will enable activity in their adolescent and adult years outside of the FitKid program. The goal is that building confidence and self-motivation in childhood will influence their desire and ability to maintain active lifestyles as they get older, reducing the development of obesity and related chronic disease risk factors. This project examined students’ access to physical activity resources in their home neighborhoods.

Methods:

Students were recruited from 18 county elementary schools. Nine schools were designated health screen only schools, and nine received health screenings and an after school program focused on physical activity. Home addresses of 594 children enrolled in the FitKid project were geocoded using TIGER line files (Map 1). Addresses from public access physical activity facilities in the country were also geocoded (Map 2). Facilities run by public and private entities were included. Access to physical activity was defined as the number of facilities within 0.5 mile or a 10 minute walk of the home address and within 1 mile of the home address. During baseline testing, each student performed a modified step test, which involved stepping on a 12-inch step for three minutes. The first heart rate after the three minutes was recorded and used to determine fitness level; the students were then divided into tertiles within the cohort. A lancet was used to obtain a drop of blood for determination of total cholesterol (mg/dL), HDLC, mg/dL, TC/HDLC ratio and glucose (mg/dL), using the Cholestech LDX system (Cholestech Corporation, Hayward, CA), with calibration to the CDC reference method. The test results are displayed in ~5 minutes. Resting seated systolic and diastolic BP (mm Hg) and heart rate (beats/minute) were measured with a Dinamap monitor after a 5-minute seated rest period; five measurements were taken at 1-minute intervals and the last three averaged.

Results:

The subjects for the study were 605 3rd grade students (47% male; 52% white, 54% black) in a northeast Georgia metropolitan area. The mean age was 8.7 years (SD=0.53). Data was collected at baseline of a 3-year longitudinal study to prevent obesity.

The average number of PA resources within 0.5mi of the subject's homes was 1.74. (Table 1). There was no significant difference between boys and girls or different racial groups in number of PA resources available within 1 mile or 0.5 mile from student's home (Table 2).

Correlation analysis indicated that the number of PA resources available within 1 mile (r=0.15) or 0.5 mile (r=0.13) from student's home was significantly related to level of HDL cholesterol (Table 5). The magnitude of correlation was very moderate. Access to PA was not related to other CVD risk factors.

Table 1. # of PA resources within 1 mile and 0.5 mile from home for boys and girls

		# of PA resources within 1 mile	# of PA resources within 0.5 mile
Male	Mean	1.77	.65
	Std. Deviation	1.837	.996
Female	Mean	1.71	.65
	Std. Deviation	1.798	.988
Total	Mean	1.74	.65
	Std. Deviation	1.815	.990

Table 2. # of PA resources within 1 mile and 0.5 mile from home for different racial groups

RACE		# of PA resources within 1 mile	# of PA resources within 0.5 mile
Caucasian	Mean	1.70	.59
	Std. Deviation	1.731	.896
African-American	Mean	1.83	.69
	Std. Deviation	1.894	1.032
Other	Mean	1.25	.57
	Std. Deviation	1.480	1.043
Total	Mean	1.74	.65
	Std. Deviation	1.815	.990

Table 3. Fitness, total cholesterol systolic and diastolic blood pressure, body mass index percentile, and HDL cholesterol for boys and girls

STSEX		Fitness	Total cholesterol	Systolic blood pressure	Diastolic blood pressure	Body mass index percentile
Male	Mean	94.25	162.38	111.91	66.57	68.29
	Std. Deviation	12.97	27.99	8.60	4.60	26.60
Female	Mean	96.34	163.90	110.86	66.12	68.80
	Std. Deviation	12.96	27.92	9.48	4.95	29.37
Total	Mean	95.35	163.21	111.36	66.33	68.56
	Std. Deviation	13.00	27.93	9.08	4.79	28.07

Table 4. Fitness, total cholesterol systolic and diastolic blood pressure, body mass index percentile, and HDL cholesterol for different racial groups

RACE		Fitness	Total cholesterol	Systolic blood pressure	Diastolic blood pressure	Body mass index percentile
Caucasian	Mean	98.47	163.39	109.95	65.16	67.57
	Std. Deviation	12.75	27.90	9.81	4.80	29.38
African-American	Mean	93.93	164.26	112.01	66.77	69.85
	Std. Deviation	12.63	27.83	8.72	4.64	27.12
Other	Mean	94.20	155.36	111.76	67.43	62.96
	Std. Deviation	14.72	28.25	8.47	5.11	29.65
Total	Mean	95.35	163.21	111.36	66.33	68.56
	Std. Deviation	13.00	27.93	9.08	4.79	28.07

Table 5. Correlations between # of PA resources within 1 mile and CVD risks

	# of PA resources within 1 mile	# of PA resources within 0.5 mile
Fitness	0.00	0.00
Total cholesterol	0.01	-0.05
Systolic blood pressure	0.00	-0.02
Diastolic blood pressure	-0.01	0.01
Body mass index percentile	-0.03	-0.07
HDL cholesterol	0.15**	0.13*

** $p < .003$; $p < .01$

Discussion

Findings from this study demonstrated that there was a difference in access to PA resources between black and white children. However, access to PA was only moderately related to student's HDL cholesterol and not related to other biological CVD risk factors in this study sample. This suggests that it is not sufficient to provide only access to PA. We need to explore other ecological factors influencing PA participation in children, such as quality of facilities and types of PA program offered in order to develop effective intervention programs (Brownson et al., 2004). GIS is a wonderful addition to the tools public health professionals use to investigate the etiology of health conditions. Its use enables professionals to quickly examine spatial relationships that would take hours and days to compile by hand. As more technology is introduced into public health, GIS will most certainly play a part in finding new ways to prevent obesity and chronic disease.

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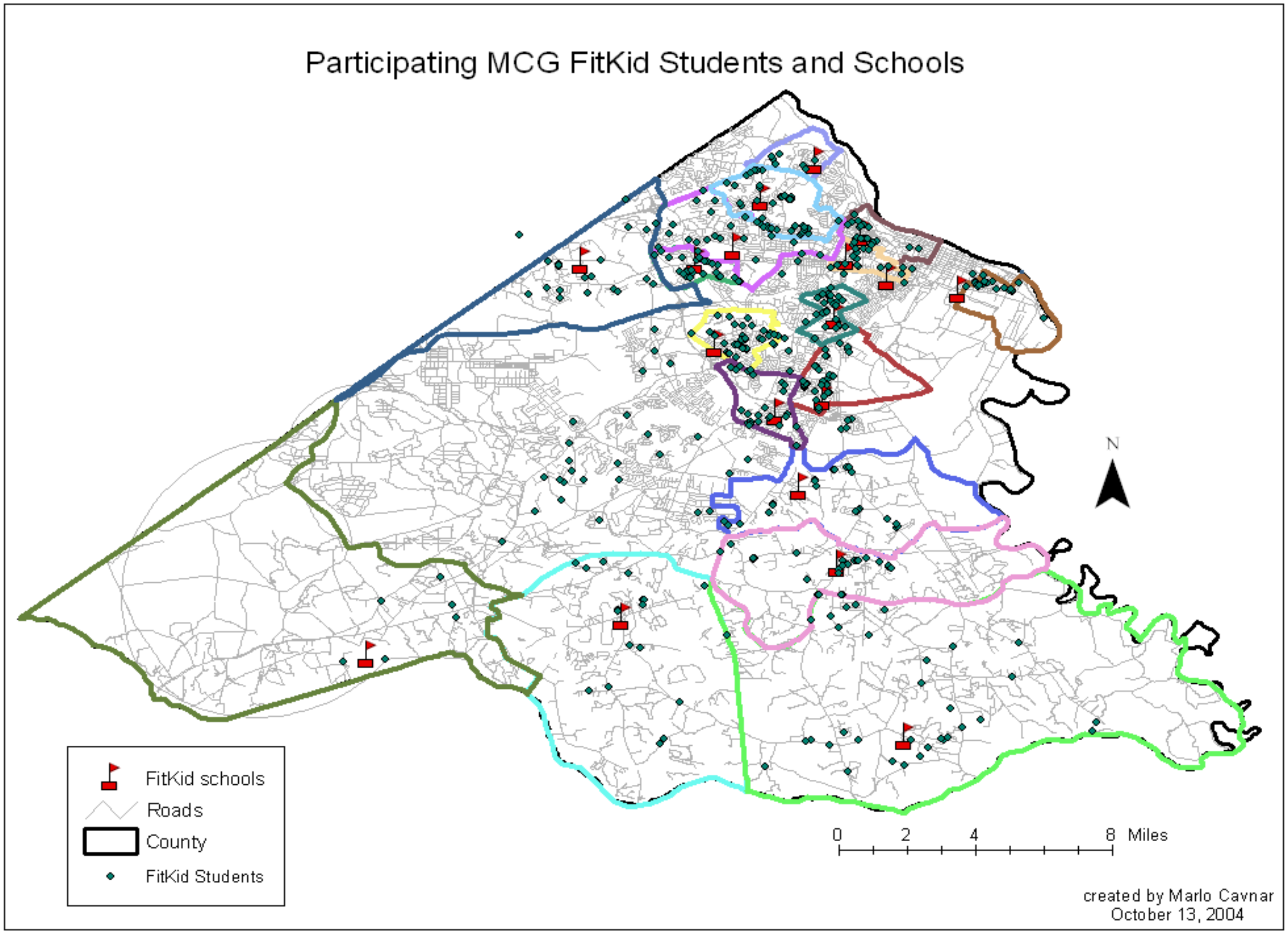
Map 1. Geocoded Students and Schools



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Map 2. Geocoded Physical Activity Resources and Participating Schools