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Disparities in the food environment surrounding US middle and high schools

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Summary

Background—Disparities in the type and density of food retail outlets have been hypothesized as a possible cause of differential obesity rates across racial/ethnic and income groups. Several local studies have documented differences in business environments by sociodemographic neighbourhood characteristics, but no data specific for youth have been published. This study analyses the food environment surrounding all public middle and high schools in the USA.

Methods—Buffers were calculated with a radius of 400 and 800 m from the main entrance of public secondary schools in the USA ($n = 31,622$), and business establishments within those buffers were identified using InfoUSA proprietary business listings. Indicators of any convenience store, limited-service restaurant, snack store or off-licences/liquor store and counts of businesses were regressed on the proportion of students eligible for free school meals, Title I eligibility of the school, racial/ethnic composition, location and student/teacher ratio.

Results—Hispanic youth are particularly likely to attend schools that are surrounded by convenience stores, restaurants, snack stores or off-licences. This effect is independent and in addition to poverty (i.e. students eligible for free school meals or schools that are Title I eligible) or location (urban core, suburban, town, rural). The association between other racial groups and nearby businesses is weaker, with the exception of off-licences, where a higher proportion of minority groups increases the probability of off-licences in close proximity to the school. Middle schools have fewer surrounding businesses than high schools, and larger schools have fewer surrounding businesses than smaller schools.

Conclusions—Easy availability of snacks, sodas and fast food in the immediate vicinity of a school could easily negate school food policies, especially among students who can leave campus. Surrounding food outlets could also lower the effectiveness of health education in the classroom by setting a highly visible example that counters educational messages. There are several clear differences across sociodemographic groups with, arguably, the most pernicious being the location of off-licences. These disparities may represent an important type of environmental injustice for minorities and lower-income youth, with potential adverse consequences for dietary behaviours.

Keywords

Obesity; Disparities; School environment; Food outlet

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Ethical approval

None sought.

Competing interests

None declared.

Background

Disparities in health risks in the USA across racial/ethnic and income groups have been documented for toxic waste sites, air pollution and industrial sites.¹ In response, a 1994 Presidential Order requires every federal agency to make ‘... achieving environmental justice part of its mission...’ and to reduce disproportionate impacts on minority low-income populations.² Most of the research and policy efforts have focused on toxic substances near residences, but environmental justice advocates argue that a wider range needs to be considered. The Institute of Medicine, a division of the National Academy of Sciences in the USA, has expanded the scope to all places where people live, work and play³; others have included factors that compromise healthy lifestyles in the definition of a ‘toxic environment’,⁴ such as exposure to unhealthy foods, barriers to physical activity, or environmental factors that encourage tobacco use or excess alcohol consumption. While clinical settings and informational strategies have been the focus for interventions in the past, there is agreement that the obesity epidemic and disparities in obesity stem from social and environmental factors that need to be understood and modified for effective prevention.^{5–7} This broader view may be particularly relevant for reducing sociodemographic health disparities because behavioural risk factors are major causes of premature mortality.^{8–10}

National data on local environmental characteristics are difficult to collect for larger geographic areas, regardless of the behavioural health risk at issue; and studies generally have a limited geographic scope, often focused on a single metropolitan area. Two exceptions in the USA are a national study of alcohol outlets and a national study of facilities related to physical activity.^{11,12} These studies found that alcohol outlets were more common and commercial physical activity facilities were less common in lower-income neighbourhoods; there were also some differences by racial/ethnic composition.^{11,12} Local or regional studies of disparities in the food environment have been conducted in several cities in the USA.^{13–17} In the UK, a related research interest appeared around the idea of ‘food deserts’, which are areas where there is little or no food retail provision.^{18,19} The hypothesis is that food deserts create a barrier to healthy eating that differentially affects low-income households, single parents, the elderly and groups with limited transportation.^{20,21} However, the evidence base for food deserts in the UK may have been overinterpreted by food activists and policy makers.¹⁹ In the USA, evidence for food deserts is ambiguous as neighbourhoods of lower socio-economic status often have more stores^{22–24} and may even have lower prices.^{14,19,25} On the other hand, US studies ranging back to the 1960s have consistently found that large suburban supermarkets have the lowest prices, whereas small grocery stores and convenience stores, which are more common in poorer urban neighbourhoods, have the highest prices.²⁶ More consistently, recent research found a higher density of less healthy food outlets in lower-income neighbourhoods.^{17,27}

This paper approaches the issue from a slightly different angle by looking at the areas surrounding schools. Many lifelong behaviour patterns are shaped in childhood and adolescence, which is why these age groups are emerging as the key group in obesity prevention efforts. This paper analyses the location of convenience stores, limited-service restaurants, snack stores and off-licences (stores specializing in selling alcohol, in the US known as liquor stores) around all middle and high schools in the USA in relation to a school’s racial/ethnic composition, student eligibility for free school meals, grade level, school resources and urban location. This analysis considers establishments within 400 and 800 m of the main school entrance, which is close enough that students are aware that these establishments are within a short walking distance and probably on the way to and from school for many. The food environment surrounding schools could easily negate school food policies and health education in the classroom, especially in high schools with an open campus policy that allows students to leave campus during their lunch break. About one-third of high school districts have open campus policies²⁸ and an open campus policy triples the number of students getting lunch from

a convenience store or fast food restaurant.²⁹ Commercial outlets are not randomly located, but aim to be near potential customers and tend to be clustered through zoning regulations. In Chicago, fast food restaurants are clustered in areas within a short walking distance from schools, with an estimated three to four times as many restaurants within 1.5 km of schools than if restaurants were distributed randomly.³⁰ It is not clear whether the environments around schools differ by school characteristics or the sociodemographic profile of students, which is the question addressed by this paper.

Methods

Schools

The Department of Education's primary database on secondary education in the USA is the Common Core of Data (CCD). CCD is a database of all public schools and school districts and is designed to make data comparable across all states. In the 2003/2004 data, 16,470 schools were classified as middle schools and 18,994 as high schools. For this paper, the following variables were used or calculated: percentage of students that are non-Hispanic Black, Hispanic, Asian or American-Indian; percentage of students eligible for free school meals; Title I eligible school; student/teacher ratio; and urban, suburban, town or rural location. Racial/ethnic composition is obviously central to the issue of demographic disparities. Eligibility for free school meals is determined by family income and therefore indicates socio-economic status of the student body. Title I is the foundation of the federal commitment to closing the achievement gap between low-income and other students, and is therefore an indicator of a school with an economically disadvantaged student body. The location variables are defined as follows: 'urban' means the school is within the principal city of a Metropolitan Core Based Statistical area (CBSA); 'suburban' is a place within a CBSA that is not the core city; 'town' is an incorporated place with more than 2500 people but not located within a CBSA; and 'rural' is any other place defined as rural by the Census Bureau.

There are two sets of co-ordinates. The coordinates in the CCD address file generally match the main entrance of the school and are more complete, whereas the co-ordinates in the CCD survey file indicate a different point on campus. However, that is not always the case and there are errors in both files. Schools were excluded if the coordinates were too inconsistent (discrepancies of more than 0.01°), and 2496 of the 35,464 schools were excluded from the analysis for this reason. In addition, 505 schools had no students enrolled and 880 operating schools did not report enrolment data by race/ethnicity and were excluded (39 of those also had inconsistent co-ordinate data). For the remaining 31,622 schools, the address file coordinates were used. Schools with missing data on other variables (student/teacher ratio, eligibility for free school meals etc.) were included when possible.

Businesses

Information on the business environment comes from InfoUSA listings. InfoUSA collects information on approximately 11 million private and public US companies, which are located by address geocoding. The data were last updated in January 2006, although that does not mean that all listings were revised; the majority of listings will be a few years old. InfoUSA claims that 90% of businesses are exactly coded to their street address and more than 99% to a census block group, although the actual accuracy of data is almost certainly lower. This analysis selected the following types of business by their North American Industry Classification System (NAICS) codes: limited-service restaurants (NAICS code 72221); snack and non-alcoholic beverage shops (722213, a subset of limited-service restaurants); convenience stores or food marts (44512); off-licences (44531); and alcoholic drinking places (7224). The NAICS has replaced the Standard Industry Classification (SIC) system, which did not distinguish convenience stores from supermarkets or limited-service restaurants from other restaurants.

The existence of finer classification does not assure that it is applied consistently in the data, and one common classification problem appears to be that full-service restaurants are also included in the limited-service restaurant category (but not the reverse). Although the NAICS code for limited-service restaurants alone was selected, the text therefore refers to ‘restaurants’. There is no specific ‘fast food’ category in either NAICS or its predecessor SIC. Fast food restaurants are typically limited-service establishments where patrons order or select items and pay before eating. One category that would appear to be important for students is snack establishments (industry 722213), which primarily sell ice cream, donuts, biscuits, sweets, non-alcoholic drinks, sodas and coffee. The NAICS does not make finer distinctions, and industry 722213 includes Baskin-Robbins or Dunkin’ Donut franchises as well as Starbucks coffee shops.

Analysis

For each school, buffers were created with a radius of 400 and 800m from the main entrance, and the numbers of establishments within those areas were calculated. The 400-m-radius buffer has been suggested in previous health research because that distance is easily walked in 5 min.³¹ A 400-m radius covers a total area of 0.5 km². This could be too small to describe the business environment because school campuses can cover much of that area and relevant businesses fall just outside the area. For example, the high school campus in Santa Monica, CA, is 0.2 miles wide and 0.3 miles long. The 800-m buffer provides an alternative measure. Even the 800-m buffer is much smaller than the median US census tract, which is 10 times larger than the 400-m buffer.

An ideal analysis would take advantage of details about the street network, and calculate walking distances from school entrances and exits. This aspect of spatial analysis remains limited by data availability. The software exists but there are no national data on the shape of school campuses and pedestrian entry/exit locations, and national street network data are acceptable for calculating driving distances but not walking distances.

For each buffer, the number of each type of establishment was calculated and an indicator of any versus no establishments was created for: (a) convenience stores; (b) restaurants; (c) snack stores; (d) off-licences; and (e) any of these types of business. In contrast to administrative geographic definitions, which differ in size and shape, buffers have the same size; therefore, the number of establishments captures the density per square kilometre. In multivariate analyses, the dependent variable is either the number of establishments regressed in a negative binomial model on explanatory variables or an indicator variable regressed in a logit model. The negative binomial model is an extension of the Poisson model that allows for overdispersion, for example, caused by unobserved heterogeneity. In the negative binomial regression with k explanatory variables, the incidence rate is $r = \exp(\beta_0 + \beta_1 x_1 + \dots + \beta_k x_k + \nu)$ for a unit exposure (in this case, per 400 m), where e^ν is an unobserved variable with a Gamma distribution. Table 4 displays the estimated incidence rate ratios e^{β_i} , i.e. the ratio of the incidence rate after a one unit increase in x_i to the original incidence rate.

Explanatory variables include: Title I eligible school; percentage of students eligible for free school meals; percentage of Hispanics; percentage of non-Hispanic Blacks; percentage of Asians; suburban location; town location; rural location (reference group: urban); middle school (reference group: high school); student/teacher ratio; and total number of students. The unit of analysis is the school, not weighted by student enrolment. Weighting by student enrolment does not change qualitative results and has only a small effect on the magnitudes. Although the data are for the universe of public schools, not just a sample of schools, school enrolment and businesses are changing constantly; therefore, the data can be interpreted to be a sample from the larger population of school/business observations at different points in time.

With this interpretation, statistical tests distinguish important effects from random variation in student enrolment or business openings/closings.

Results

Table 1 shows descriptive statistics stratified by level of school. There are no significant differences between middle and high schools in the number of convenience stores within 400 m and the number of off-licences within 400 or 800 m; all other comparisons are statistically significant at $P < 0.001$. The most important differences are that middle schools are smaller, more likely to qualify for Title I, and more likely to have a majority of students who are eligible for free school meals. Differences in the business environment are relatively small, which was an unexpected finding given the differences in school size and location.

Table 2 stratifies schools by the existence or absence of a particular type of business within 400 m. The rows show schools without any businesses within 400 m ($n = 17,972$), schools with at least one business within 400 m ($n = 13,650$), schools with at least one convenience store within 400 m ($n = 5335$), and schools with at least one off-licence within 400 m; arguably the least desirable type of establishment among those considered ($n = 2849$). Ordering schools in this way reveals a very strong association with student and school characteristics. For example, consider the first column (Title I eligible school): among schools with no businesses within 400 m, 36.9% are Title I eligible. The percentage of Title I eligible schools increases to 40.0% among schools with at least one convenience store, restaurant or off-licence, 42.2% among schools with at least one convenience store, and 43.1% among schools with an off-licence within 400 m.

The gradient is even stronger for race/ethnicity. In schools with no businesses within 400 m, 13.6% are Hispanic and 12.8% are non-Hispanic Black. In schools with nearby convenience stores, 17.6% are Hispanic and 18.2% are non-Hispanic Black. In schools with at least one off-licence within 400 m, 21.7% are Hispanic and 22.7% are non-Hispanic Black. There were no significant differences for percentage of Asians, percentage of Native Americans, total enrolment and student/teacher ratio, and these variables are not shown. However, there is also an important difference in terms of location, in that schools with nearby off-licences are more likely to be in an urban area and those with no businesses in a rural area; potentially an important confounder.

Tables 3 and 4 show the results from the multivariate analysis, and Table 5 provides additional sensitivity analyses stratifying by location. In Table 3, the dependent variable is whether or not there is at least one business of a certain type within 400 m. In Table 4, the dependent variable is the number of outlets (a measure of density). The entries in Table 3 are odds ratios and standard errors associated with the explanatory variables. In some ways, this provides a mirror image of Table 2, which is stratified by business environment and gave the means of the explanatory variables. Odds ratios that are significantly different from 1.00 at $P < 0.01$ are in bold. Regarding economic characteristics, a higher proportion of students eligible for free school meals increases the likelihood of any nearby businesses (other than snack stores) and is significant for any business, convenience stores and restaurants. A similar association holds for Title I eligibility of schools. However, remarkably, student poverty, after controlling for type of location, is not predictive of nearby off-licences, even though low-income neighbourhoods nationally have a higher density of alcohol outlets.¹²

Hispanic students are more likely to be in schools surrounded by restaurants, snack stores or off-licences. A higher percentage of Asian or non-Hispanic Black students is associated with a higher likelihood of nearby off-licences. In contrast, there is no significant association between the proportion of non-Hispanic Blacks and any businesses, convenience stores,

restaurants or snack stores after controlling for location (direct effect only, see Table 5 for interaction sensitivity analyses). Thus, the strong association seen in bivariate comparisons disappears for non-Hispanic Blacks when distinguishing urban, suburban, town and rural locations. As expected, locations other than urban are associated with fewer businesses, middle schools are associated with fewer surrounding businesses than high schools, and larger schools are associated with fewer businesses than smaller schools, probably because they also cover more of the area within 400 m of the main entrance. There is no clear or consistent effect of student/teacher ratio.

Table 4 repeats the analysis using counts of establishments within 400 m, thus analysing the density of food-related businesses. The qualitative results are unchanged, and even the magnitude of the incidence rate ratio is similar to the odds ratio for the less common types of stores (convenience stores and off-licences).

A number of sensitivity analyses were conducted to test whether the findings are robust to model specifications, with the main concern being possible interactions between location and race/ethnicity. Generally, the main findings from Tables 3 and 4 hold when urban, suburban, town and rural areas are analysed separately. The largest difference between a pooled and a stratified analysis is for the percentage of non-Hispanic Blacks, and Table 5 shows the incidence rate ratios for percentage of non-Hispanic Blacks when stratifying the models by location. The notable result is that in urban areas, Black students tend to be exposed to more food businesses than their non-Hispanic White counterparts, but the opposite is true in rural areas and towns. For restaurants, the stratified analysis shows significantly higher rates in urban areas and significantly lower rates in rural areas, which disappear in the pooled analysis of Table 4. The qualitative results also remain largely unchanged when using 800-m buffers, except that results tend to be more statistically significant.

Discussion

This paper has looked at disparities in the food environment surrounding public secondary schools across racial/ethnic groups nationwide. Hispanic students are particularly likely to be in schools that are surrounded by convenience stores, restaurants, snack stores or off-licences. This effect is independent and in addition to poverty (i.e. students eligible for free school meals or schools that are Title I eligible). The association between other racial groups and nearby businesses is weaker or non-existent, with the exception of off-licences, where a higher proportion of minority groups increases the probability of an off-licence very close to the school.

Environmental factors may contribute to the increasing prevalence of obesity, especially in minority and low-income populations. Several recent studies argued that observed associations between presence or absence of fast food outlets and neighbourhood deprivation may provide support for environmental explanations for the higher prevalence of obesity in poor neighbourhoods.^{17,27} In New Orleans, researchers found a link between fast food restaurants and Black and low-income neighbourhoods.¹⁷ In England and Scotland, there are more McDonald's restaurants in poorer neighbourhoods.²⁷ In three US states, low-income neighbourhoods had more grocery stores and fewer supermarkets, fruit and vegetable markets, bakeries, specialty stores and natural food stores.²⁴ Housing prices and rents tend to be lower near busy streets and commercial areas, so it is not surprising to see an association between more commercial outlets (particularly fast food restaurants that are often located on major streets and intersections) and residential characteristics. It is much less obvious that a similar association would hold for school neighbourhoods, and this study provides a different angle on this issue.

So far, the hypothesis that differential business structures affect eating patterns and obesity remains just a plausible hypothesis. This is a limitation of this paper and the literature at the moment. The next step is to collect evidence on this missing link. While this is the most important next research step, there are other limitations that future work could address. While the data are geographically comprehensive, business listings are typically incomplete. In the study data, the classification of restaurants by NAICS codes is not ideal. An alternative, as done in the UK study, would be to focus on selected restaurant chains, but that creates a different bias by omitting non-franchised establishments. The data include public schools classified by the Department of Education as middle or high schools. Private schools are excluded as well as elementary schools that include higher grades.

Easy availability of snacks, sodas and fast food in the immediate vicinity of a school may negate internal school food policies, especially among students that can leave campus. Surrounding food outlets could also lower the effectiveness of health education in the classroom by setting a highly visible example that counters educational messages. There are several clear differences across sociodemographic groups with, arguably, the most pernicious being the location of off-licences. These disparities may represent an important type of environmental injustice for minorities and lower-income youth, with potential adverse consequences for dietary behaviours.

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Table 1

Descriptive statistics.

	Middle schools <i>n</i> = 14,984	High schools <i>n</i> = 16,638
Number of students	617 (385)	766 (773) ^a
Student/teacher ratio	16.4 (4.7)	16.0 (6.7) ^a
Location		
Urban	23.8	22.3 ^a
Suburban	36.8	28.5 ^a
Town	12.6	11.6 ^a
Rural	25.7	37.8 ^a
Title I school	51.1	26.6 ^a
<50% of students non-Hispanic White	31.9	28.3 ^a
>50% students eligible for free school meals	25.9	16.2 ^a
Businesses within 400 m		
Convenience stores	0.21 (0.54)	0.21 (0.54)
Restaurants	1.6 (5.41)	2.0 (8.03) ^a
Snack stores	0.14 (0.57)	0.17 (0.78) ^a
Off-licences	0.11 (0.41)	0.12 (0.45)
Businesses within 800m		
Convenience stores	0.77 (1.22)	0.72 (1.17) ^a
Restaurants	6.2 (16.9)	7.1 (27.97) ^a
Snack stores	0.53 (1.51)	0.60 (2.3) ^a
Off-licences	0.45 (1.12)	0.45 (1.27)

Note: Descriptive (unadjusted) statistics. Standard errors in parentheses except for variables expressed in percentages.

^aHigh schools significantly different from middle schools at $P < 0.001$. Location classification was undetermined for 471 schools.

Table 2

School characteristics by presence and absence of businesses within 400 m.

	Title 1 eligible schools (%)	Students eligible for free school meals (%)	Hispanic students (%)	Non-Hispanic Black students (%)	Non-Hispanic White students (%)	Schools in urban area (%)	Schools in suburban area (%)	Schools in town (%)	Schools in rural area (%)
Schools without any convenience stores, restaurants or off-licences within 400 m (n = 17,972)	36.9	29.8	13.6	12.8	70.0	16.8	33.5	10.5	39.3
Schools with at least one convenience store, restaurant or off-licence within 400 m (n = 13,650)	40.0	33.7	16.8	17.1	60.8	30.4	31.7	14.6	23.4
Schools with at least one convenience store within 400 m (n = 5335)	42.2	35.7	17.6	18.2	59.4	31.7	26.8	16.1	25.4
Schools with at least one off-licence within 400 m (n = 2849)	43.1	35.9	21.7	22.7	49.7	42.2	31.7	11.3	14.9

Note: Descriptive (unadjusted) statistics. The difference in percentages between the first data row (no businesses) and any other row is statistically significant at $P<0.001$ for every variable in this table. Differences are insignificant for percentage of Asian students, total enrolment and student/teacher ratio (not shown).

Table 3

Odds ratios: predictors of business types near schools.

Predictors	Any business within 400 m (mean 0.43)	Any convenience store within 400 m (mean 0.17)	Any restaurant within 400 m (mean 0.39)	Any snack store within 400 m (mean 0.10)	Any off-licence within 400 m (mean 0.09)
Title I eligible school	1.067 (0.032)	1.071 (0.041)	1.09 (0.033)	1.12 (0.058)	1.09 (0.058)
Students eligible for free school meals (%)	1.77 (0.154)	1.99 (0.217)	1.52 (0.133)	0.69 (0.098)	1.07 (0.15)
Student body race/ethnicity (%)					
Hispanic	1.42 (0.104)	1.18 (0.11)	1.41 (0.104)	1.94 (0.22)	2.25 (0.26)
Non-Hispanic Black	0.89 (0.066)	0.92 (0.09)	0.87 (0.064)	0.84 (0.106)	1.94 (0.023)
Asian	1.01 (0.191)	0.49 (0.14)	1.25 (0.24)	4.26 (1.01)	4.27 (1.14)
Native American	0.522 (0.081)	0.53 (0.11)	0.55 (0.09)	0.91 (0.31)	0.84 (0.27)
Location (compared with urban)					
Suburban	0.66 (0.025)	0.67 (0.03)	0.68 (0.025)	0.69 (0.038)	0.77 (0.046)
Town	0.87 (0.042)	1.02 (0.06)	0.87 (0.04)	0.58 (0.05)	0.70 (0.056)
Rural	0.34 (0.015)	0.51 (0.029)	0.34 (0.015)	0.18 (0.04)	0.34 (0.027)
Middle school (compared with high school)	0.76 (0.021)	0.85 (0.03)	0.75 (0.02)	0.79 (0.038)	0.77 (0.037)
Student/teacher ratio	0.997 (0.002)	0.987 (0.003)	0.9995 (0.0025)	1.01 (0.004)	1.01 (0.004)
Total enrolment	0.9997 (0.00002)	0.9997 (0.00003)	0.9997 (0.00002)	0.999987 (0.00004)	0.99956 (0.0004)

Note: Odds ratios based on multivariate logistic regression with variable in top row as the dependent variable. Standard errors in parentheses. Entries in bold: odds ratio significantly different from 1.0 at $P < 0.01$.

Table 4

Incidence rate ratios for number of establishments within 400 m of schools.

Predictors	Number of convenience stores	Number of restaurants	Number of snack stores	Number of off-licences
Title I eligible school	1.046 (0.037)	1.05 (0.031)	1.12 (0.059)	1.08 (0.055)
Students eligible for free school meals (%)	1.97 (0.194)	0.54 (0.070)	0.51 (0.072)	1.08 (0.15)
Student body race/ethnicity (%)				
Hispanic	1.18 (0.097)	2.15 (0.159)	2.37 (0.29)	2.55 (0.29)
Non-Hispanic Black	0.99 (0.83)	1.23 (0.088)	1.13 (0.14)	2.14 (0.24)
Asian	0.75 (0.18)	4.65 (0.89)	8.91 (2.46)	5.52 (1.40)
Native American	0.53 (0.11)	0.73 (0.12)	1.13 (0.405)	1.26 (0.36)
Location (compared with urban)				
Suburban	0.69 (0.03)	0.65 (0.024)	0.66 (0.038)	0.83 (0.047)
Town	1.01 (0.05)	0.71 (0.034)	0.535 (0.044)	0.72 (0.057)
Rural	0.56 (0.029)	0.25 (0.011)	0.157 (0.013)	0.36 (0.027)
Middle school (compared with high school)	0.86 (0.03)	0.78 (0.02)	0.785 (0.038)	0.77 (0.036)
Student/teacher ratio	0.991 (0.003)	1.0001 (0.0024)	1.004 (0.004)	1.000 (0.004)
Total enrolment	0.9997 (0.00003)	0.9998 (0.00002)	0.99987 (0.00004)	0.9996 (0.0004)

Note: Incidence rate ratios based on negative binomial regression with variable in top row as the dependent variable. Standard errors in parentheses.
Entries in bold: incidence rate ratio significantly different from 1.0 at $P < 0.01$.

Table 5

Incidence rate ratios for number of establishments within 400 m of schools by location for non-Hispanic Blacks.

Predictors	Number of convenience stores	Number of restaurants	Number of snack stores	Number of off-licences
Urban	1.14 (0.16)	1.95 (0.23)	1.20 (0.22)	3.45 (0.63)
Suburban	1.02 (0.17)	1.26 (0.17)	1.07 (0.25)	2.32 (0.49)
Town	0.80 (0.18)	0.54 (0.11)	0.36 (0.17)	0.70 (0.27)
Rural	0.85 (0.18)	0.51 (0.097)	0.30 (0.19)	1.4 (0.57)

Note: Incidence rate ratios based on negative binomial regression with variable in top row as the dependent variable. Same statistical model as in Table 4, but separate models by location. Standard errors in parentheses. *Entries in bold:* incidence rate ratio significantly different from 1.0 at $P<0.01$.