



Socio-spatial dimensions of school closures and neighbourhood change in Ontario: An environmental injustice?

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ARTICLE INFO

Keywords:

School closures
Rural communities
Mid-sized cities
Deprivation
Spatial analysis
Ontario

ABSTRACT

In addition to their educational purposes, public schools and their surrounding properties are essential to community liveability, as they enrich the daily lives of children, parents, and nearby residents. Yet, decisions are being made to close schools in Ontario, Canada based on declining enrolments, without due consideration of these benefits. Since 2011, over 400 public schools have been closed in Ontario, causing communities across the province to lose essential hubs. In a province where significant socio-spatial inequities persist, public school closures could worsen the conditions of daily living for residents in neighbourhoods that have already been deprived of resources and opportunities through failed public policy. The objectives of this study were to document the spatial scope of public school closures in Ontario, to understand the population change profiles in communities where closures happened, and to elucidate how these closures temporally relate to structural vulnerabilities of the communities in which these closures took place. Using Census-derived deprivation index scores geo-coded dataset to both currently open and recently closed public schools in Ontario, our analysis revealed three key findings. First, school closures have occurred disproportionately in small to mid-sized cities and rural communities. Second, there is no evidence of significantly declining child populations prior to school closures, in communities where schools closed. And third, closures were more common in higher deprivation communities in small to mid-sized cities. Taken together, these findings offer critical insights on the challenges that many communities face due to insufficient and inequitable policies that govern school closure decisions in Ontario. The study signals an urgent need for a more collaborative, forward-thinking, and equity-oriented school closure decision-making model that supports residents and protects communities from losing a vital public asset.

Introduction

Public schools are more than educational institutions; they are public assets that have long proven to be essential parts of healthy, sustainable, and complete communities (Butler and Diaz, 2016; SGO, 2015). Yet, public school closures have been taking place at an increasing pace across Canada, and particularly within urban inner-city and rural settings in Ontario. Furthermore, the policies underwriting decision-making processes surrounding these closures have recently excluded possible community impacts (PFE, 2017). The purpose of this study was to document the socio-spatial characteristics of public school closures in Ontario to discern contextual insights into their potential impacts on surrounding communities. The findings offer valuable insights about the unforeseen consequences of school closure policies in terms of exacerbating structural deprivation in communities.

The value of schools to communities

The importance of public schools for community liveability was recognized as early as the 1920s by planner Clarence Perry (Perry, 1929), who proposed that schools be the foundation of the neighbourhood unit. His seminal work served as the backbone of subdivision planning for decades in North America (Stein, 1958), with schools being built throughout Canadian cities of all sizes to accommodate the children living with a walkable radius of the site. Consequently, public schools in Canada have become vital public assets that anchor their surrounding communities (Figlio and Lucas, 2004; Gibbons and Machin, 2008; Holme, 2002; Vincent, 2006). Not only are they frequented daily by children and parents, they also serve as sites for important community events and services for people of all ages (M. Seasons, 2013; Vincent, 2006), and they are key builders of community

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<https://doi.org/10.1016/j.wss.2023.100138>

Received 17 October 2022; Received in revised form 23 January 2023; Accepted 28 February 2023

Available online 1 March 2023

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social capital (Garnett, 2014). Public schools are particularly crucial in rural settings, where the presence of a school can literally determine a town's future viability (Gollom, 2017; Hill, 2017; Miller, 1995), as well as in socioeconomically deprived areas, where schools provide essential services for residents for whom distance may be a barrier for access and are more reliant on resources closer to home (Galindo et al., 2017; Witten et al., 2001).

Given the demonstrated utility of schools as essential infrastructure for neighbourhood well-being and equity, their closure can be construed as a potential injustice. Drawing from environmental justice studies, we see schools as place-based assets that have distributional, procedural, and recognitional dimensions (Schlosberg, 2004; Young, 1990). School properties (building sites, playgrounds, etc.) are environmental "goods" that can foster physical activity, social connection, and access to nature. Schools are also often the realization of, and basis for, significant community mobilization and advocacy. Therefore, policies that effect decisions on the fate of schools are an important site for procedural justice – decisions taken with community consent would ensure that potentially negative outcomes can be prevented from the outset, for instance, through assurances of acceptable replacement uses for the school site. Finally, when schools are closed in places where communities are particularly dependent upon them, not only does their loss represent a material deprivation of an environmental "good", but it can also significantly undermine the capacity of communities to advocate for their unique insights, knowledge, and cultural dimensions in future policy discussions, thus representing a recognitional injustice. More specifically, we argue in this paper that school closure policies that fail to attend to the distributional, procedural, and recognitional consequences for communities are themselves a form a policy failure (McConnell, 2010), particularly among those who are concerned about communities facing structural deprivation. Policy failure theory sees policy decisions not as accidental or unintentional outcomes of "bad" or poorly designed policy formation processes and decisions; rather, such processes are imbued with power, and decisions taken may result in benefits for some constituents while effecting losses for others. Thus, policies, in this case Ontario's school closure policies, are a site of environmental justice conflict, and potentially resolution. This study aims to equip those who wish to seek justice with evidence and insight into the geographic and socioeconomic consequences of policy failure.

The phenomenon of, and response to, school closures in ontario

Management of school assets in Ontario is the responsibility of regional school boards, which are governed by democratically elected trustees and staffed by bureaucrats. The number of schools that each board manages is a function of the population density of the region, ranging from fewer than 50 schools in more rural and remote regions of Ontario, to over 500 in the province's most densely populated region. Funding for public schools is directly tied to student enrolments by the provincial government's funding formula (MOE, 2022), so when enrolments decline within a school board region, so too does the availability of government funding to keep that region's schools operating (Andreas, 2013; MOE, 2014). When faced with the fiscal deficit created by declining student enrolments within their region, school boards are forced to review their school assets and determine whether closures would be appropriate. The complex calculus for closing schools is guided by the Ontario Ministry of Education's pupil accommodation review (PAR) model (MOE, 2006). This model prioritizes the value of schools to students and the school board, with the primary considerations in PARs pertaining to the quality of the learning environment, access to academic and extracurricular offerings, condition of the space and the grounds, facility operation costs, and transportation costs. While the 2006 and 2009 versions of the PAR model had also required that school boards account for the value of schools to the community and the local economy (e.g., use of the school and its grounds by residents, significance as the only school in the community, employer, site for

adult training, attracting and retaining families, etc.), these provisions were removed in the 2015 version of the guidelines (MOE, 2015), in an effort to simplify and expedite the decision-making process for Ontario's boards.

Not surprisingly, the processes involved in school closure decisions have been highly divisive, particularly prior to 2015, characterized by intense power struggles that have alienated affected communities in the process (Albinson, 2014; Blizzard, 2011; Fredua-Kwarteng, 2005; McDonald, 2014; Ritchie, 2012; Roth, 2011), and by drawn-out appeals processes that have bred public distrust with school boards and other local officials (Ferguson, 2014; Moro, 2014; O'Hara, 2014; "Parents threaten to leave public system," 2010; Starr, 2013). Meanwhile, evidence has begun to emerge that suggests school closures have not been a universal phenomenon in Ontario, but rather one that is happening disproportionately in certain areas, such as rural communities (P4E, 2017). These conditions triggered (rural) residents and experts alike in Ontario to demand that the provincial government better consider and account for the needs of communities in school closure decision-making processes (B. Irwin et al., 2017; Pedro, 2014; M Seasons et al., 2017). Consequently, in 2017, the then Liberal government declared a moratorium on school closure decisions in Ontario to review and revise the PAR framework, accordingly (MOE, 2017). A revised copy of the PAR guidelines was published in 2018 but, as of 2022, the Ministry of Education has not yet developed the supports required for the use of the accommodation review, effectively suspending its use indefinitely (MoE, 2018).

Knowledge gaps and study objectives

Scholarly literature on public school closures and the policies that affect them is limited. Most research in the Canadian context has focused on the flaws with the decision-making process (Basu, 2004; Fredua-Kwarteng, 2005; Irwin and Seasons, 2012). Only a handful of studies have examined the impacts of public school closures on surrounding communities. One study from New-Zealand found that school closures negatively impacted community cohesion, particularly in lower-income communities (Witten et al., 2001); a US study observed that school closures can lead to broader feelings of desertion in the community, triggering crime and youth delinquency (Roman, 2004); and a Canadian study found that the decision to close a local public secondary school poses significant threats to household-level and neighbourhood-level well-being (Collins et al., 2019).

Furthermore, very little is known about the characteristics of communities where schools have closed in the Canadian context. In fact, only two publications, both from Europe, found that school closures had little appreciable effect on communities and were simply indicative of community decline that was already well underway (Barakat, 2014; Egelund and Laustsen, 2006). Given the high number and wide distribution of school closures that have transpired in Ontario in the past decade, and the dearth of research on this issue, more research is needed in this area. Therefore, the objectives of this study were threefold: 1) to document the spatial scope of public school closures in Ontario over a ten-year period; 2) to understand the population change profile in communities where closures happened; and 3) to elucidate how these closures temporally relate to the structural deprivation of the communities in which these closures took place. We see this as foundational work that will be essential in providing insight into future in-depth examinations of sites of potential injustice associated with school closure decisions as contributors to further structural deprivation.

Methods

This study followed a three-part methodology. First, we created a comprehensive dataset of Ontario's public schools, including currently operating schools and schools that closed between 2011 and 2021. Then, we harmonized this dataset with population and deprivation data at the

dissemination area level, to link closure decisions to established dimensions of structural deprivation via a commonly used Canadian deprivation index at the community level. Finally, spatial and quantitative analyses were conducted with this dataset to address the study objectives.

Ontario public school dataset development

To acquire data on Ontario public school closures that occurred between 2011 and 2021, a freedom of information (FOI) request was submitted to Ontario's Ministry of Education in May 2022. As a result, 404 entries were identified as closed school sites by the Ministry of Education, according to the following criteria:

- The site operated with public funding to deliver government-mandated education curriculum; AND
- The site no longer offers any type of publicly funded elementary and/or secondary-level education; AND
- The site must not have been the location for renovated or replaced facilities to deliver education for a publicly funded school board.

As part of the FOI request, we received the following information for each school closure entry: school board name, school board type, school board language, city, postal code, address, and closure year. These entries were then merged with a comprehensive 2021 dataset of all publicly funded schools in Ontario that are currently open. This data on open schools was free to download from the Ministry of Education website, and it contained the same details about each school (i.e., location, board name, type, and language) as the closed school entries.

This merged dataset of all publicly-funded Ontario schools—including both open and closed schools—is heretofore referred to as the 'School Status dataset'. Entries were then reviewed and modified in preparation for harmonization with Census population variables and Ontario Deprivation Index data.

Harmonization of school status dataset

In the next phase of the study, we harmonized the School Status Dataset with area level population and deprivation data. This first involved acquiring Pampalon's Deprivation Index data, which is publicly available for download from the Quebec Public Health website (INSPQ, 2018). Area-level deprivation levels are represented by scores and quintiles, with higher scores and quintiles corresponding with higher levels of deprivation, and are available for all census years between 1991 and 2016 (1991, 1996, 2001, 2006, 2011 and 2016) (Gamache et al., 2019). This index uses six socioeconomic indicators from the Canadian census to document 'material deprivation' and 'social deprivation'. Material deprivation is a composite of high school completion, employment status, and income, while social deprivation is a composite of single-person household status, marital status, and lone-parent status.

Enabling socio-spatial analysis of school closures in Ontario required merging the deprivation data with the School Status Dataset. While the School Status and Ontario Deprivation Index datasets were both spatially referenced, they relied on different geographic systems. School Status dataset entries were referenced via 6-digit postal codes while those of the Ontario Deprivation Index were referenced via census geography codes (i.e., unique codes developed by Statistics Canada to identify census tracts, census subdivisions, dissemination areas, etc.). To overcome this discrepancy, we used the Postal CodeOM Conversion File Plus (PCCF+) to join the School Status dataset with Deprivation Index data by a common geographic system (Statistics Canada, 2018).

Processing the School Status dataset through PCCF+ enabled us to assign entries in the School Status dataset to census geography codes based on their existing 6-digit postal codes. If a postal code is located between two census areas, PCCF+ uses a population weighted process to

determine which geographic area to assign said postal code. Additionally, PCCF+ assigned valuable population characteristics to each entry. The variable, CSizeMIZ, for instance, provides critical dissemination area-level data on community size and the degree to which said community is influenced by metropolitan area(s).

For this study, each School Status dataset entry was assigned a dissemination area-level census geography code. Dissemination areas (DAs) are the smallest geographic area for which all census data is available, making them ideal for analyzing neighbourhood-level impacts of school closures. Furthermore, dissemination area-level assignment facilitated the analysis of the Deprivation Index data, which was only available for that geographic unit. Once PCCF+ assigned dissemination area-level census geography codes and population data to School Status dataset entries, it became possible to link this dataset to the Ontario Deprivation Index. Based on common census geographic codes (i.e., DAuid), the School Status and Ontario Deprivation Index datasets were merged in SPSS. The result of this merge was a comprehensive dataset of roughly 5300 entries which contains information relating to school status (i.e., open or closed), school specifications (i.e., level, board type, language, location, etc.), population characteristics, census geographic codes, and social and material deprivation scores.

Spatial and statistical analyses

To study the spatial distribution of public school closures in Ontario, we created a shapefile containing all closed school data from the public school dataset. The dataset was imported into ArcGIS as a dBase file, entries were geocoded by postal code using CanMap Postal Code Suite, and a new layer including only closed public schools was created. The point features were then grouped by year of closure (2011–2014, 2015–2017 and 2018–2021) and color coded.

Using SPSS, we analysed correlations and trends in community characteristics where schools have remained open and where schools have closed. Descriptive analyses included frequency distributions and cross-tabulations of the dataset. Inferential analyses included chi-square tests, parametric paired sample t tests, and independent sample t tests. The purpose of these analyses was to determine the relationship between school status and material and social deprivation, community size, and population change.

Results

The study results have been divided into three sections, with each section aligning with one of the three study objectives. The first section presents the spatial distribution of the 404 public school closures that occurred from 2011 to 2021 in Ontario. The second section presents the results of analyses identifying population trends prior to school closures. The third section summarizes the results of trends in deprivation index scores in the years immediately preceding and proceeding school closures.

Spatial scope of school closures in Ontario

Fig. 1 presents the distribution of public school closures across Ontario from 2011 to 2021. Most school closures occurred in Southern Ontario, and in the urban built up area along the southwestern shore of Lake Ontario commonly known as the Greater Golden Horseshoe specifically, which is the province's most heavily populated region. There are, however, a substantial number of school closures that have occurred outside of census metropolitan areas (CMAs) (defined as settlement areas with populations of 100,000 or more). A cross-tabulation analysis confirmed that communities with a population of less than 500,000 had a higher proportion of closed schools than cities with a population of more than 500,000, with the proportion of closed schools to open schools being nearly double in communities with a population of less than 100,000 ($p < 0.001$; see Table 1).

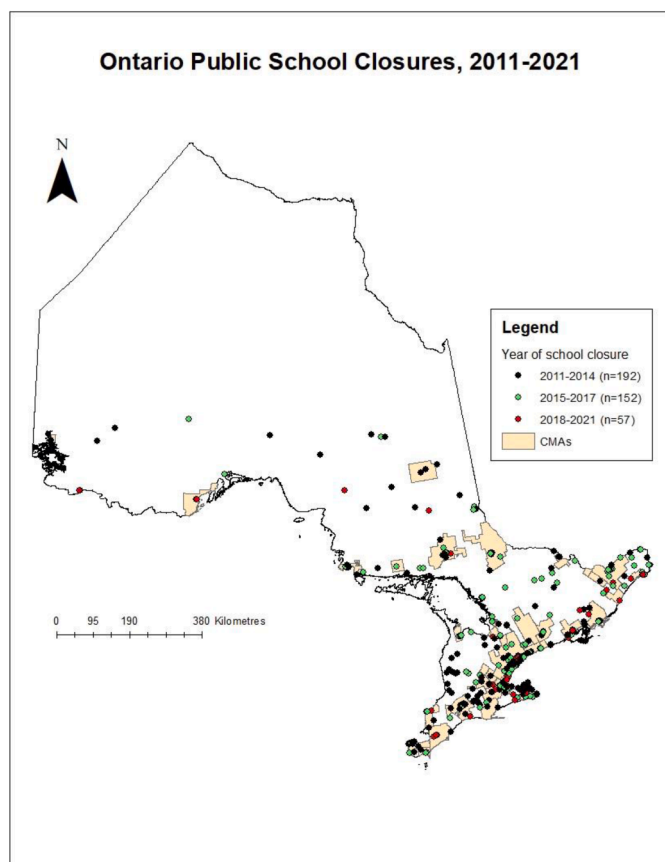


Fig. 1. Distribution of Ontario public-school closures.

Table 1
Comparisons of the geographic profiles of open and closed schools in Ontario.

Variable Name	Variable Categories	Closure Status		Chi-Square	p-value
		Closed Schools	Open Schools		
CSizeMIZ		(N = 402)	(N = 4829)	137.4 ^a	<0.001
	1500,000 +	13.0	37.9		
	500,000 – 1499,999	13.0	15.2		
	100,000 – 499,999	27.5	22.6		
	10,000 – 99,999	19.2	9.6		
	(any CMACA < 100,000)				
	Non-CMACA, Strong MIZ	13.2	6.1		
Community Type	Non-CMACA, Moderate MIZ	8.8	5.4	109.6 ^a	<0.001
	Non-CMACA, Weak / No MIZ	5.4	3.2		
	Metropolitan & Large Urban (500k-1.5M+)	25.8	53.1		
	Small to Mid-Sized CMA (10k-500k)	47.0	32.2		
	Rural Non-CMA	27.2	14.7		

Population change profiles of open and closed school communities

To analyze demographic trends prior to school closures, the closed school entries were filtered to only include schools that closed between 2017 and 2021. Population data from the 2011 and 2016 Census were utilized to measure total population change, relative and absolute child

population change (age 0–14), young adult population change (age 15–39), middle-aged adult population change (age 40–59) and older adult population change (age 60+). This analysis of pre-closure population change is important since declining student enrolments (which should reflect area-level population changes) is the rationale used by public school boards to close schools in Ontario.

Paired t-tests of 2011–2016 population change were conducted for the entire group of DAs where schools closed between 2017 and 2021, as well as by Community Type (Table 2). Analyses by community type were conducted since differences in population change by geography could have been masked in the analysis of all DAs. These tests revealed the following: extremely significant ($p < 0.001$) increases in the older adult population (in absolute and relative terms) in all community types; modestly significant decreases in the middle-aged adult population in small/mid-sized CMAAs and rural non-CMAAs; and a modestly significant ($p = 0.014$) decrease in the relative child population in metropolitan and large urban centers only. Compared with paired t-test results from DAs with open schools and their mean population changes (results not shown), the older adult populations in DAs with closed schools are not increasing as rapidly as in DAs with open schools.

Independent t-tests were conducted to determine if population changes in DAs with closed schools were statistically different from population changes in DAs with open schools (results not shown). Contra the established rationale of government policy to base school closures on declining enrolments, this analysis revealed no statistically significant differences in any of the absolute and relative age group comparisons (i.e., total, children, young adult, middle-aged adult, and older adult) between open and closed school DAs. There were also no significant differences between these groups when the results were split by the Community Type variable.

School closures and community deprivation

Chi-Squared analyses were conducted (Table 3) to determine whether there was a significant relationship between school closure status and deprivation quintile. This analysis revealed notable gradients of school closure prevalence by pre-closure (i.e., 2006) and post-closure (i.e., 2016) material and social deprivation levels, with significantly higher prevalence of school closures in DAs from more deprived quintiles ($p < 0.001$), while no such gradients were observed among the DAs where schools remained open (i.e., the proportions of open schools were relatively consistent across the quintiles). However, when this analysis was teased out by Community Type, more nuanced trends emerged. Specifically, we found that the gradient in closure status by deprivation quintile was most pronounced among DAs located in small to mid-sized CMAAs. For instance, the gradient of pre-closure material deprivation of DAs ranged from 8% (least deprived) to 29% (most deprived) ($p < 0.001$), and the gradient of post-closure social deprivation ranged from 4% (least deprived) to 35% (most deprived). Meanwhile, among DAs in metropolitan and large urban CMAAs, more modest, yet still significant relationships were observed between closure status and social deprivation, both pre-closure ($p = 0.019$) and post-closure ($p = 0.006$), with clustering of closures within DAs in the fourth quintile (31% and 33%, respectively). For the rural non-CMAAs DAs, a significant relationship was only detected for the pre-closure social deprivation ($p = 0.027$), with clustering of school closures in quintile 3 (40%).

To determine trends in deprivation index scores in the years immediately preceding and proceeding school closures, the closed school cases were filtered to only include schools that closed between 2011 and 2016. Deprivation index scores from 2006 to 2016 were once again used to measure DA-level changes in material and social deprivation following school closures. A paired t-test identified a significant increase in both material and social deprivation scores between 2006 and 2016 in DAs with closed schools ($p = 0.012$ and $p = 0.002$; see Table 4). When the results were split by Community Type, we found a significant increase in material deprivation in DAs from metropolitan and large urban

Table 2

Paired samples t-tests measuring pre-closure population change (2011–2016) in dissemination areas (DAs) where schools closed between 2017 and 2021, organized by all closed school DAs and by community type (*only significant results shown*).

2016 Population Group – 2011 Population Group	Mean Difference	95% Confidence Interval of the Difference		t	df	Two-Sided p-value
		Lower	Upper			
All Closed School DAs						
Pair 7 = Relative Middle Adult Pop	-0.013	-0.019	-0.006	-3.917	101	<0.001
Pair 8 = Absolute Older Adult Pop	18.382	13.042	23.723	6.828	101	<0.001
Pair 9 = Relative Older Adult Pop	0.026	0.019	0.032	8.040	101	<0.001
Closed School DAs in Metropolitan and Large Urban Centres						
Pair 3 = Relative Child Pop	-0.009	-0.015	-0.002	-2.602	34	0.014
Pair 8 = Absolute Older Adult Pop	21.857	9.092	34.623	3.480	34	0.001
Pair 9 = Relative Older Adult Pop	0.024	0.013	0.035	4.345	34	<0.001
Closed School DAs in Small to Mid-Sized Cities						
Pair 6 = Absolute Middle Adult Pop	-5.952	-11.230	-0.674	-2.278	41	0.028
Pair 7 = Relative Middle Adult Pop	-0.014	-0.023	-0.005	-3.256	41	0.002
Pair 8 = Absolute Older Adult Pop	12.857	7.006	18.709	4.437	41	<0.001
Pair 9 = Relative Older Adult Pop	0.021	0.011	0.031	4.241	41	<0.001
Closed School DAs in Rural Non-CMAs						
Pair 6 = Absolute Middle Adult Pop	-11.875	-21.168	-2.582	-2.643	23	0.015
Pair 7 = Relative Middle Adult Pop	-0.024	-0.043	-0.006	-2.705	23	0.013
Pair 8 = Absolute Older Adult Pop	22.083	12.956	31.211	5.005	23	<0.001
Pair 9 = Relative Older Adult Pop	0.035	0.022	0.047	5.511	23	<0.001

Table 3

Relationship between school closure status and deprivation index quintiles in 2006 and 2016, for all dissemination areas (DAs) and by community type.

		All DAs		DAs in Metro & Large Urban CMAs		DAs in Small to Mid-Sized CMAs		DAs Rural Non-CMAs	
		Closed Schools (N = 402)	Open Schools (N = 4829)	Closed Schools (N = 95)	Open Schools (N = 2398)	Closed Schools (N = 1433)	Open Schools (N = 168)	Closed Schools (N = 649)	Open Schools (N = 94)
2006 Material Deprivation	Quintile 1 (Least Deprived)	10.3	18.5	18.9	24.4	8.3	14.7	5.3	4.8
	Quintile 2	16.4	20.2	16.8	21.1	16.7	20.8	16.0	15.7
	Quintile 3	22.3	21.6	24.2	20.0	22.6	23.8	20.2	23.1
	Quintile 4	22.6	21.6	15.8	18.5	23.2	22.8	27.7	30.5
	Quintile 5 (Most Deprived)	28.4	18.1	24.2	16.1	29.2	17.9	30.9	25.9
	X ² , p-value	33.7, <0.001		6.8, 0.146		15.6, 0.004		1.3, 0.854	
2006 Social Deprivation	Quintile 1 (Least Deprived)	12.8	19.1	16.8	24.8	8.9	12.1	16.0	13.7
	Quintile 2	16.2	22.1	17.9	22.6	13.1	19.5	20.2	26.0
	Quintile 3	21.4	21.7	17.9	21.1	12.5	21.1	40.4	25.7
	Quintile 4	25.1	20.9	30.5	18.5	26.8	24.4	16.0	22.2
	Quintile 5 (Most Deprived)	24.5	16.1	16.8	13.0	38.7	23.0	7.4	12.3
	X ² , p-value	29.4, <0.001		11.8, 0.019		25.5, <0.001		11.0, 0.027	
2016 Material Deprivation	Quintile 1 (Least Deprived)	10.6	17.3	20.7	21.6	7.3	14.9	6.9	6.9
	Quintile 2	18.9	21.0	16.3	19.9	20.1	22.3	19.6	22.3
	Quintile 3	19.4	21.8	15.2	19.6	19.5	22.3	23.5	28.8
	Quintile 4	26.4	20.9	20.7	18.7	24.4	22.8	35.3	24.5
	Quintile 5 (Most Deprived)	24.7	19.0	27.2	20.2	28.7	17.6	14.7	17.5
	X ² , p-value	21.0, <0.001		3.8, 0.438		16.5, 0.002		5.5, 0.240	
2016 Social Deprivation	Quintile 1 (Least Deprived)	9.7	18.1	17.4	25.5	3.7	8.6	12.7	11.4
	Quintile 2	18.9	21.1	16.3	22.0	11.6	17.7	33.3	25.2
	Quintile 3	18.9	22.6	18.5	21.9	15.2	20.9	24.5	28.8
	Quintile 4	28.9	21.6	32.6	18.2	34.1	26.5	16.7	23.8
	Quintile 5 (Most Deprived)	23.6	16.6	15.2	12.4	35.4	26.3	12.7	10.8
	X ² , p-value	33.7, <0.001		14.6, 0.006		17.7, 0.001		5.2, 0.266	

Table 4

Paired samples tests measuring changes in deprivation index scores (2006–2016) in dissemination areas where schools closed between 2011 and 2016.

2016 Deprivation Score – 2006 Deprivation Score	Mean Difference	95% Confidence Interval of the Difference		t	df	Two-Sided p-value
		Lower	Upper			
All Closed School DAs						
Pair 1 = Material Deprivation	0.005	0.001	0.008	2.528	244	0.012
Pair 2 = Social Deprivation	0.005	0.002	0.008	3.138	244	0.002
Closed School DAs in Metropolitan and Large Urban Centres						
Pair 1 = Material Deprivation	0.011	0.003	0.019	2.745	54	0.008
Pair 2 = Social Deprivation	0.002	-0.004	0.009	0.656	54	0.515
Closed School DAs in Small to Mid-Sized Cities						
Pair 1 = Material Deprivation	0.002	0.001	0.012	2.404	120	0.018
Pair 2 = Social Deprivation	0.007	0.002	0.010	2.845	120	0.005
Closed School DAs in Rural Non-CMAs						
Pair 1 = Material Deprivation	-0.003	-0.010	0.003	-1.032	68	0.306
Pair 2 = Social Deprivation	0.005	-0.001	0.010	1.573	68	0.120

centres ($p = 0.008$), while significant increases in material *and* social deprivation were found in DAs from small to mid-sized cities ($p = 0.018$, $p = 0.005$). There were no significant changes in deprivation scores in DAs from rural non-CMAs.

Discussion

Key findings

The first objective of this study was to document the spatial scope and distribution of public school closures in Ontario. Between 2011 and 2021, 402 public schools were closed in Ontario, and these closures happened disproportionately in small to mid-sized CMAs and rural non-CMAs. From a spatial justice perspective, this pattern is problematic for at least three reasons. First, smaller CMAs and rural communities are less likely to have other public schools nearby for children in the community to attend (Haynes, 2022; Aasland and Søholt, 2001), forcing these students to travel even longer distances to get to school every day (Howley et al., 2001). Second, while all students attending public schools in Ontario are eligible to ride the school bus if they live beyond walking distance of their school, school closures in these less populated communities increase students' reliance and time spent on motorized transportation for travel to school (Bennett, 2013). This trend directly and indirectly (e.g., extracurriculars) diminishes students' opportunities to engage in physical activity, while also undermines the potential for our society to transition to a low carbon future. Finally, this pattern is problematic because of the particularly important role these schools play in providing essential services to residents and enhancing community social capital (Haynes, 2022; Autti and Hyry-Beihammer, 2014). The loss of school sites in these communities raises important questions about how residents will cope with the reduced access to these services, about the potential trauma associated with the loss of important cultural resources in their community, and whether these communities will be able to retain residents over the long-term without a public school present.

The second objective of this study was to understand the population change profile in communities where closures happened, since population decline would understandably lead to declining student enrolments. Through paired samples t-tests, we did find significant increases in older adult populations in DAs where schools closed prior to closures in general, and across community types, and we found significant decreases in the middle-aged adult population groups in both small to mid-sized CMAs and in rural non-CMAs. However, we found no statistically significant changes in child populations in DAs located in either small to mid-sized CMAs or rural non-CMAs prior to school closures. Meanwhile, for DAs in metropolitan and large urban centres, we did find a statistically significant decrease in the relative child population, which is notable given that DAs within this community type had the lowest proportion of school closures (Table 1). Taken together, these findings are troubling given that declining enrolment, which reflects population

change, is the condition that triggers a pupil accommodation review process in Ontario. These findings contrast with previous studies that have found school closures were symptoms of communities that were already in decline (Barakat, 2014; Egelund and Laustsen, 2006). Possibly unique to Canada, our findings suggest relative stable populations in communities where schools have closed, raising questions about the validity of using current and projected student enrolments as the basis to justify school closures (MOE, 2018).

The third objective of this study was to elucidate how school closures temporally relate to the structural deprivation of the communities in which these closures took place. In general, we found that school closures happened more often in communities with high levels of both material and social deprivation prior to, and following, the school closure. This trend is primarily attributable to substantial gradients in pre- and post-closure deprivation quintiles within DAs located in small to mid-sized cities; similar gradients were not observed in DAs in metropolitan and large urban centres, or in rural non-CMAs, and it is unclear why this is the case. In terms of changes in deprivation from 2006 to 2016, we found statistically significant increases in social and material deprivation in DAs where schools closed in general, and in small to mid-sized CMAs specifically. While we do not infer causation in this relationship, from an environmental justice perspective, we can understand this pattern as one of interlocking injustices (Popescu, 2018), where the closure of a vital community asset such as a school only further compounds the deprivations, including material losses, reduced opportunities for access to future school decisions, and recognitional invisibilization that people face in relation to urban change.

That closures happened disproportionately in communities with existing high levels of social and material deprivation means that populations that were already facing structural deprivation prior to a school closure are more at risk of losing an essential piece of social infrastructure, thereby exacerbating social inequities in Ontario. These findings point to the essence of policy failure; that Ontario's public school boards did not adequately consider the additional burden that the loss of these public assets would inflict on students and residents in communities with higher levels of structural deprivation, and/or that school boards opted to close the schools in communities where residents might be less capable of fighting the closure. Previous research (Fredua-Kwarteng, 2005; Irwin and Seasons, 2012), and public outcry (Albinson, 2014; Blizzard, 2011; Ferguson, 2014; McDonald, 2014; Moro, 2014; O'Hara, 2014; "Parents threaten to leave public system," 2010; Pedro, 2014; Ritchie, 2012; Roth, 2011; Starr, 2013), supports the argument that Ontario's boards have inadequately considered the existing and future needs of communities in their school closure decision-making processes. And while increased DA-level deprivation cannot be attributed to the closures of schools, it does highlight the increased challenges that residents may be facing in their daily lives without this important community hub near their homes, thereby limiting the ability of the community to recover.

Policy and practice implications

A moratorium on public school closures in Ontario has been in effect since 2017 (MOE, 2017). While 57 school closures occurred between 2017 and 2021, these were the results of closure decisions that had been rendered prior to the moratorium. Thus, the moratorium has halted decisions to close schools in Ontario, thereby preserving these community spaces, however temporarily. With the installment of a Conservative government in Ontario for a second consecutive term, observers expect the moratorium to be lifted soon (Blancher, 2022), and replaced by a revised pupil accommodation review (PAR) model that is being welcomed by Ontario's school board officials (Blancher, 2020). How the PAR model has been revised, and how these revisions will improve outcomes for Ontario residents, remains unclear at the time of this writing.

A more collaborative and justice-oriented model would ensure that public school closure decisions are evidence based and analytically robust. From a distributional justice perspective, schools are not just educational settings, but vital place-based assets for collective well-being in all communities. Previous versions of the PAR model, which made provisions for boards to account for the value of school assets to the community and the local economy, created a framework for distributionally just outcomes to be pursued in school closure decisions. In the absence of these broader considerations of the value of schools, closure decisions hinge on the scope and quality of school resources, which reflect the level of resources that have been invested in those assets over time. Indeed, some advocates have brought attention to the trend of boards to defer maintenance on schools that are earmarked for closure so that they deteriorate to the point of being deemed "prohibitive to repair" (Templeman, 2014). A distributional justice lens would challenge boards to question and address the systemic inequities in the resourcing of schools within their regions, to ensure that all schools are being given a chance to succeed.

Procedurally, our findings highlight the need for school boards to work closely and collaboratively with municipal governments, especially in long-term population projections and planning, to ensure that school closures truly reflect a shrinking child population in those areas. That school boards have the unilateral authority to permanently close schools, and to forever change the future liveability of communities, represents a significant procedural injustice. A more procedurally just approach would necessitate ongoing engagement with government partners and communities on school asset management, not just when student enrolments are unsustainably low, and have clear mechanisms in place for maximizing transparency in closure decisions.

Finally, the centrifugal force of school infrastructure in bringing communities together, whether through providing meeting space for civic groups or casual encounters in playgrounds, is essential to fostering a sense of culture and a political voice, and therefore an essential contributor to recognition justice. School closures may be an inevitable result of an aging population and localized population decline (Hummel, 2015); but given the harm that closure decisions pose for public confidence and trust in institutions (Albinson, 2014; Blizzard, 2011; Ferguson, 2014; McDonald, 2014; Moro, 2014; O'Hara, 2014; "Parents threaten to leave public system," 2010; Pedro, 2014; Ritchie, 2012; Roth, 2011; Starr, 2013), citizens need assurance that these decisions are as evidence-based and forward thinking as possible. Further, in cases where school closures are justifiable from an enrolment perspective, government policies must ensure adequate attention is given to ensuring school infrastructure and property remain available as community assets and that all three dimensions of justice are preserved in other ways.

Limitations and directions for future research

Our analysis of population change differs from that used by school boards. More studies would be required to determine the cause of low

enrolment numbers and to determine if general child population decline in a community should be considered a reliable cause for a school closure.

Given the greater availability of undeveloped land, it is possible that a higher number of amalgamated schools opened in rural CAs and in small to mid-sized CMAs during the study timeframe (2011–2021). Indeed, funding from the provincial government was commonly used by Ontario boards to finance construction of new schools across the province (Templeman, 2014). Future research should investigate the geographies of these new schools in Ontario to establish the extent to which residents from less populated communities were the beneficiaries of these investments.

Loss of a public school may be easier for residents to recover from in cases where properties are replaced by a public amenity that meets residents' needs. A future contribution from this study will offer a detailed account of how and in what context closed school properties have been repurposed, including in depth, qualitative case studies of how subsequent land uses shape community well-being.

Finally, this study aimed to elucidate patterns in the population and deprivation-related characteristics of communities where schools have closed in Ontario. Experienced or observed impacts of school closures on community liveability requires more in-depth study of communities that have encountered this event.

Conclusions

Over the past decade, school closures in Ontario have been happening disproportionately in small to mid-sized cities characterized by higher levels of material and social deprivation both prior to, and following, the closures. The loss of this key institution potentially represents a social and environmental injustice to communities by reducing their collective capacity to adjust and adapt to an altered landscape. Furthermore, these closure decisions represent a key policy failure as they have been made by Ontario's school boards in the absence of holistic evidence of the potential harms to communities resulting from closures. Taken together, these findings signal an urgent need for a more collaborative, forward-thinking, and equity-oriented school closure decision-making model that minimizes harm to residents and protects communities from losing a vital public asset.

Declaration of Competing Interests

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Acknowledgements

This study was funded by the Social Sciences and Humanities Research Council of Canada.

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