

Conceptualizing and Operationalizing Neighbourhoods

The Conundrum of Identifying Territorial Units

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ABSTRACT

Background: Over the past 10 years, there has been a surge of interest in studying small-area characteristics as determinants of population and individual health. Accumulating evidence indicates the existence of variations in the health status of populations living in areas that differ in affluence and shows that selected small-area characteristics are associated with the occurrence of selected health behaviours. These variations cannot be attributed solely to differential characteristics of populations living within small areas. One vexing problem that confronts researchers is that of conceptualizing and operationalizing neighbourhoods through delineation of small territorial units in health research.

Goals and Methods: The aims of this paper are to selectively overview conceptual definitions of neighbourhoods and to illustrate the challenges of operationalizing neighbourhoods in urban areas by describing our attempts to map out small territorial units on the Island of Montreal and in the City of Calgary.

Conclusion: We outline guiding principles for the construction of a methodology for establishing small-area contours in urban areas and formulate recommendations for future research.

MeSH terms: Residence characteristics, social conditions, social environment, urban health, methods

La traduction du résumé se trouve à la fin de l'article.

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Over the past 10 years, a growing literature subsumed under the heading of "neighbourhoods and health"¹ has accumulated regarding how characteristics of small areas are associated with a variety of health outcomes. Special emphasis has been devoted to how features of residential areas are associated with health outcomes beyond the characteristics of the populations residing in these locales.²⁻⁴ There is consensus that knowledge emerging from this research can be helpful in the development of relevant public policy initiatives^{2,4,5} aimed at improving the salutogenic potential of the physical and social environments that people live in. Although advances have accrued at an accelerated rate, the task of conceptualizing neighbourhoods and operationalizing them, through the joint delineation of small territorial units and measurement of exposures within them, remains a daunting challenge. In fact, this task of delineating small territorial units can be likened to a conundrum – a vexing riddle that continues to elude a satisfactory solution.

In an effort to contribute to the task of conceptualizing and operationalizing neighbourhoods for health research, we pursue two goals in this paper. First, we selectively overview definitions of "neighbourhoods" to provide a conceptual backdrop to the second goal. This second goal consists of illustrating the challenges of one aspect of the use of the concept of neighbourhoods, namely the delineation of small areas, using as examples attempts to map out small territorial units on the Island of Montreal and in the City of Calgary. Towards this second goal, we also examine the issue of small territorial units as fixed or malleable entities by exploring the utility of aggregating statistical units into larger territories. In closing, we suggest preliminary guidelines for conceptualizing and operationalizing neighbourhoods in health research, which consist of identifying the specific health outcome of interest, defining the specific exposures to be linked to health outcomes and identifying territorial units that are homogeneous in terms of exposures.

The context of the present work

About five years ago, our team of researchers embarked somewhat naïvely upon the task of developing an inventory

TABLE I
Characteristics of Calgary and Montreal

Year founded	Calgary (Maps 1, 2, 3) 1875	Montréal (Maps 4, 5, 6) 1642
Total population according to Canadian Census 2001	878,866	1,812,723
Population density according to Canadian Census 2001 (persons/census tract)	1,252.3	3,625.1
Official number of administrative districts	273 communities	27 boroughs
Range of population sizes in districts	205-17,075	17,919-163,110
Range of district sizes (km ²)	0.21-20.4	3.8-61.5

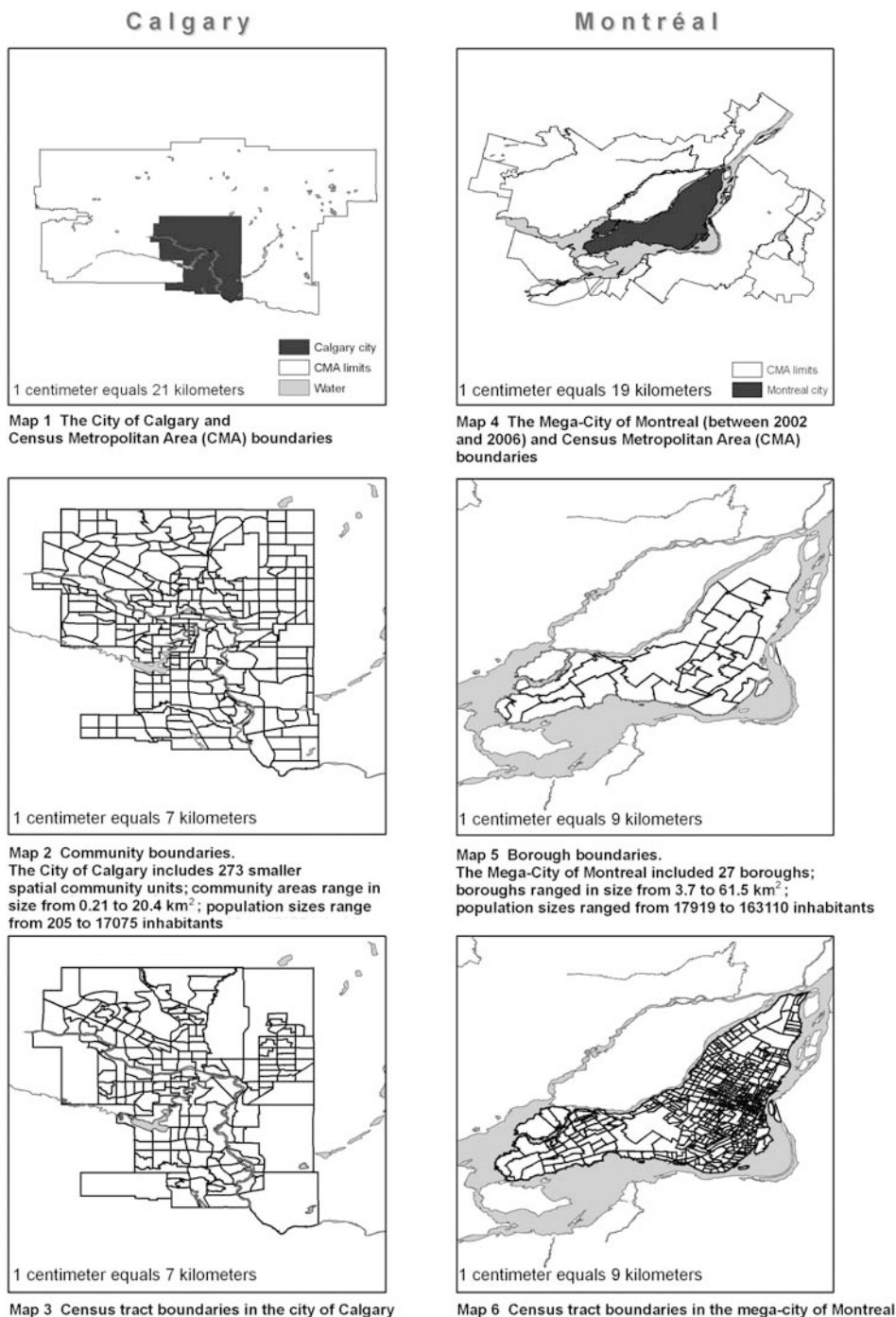


Figure 1. Illustrations of administrative and statistical boundary division maps in Calgary and Montreal

of databases and linking them in order to study relationships between exposures in small areas and health in urban settings,

using datasets on small territorial units on the Island of Montreal and in Calgary as examples. In retrospect, we qualify these

initial efforts as naïve: we believed at the time that by enumerating data sources and conducting a thoughtful analysis of their content based on existing theoretical frameworks, we could readily determine how to operationalize the concept of neighbourhood boundaries as small territorial units in order to (a) derive maximum explanatory power for studies dealing with area effects on health and (b) identify a series of indicators of exposures in small territorial areas that could be derived from these databases. Unfortunately, as indicated by other researchers,^{6,7} it now seems clear that global “off the shelf” measures derived from censuses and other surveys provide truncated information about the context of small territorial areas and therefore offer only limited potential for studying neighbourhoods and health.

Cummins et al.⁶ argue for the construction of a variety of small-area indicators from routine and non-routine data sources, which could subsequently be linked to a variety of physical and mental health outcomes. As illustrated below, we concur that “off the shelf” data have limitations and argue that they are most valuable within an exposure-specific and health-outcome-specific tactic to operationalize neighbourhoods, which we develop in this paper.

Conceptual definitions of neighbourhood: the elusive consensus

From an historical perspective, Forest and Kearns⁸ noted that in the early part of the last century, neighbourhoods were “cellular, bounded, inwardly focused and relatively self-contained”. Increasing urbanization raised concerns about creating places that were safe and secure for the pursuit of daily activities. The use and promotion of the concept of neighbourhood was thus adopted to address such concerns. These cogent remarks are indicative of the richness of the concept of neighbourhood (which is often used interchangeably with small areas and place), yet a definition remains elusive. In an effort to ground

empirical work on small-area effects on health, we thus examined definitions of neighbourhoods using as a starting point integrative efforts by Galster⁹ and Meegan and Mitchell.¹⁰ Numerous definitions have been proposed, and no consensus has emerged, although at least two foci have been identified.⁷⁻¹¹ *Ecological* definitions focus on aspects of the built environment and contours of a territorial unit whereas *social* definitions emphasize the interrelationships among people in a given territorial unit. Interestingly, in existing small-area research,⁵ little or no reference is made to any of these definitions.

Nonetheless, in underscoring this diversity, Galster⁹ called for a more integrative approach to the challenge of defining the concept of neighbourhood. He proposes that neighbourhood is “the bundle of spatially based attributes associated with a cluster of residences, sometimes in conjunction with other land uses.” He goes on to list 10 categories of attributes, namely (1) residential and non-residential non-structural elements (type, materials, state of built environment); (2) characteristics of the infrastructure (roads, sidewalks, services); (3) demographic characteristics of the population (age, ethnic composition, religious affiliations, families); (4) socio-economic characteristics of the population (income, labour, education); (5) characteristics of public services (schools, public security, administration, parks); (6) environmental characteristics (noise, air and water pollution, elements of the topography); (7) proximity characteristics (access to areas of economic, cultural and commercial significance); (8) political characteristics (mobilization of elected officials); (9) social-interactive characteristics (social networks, relationships among residents); and (10) emotional characteristics (identification/sense of belonging of residents to their neighbourhood). We note with some enthusiasm that this listing of attributes provides a useful basis from which to create an interface between concept and measurement of neighbourhoods, as these spatially based attributes can be likened to categories of exposure. As noted by Galster,⁹ this listing does not, however, provide guidance on how to delineate territorial units or contours, the conundrum of interest in this paper.

Delineating small territorial units: extracting the main issues using examples from two urban settings

To illustrate the challenges of delineating small areas, we examined available “off the shelf data” in two Canadian urban settings, namely the Island of Montreal, Quebec, and in the City of Calgary, Alberta. Comparison of these two urban settings allowed for juxtaposition of profiles from newer and older urban settings and for exploration of different delineations of small territorial units. Table I and Figure 1 present basic descriptive information and maps about these two Canadian urban settings.

Our first task consisted of identifying existing datasets providing information on territorial units in both settings. Two types of small-area dataset were identified, namely administrative boundary and statistical spatial boundary files. Administrative boundary files delineate territories that are created by community- or government-based organizations to achieve specific organizational objectives. Statistical spatial boundary files delineate territories for the collection of census-based information for the description of the Canadian population by Statistics Canada.¹² Table II outlines datasets under the headings of administrative boundary and statistical spatial files that were identified for Montreal and Calgary.

For Montreal, we enumerated nine distinct yet sometimes overlapping administrative boundary files, which outlined various territories, e.g., police districts, boroughs, communities, and included populations of varying sizes. There were seven different statistical spatial area files with accompanying territorial definitions, e.g., census tract, dissemination areas. This set does not include other small-area divisions created for the purpose of specific studies by researchers concerned with the issues raised in this paper.¹³ For Calgary, enumeration resulted in the identification of four different administrative boundary files and accompanying territorial units ranging in population size, and four statistical spatial boundary files with territorial contours. The administrative territories, in most cases, were related to services provided by an organization and often became the service catchment area of the organization.

More in-depth examination of the uses and functions of these two types of territorial division (e.g., police districts, boroughs, communities, census tracts) revealed that both had advantages and disadvantages. Administrative boundary files and associated territories were characterized by an explicit set of rules for their creation and often included unique information about material and social characteristics of the delineated territories, and more particularly about the use of services provided by the organization that was the fiduciary of the database. Unfortunately, the administrative territories were often very large. We thus anticipated that they would likely have large within-area variability in any contextual features or exposures of interest.

By contrast, statistical spatial units, e.g., census tracts, are the territorial units most frequently used in research on small-area effects on health.^{3,4} Their advantage is that they include a wealth of information about the material and social conditions of populations living in these territories (one important spatially based attribute as identified by Galster⁹), and they can often be linked to other area-based datasets through geocoding. They, too, are created according to an explicit set of rules. However, as indicated by several authors,¹³⁻²⁰ statistical spatial units do not adequately express the subjective meaning of neighbourhood held by different people¹⁴⁻¹⁶ (the emotional characteristics identified by Galster⁹). For example, although most people cannot identify which census tract they live in, they can identify the name given to the area that they live in, e.g., I live in Côte-des-Neiges or Hillhurst/Sunnyside,¹³ and whether or not they are within the catchment area of an organization that provides services. As discussed below, depending on the exposures of interest, this feature of statistical spatial units can hamper their utility in research on neighbourhoods and health.

In an effort to further capture the utility of existing territory boundaries, we enumerated how each territorial division was created, and identified six criteria that had implicitly been used. These were (1) presence of intraneighbourhood homogeneity of socio-economic characteristics of residents; (2) presence of historically defined neighbourhoods; (3) presence of geograph-

TABLE II
Territorial Units in Calgary and Montreal

Calgary						
Domain	Organization	Area Name	No. of Spatial Units	Range of Population Size	Size of Area (km ²)	Criteria for Defining Boundaries*
<i>Administrative Boundary Files</i>						
Police service	Calgary City	Police districts	8	40,875-178,280	10.6-161.2	1, 2, 3, 4, 5
Local service	Calgary City	Communities	273	0-17,075	0.2-20.2	2, 3, 4
Election	Government of Canada	Federal electoral districts	7	101,882-141,905	41.1-146.6	2, 6, 3
Election	Alberta government	Provincial electoral districts	24	30,550-45,000	10.46-89.49	6
Election	Alberta government and municipality	Municipal electoral districts	14	n/a	n/a	1, 2, 3, 4, 6
<i>Statistical Boundary Files</i>						
Official statistics	Statistics Canada	Census tracts	181	617-21,752	0.4-71.1	1, 2, 3, 5, 6
Official statistics	Statistics Canada	Dissemination area	1,384	0-5,452	0-38.0	1, 2, 3, 5, 6
Official statistics	Statistics Canada	Block	7,794	0-1,784	0-17.0	3
Official statistics	Statistics Canada	Forward sortation areas	32	1,853-66,591	1.36-28,252	3
Montreal						
Domain	Organization	Area Name	No. of Spatial Units	Range of Population Size	Size of Area (km ²)	Criteria for Defining Boundaries*
<i>Administrative Boundary Files</i>						
Health and social services	Ministry of Health and Social Services – Québec	CLSC districts	35	10,421-118,759	1.6-64.7	2, 3, 4
Public security	Montréal urban community police	Police districts	49	15,225-111,510	1.6-44.4	1, 2, 3, 4, 5
Municipal services	City of Montréal	Boroughs	27	17,919-163,110	3.8-61.5	2, 3, 4
Election	Government of Canada	Federal electoral districts	20	91,795-112,159	9.3-96.1	2, 6, 3
Election	Government of Quebec	Provincial electoral districts	28	51,965-77,560	5.5-71.2	1, 2, 3, 4, 6
Election	Municipal government	Municipal electoral districts	71	n/a	n/a	1, 2, 3, 4, 6
Education service allocation	Montreal School Board (French)	School districts	21	30,225-84,758	3.7-16.1	1, 2, 3, 4, 6
Employment	Quebec Ministry of Employment and Social Solidarity	Local employment centre territory	17	40,385-214,595	10.9-149.9	1, 2, 3, 4, 5
Local urban planning	City of Montreal	Urban planning of older neighbourhoods	54	965-1,039,534	102.4-19,172.7	1, 2, 3, 4, 5
<i>Statistical Boundary Files</i>						
Official statistics	Statistics Canada	Census tracts	521	0-9,288	0.01-28.82	1, 2, 3, 5, 6
Official statistics	Statistics Canada	Dissemination areas	3,254	0-2,138	0-17.66	1, 2, 3, 5, 6
Official statistics	Statistics Canada	Street blocks	13,313	0-1,248	0-6.41	3
Official statistics	Statistics Canada	Forward sortation areas	96	195-48,507	0.28-27.5	3
Official statistics	Committee for Management of School Taxes	School planning areas	393	n/a	0.07-13.5	1, 2, 3, 6

* Criteria:

1. Presence of intraneighbourhood homogeneity of socio-economic characteristics of residents
2. Presence of historically defined neighbourhoods
3. Presence of geographic or natural boundaries (e.g., railroads, creeks)
4. Presence of a subjective sense of place
5. Presence of social networks
6. Threshold for population size

ic or natural boundaries (e.g., railroads, creeks); (4) presence of a subjective sense of place; (5) presence of social networks; and (6) threshold for population size. Table II lists the criteria that were apparently or explicitly used in creating the different territorial divisions. In the following sections, we examine the potential of different territorial definitions for characterizing the material and social conditions of small areas in Calgary and on the Island of Montreal using these six criteria.

Calgary communities: a useful cornerstone for examining effects of small-area exposures on health

From the beginning of the 20th century, the urbanization of Calgary was marked by a preoccupation with the development of

infrastructures (street configuration) and planning of growth. As a result, Calgary's central area contains territories characterized by multiple land uses (e.g., residential, commercial) and other areas of the agglomeration developed through separation of functions, e.g., relatively homogeneous socio-economic residential areas (www.calgarycommunities.com). The fast pace of development early in the 20th century compromised access to community services. To solve this problem, community initiatives were launched to provide services of proximity e.g., leisure programs, social services. These small communities still exist today and represent the front line area for service provision in many domains of community life (www.calgary.ca). The growing number of Calgary communities

led to the creation of a federation of associations to unify their coordination (www.calgarycommunities.com). Currently, the City of Calgary includes 273 community territories, of which 131 are governed by an association (www.calgaryarea.com). These territories are very small spatial units in which several services are coordinated and managed (primary schools, medical centre, churches, etc). Population sizes range from 205 to 17,000 inhabitants. These smaller spatial units (mean area: 0.20 to 20.41 km²) appear as reasonable territorial units for the study of small-area exposures because they were constructed on the basis of social, historical and geographic criteria and therefore likely include homogeneous exposures of at least some spatially based attributes. However,

in some extreme cases they are so small and scarcely populated as to be devoid of any sense of belonging and social interrelationships.

Montreal municipalities and boroughs: the challenge of uniting political realities with meaningful territorial units

At the time the analyses were performed, there was one basic administrative territorial unit on the Island of Montreal, namely the borough (“arrondissement”). Until the year 2002, the Island of Montreal had encompassed 28 municipalities (the City of Montreal and 27 other municipalities), but a provincially led initiative to merge municipalities located in the same region resulted in the creation of one mega-city, which comprised 27 boroughs. Citizens from selected former municipalities protested the merger, and after the election of a new provincial government in 2003 referendums were held to allow populations to decide whether they wanted to pull out of the mega-city. A total of 15 municipalities voted in favour of withdrawing from the mega-city. As a result, on the Island of Montreal there are now 15 municipalities in addition to the municipality of Montreal, which includes 19 boroughs (see www.ville.montreal.qc.ca and Figure 2). In the following paragraphs, we describe territorial divisions as they existed when the Island of Montreal was one mega-city with 27 boroughs.

The 27 boroughs have a function that is similar to that of Calgary communities, i.e., to provide proximity services, although Montreal boroughs are very different in terms of shape and area in comparison with Calgary communities.¹³ Nevertheless, planners have successfully compiled several databases at the borough level. However, these territories are very large in comparison with older districts, planning districts or the municipal and school electoral districts. As a result, there is so much within-territory variability in population characteristics and other exposures that these units may not be especially useful in uncovering neighbourhood determinants of health.

Cross-classification of territorial units

In addition, in our quest to develop useful territorial boundaries to operationalize the



Figure 2. Map of the Island of Montreal with territorial divisions as of January 2006

concept of neighbourhood, we stumbled across yet another issue. Indeed, the ultimate goal of using the concept of neighbourhoods is to link exposures to health outcomes in individuals and populations. However, experts in geocoding are well aware of the fact that smaller territorial units do not always neatly nest, unequivocally, into larger territorial units. For example, postal codes, the simplest and most frequently used geocode to identify very small areas, do not always link up cleanly with other larger territorial divisions (examples of geocoding challenges in the United States are relevant here²¹). There are 17,096 Canadian postal codes (2.07%) that overlap more than one census tract.²² This feature of territorially based data files obviously increases the complexity of any procedures of aggregation and disaggregation that might be adopted to develop territorial delineations that are homogeneous in terms of exposures.

Summary

Both administrative and spatial statistical units provide useful information for characterizing some of the material and social conditions of territorial units. However, their potential appears to vary from one urban setting to another. In Calgary, the communities divisions appear to provide useful information about material and social conditions, and residents are likely to have at least a moderate sense of belonging to many of them. In other words, Calgary communities could be viewed as a potentially useful delineation of the neighbourhoods. On the Island of Montreal,

none of the territorial divisions available seems to appropriately capture the full reality of exposures to spatially based attributes while being subjectively meaningful to participants, perhaps because of size, complexity or recent structural changes.

Nonetheless, in the interests of further exploring how to delineate small territorial units in order to operationalize the concept of neighbourhood, we elected to examine the viability and utility of aggregating smaller territorial units to create larger territories that were more homogeneous in terms of one specific exposure, namely the material and social characteristics of populations residing within them. In other words, we experimented with the viability of creating territorial units that were homogeneous in terms of one selected, spatially based attribute. We believed that this exercise might allow for the development of a flexible mapping approach that could overcome some of the difficulties associated with using “off the shelf” divisions and therefore bring us closer to operationalizing the concept of neighbourhood in urban settings.

Small territorial units as fixed or malleable entities

We explored the utility of aggregating census tracts into larger territorial units on the Island of Montreal and in the City of Calgary, as outlined by Pumain and Saint-Julien,²³ in order to create the largest possible areas that were homogeneous in terms of the characteristics related to material and social conditions. We used this approach because Pumain and Saint-Julien²³ underscore the fact that the process

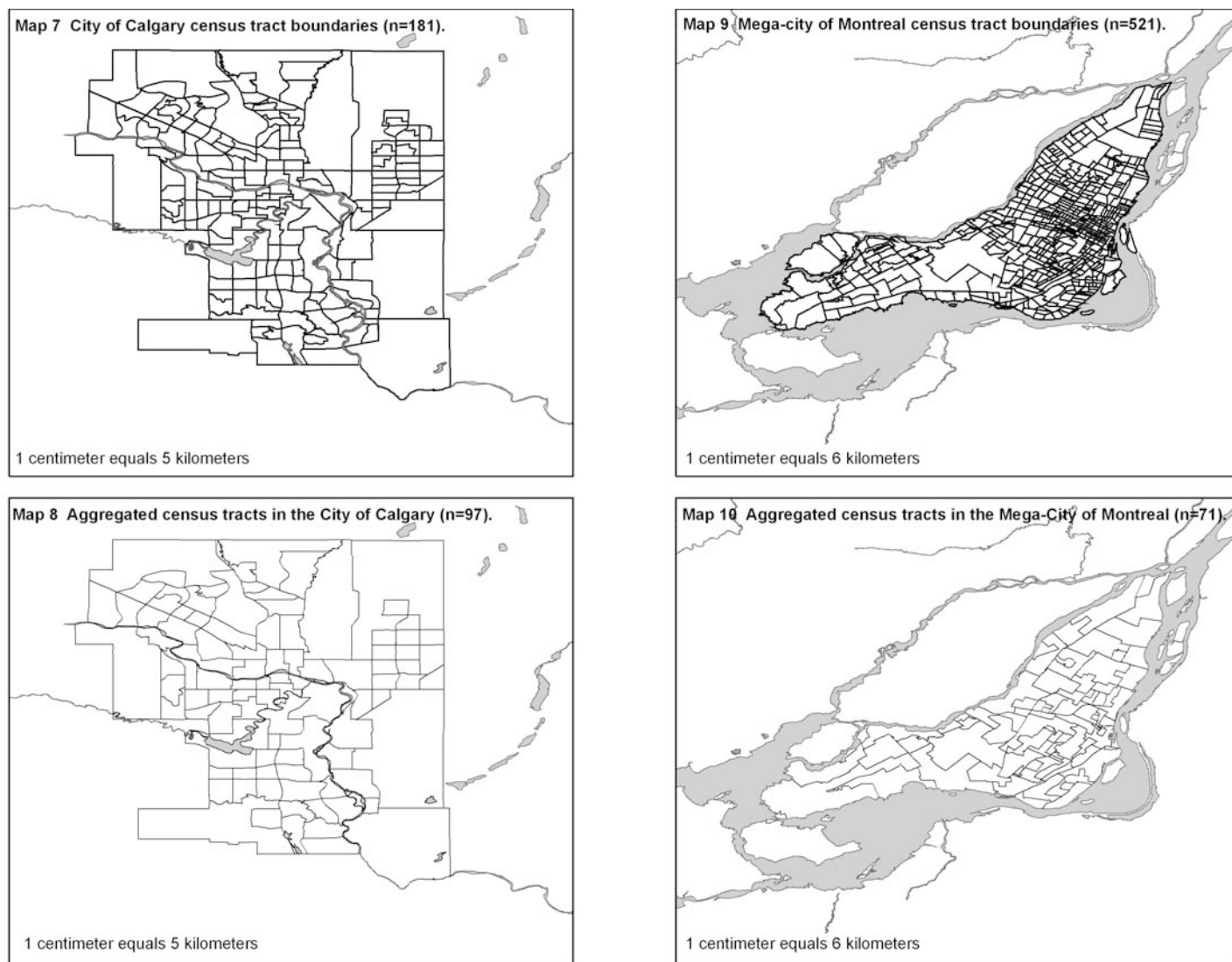


Figure 3. Maps resulting from the aggregation of census tracts based on homogeneity of material deprivation in Calgary and Montreal

of aggregation is flexible and can be designed as a function of specific study questions – a scenario that was obviously in line with our concern to conceptualize and operationalize neighbourhoods in health research.

Aggregation proceeded in three steps. First, we created three composite indices of social and material conditions using data from the Canadian census. That is, we identified 17 variables from the census (2001 for Calgary and 1996 for Montreal) that were indicative of material and social conditions of populations and performed data reduction analyses to create overall deprivation indices.²⁴⁻²⁶ A principal components analysis resulted in the identification of three composite indices of deprivation, namely (1) social isolation, (2) material deprivation and (3) social deprivation.

Second, we explored the utility of regrouping units by aggregating census tracts using one of the indices, i.e., material deprivation, while respecting other, more secondary, territorial shaping criteria, namely (1) geographic barriers (e.g., railroads, highways) and population size, (2) subjective sense of place expressed by inhabitants (as reported in a previous survey), (3) history of the neighbourhood (i.e., whether the territory had a name and contours), and (4) social dynamics of the neighbourhood. This aggregation of units was performed discursively by a geographer using Geographical Information System (GIS) software called MapInfo,²⁷ that is, various classes of material deprivation were created by using the “equal count” function of MapInfo, which subdivides a sample of entities (in this case census tracts)

into roughly equal groups (equivalent to creating sextiles). In this case, we chose to create six classes of material deprivation. Aggregation of tracts occurred when adjacent or contiguous tracts were in similar classes. However, contiguous tracts that were separated by a major road network were not aggregated. Similarly, we used a maximum population size (approximately 15,000 inhabitants) to limit the number of tracts aggregated. This population size limit allowed us to maintain aggregated territories small enough to investigate possible social dynamics and the existence of a subjective sense of place while at the same time regrouping populations with similar socio-economic characteristics.

Third, in order to verify optimization of aggregation in terms of the homogeneity of material deprivation, we estimated intra-

class correlation coefficients, which provide an index of the proportion of the total variance in material deprivation that can be ascribed to between- rather than within-area variation. The maximization of between-area variation and thus creation of homogeneity of material deprivation within territories was the major criterion used in this example, but clearly other criteria can be used.

Aggregation of census tracts in Calgary
As of 2001, Calgary had 181 census tracts with population sizes varying from 617 to 11,798 inhabitants (average 4,903). After the initial aggregation, the number of units was reduced from 181 to 97, a little less than a 2-fold reduction. Estimation of intraclass correlation coefficients showed that 73.67% of the total variance in material deprivation was at the between-area level and the remainder of the variance at the within-area level, suggesting reasonable optimization of the new spatial units (see Maps 7 and 8 in Figure 3 for resulting territorial divisions).

Aggregation of census tracts in Montreal

The same exercise was performed with data from the Island of Montreal. As of 2001, Montreal had 521 census tracts with population sizes ranging from 0 to 9,288 residents (average of 3,979). After removing those areas with no residents and performing an initial aggregation of tracts using the index of material deprivation, the number of spatial units was reduced from 511 to 71, an approximate 7-fold reduction. The intraclass correlation coefficient was 0.7532, suggesting that about 75.32% of the total variance in material deprivation in the new territorial divisions was at the between-territory level and the remainder at the within-territory level (see Maps 9 and 10 in Figure 3 for resulting divisions).

Other potential hazards

In performing this exercise, another methodological pitfall became evident, namely the modifiable areal unit problem (MAUP²⁸⁻³²). The MAUP refers to the sensitivity of analytic results to the definition of spatial units for which data are collected.^{32,33} It arises from the fact that territorial units are often arbitrarily determined and modifiable, in the sense that they can be

aggregated to form units of different sizes and spatial arrangements.^{32,33} Thus, territorial units can be aggregated hierarchically into different sets of larger spatial units, such as enumeration districts nested within census tracts, which in turn are nested within city boroughs, or into various spatial configurations, e.g., aggregating census tracts into larger spatial units based on their similarity in terms of material deprivation, as we have done.

The implications of the MAUP in research on small areas and health can be effectively illustrated by referring to John Snow's findings that the Broad Street Pump in London was associated with the cholera epidemic.³⁴ Snow examined the distribution of deaths from cholera in southern areas of London using point data to identify each case of death. The higher concentration of points around the Broad Street pump was indicative of the contaminated water. However, instead of using points to identify cholera cases, the concentration of cases of death could have been mapped out using density areas. Depending on the spatial boundaries of areas, higher densities might have been observed in areas contiguous to the area where the Broad Street pump was located. Thus, if Snow had represented deaths from cholera using density areas rather than point data, he might not have been able to identify clusters of cholera cases around the Broad Street pump and subsequently ascribe the cause of death from cholera to the contaminated water.

The presence of the MAUP has significant consequences on research into small-area effects on health because associations between health outcomes and characteristics of the social and built environment established using one spatial definition of the neighbourhood (e.g., census tracts) may not be replicated if the same association is examined using another spatial definition.³⁵⁻³⁹ In response to the conceptual and methodological challenges of the MAUP in examining small-area effects on health, different solutions have been proposed, but further research is required to determine their respective viability.^{28,29,40-42}

Summary

Aggregating spatial units represents a useful and powerful means of creating territorial units that could more readily aid

researchers in uncovering associations between material and social conditions in small areas and health outcomes. More recent advances in the application of this methodology show that with some programming the process can be automated.^{43,44} Furthermore, although in this case spatial areas were regrouped using an index of material deprivation, other criteria for aggregation could be used, including health outcomes, characteristics of the physical environment, socio-environmental features, access and availability of services, or any other spatially based attribute. Notwithstanding these possibilities, it should be noted that aggregation does not address the MAUP, a solution to which will require further research.

Small area effects: "modest and meek" or "powerful and disguised"

The trials and tribulations associated with conceptually and operationally defining neighbourhood impelled us to reconsider the evidence on the associations between neighbourhoods and health. In addition to examining previous reviews,³ elsewhere we performed a synthesis of existing research⁴ from which several important observations are underscored here. First, in most studies of neighbourhood, researchers have used spatial units that draw upon administrative boundary units, statistical spatial units or some combination of both. Few, if any, attempts at examining small-area effects on health have explored how to maximize between-area variability and to minimize within-area variability in exposures or health outcomes to explore small-area effects. Second, although the social and material conditions of small areas are quite consistently related to health outcomes, some studies do not report area effects.^{4,45-47} Third, findings of the scoping study show that area effects on a specific health indicator may depend on the measure of area exposure and the spatial level (territorial unit) at which associations are investigated.^{48,49}

These observations lead to two distinct yet interrelated sets of questions: (1) What is the magnitude of neighbourhood effects? What are the implications of the size of these effects for advancement of knowledge and for public health intervention? and (2) Are widely used methodologies for operationalizing neighbourhoods in small area

and health studies well suited to the task? As articulated elsewhere,⁴ we believe that an exposure-specific and a health-outcome-specific tactic is the most promising but that such a tactic can be successful only if accompanied by a strategy to operationalize neighbourhoods, which consists of creating territorial units that are homogeneous on exposures of interest. In the following section, we outline guidelines for achieving this end given the current state of knowledge and theorizing.

Towards an integrative approach

The previous illustration, along with a perusal of the literature, leads us to propose that using a more exposure-specific and outcome-specific approach might result in important strides in the advancement of knowledge. Our thinking is based on the following observations. First, small-area effects are best addressed through *examination of specific health outcomes and specific exposures*. In this regard, we view as particularly enlightening initiatives such as those by Sampson et al.,⁵⁰ Frank et al.,⁵¹ and Humpel et al.,⁵² who laid out conceptually based hypotheses about how specific aspects of small areas are associated with specific health outcomes.

Second, defining and operationalizing neighbourhoods will continue to pose a challenge to researchers. Some of the most promising strategies for overcoming this problem consist of delineating territorial units that maximize between-neighbourhood variability while minimizing within-neighbourhood variability on exposures of interest through the application of geographic analysis techniques. Others have experimented with obtaining resident input.¹⁶ We thus believe that another rung in an integrative strategy for conceptualizing and operationalizing neighbourhoods consists of *delineating the most appropriate territorial unit for the specific exposures of interest*. Proponents of the currently used approach may argue that this approach is not overarching enough to provide substantive advancements in knowledge. However, we believe that, through gathering and compiling evidence about the overlap and distinctiveness among territorial units in the association between a variety of exposures and health outcomes, the evidence base can be built. On the basis of numerous attempts at delineating territori-

al boundaries it may be possible to identify a more limited set of territorial units that are appropriate for deriving maximum explanatory power to study neighbourhoods and health in various settings. This might also serve as the foundation for a policy initiative to develop data collection sampling plans based on these territorial units.

In coming full circle to the introduction to this paper, we have argued that one of the most promising approaches to defining and operationalizing neighbourhoods for research on health outcomes lies in an approach that combines an examination of specific exposures and health outcomes and explicit choices about delineating territorial units. It should be noted that several other important issues in research on neighbourhoods and health will also require thoughtful attention. For example, crafting longitudinal designs that can simultaneously capture changes in neighbourhood environments and populations will require important conceptual and methodological advances,⁴ as will the need to account for self-selection into neighbourhoods.⁵³ Similarly, the issue of controlling for the degree of exposure to residential neighbourhoods (i.e., some people spend most of their time in their residential neighbourhoods, whereas others spend time in their neighbourhood only on weekends) has not been addressed to our knowledge but has important implications for developing an understanding of the role of neighbourhoods in health. Finally, there is a need to develop transfer of knowledge approaches such that the knowledge gained from existing and future research is appropriately integrated into public health policy and practice.

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RÉSUMÉ

Introduction : Au cours des 10 dernières années, il y a eu un intérêt accru pour la recherche portant sur les caractéristiques de petites unités territoriales comme déterminants de la santé des populations et des individus. Plusieurs études démontrent l'existence de variations dans l'état de santé des populations en fonction du degré de favorisation dans différents territoires et d'associations entre certaines caractéristiques des territoires et la pratique de différentes habitudes de vie. Ces variations ne semblent pas pouvoir être attribuées uniquement aux caractéristiques différentielles des populations qui y vivent. Un des problèmes de recherche les plus vexant dans ce domaine se rapporte à la conceptualisation et l'opérationnalisation de la notion de quartiers à travers la délimitation d'unités territoriales.

Buts et méthodes : Les buts de cet article sont de sélectivement énumérer les définitions conceptuelles du quartier et d'illustrer les défis associés à l'opérationnalisation de la notion de quartiers dans des milieux urbains en décrivant nos propres tentatives de cartographier de petites unités territoriales sur l'île de Montréal et dans la ville de Calgary.

Conclusion : Nous proposons des lignes directrices pour le développement d'une méthodologie pour établir les contours de quartiers dans des milieux urbains et formulons des recommandations pour la recherche future.