

Social and Physical Contexts of Schools and Neighborhoods: Associations With Physical Activity Among Young People in New Zealand

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Physical activity patterns among young people are influenced by factors at the individual, school, and community levels. At the individual level, physical activity participation is highest among males and younger adolescents, and socioeconomic differences are less consistently reported.¹ A body of research is emerging that demonstrates the role of schools in student physical activity patterns. Research has demonstrated the social environments and physical environments of schools to be associated with student physical activity behaviors.^{2,3} Specifically, social environments of school (e.g., teacher support,⁴ use of physical activity as a reward⁵) and physical environments (e.g., number of recreational features,⁶ accessibility of equipment outside school⁵) are associated with physical activity participation among young people. Yet school-based interventions to increase physical activity among adolescents have demonstrated minimal effectiveness, except when they involve local communities.⁷

Thus, there is growing interest and investment in research that aims to determine the influence of community-level factors on population physical activity.^{2,8} Neighborhoods can influence the engagement in physical activity by their population through numerous mechanisms including interpersonal relationships (e.g., social supports), social inequalities (e.g., socioeconomic position), and neighborhood characteristics (e.g., cohesion, access to resources, walkability).⁹ The relative importance of the influence of neighborhoods is often debated because adults easily move among neighborhoods for work, residence, and recreation, but young people may be more captive and susceptible to their neighborhood environments.

Previous studies examining the relationships between neighborhoods and physical activity have been limited in methodology and measurement. For example, numerous studies have

Objectives. We sought to determine the association between school- and neighborhood-level characteristics and physical activity among young people.

Methods. We collected the data as part of Youth'07, a nationally representative survey of the health and well-being of high school students in New Zealand. In total, 9107 students from 96 schools participated (63% response rate). Students answered questions about their schools (e.g., support for physical activity) and neighborhoods (e.g., community cohesion, disintegration, safety, and recreational facilities). We created school-level measures by aggregating the students' reports within their schools and we created neighborhood-level measures by aggregating the students' reports of their neighborhoods to the census area unit of their residential address. We conducted analyses by using cross-classified random-effects models controlling for individual variables, with school and neighborhoods treated as random effects.

Results. Schools characterized by high sports team participation and neighborhoods characterized by high social connections were positively associated with student physical activity. We observed few other significant characteristics of school and neighborhood environments.

Conclusions. Our findings highlight that opportunity for sports participation and strong social connections in neighborhoods are particularly important for youths' physical activity. (*Am J Public Health.* 2011;101:1690–1695. doi:10.2105/AJPH.2011.300171)

reported the association between perceived availability of recreational facilities and physical activity for young people.^{10–13} When these studies are analyzed at the individual level, the major limitation is that young people who are more physically active may perceive more opportunities for physical activity in their environments than do those who are less active. More recently, researchers have improved on the measurement of the physical environment through use of geographic information systems to link objective measures of neighborhood resources.^{14,15} Although this approach inherently yields more accurate measures of the neighborhood,¹⁵ it assumes that all young people have equitable access to their neighborhoods and that their perceptions of their environments do not influence how they engage with them. For example, perceived safety of an environment may act as a barrier to physical activity,

independent of what the actual reported safety indicators may be.¹⁶ Therefore, reliance on objective measures of the physical environment may overlook significant features of the environment that influence how the population relates to it.

Measuring the social contexts of young people and their neighborhoods is somewhat more difficult and cannot easily be achieved with objective measures. Thus, previous studies describing the influence of social contexts in youths' physical activity have been predominantly operationalized at the level of the student, not the neighborhood. For example, several studies have found associations between peer engagement and parent support and engagement in physical activity with physical activity among young people.^{17–19} Fewer studies have used appropriate multi-level statistical techniques to document the

relationship between the community social context and youths' physical activity.² Two studies^{20,21} from the Project on Human Development in Chicago Neighborhoods used a multilevel approach and found that neighborhood-level safety and social cohesion are associated with physical activity among young people, but little is known about how generalizable these findings are outside Chicago and with different populations.

Our aim, then, was to determine the influence of social and physical features of school and neighborhood environments on youths' physical activity in a nationally representative sample of secondary school students in New Zealand. We sought to contribute to the growing literature on the topic by using multilevel statistical techniques to examine the associations between both social and physical attributes of schools and neighborhoods and youths' physical activity in a nationally representative sample.

METHODS

We collected the data for the current study in 2007 as part of Youth'07, a national survey of the health and well-being of New Zealand secondary school students (aged approximately 13–18 years). Full details of the methodology and survey design of the Youth'07 survey are described elsewhere²² and are available at <http://www.youth2000.ac.nz>.

Briefly, we randomly selected participating students through a 2-stage clustered sampling design. First, we randomly selected 115 schools for participation; then we randomly selected students from the school roll. In total, 9107 students from 96 schools agreed to participate in the survey. The final response rate for schools was 84% and for students was 74%. Among the most common reasons for students not participating were being absent from school, being unavailable, or declining to take part.²²

School principals consented to participation in the survey on behalf of the boards of trustees. We provided selected students and their parents with information sheets about the survey. Students consented themselves to participate in the study on the day of the survey. The University of Auckland Human Subject Ethics Committee granted ethical approval for the study.

All data were collected during the school day. On the day of the survey, students arrived at a designated room where they were given an anonymous login code to access the survey. The Youth'07 survey included a 622-item multimedia questionnaire administered on a tablet computer, anthropometric measurements, and identification of their census meshblock number (based on their residential address).

Individual-Level Measures

The students self-reported age, gender, and ethnicity. We assessed ethnicity with the standard measures developed for the New Zealand census²³ where participants can select all of the ethnic groups that they identify with. Approximately 40% of students identified with more than 1 ethnic group.²² To facilitate statistical analyses, we created discrete ethnic populations by using a prioritization method whereby students were assigned to 1 ethnic group in the following order: Māori, Pacific Islander, Asian, other ethnicity, European.²³

We used the 2006 New Zealand Deprivation Index to determine deprivation.²⁴ The index measures 8 dimensions of deprivation (income, home ownership, support, employment, qualifications, living space, communication, and transportation) with 2006 census data based on small area geographical (meshblock) units. During the survey, students were asked to provide their home address to ascertain the small area geographical unit in which they lived. That unit was recorded (but not their address) and later matched to the Deprivation Index. We categorized the index deciles into 3 groups reflecting low deprivation (1–3), middle levels of deprivation (4–7), and high deprivation (8–10). Living in an urban or rural locality was based on the location of the student's residential meshblock. Urban areas have a population of 1000 or greater, whereas rural areas have a population between 300 and 999.²²

We assessed physical activity with a single item, "During the past 7 days, on how many days were you physically active for a total of at least 60 minutes per day? (Add up all the time you spend in any kind of physical activity that increases your heart rate and makes you breathe hard some of the time.)" as is asked in the Youth Risk Behavior Survey.²⁵ We chose this measure of physical activity as it aligns with global

recommendations for physical activity and health for children and young people.²⁶ Eight responses were offered ranging from 0 days to 7 days. We treated the physical activity variable as a continuous variable and the responses were approximately normally distributed.

School-Level Measures

We assessed all school-level measures in the student survey and aggregated them to the school level. The median number of students in each school was 81 (range, 15–382). We assessed whether school encourages physical activity with the item, "How much does your school encourage you to be physically active?" with 4 response options ranging from "not at all" to "very much." We assessed physical education (PE) class attendance with the item, "Over the past week did you go to a PE class?" (yes or no). We assessed school sports teams with the question, "Do you belong to any school sports teams?" (yes or no).

Neighborhood-Level Measures

We assessed all neighborhood-level measures in the student survey and aggregated them to the neighborhood level; neighborhoods were defined by Census Area Units, which are aggregations of adjacent meshblocks. In New Zealand, Census Area Units approximate the size of suburbs and have a median population of 2000 people.²⁷ The 9107 students participating in the Youth'07 survey resided in 1187 Census Area Units (62% of the total in New Zealand). Census Area Units that contained fewer than 10 participating students were dropped from analyses to ensure the reliability of the neighborhood-level measures.²⁸ Thus, we retained 6101 students from 292 Census Area Units for analysis. The median number of students in the remaining 292 Census Area Units was 16 (range, 10 to 256). Students who were not included in the current analyses did not differ from those who were retained by gender, age, or deprivation, but were more likely to reside in rural areas.

We assessed community cohesion with 6 items asking, "Do you trust the people in your neighborhood?"; "Do you feel you belong to your neighborhood?"; "Do the people in your neighborhood help each other?"; "Are people in your neighborhood friendly?"; "Do you like your neighborhood?"; and "Do you like the

TABLE 1—Individual Characteristics of Reduced Study Sample: Youth’07 Survey, New Zealand, 2007

Characteristic	% (95% CI ^a)
Gender	
Male	52.8 (46.8, 58.8)
Female	47.2 (41.2, 53.2)
Age, y	
13	20.2 (18.2, 22.3)
14	23.2 (21.8, 24.7)
15	21.4 (20.4, 22.4)
16	19.0 (17.9, 20.2)
17	16.1 (14.4, 17.9)
Ethnicity	
Asian	13.9 (7.9, 19.9)
European	50.3 (44.8, 55.8)
Māori	19.2 (15.4, 22.9)
Other	6.0 (4.8, 7.1)
Pacific Islander	10.6 (6.2, 15.0)
Deprivation	
Low	36.4 (29.7, 43.2)
Middle levels	37.7 (34.5, 41.0)
High	25.8 (19.0, 32.7)
Locality	
Urban	87.6 (83.1, 92.0)
Rural	12.4 (8.0, 16.9)

Note. CI=95% confidence interval. Sample size was n=6101. Youth’07 survey is a national survey of secondary school students.

^aAccounts for clustering.

people in your neighborhood?” Students could respond to each item with 1 of 4 responses (never, not often, sometimes, all the time). If students were missing an item, that item was assigned the mean of the other items. The responses to the 6 items were averaged and possible scores ranged between 1 and 4 (Cronbach’s $\alpha=0.90$).

We assessed neighborhood disintegration as a scaled measure with 7 items asking “What are the bad things about the area where you live?” including not enough footpaths, rough and broken footpaths, not enough street lighting, no one cares how the place looks, too many dogs, not enough bike lanes, and rubbish and mess. Students could choose as many from the list as appropriate. The responses to the 6 items were averaged and possible scores ranged between 0 and 1 ($\alpha=0.63$).

We assessed neighborhood safety with a single item asking, “Do you feel safe in your neighborhood?” Students could choose from 1 of 5 responses ranging from “not at all” to “all the time.”

We assessed availability of recreational facilities with the question “What things are there to do in the area where you live that you can walk to from home?” including a park, a youth center, the movies, a skateboard ramp, a basketball court or hoop, a sports field, a swimming pool or place to go swimming, a gym, a bike track, a place to play video games, other, or there is nothing to do where I live. We averaged the numbers of facilities, and possible scores ranged between 0 and 1.

Analysis

We conducted all analyses with the SAS version 9.2 (SAS Institute, Cary, NC). We generated the descriptive statistics (means and percentages) at the student level by using the survey procedures to account for the clustering and weighting of the data set. To account for clustering of students within schools and neighborhoods, we generated cross-classified random-effects models²⁹ to determine the associations between the school- and neighborhood-level attributes and student physical activity with both schools and neighborhoods treated as random effects.

We standardized all school- and neighborhood-level variables before analyses. In the first stage of regression analyses, we tested each of the school- and neighborhood-level variables in separate regression models with schools and neighborhoods treated as random effects. In the second stage of regression analyses, we ran the same models again but with age, gender, ethnicity, and deprivation included as confounders. As the dependent variable (physical activity) was approximately normally distributed, we assumed a Gaussian distribution. The covariance matrix was unrestricted. Associations were considered to be statistically significant at $P<.05$.

RESULTS

The demographic characteristics of the final study sample are described in Table 1. On average, students met the recommendation for physical activity (1 hour per day) on 4.3 days (95% confidence interval [CI]=4.2, 4.4) in the

previous 7 days (Table 2). There were no differences in the mean number of days doing physical activity by deprivation level or urban or rural locality, but female students, older students, and Asian students did physical activity on fewer days than did other students.

Descriptions of the neighborhood-level characteristics are displayed in Table 3. The intraclass correlations (ICCs) for the school-level measures ranged between 5% and 6% and the reliability for each school-level measure was good. The ICCs for the neighborhood-level measures were between 5% and 18%, with neighborhood-level reliability estimates in the acceptable ranges. We assessed the correlations between each of the area-level measures

TABLE 2—Days Doing at Least 1 Hour of Activity in Past Week: Youth’07 Survey, New Zealand, 2007

Characteristic ^a	Days Doing 1 Hour of Activity	
	No.	Mean (95% CI ^b)
Total	5482	4.3 (4.2, 4.4)
Gender		
Male	2916	4.7 (4.5, 4.8)
Female	2566	3.9 (3.7, 4.0)
Age, y		
13	1113	4.5 (4.4, 4.6)
14	1289	4.4 (4.2, 4.5)
15	1180	4.4 (4.2, 4.5)
16	1036	4.2 (4.0, 4.4)
17	864	3.9 (3.7, 4.0)
Ethnicity		
Asian	764	3.6 (3.4, 3.9)
European	2831	4.4 (4.2, 4.5)
Māori	1032	4.3 (4.2, 4.5)
Other	323	4.3 (4.0, 4.6)
Pacific Islander	532	4.6 (4.3, 4.9)
Deprivation		
Low	2013	4.3 (4.1, 4.5)
Middle levels	2070	4.2 (4.1, 4.4)
High	1328	4.3 (4.2, 4.5)
Locality		
Urban	4713	4.3 (4.1, 4.4)
Rural	699	4.4 (4.2, 4.6)

Note. CI=95% confidence interval. Youth’07 survey is a national survey of secondary school students.

^aDemographic characteristics of reduced sample sizes.

^bAccounts for clustering.

TABLE 3—Description of School- and Neighborhood-Level Measures: Youth’07 Survey, New Zealand, 2007

Measure	No.	No. of Items	Range of Scores	Mean (95% CI)	Reliability	ICC, ^a %	Correlation With Deprivation ^b
School-level measures							
School encourages physical activity	96	1	2.4–3.8	3.06 (3.0, 3.1)	0.772	5.2	0.061
Student attends PE class (past week)	96	1	0.33–1.0	0.71 (0.6, 0.7)	0.781	5.5	0.080
School sports teams	96	1	0.13–1.00	0.58 (0.5, 0.6)	0.813	6.7	–0.163
Neighborhood-level measures							
Community cohesion	292	6	2.15–3.83	3.16 (3.1, 3.2)	0.523	5.8	–0.33
Neighborhood disintegration	292	7	0.00–0.41	0.10 (0.1, 0.1)	0.546	6.3	0.429
Neighborhood safety	292	1	2.50–4.89	4.13 (4.1, 4.2)	0.599	7.8	–0.391
Availability of recreational facilities	292	11	0.05–0.64	0.34 (0.3, 0.3)	0.791	18.2	0.153

Notes. CI = 95% confidence interval; ICC = intraclass correlation; PE = physical education. Youth’07 survey is a national survey of secondary school students.

^aIntraclass correlation for school-level variance and neighborhood-level variance for school-level measures and neighbourhood-level measures, respectively.

^bPearson correlation coefficient.

and individual-level measures to determine potential issues of collinearity. Deprivation was the individual-level measure most highly correlated with any of the area-level measures, but, as the highest correlation was only 0.4, collinearity did not threaten the stability of the regression models.³⁰

In the unadjusted analyses, schools characterized by students attending PE classes and school sports teams were positively associated with the number of days young people did physical activity (Table 4). Likewise, neighborhoods characterized by high community cohesion and safety were also positively associated with physical activity. When we entered age, gender, ethnicity, and deprivation into the model as individual-level covariates, the

positive relationships retained statistical significance for school sports teams (B=0.19; SE=0.05; P<.001) and community cohesion (B=0.08; SE 0.05; P=.025). We observed no relationships between school encouraging physical activity and PE class attendance at the school level and disintegration and availability of facilities at the neighborhood level and physical activity. Table 4 also includes the random parameters estimates for each model. The residual variance for physical activity with no school- or neighborhood-level covariates in the model was 0.12 at the school level and 0.039 at the neighborhood level. When we controlled for age, gender, ethnicity, and deprivation, the variances were reduced to 0.064 and 0.027, respectively.

DISCUSSION

We aimed to describe the association between school and neighborhood characteristics and physical activity among young people. In the fully adjusted analyses, schools characterized by high sports team participation and neighborhoods characterized by strong social relationships were associated with more physical activity among young people. By contrast, we found no relationships between school encouragement for physical activity, PE class attendance, neighborhood safety, or availability of physical resources and physical activity.

Overall, physical activity levels among New Zealand young people were very low. The

TABLE 4—Regression Coefficients and Robust Standard Errors for Associations Between Neighborhood Measures and Days per Week Doing at Least 1 Hour of Physical Activity: Youth’07 Survey, New Zealand, 2007

	Unadjusted			Adjusted ^a			Random Parameters ^a		
	B	SE	P	B	SE	P	Neighborhood	School	Residual
School encourages physical activity	0.084	0.056	.145	0.066	0.049	.178	0.029	0.062	4.021
PE class attendance (past wk)	0.129	0.055	.022	0.075	0.046	.112	0.027	0.064	4.021
School sports teams	0.228	0.055	<.001	0.186	0.049	<.001	0.028	0.047	4.019
Community cohesion	0.108	0.036	.003	0.081	0.036	.025	0.026	0.062	4.021
Neighborhood disintegration	0.007	0.034	.849	–0.019	0.037	.599	0.028	0.064	4.021
Neighborhood safety	0.083	0.037	.024	0.061	0.037	.102	0.028	0.061	4.021
Availability of facilities	0.015	0.034	.664	0.035	0.033	.286	0.027	0.064	4.022

Note. PE = physical education. Youth’07 survey is a national survey of secondary school students.

^aAdjusted for age, gender, ethnicity, and deprivation.

proportion of students meeting the recommendation for an hour of daily physical activity was only 11%.²² By the same measure, 17% of young people did an hour of daily physical activity in the United States.³¹ Even with objective measures of physical activity in nationally representative studies, the proportion of young people who do the recommended amounts of physical activity are low and concerning.³²

Schools can promote physical activity in a number of ways for young people, including physical education classes, opportunities for activity during breaks during the school day, extracurricular sports and activity-based events, and access to recreational facilities and equipment.³ We found that schools characterized by high sports team participation were significantly associated with student physical activity whereas encouragement for physical activity and PE class attendance were not. Although participation in sports is obviously associated with physical activity at the student level, less is known about the impact of a school environment promoting sports and physical activity among the students.

Our findings are consistent with a Canadian study of middle- and high-school students that also reported a positive relationship between school varsity sports availability and student physical activity.⁶ That we did not observe a relationship between PE class attendance and school encouragement of physical activity is of interest and contributes to the mixed findings of previous research. Findings from a nationally representative study of adolescents in the United States showed that PE class attendance was positively associated with physical activity when analyzed at the individual level.³³ However, a multilevel study of Canadian middle-school students found no relationship between physical education measured at the school level and student physical activity.⁵ Likewise, findings from previous research on the contributions of the social environments of schools to youths' physical activity were also inconclusive.^{2,5} It may be that schools in New Zealand are relatively homogenous with respect to PE class attendance and school encouragement of physical activity. Physical education classes are part of the national education curriculum and, therefore, are compulsory for all schools in New Zealand until the end of year 10. However, the degree of between-school variation for PE class attendance and

school encouragement of physical activity was only slightly lower than that of sports team participation.

Socially cohesive neighborhoods, through their shared goals, collective trust, and social norms, can encourage healthy behaviors, such as physical activity.⁹ Our findings that socially cohesive neighborhoods were associated with greater physical activity among young people are consistent with those of the Project on Human Development in Chicago Neighborhoods, which found that community cohesion²⁰ (measured through surveys of community residents) was positively associated with youths' physical activity, whereas neighborhood disorder²¹ was negatively associated with physical activity. Likewise, in a recent survey of Portuguese young people, student perception of the social environment in their neighborhoods was positively associated with physical activity levels.¹⁰

Interestingly, we did not observe any relationship between neighborhood access to recreational facilities and physical activity. These findings are inconsistent with previous research on this topic. Studies of perceived neighborhood recreational facilities,¹⁰⁻¹³ objectively measured neighborhood recreational facilities,^{14,15} and physical activity among young people have suggested a positive relationship. Yet, a nationally representative study of neighborhood access to open spaces in New Zealand found no association with adult physical activity.³⁴ Furthermore, Witten et al.³⁴ found that residents in approximately 75% of neighborhoods in New Zealand lived within a 2-minute drive to a park and 30-minute drive to a beach. Thus, it may be that we did not observe a relationship between neighborhood facilities and physical activity because, overall, access is very good for the New Zealand population. Our lack of findings related to neighborhood disintegration and physical activity are difficult to relate to previous research because of the ways this measure was operationalized. For example, physical disorder (e.g., graffiti, rubbish) has been reported as inversely associated with physical activity,²¹ whereas the findings related to walking or cycling infrastructure have been inconsistent.⁸ The lack of findings with relation to neighborhood safety and physical activity in the current study are consistent with reviews^{2,8,16} on the topic that concluded mixed findings for perceived safety and physical activity.

Strengths and Limitations

Our study is one of the first nationally representative studies of young people that used multilevel methodologies to examine the social and physical contexts of schools and neighborhoods on physical activity. Other strengths of the current study include the large, diverse population of young people and good survey response rates. That said, our study has several limitations to consider in interpreting the findings. First, our measure of physical activity was crude; this crudeness was necessary because the Youth'07 survey is a broad health and well-being survey, and comprehensive or objective measures of physical activity were not feasible. However, we used the same measure of physical activity as the Youth Risk Behavior Survey²⁵ as a means for creating comparability across studies. Second, we defined the neighborhood based on the administratively defined Census Area Unit. This definition of neighborhood may not be consistent with how the young people conceptualized their neighborhoods in the survey items. Likewise, because we dropped Census Area Units with fewer than 10 students to ensure the reliability of the neighborhood-level measures, young people living in rural areas may have been systematically underrepresented in the current analyses.

Lastly, we may not have measured all of the important aspects of the schools and neighborhoods for determining youth physical activity. For example, in the current analyses we did not include measures of social inequality, racial discrimination, or social capital, yet it has been hypothesized that these factors may be important influences on the physical activity of young people.⁹ Similarly, we were unable to measure important aspects of the home environment and other student characteristics that are important determinants in youths' physical activity.²

Conclusions

Our findings are generally consistent with a growing body of literature that emphasizes the importance of schools and neighborhoods in creating opportunities for adolescents to be physically active. In particular, our findings highlight that the social aspects of neighborhoods (e.g., neighborhood connection) rather than physical attributes may be particularly important. ■

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Contributors

J. Utter and S. Denny devised the research questions and conducted the statistical analyses. J. Utter drafted the article. E. Robinson provided statistical advice and oversight. All authors contributed to the design of the overall Youth'07 survey, to the interpretation of analyses, and to the critical revision of the article.

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Human Participant Protection

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