The Effect of Neighborhood Socioeconomic Status on Education and Health Outcomes for Children Living in Social Housing

Patricia J. Martens, PhD, Daniel G. Chateau, PhD, Elaine M. J. Burland, PhD, Gregory S. Finlayson, PhD, Mark J. Smith, MSc, Carole R. Taylor, MSc, Marni D. Brownell, PhD, Nathan C. Nickel, PhD, Alan Katz, MB, ChB, MSc, James M. Bolton, MD, and the PATHS Equity Team

Adequate housing is a critical determinant of health. Social housing (also known as public housing) is an important aspect of public policy, the purpose being to provide quality housing at affordable rents to individuals and families who could not otherwise afford this.

In the province of Manitoba, Canada, social housing residents pay approximately one quarter of their income for rent. In 2009, there were approximately 13 000 social housing units, accommodating 31 000 Manitobans, nearly 50% of whom were younger than 20 years.[1] Because children constitute almost half the residents in social housing, it is important to investigate children's health and education outcomes when one is exploring the impact of social housing. Is living in social housing associated with differential outcomes compared with not living in social housing? Does placement of the social housing unit itself, in wealthier or poorer neighborhoods, have an additional effect? A study of the provincial capital city, Winnipeg, is an ideal setting to answer these questions. Social housing units are distributed throughout Winnipeg's neighborhoods ranging from low to high socioeconomic status (SES) based on average household income (Figure 1).

Many studies show associations between area-level SES and child health or education outcomes, such that the wealthier the area, the better the outcomes.[2–6] Studies around the world have shown an independent effect of neighborhood SES on child and adolescent educational outcomes, even after they controlled for family, peer, and school effects.[4,7–18]

However, some studies contradict this, finding nonsignificant or trivial effects of neighborhood.[19–23] A review by Leventhal et al.[8] reinforces the importance of neighborhood SES effect on adolescent development, with those living in higher socioeconomic areas

Objectives. We explored differences in health and education outcomes between children living in social housing and not, and effects of social housing's neighborhood socioeconomic status.

Methods. In this cohort study, we used the population-based repository of administrative data at the Manitoba Centre for Health Policy. We included children aged 0 to 19 years in Winnipeg, Manitoba, in fiscal years 2006–2007 to 2008–2009 (n = 13 238 social housing; n = 174 017 others). We examined 5 outcomes: age-2 complete immunization, a school-readiness measure, adolescent pregnancy (ages 15–19 years), grade-9 completion, and high-school completion. Logistic regression and generalized estimating equation modeling generated rates. We derived neighborhood income quintiles (Q1 lowest, Q5 highest) from average household income census data.

Results. Children in social housing fared worse than comparative children within each neighborhood income quintile. When we compared children in social housing by quintile, preschool indicators (immunization and school readiness) were similar, but adolescent outcomes (grade-9 and high-school completion, adolescent pregnancy) were better in Q3 to Q5.

Conclusions. Children in social housing had poorer health and education outcomes than all others, but living in social housing in wealthier areas was associated with better adolescent outcomes. (*Am J Public Health*. Published online ahead of print September 11, 2014: e1–e11. doi:10.2105/AJPH.2014.302133)

showing more positive results in educational achievement and behavioral and emotional outcomes, and less risky sexual activity (including reductions in adolescent pregnancy). The authors describe conceptual models relating this advantage to institutional resources, norms, and collective efficacy of neighborhoods, and relationships. But they also identify a weakness in most studies to date—people have a choice where they live, so some low-SES families may choose to live in a higher-SES area because of motivation, which may also influence outcomes.

The strength of our study is that we controlled for this effect by researching those living in social housing where choice is limited because of allocation methods and high occupancy rates; thus, although families are given choice as to neighborhood when filling out an application, Manitoba Housing may not be able

to accommodate applicants with their first location of preference because of the size of the unit required. As well, population-based analyses possible by using administrative databases housed at the Manitoba Centre for Health Policy allow for analyses of all children, not just those agreeing to primary data collection.

There are mixed results in the literature concerning social housing and health or educational outcomes. The Moving to Opportunity study found limited effects in reading and mathematics scores 4 to 7 years after families were given the opportunity to move from social housing to private dwellings in a higher-SES area.[24] One limitation was that few families moved to a high-SES area; rather, most families moved to a "less poor" area where the school's ranking was similar to the school in the families' area of origin. As well, during the 4 to 7 years following, most families resided in a substantially
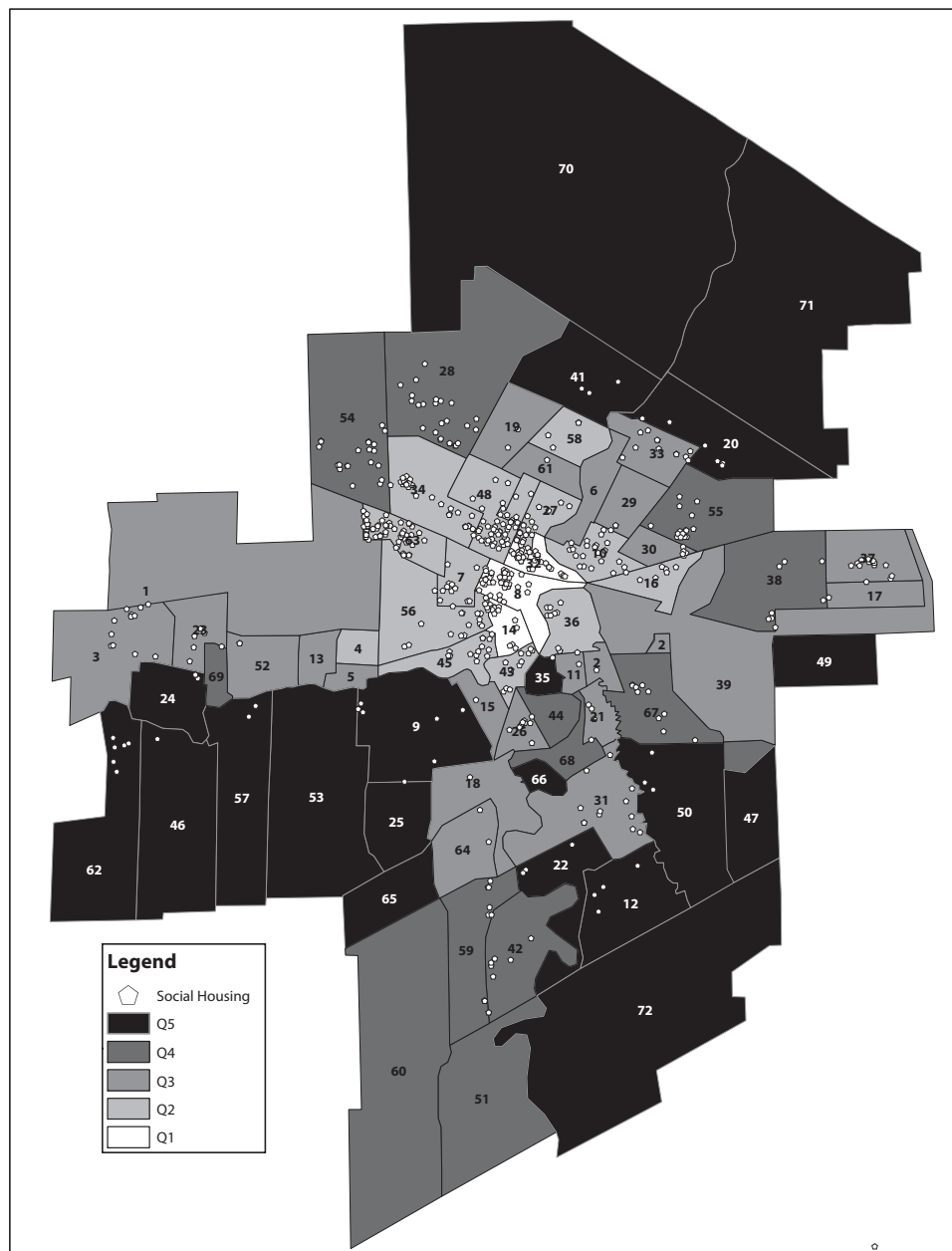
FIGURE 1—Placement of social housing units in Winnipeg, by 72 Community Centre Areas and neighborhood income quintiles (2006 census data).

less affluent neighborhood compared with their first move in the Moving to Opportunity study, whereas control families often moved to a more affluent area from their original neighborhood. Other evaluations of Moving to Opportunity found lower psychological distress for female youths and better adolescent male achievement scores among the intervention group.[25,26]

The earlier Gautreaux Study in 1976 found that when families in Chicago, Illinois, received vouchers to move from low- to higher-SES neighborhoods, children were 4 times less likely to drop out of high school.[27,28] A more recent Chicago study by Burdick-Will et al., involving randomized allocation of housing vouchers, found a significant increase in

mathematics and verbal skills when families relocated to higher-SES areas.[5] Jacob studied the effect of offering private housing vouchers for those involved in a social housing demolition in Chicago, compared with those in the same complex whose social housing was not being demolished.[29] They found no effect on educational outcomes of children, and

concluded that social housing did not bestow an independent effect above and beyond neighborhood SES. However, the social housing residents mostly moved to similar-SES neighborhoods. All of these studies revolve around individual families leaving social housing and going into private housing by using voucher programs. None of the literature examined the effect of social housing itself, and the effect of surrounding neighborhood SES on those living in social housing.

We examined the effect of living in social housing on health and educational outcomes of children. We specifically addressed the following:

1. Are there differences in the health and education outcomes of children living in social housing versus those who do not?

2. Is there an effect of area-level SES on health and education outcomes of children, both in social housing and not?

3. After adjustment for family poverty and other confounders, is there a relationship between placement of social housing in wealthier or poorer neighborhoods and the health and education outcomes of children living in social housing?

METHODS

Data were drawn from the PATHS data resource,[30] derived from the population-based Population Health Research Data Repository (Repository) housed at the Manitoba Centre Health Policy (MCHP) in the University of Manitoba. This repository has information for virtually the entire population of Manitoba, as it is based on registry data for the universal health care program. We used the following sources of data in the analysis: Manitoba Health Insurance Registry (demographics), hospital discharge abstracts, Manitoba Immunization Monitoring System, income assistance data (a program for families who need financial help to meet basic needs), educational outcomes data from Manitoba Education, Census data from Statistics Canada, the Early Development Instrument (EDI) from Healthy Child Manitoba, and social housing data based on the Manitoba Tenant Management System. The study period consisted of fiscal years 2006–2007 to 2008–2009. Eligible participants for inclusion in this study were all

children aged 0 to 19 years living in the city of Winnipeg (n = 187 255; 13 238 in social housing and 174 017 other children).

We evaluated 2 cohorts of children. The social housing cohort consisted of Winnipeg children who lived in a social housing unit directly managed by Manitoba Housing and Community Development for at least 1 day in a given study year. In our cohort, median duration in social housing was 2.33 years (25th percentile = 0.83 years, 75th percentile = 4.84 years). The comparison cohort was composed of all other Winnipeg children in a given study year who were present in the Manitoba Health Insurance Registry.

We examined 5 outcomes: complete childhood immunization at age 2 years; a school readiness measure at school entry, based on the EDI[31]; adolescent pregnancy; grade-9 completion; and high-school completion. We defined complete childhood immunization at age 2 years because of the percentage of 2-year-old children who had received all recommended immunizations for their age (i.e., 4 diphtheria, acellular pertussis, tetanus; 3 polio; 4 *Haemophilus influenzae* type B; 1 measles, mumps, and rubella; 1 varicella; and 4 pneumococcal conjugate-7 immunizations). We measured school readiness with the EDI, a population-based measure of children's development across 5 domains.[31] The children considered not ready for school were those in kindergarten (aged 5–6 years) who scored below the 10th percentile, based on national norms, in at least 1 EDI domain. Adolescent pregnancy was the rate per thousand female adolescents aged 15 to 19 years who had a pregnancy (including live births, stillbirths, abortions, and ectopic pregnancies). For female adolescents living in social housing, we only ran this indicator on those who lived in social housing for at least 1 year before the pregnancy-related hospital admission, with those already pregnant before moving into social housing excluded. We defined grade-9 completion as the percentage of adolescents completing 8 or more credits in their expected year of grade-9 attendance. High-school (grade-12) completion was the percentage of children that graduated high school within 6 years after entering grade 9.

We calculated rates for each of the 5 outcomes by income quintile groupings. We assigned each of the 72 subsections of

Winnipeg, called Community Centre Areas (CCAs) with average populations of approximately 10 000,[32] an income quintile grouping based on the weighted average household income information derived from the CCA's dissemination areas, as recorded in the 2006 Census. A CCA is, in a sense, a way to look at a true sense of community neighborhood in the city of Winnipeg. Local establishments that provide recreation and community sports and events, called community centers, are the heart of a CCA because these are built throughout the city to provide area residents within a designated catchment area with resources. Hence, a sense of neighborhood is often derived from the CCA boundaries. We based the income quintile Q1 (lowest) to Q5 (highest) cut-offs on previous research at Manitoba Centre for Health Policy[33] that represent approximately 20% of the Manitoba population. Ranges of average annual household income in each quintile were Q1 = $34 642 or less, Q2 = $34 643 to $48 525, Q3 = $48 526 to $64 444, Q4 = $64 445 to $77 264, Q5 = $77 265 and higher. We generated each outcome for the social housing group and for all others (i.e., those not in social housing) in that quintile. As well, clustering effects for the models included the CCA level to take into account neighborhood correlational effects, and for any school outcomes, we included "school" as an additional cluster in the model. We conducted statistical testing of these crude age-specific rates with Poisson regression on counts of events within each stratum, with the log of the strata-specific population as an offset in the model.

To investigate the second question (i.e., the effect of neighborhood SES on differential outcomes of those children in social housing) we generated models in addition to the crude rates of the outcomes. We employed logistic regression models to adjust for various covariates by using only the social housing cohort: area income,[34,35] single parenthood,[36,37] total number of moves,[38] mother's age at first birth,[39,40] duration of living in social housing, receiving income assistance,[39,41–47] child's sex,[48] and type of social housing (i.e., single dwelling, townhouse, or apartment). We also included child's age in the adolescent pregnancy model. This explored the effect of "place" of social housing on the health and educational outcomes. These models also

included the child's CCA and school at time of outcome as a clustering level to control for neighborhood and school effects in analyzing location of residence, rendering these generalized estimating equations analyses.

RESULTS

Table 1 shows the demographics for children living or not living in social housing. In general, children in social housing were younger, and were more likely to be living in lower socioeconomic areas of Winnipeg, to have an adolescent mother, to be living in a household that is receiving income assistance, and to have lived less time in the current residence.

Table 2 shows large differences in the overall health and education outcomes of the 2 groups, with children in social housing overall doing worse than all others for each of the outcome variables. This trend is apparent in each of the income quintile areas of Winnipeg, with the exception of complete immunizations of 2-year-olds and not being ready for school, for which children in social housing did not differ from all other children in the lowest income quintile (Q1) area.

Effect of Area-Level Socioeconomic Status on Outcomes

For complete immunization of 2-year-olds, Table 2 indicates greater gaps between children in social housing and all others as the wealth of the area increases. The worst inequity is evident in the wealthiest SES area, with a rate ratio (RR) of 0.71 ($P<.008$), and a rate difference (RD) of 21% ($P<.002$). Similar findings for school readiness indicate that children in social housing were more than twice as likely to be not ready for school (RR = 2.09; $P<.001$), with an RD of 25% ($P=.02$). Gaps in adolescent pregnancy rates were also the largest in the highest-income quintile area (Q5), with an RR of 5.65 ($P<.001$) and RD of 137 per 1000 ($P<.001$). For both grade-9 credits and grade-12 high-school completion, the difference in the rates did not become wider with increasing wealth of the area of residence, but rather stayed as a constant RD gap.

Figure 2 illustrates these findings in a pictorial way, showing widening gaps from Q1 (lowest) to Q5 (highest) SES areas for not being

ready for school, mainly because of non-changing outcomes of children in social housing but better outcomes for those not in social housing as income quintile increases. This is in contrast to the grade-12 high-school completion rates, in which both groups experienced better outcomes as SES of the area increases,

showing a similar difference in rates in each income quintile area.

Table 2 also gives information on the linear trends from Q1 to Q5 for each of the 2 groups by outcome. For complete immunizations at 2 years and school readiness (EDI scores), the linear trend was nonsignificant for children in

TABLE 1—Demographic Description of Children Living or Not Living in Social Housing, Winnipeg, 2008–2009

Characteristic	In Housing No. (%) or No.	In Housing Mean (Median; SE)	All Others No. (%) or No.	All Others Mean (Median; SE)	P
Age, y					< .001
< 1	447 (4.7)		9090 (6.1)		
1–5	2813 (29.5)		33 799 (22.5)		
6–12	3436 (36.0)		50 180 (33.4)		
13–19	2843 (29.8)		57 207 (38.1)		
Sex					.61
Male	4859 (50.9)		76 951 (51.2)		
Female	4680 (49.1)		73 325 (48.8)		
Neighborhood income quintiles					< .001
Q1 (lowest)	1369 (14.4)		5258 (3.5)		
Q2	3362 (35.2)		34 579 (23.0)		
Q3	2490 (26.1)		32 945 (21.9)		
Q4	1653 (17.3)		32 645 (21.7)		
Q5 (highest)	665 (7.0)		44 843 (29.8)		
Mother's age at first birth, y					< .001
≤ 19	5058 (53.6)		22 763 (15.3)		
20–24	2885 (30.6)		36 478 (24.5)		
≥ 25	1488 (15.8)		89 498 (60.2)		
Single-parent family					NA
Yes	4264 (44.7)		NA		
No	5275 (55.3)		NA		
No. of moves in 3-y period					< .001
0	7245 (76.0)		116 938 (77.8)		
1	2075 (21.8)		29 183 (19.4)		
≥ 2	219 (2.3)		4155 (2.8)		
Income assistance in 3-y period					< .001
Yes	6897 (72.3)		12 408 (8.3)		
No	2642 (27.7)		137 868 (91.7)		
Building type					NA
Single detached dwelling	438 (4.6)		NA		
Attached (semi, duplex, triplex, fourplex)	918 (9.6)		NA		
Townhouse or row (motel, maisonette, hostel)	6039 (63.3)		NA		
Low-rise apartment	1126 (11.8)		NA		
Mid- or high-rise apartment	1017 (10.7)		NA		
Years in current residence	9539	3.55 (2.33; 0.04)	150 276	5.31 (3.33; 0.01)	< .001

Note. NA = not applicable. The sample sizes were n = 13 238 in social housing and n = 174 017 other children.

TABLE 2—Health and Education Outcomes of Children in Social Housing or Not, Overall and by Income Quintile, Winnipeg, 2008–2009

Neighborhood Area Income Quintile	Rate (95% CI)	Social Housing–All Others, Rate Ratio (95% CI)	P	Social Housing–All Others, Rate Difference (95% CI)	P
Complete immunizations for 2-year-olds, % (n = 2089 social housing; n = 18 436 all others)					
Income quintile 1 (lowest)					
Housing	52.2 (46.5, 57.8)	0.87 (0.72, 1.04)	.13	−8.0 (−18.0, 1.9)	.11
All others	60.2 (56.6, 63.8)				
Income quintile 2					
Housing	51.1 (47.7, 54.4)	0.86 (0.78, 0.95)	.004	−8.3 (−13.6, −3.0)	.002
All others	59.3 (57.9, 60.7)				
Income quintile 3					
Housing	55.1 (50.6, 59.6)	0.79 (0.69, 0.90)	<.001	−14.8 (−22.0, −7.6)	<.001
All others	69.9 (68.6, 71.2)				
Income quintile 4					
Housing	53.0 (47.8, 58.2)	0.74 (0.64, 0.86)	<.001	−18.7 (−26.8, −10.7)	<.001
All others	71.7 (70.3, 73.2)				
Income quintile 5 (highest)					
Housing	51.6 (42.8, 60.5)	0.71 (0.56, 0.92)	.008	−20.7 (−33.7, −7.7)	.002
All others	72.3 (71.1, 73.6)				
Overall					
Housing	52.5 (50.3, 54.6)	0.77 (0.73, 0.82)	<.001	−15.3 (−18.7. −12.0)	<.001
All others	67.8 (67.1, 68.5)				
Linear trend on income quintiles for housing					.96
Linear trend on income quintiles for all others					<.001
EDI not ready in 1+ domains, % (n = 712 social housing; n = 8776 all others)					
Income quintile 1 (lowest)					
Housing	38.8 (29.4, 48.2)	0.89 (0.62, 1.27)	.52	−4.8 (−19.0, 9.5)	.51
All others	43.6 (37.9, 49.3)				
Income quintile 2					
Housing	47.4 (41.5, 53.4)	1.45 (1.20, 1.75)	<.001	14.8 (6.2, 23.3)	<.001
All others	32.7 (30.6, 34.7)				
Income quintile 3					
Housing	48.3 (41.0, 55.7)	1.92 (1.53, 2.42)	<.001	23.2 (12.8, 33.7)	<.001
All others	25.1 (23.2, 27.0)				
Income quintile 4					
Housing	49.6 (40.5, 58.6)	1.94 (1.48, 2.55)	<.001	24.0 (11.1, 37.0)	<.001
All others	25.5 (23.6, 27.5)				
Income quintile 5 (highest)					
Housing	47.7 (33.0, 62.5)	2.09 (1.35, 3.24)	<.001	24.9 (4.4, 45.4)	.02
All others	22.8 (21.2, 24.5)				
Overall					
Housing	46.8 (43.1, 50.4)	1.73 (1.55, 1.95)	<.001	19.8 (14.7, 24.9)	<.001
All others	27.0 (26.0, 27.9)				
Linear trend on income quintiles for housing					.42
Linear trend on income quintiles for all others					<.001
≥ 8 grade-9 credits passed on time, % (n = 933 social housing; n = 21 498 all others)					
Income quintile 1 (lowest)					
Housing	36.9 (28.0, 45.9)	0.62 (0.45, 0.85)	.004	−22.8 (−35.6, −9.9)	<.001
All others	59.7 (55.8, 63.6)				

Continued

TABLE 2—Continued

Income quintile 2					
Housing	40.2 (34.3, 46.1)	0.60 (0.50, 0.73)	< .001	−26.5 (−34.6, −18.5)	< .001
All others	66.7 (65.3, 68.2)				
Income quintile 3					
Housing	55.8 (49.9, 61.7)	0.68 (0.58, 0.80)	< .001	−26.1 (−35.3, −16.9)	< .001
All others	81.9 (80.8, 83.0)				
Income quintile 4					
Housing	53.6 (46.3, 60.9)	0.67 (0.55, 0.82)	.001	−26.4 (−37.4, −15.4)	< .001
All others	80.0 (78.9, 81.1)				
Income quintile 5 (highest)					
Housing	66.3 (57.1, 75.6)	0.75 (0.59, 0.95)	.02	−22.6 (−38.6, −6.5)	.006
All others	88.9 (88.2, 89.6)				
Overall					
Housing	49.8 (46.6, 53.0)	0.62 (0.57, 0.68)	< .001	−30.5 (−35.1, −25.8)	< .001
All others	80.3 (79.8, 80.8)				
Linear trend on income quintiles for housing					< .001
Linear trend on income quintiles for all others					< .001
Grade-12 completion, % (n = 864 social housing; n = 20 236 all others)					
Income quintile 1 (lowest)					
Housing	26.5 (18.4, 34.7)	0.57 (0.39, 0.83)	.003	−20.2 (−31.2, −9.3)	< .001
All others	46.8 (42.9, 50.7)				
Income quintile 2					
Housing	30.6 (25.0, 36.2)	0.48 (0.38, 0.60)	< .001	−33.1 (−40.4, −25.9)	< .001
All others	63.8 (62.2, 65.3)				
Income quintile 3					
Housing	57.0 (50.8, 63.1)	0.68 (0.57, 0.80)	< .001	−27.0 (−36.7, −17.3)	< .001
All others	84.0 (82.9, 85.0)				
Income quintile 4					
Housing	55.0 (47.5, 62.5)	0.64 (0.52, 0.78)	< .001	−31.2 (−42.7, −19.7)	< .001
All others	86.2 (85.3, 87.2)				
Income quintile 5 (highest)					
Housing	63.0 (51.9, 74.1)	0.68 (0.51, 0.91)	.009	−29.7 (−48.1, −11.4)	.002
All others	92.7 (92.1, 93.4)				
Overall					
Housing	45.3 (41.9, 48.6)	0.55 (0.50, 0.61)	< .001	−37.2 (−41.8, −32.5)	< .001
All others	82.4 (81.9, 82.9)				
Linear trend on income quintiles for housing					< .001
Linear trend on income quintiles for all others					< .001
Adolescent pregnancy, per 1000 (n = 1396 social housing; n = 28 349 all others)					
Income quintile 1 (lowest)					
Housing	278.8 (207.1, 350.6)	1.45 (1.08, 1.95)	.01	86.5 (84.0, 88.9)	< .001
All others	192.4 (164.8, 220.0)				
Income quintile 2					
Housing	241.7 (198.9, 284.4)	1.38 (1.14, 1.66)	< .001	65.9 (64.5, 67.3)	< .001
All others	175.7 (165.2, 186.3)				
Income quintile 3					
Housing	142.4 (101.7, 183.1)	1.95 (1.44, 2.63)	< .001	69.3 (68.0, 70.6)	< .001
All others	73.1 (66.4, 79.8)				

Continued

TABLE 2—Continued

Income quintile 4					
Housing	148.0 (97.5, 198.5)	2.75 (1.92, 3.93)	< .001	94.1 (92.5, 95.7)	< .001
All others	53.8 (48.1, 59.6)				
Income quintile 5 (highest)					
Housing	166.7 (95.4, 238.0)	5.65 (3.62, 8.81)	< .001	137.2 (134.9, 139.4)	< .001
All others	29.5 (25.9, 33.1)				
Overall					
Housing	202.0 (178.4, 225.6)	2.48 (2.19, 2.80)	< .001	120.4 (119.7, 121.2)	< .001
All others	81.6 (78.3, 84.9)				
Linear trend on income quintiles for housing					.005
Linear trend on income quintiles for all others					< .001

Note. CI = confidence interval; EDI = Early Development Instrument.

social housing (*P* = .96 and .42, respectively), but statistically significant for all other children (*P* < .001 for both) in that the wealthier the area, the better the outcomes. This is in contrast with grade-9 completion, grade-12 completion, and adolescent pregnancy, for which there were significant linear trends for both children in social housing and all others, with Q5 showing the best outcomes. Figure 2 illustrates this for 2 selected outcomes—not being ready for school and grade-12 completion.

Effect of Place of Residence on Children in Social Housing

Table 3 shows the generalized estimating equations model results for children in social housing, to determine whether there was a unique and significant effect of place (i.e., income quintile area) where the social housing unit was located. This analysis controlled for family-level income by using income assistance status of the family unit of each child as a surrogate for poverty of the individual. For complete immunizations at 2 years and school readiness outcomes, there was no statistically significant independent effect of income quintile area. However, for grade-9 completion, grade-12 high-school completion, and adolescent pregnancy, social housing residency in Q1 (and Q2 for the first 2) was associated with statistically significantly poorer outcomes compared with social housing residency in Q3, Q4, and Q5. For example, the odds ratio for grade-12 completion was only 0.34 (95% confidence interval = 0.15, 0.81) in Q1 and Q2 compared with Q5.

Additional factors associated with poorer outcomes in at least 3 of the models in Table 3 include being on income assistance (i.e., living in poverty), having a mother who was younger at the birth of her first child, and being male for the education outcomes. Referring back to Table 2, a comparison of adolescents living in social housing by income quintile—lowest (Q1) to highest (Q5)—shows grade-9 credits at 36.9% versus 66.3% (i.e., 1.8 times more likely to complete grade 9 in Q5; *P* = .003), grade-12 completion at 26.5% versus 63.0% (2.4 times more likely to graduate from high school in Q5; *P* < .001), and adolescent pregnancy at 278.8 per 1000 versus 166.7 per 1000 (1.7 times more likely to have an adolescent pregnancy in Q1; *P* = .04).

DISCUSSION

Overall, children living in social housing had poorer health and education outcomes than all other children, and in most cases when compared with those living in the same socioeconomic areas of Winnipeg. The implication is clear for government and community programs—health and education officials know exactly which housing is social housing, so targeted preventive health or educational programs could be provided to residents.

When we compared children in social housing within different SES areas, outcomes were distinctively different for early childhood versus school age. For the 2-year-old complete immunizations and school readiness indicators,

differences were similar by socioeconomic area of residence. In contrast, for school-aged indicators (i.e., grade 9, grade 12, adolescent pregnancy), the wealthier the area in which social housing was located, the better the outcomes for social housing residents. This was especially evident when we compared placement of social housing in the 2 poorest quintile areas (Q1, Q2) with placement of social housing in the middle and wealthiest income quintile areas (Q3–Q5), where children in the latter showed improvements in positive outcomes.

One could hypothesize that once children experience peer influence in school, their behavior may be affected by peers. So even though the outcomes of children in social housing were worse than their corresponding "all others" in wealthier neighborhoods (not surprising, when one considers the challenges of poverty), they did better compared with their social housing counterparts in poorer areas. Thus, "place of residence" of social housing may be important, with better outcomes for school-aged social housing residents for higher-SES areas. This would mirror the majority of studies earlier cited regarding the importance of neighborhood effects. Cairney studied adolescents living in rental or home ownership situations and found that the older the adolescent, the less the residential environment affected mental health.[49] He hypothesized that not only would older adolescents desire a separation from home, but also their preoccupation with school and peer groups may counter the effect of housing type and home environments. This effect appears
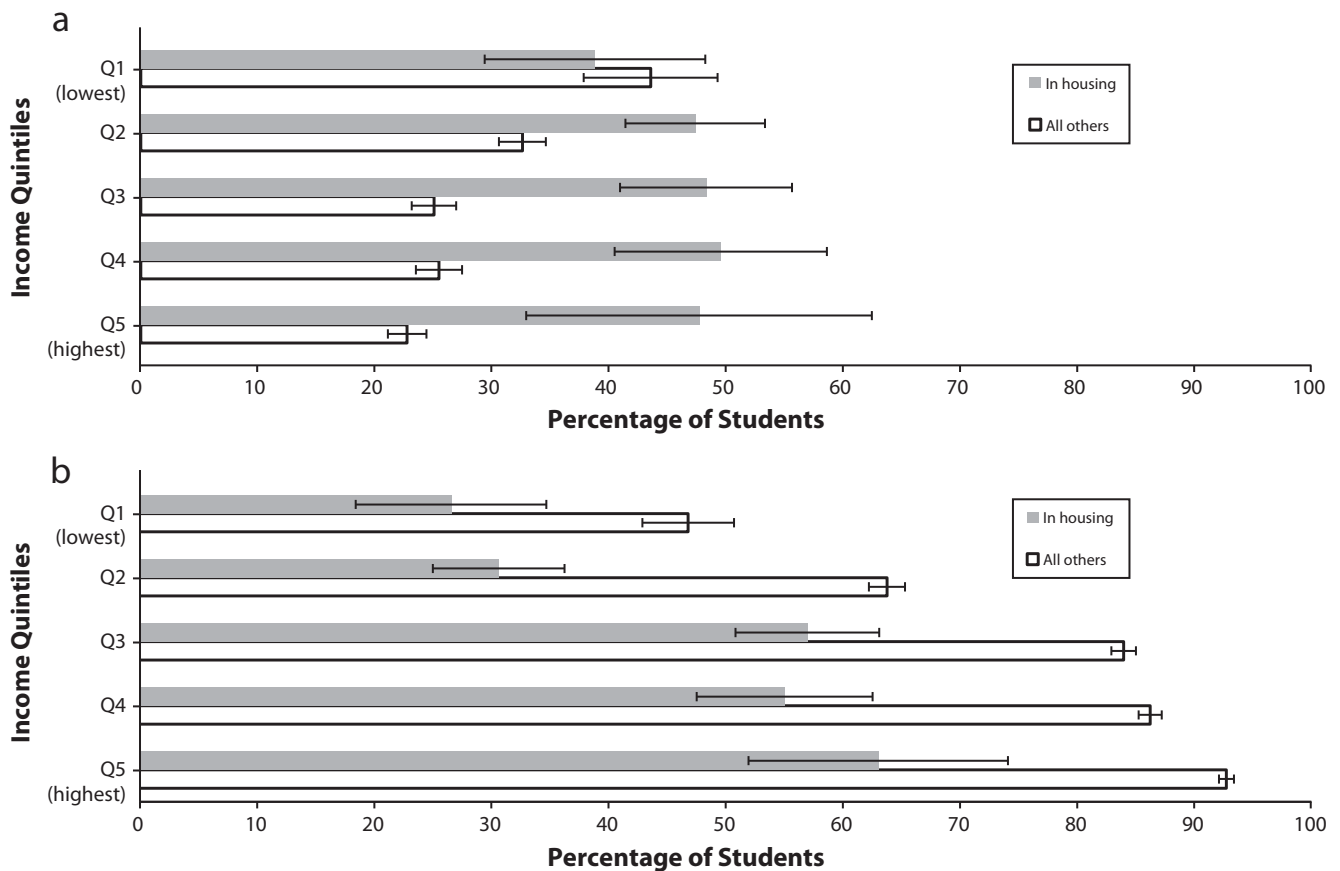
FIGURE 2—Educational outcomes for children living in social housing and all others by neighborhood income quintile and (a) proportion of kindergarten students (2005–2006 to 2006–2007) not ready for school in 1 or more domains of the Early Development Instrument (EDI) and (b) grade-12 completion (proportion of grade-9 students 2006–2007 to 2008–2009 followed for 6 years): Winnipeg.

to be functioning in our current study, with the "social housing effect" in preschool showing similar findings across area SES, whereas for older adolescents, the effects of area SES (possibly through peer and school influences) appears to mitigate the family or home environment effect. Ceballo et al. found that adolescents in higher neighborhood income areas had higher educational values,[50] which may explain the peer influence, and Rumberger et al. reported that SES level of students' schools had as much impact on achievement as their own SES.[7]

Sacerdote's literature review on peer effects in student outcomes found that high-school peer effects were apparent both for behavioral and educational outcomes but stronger for the former (including adolescent pregnancy).[51] By

contrast, our results showed similar effects of "place" for adolescents in social housing in both behavioral and educational outcomes—comparing Q1 to Q5 adolescents in social housing shows similar rate ratio effects for completion of grade-9 credits (1.8 times more likely in Q5), grade-12 completion (2.4 times more likely in Q5), and adolescent pregnancy (1.7 times more likely in Q1).

Because our study was a population-based observational study, not a randomized or quasi-experimental design, no causation can be inferred. However, examining the associations as well as extending these outcomes to include mental health are worthy of study, as policy implications surrounding location of social housing to maximize child outcomes are profound. One potential confounder

mentioned in similar nonexperimental study design critiques[8] is that more assertive families (who may be generally healthier and more interested in education) may also insist on being located in social housing in higher-SES areas.

What contradicts the bias and strengthens the plausibility that "place" has a causal effect is that preschool outcomes were not associated with socioeconomic environment, but rather similar throughout Winnipeg. Moreover, Winnipeg families may make application for several areas of the city, but because of space and resources being at a premium, Manitoba Housing will extend up to 3 housing offers to an applicant. So, although there is choice, there is limited opportunity for bias in this study because of the nature of this choice by clients.

TABLE 3—Regression Model for Children Living in Social Housing Only, by Health and Education Outcomes: Winnipeg, Manitoba, 2008–2009

Variable	Complete Immunizations for 2-Year-Olds		EDI Not Ready in 1+ Domains		8+ Grade-9 Credits Passed on Time		Grade-12 Completion		Adolescent Pregnancy	
	OR (95% CI)	P	OR (95% CI)	P	OR (95% CI)	P	OR (95% CI)	P	OR (95% CI)	P
Age	NA		NA		NA		NA		1.62 (1.46, 1.80)	< .001
Income quintiles										
Q1 (lowest)	1.09 (0.67, 1.77)	.72	0.77 (0.32, 1.82)	.55	0.40 (0.18, 0.91)	.03	0.34 (0.15, 0.81)	.01	1.90 (1.03, 3.50)	.04
Q2	1.02 (0.67, 1.56)	.91	0.99 (0.47, 2.09)	.98	0.39 (0.20, 0.78)	.008	0.34 (0.16, 0.70)	.003	1.45 (0.84, 2.51)	.19
Q3	1.16 (0.75, 1.80)	.51	1.01 (0.47, 2.16)	.99	0.61 (0.31, 1.20)	.15	0.77 (0.37, 1.60)	.49	0.91 (0.50, 1.66)	.76
Q4	1.12 (0.71, 1.75)	.63	1.11 (0.49, 2.51)	.8	0.69 (0.33, 1.43)	.32	0.76 (0.35, 1.62)	.48	0.89 (0.47, 1.68)	.72
Q5 (highest; Ref)	1.00		1.00		1.00		1.00		1.00	
Single-parent family, yes versus no	0.96 (0.80, 1.14)	.63	1.04 (0.76, 1.44)	.79	0.80 (0.60, 1.07)	.14	1.25 (0.92, 1.69)	.16	1.18 (0.88, 1.59)	.27
Total no. of moves										
0	1.15 (0.63, 2.11)	.65	0.86 (0.48, 1.53)	.61	0.88 (0.20, 3.92)	.86	1.50 (0.33, 6.86)	.6	0.43 (0.16, 1.14)	.1
1	1.19 (0.64, 2.18)	.58	1.00		1.00		1.37 (0.29, 6.39)	.69	0.67 (0.24, 1.87)	.45
≥ 2 (Ref)	1.00		NA		NA		1.00		1.00	
Mother's age at first birth	1.07 (1.04, 1.10)	< .001	0.98 (0.94, 1.02)	.24	1.05 (1.02, 1.09)	< .001	1.04 (1.01, 1.07)	.007	0.97 (0.94, 0.99)	.02
Duration in housing	1.11 (1.02, 1.20)	.02	0.97 (0.90, 1.06)	.55	1.04 (1.00, 1.07)	.04	1.00 (0.96, 1.04)	.95	1.01 (0.98, 1.04)	.66
Income assistance, yes versus no	0.85 (0.66, 1.09)	.2	1.37 (0.94, 1.99)	.1	0.53 (0.39, 0.73)	< .001	0.62 (0.45, 0.86)	.004	1.99 (1.44, 2.75)	< .001
Sex										
Male	0.94 (0.79, 1.12)	.48	2.55 (1.87, 3.49)	< .001	0.62 (0.47, 0.83)	.001	0.73 (0.54, 1.00)	.05	NA	
Female (Ref)	1.00		1.00		1.00		1.00		NA	
Building type										
Single detached dwelling	0.45 (0.25, 0.81)	.008	0.66 (0.23, 1.91)	.45	1.43 (0.57, 3.59)	.45	1.46 (0.61, 3.48)	.4	1.23 (0.63, 2.39)	.54
Attached (semi, duplex, triplex, fourplex)	0.92 (0.63, 1.35)	.68	1.04 (0.47, 2.30)	.92	0.88 (0.37, 2.06)	.76	0.87 (0.40, 1.87)	.71	1.18 (0.62, 2.23)	.61
Townhouse or row (motel, maisonette, hostel)	0.80 (0.61, 1.06)	.12	1.22 (0.67, 2.21)	.52	1.13 (0.55, 2.30)	.74	1.07 (0.57, 2.02)	.82	1.32 (0.81, 2.16)	.26
Low-rise apartment	0.92 (0.66, 1.29)	.63	1.05 (0.51, 2.14)	.9	1.38 (0.58, 3.32)	.47	1.20 (0.55, 2.63)	.65	0.59 (0.29, 1.19)	.14
Mid- or high-rise apartment (Ref)	1.00		1.00		1.00		1.00		1.00	

Note. CI = confidence interval; EDI = Early Development Instrument; NA = not applicable; OR = odds ratio.

This lends itself to future studies to find out what is driving the neighborhood peer effects being especially important for better school-aged outcomes in wealthier areas. Further studies could try to untangle the effects of peers, neighborhood resources, and social environments. Possibly, conceptual models by Leventhal et al.[8] relating to institutional resources, area norms, collective efficacy, and relationships can add to our understanding of area-level SES placement of social housing.

These results add to the knowledge base about the effect of neighborhood SES on children's outcomes. Moreover, placing social housing units in advantaged neighborhoods was associated with improved outcomes for school-aged children and adolescents living in social housing. ∎

About the Authors

Patricia J. Martens, Daniel G. Chateau, Elaine M. J. Burland, Gregory S. Finlayson, Mark J. Smith, Carole R. Taylor, Marni D. Brownell, and Nathan C. Nickel are with Department of Community Health Sciences, College of Medicine, Faculty of Health Sciences, University of Manitoba; and Manitoba Centre for Health Policy, Winnipeg, Manitoba, Canada. Alan Katz is with Department of Family Medicine and Community Health Sciences, College of Medicine, Faculty of Health Sciences, University of Manitoba; and Manitoba Centre for Health Policy. James M. Bolton is with Department of Psychiatry, Department of Psychology, Department of Community Health Sciences, College of Medicine, Faculty of Health Sciences, University of Manitoba; Manitoba Centre for Health Policy; and Crisis Response Centre, Winnipeg Regional Health Authority, Winnipeg.

Correspondence should be sent to Patricia J. Martens, PhD, 408-727 McDermot Ave, Winnipeg, Manitoba, Canada R3E 3P5 (e-mail: pat_martens@cpe.umanitoba.ca) or Daniel Chateau, PhD, 408-727 McDermot Ave, Winnipeg, Manitoba, Canada R3E 3P5 (e-mail: dan_chateau@cpe.umanitoba.ca). Reprints can be ordered at http://www.ajph.org by clicking the "Reprints" link.
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