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Brief Original Report

Association of outdoor recreation availability with physical activity and weight status in Minnesota youth

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ABSTRACT

Objective. Examine macro-level associations of youth physical activity (PA) and weight status with availability of outdoor recreation resources (i.e., parkland, forestland, natural preserves, nonmotorized trails, and motorized trails) across counties in Minnesota.

Methods. Hierarchical regression models examined if availability of recreation resources significantly improved prediction of PA and weight status of 9th and 12th grade boys and girls (2010) across Minnesota counties.

Results. The inclusion of county-level densities of recreational land variables did not produce a significant increase in R^2 for any of the models predicting 9th grade outcomes, yet county-level densities of recreational trails did significantly increase R^2 for both levels of PA and weight status. In contrast, the inclusion of recreational trails did not produce any significant increases in R^2 for 12th grade outcomes, although the inclusion of recreational land did significantly increase the R^2 for 12th grade girls achieving 30 min of PA 5 or more days of the week.

Conclusion. Findings indicate that various recreational land and trail types may have different impacts on and associations with PA and health outcomes. As such, it is important that future studies focus not only on parks, but also on other types of recreational lands and trails as well.

Introduction

With a third of adolescents ages 12–19 overweight or obese in the United States (Ogden et al., 2012) and only 29% of students in grades 9–12 achieving recommended levels of physical activity (PA; Centers for Disease Control and Prevention [CDC], 2012), understanding factors influencing youth's PA and weight status is critical. Parks and trails serve as important settings for both youth and adult physical activity (Bedimo-Rung et al., 2005; Godbey et al., 2005; Kaczynski and Henderson, 2007). Previous research shows associations between numerous park variables and youth PA and health, including proximity, size, access, and availability of parkland and facilities (Boone-Heinonen et al., 2010; Cohen et al., 2006; Norman et al., 2006; Potwarka et al., 2008; Roemmich et al., 2006; Wolch et al., 2011). However, most of these studies on parks, PA, and health outcomes primarily use the individual as the unit of analysis. Only a few studies have examined outdoor recreation opportunities and PA at macro-level scales (e.g., across counties or metropolitan areas; Edwards et al., 2011; Rosenberger et al., 2005, 2009; West et al., 2012). Understanding the benefits of outdoor recreation opportunities at macro-level scales is important for wide-reaching public health interventions.

Although macro-level studies continue to demonstrate the association of outdoor recreation opportunities with PA and health outcomes, to date no macro-level studies have focused on youth. Further, macro-level research has yet to explore the effect of different types of recreational resources on health (i.e. studies have relied on broad measures of public land rather than more specific land types such as parkland and natural preserves). Therefore, this study examines macro-level associations of youth PA and weight status with availability of various types of outdoor recreation resources across Minnesota counties.

Methods

Data on 9th and 12th grade youth PA and weight status are from the 2010 Minnesota Student Survey (MSS). In 2010, 130,908 students across 295 of 335 operating school districts completed the survey. All data was aggregated at a county level, stratifying by gender and grade (see Table 1). Valid data was available for 71 of the 87 counties in Minnesota. Self-reported PA was measured by asking students to report how many of the last 7 days they were physically active for a combined total of at least 30 min. Although current guidelines recommend a combined total of 60 min per day (CDC, 2011), the 2010 MSS assessed achieving at least 30 min and thus is an assessment of PA, but not if meeting recommended levels. Weight status was assessed using BMI percentiles (age and sex specific) calculated from students' self-reported weight and height to identify if overweight or obese (Ogden et al., 2012). For each grade and gender, models were developed to predict the percentage of students in four health measures: achieving 30 min of PA at least 5 days a week, achieving 30 min

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Table 1
Descriptive statistics of youth physical activity (PA), socio-demographics, and recreation availability of Minnesota counties.

	Overall	9th grade		12 grade	
		Boys	Girls	Boys	Girls
Number of counties reporting data	71	71	71	71	71
Mean age	–	14.7	14.6	17.7	17.6
PA and weight status, % of county youth[a]					
PA for 30 min. on at least 5 of last 7 days	51.7 (13.6)	64.5 (7.2)	51.0 (7.9)	57.6 (7.8)	33.7 (6.3)
PA for 30 min. for each of last 7 days	23.0 (11.0)	34.7 (7.6)	18.4 (5.4)	28.6 (5.9)	10.4 (4.0)
Overweight	14.2 (5.1)	17.1 (6.0)	12.8 (8)	14.1 (3.9)	12.8 (4.8)
Obese	10.6 (5.4)	14.4 (4.7)	6.7 (2.9)	14.3 (4.3)	7.0 (3.6)
Socio-demographics, % of county youth[a]					
Non-White[b]	17.0 (10.3)	19.9 (10.6)		14.0 (9.2)	
Rural[c]	61.6 (27.4)	61.6 (27.4)		61.6 (27.4)	
Free/reduced lunch	28.0 (10.1)	30.2 (9.2)	30.1 (9.9)	24.4 (8.5)	27.5 (11.2)
Safe neighborhood	95.5 (2.8)	94.9 (2.7)	94.7 (3.0)	95.7 (2.8)	96.7 (2.2)
Recreational land, % of county area[d]					
Parkland	0.9 (1.5)	–	–	–	–
Forestland	6.4 (15.1)	–	–	–	–
Nature preserve	2.8 (3.9)	–	–	–	–
Recreational trails, miles per 10 sq. miles[d]					
Non-motorized trails	1.4 (1.0)	–	–	–	–
Motorized trails	3.3 (1.4)	–	–	–	–

Data are mean (SD).
[a] Minnesota Student Survey, 2010. Minnesota Student Survey provided by public school students in Minnesota via local public school districts (or alternative education programs) and managed by the Minnesota Student Survey Interagency Team, 2010.
[b] To protect student identity, race/ethnicity available by grade but not gender.
[c] U.S. Census Bureau, 2009.
[d] University of Minnesota Center for Changing Landscapes & University of Minnesota Dept. of Forest Resources, 2011.

of PA all 7 days of the week, categorized as overweight, and categorized as obese.

Availability of outdoor recreation resources was measured on a per-area basis from a 2011 statewide inventory of parks and trails managed at the federal, state and local level, see Table 1; (University of Minnesota Center for Changing Landscapes and University of Minnesota Dept. of Forest Resources, 2011). Recreational land was classified as parkland (lands dedicated primarily for public use and recreation), forestland (managed for multiple uses, including timber production and recreation), or natural preserve (undeveloped and primarily dedicated to wildlife habitat, scientific exploration, and/or open space preservation). Trails were classified as nonmotorized (e.g., hiking, equestrian) or motorized (e.g., all-terrain vehicles, snowmobiles). A natural log transformation reduced the influence of extreme outlier counties of the three recreational land variables.

All four dependent variables were approximately normal for each grade-level and gender. Hierarchical regression models were examined to see if availability of recreation resources improved the prediction of the dependent variables. Step 1 included percentage of students non-White, on free or reduced-price lunch, and reporting a safe neighborhood, as well as percentage of county classified as rural (socio-demographic variables). Step 2 included percentage of county designated as parklands, forestlands, and natural preserves (recreational land variables). Step 3 included miles of non-/motorized trails per square mile (recreational trail variables). At each step, incremental changes in R^2 were assessed. Multicollinearity was monitored using bivariate correlation coefficients and Variance Inflation Factors, both of which were acceptable.

Results

The inclusion of county-level densities of recreational land variables did not significantly increase R^2 for any of the models predicting 9th grade outcomes (Table 2). However, the parkland variable was negatively associated with achieving 30 min of PA all 7 days of the week and positively associated with obesity among 9th grade boys, although this association only became significant once recreation trails were included in the model. County-level densities of recreational trails significantly increased R^2 for both levels of PA and weight status. Higher non-motorized trail densities were associated with 30 min of PA all 7 days of the week for 9th graders. Likewise, higher non-motorized trail densities were associated with lower obesity rates among 9th grade boys.

Models for 12th grade students found few significant associations (Table 2). The inclusion of recreational trails did not significantly increase R^2, yet the inclusion of recreational land did significantly increase the R^2 for 12th grade girls achieving 30 min of PA 5 or more days per week. Observed effects showed a negative association of natural preserves with increased PA. Including recreational land and trails did not produce other significant increases in R^2 among 12th graders, although several individual variables were significantly related with 30 min of PA all 7 days of the week. Specifically, among 12th grade boys, forestland and nonmotorized trails showed positive associations, whereas natural preserves revealed a negative association. Forestland also showed a positive association for 12th grade girls, although this association was no longer significant once recreation trails were added to the model.

Discussion

Findings reveal mixed associations between outdoor recreation availability, PA and weight status for Minnesota youth. The inclusion of recreational trails increased the model prediction in two PA models and one weight model. The availability of non-motorized trails was associated with greater PA rates among 9th grade boys and girls, and lower obesity rates among 9th grade boys. Although the inclusion of recreation trails did not increase model prediction for 12th graders, non-motorized trails were associated with greater rates of PA among 12th grade boys. Similar to Rosenberger et al.'s (2009) study of adults, this finding suggests the importance of non-motorized trails in promoting PA and maintaining healthy weight. Including recreational land increased the prediction for only one model among 12th grade girls, in which the availability of natural preserves was associated with decreased PA levels. Likewise, the availability of natural preserves was associated with decreased PA levels for 12th grade boys, whereas forestland was associated with increased PA, although these associations did not improve model prediction. These divergent associations may reflect the different focus of each of these lands, with greater emphasis on recreation opportunities on forestland than natural preserves, which often have limited access and offer mostly passive recreation opportunities (e.g., wildlife viewing). While previous studies show that