*Scoping Review Protocol*

# Spatial models of access to health and care services in rural and remote Canada: a scoping review protocol

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## Abstract

**Objective**: The objective of this review is to determine the scope of spatial modelling approaches used to evaluate geographic access to health and care services in rural Canada.
**Introduction**: Canada's health and social policy agenda has made the requirement for equal access to primary and secondary health services for rural populations a key priority. Most rural health research in Canada has focused on measuring patterns of health outcomes or modelling geographic access to a narrow range of services, health conditions, or within specific regions. This scoping review will provide an in depth look at the spatial modelling currently being used to evaluate the barriers and facilitators for access to health and care services and will provide direction for further research.
**Inclusion criteria**: This review will consider studies that include any person accessing health and care services in Canada, focusing on those who reside in rural or remote communities, or access health services in those areas.
**Methods**: Published primary studies, reviews, opinion papers, reports, theses, and dissertations published in English or French across all dates will be searched in databases including CINAHL via EBSCO, PubMed, ProQuest, Scopus, Web of Science and Dissertations and Theses Global. Following the search, all titles and abstracts will then be assessed against the inclusion criteria for the review. Potentially relevant papers will be assessed in detail against the inclusion criteria. The data extracted will include geographic location, service under study, analytic methodology, data included, and specifics of the spatial models employed.

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**Keywords:** Access to Care; Access to Health Services; Rural Health; Spatial Analysis

## 1. Introduction

The rising cost of providing health care services and inability for services to meet the population demand in 21st Century Canada was predicted by economists and health researchers decades ago (1). Difficulty in ensuring equal access to health and care services is tied to the geographic nature of the country, which is dominated by rural and remote regions with diverse settlements spread over vast geographic areas. While the majority of Canada's population resides in urban areas, about 18% of Canadians reside in rural regions (2). Canada is unique compared to its peers, in that it is the only Group of Seven (G7) country where the rural population is increasing, although rural growth is highest for less-remote communities. Like its G7 counterparts, rural Canada is faced with an aging rural population; 22.7% of the rural population is aged 65 years and older, compared to 17.7% of the urban population, further highlighting need for additional health and care services in the coming decades (3,4).

While the impacts of demographic change are felt in health services Canada-wide, rural hospitals are seeing impacts ahead of their urban counterparts, with media regularly reporting rolling closures of rural emergency, surgical and obstetrical services. The mounting impacts on rural communities have revived interest in rural health and care service delivery and the complexity of local health systems (5–7). The underlying reasons for health service shortages are multiple and span a wide range of professions including physicians, nurses, dentists, psychologists, and the full range of allied health professionals. (8).

Many rural residents are long distances from the health services they require, and available services are often limited in comparison to those in urban communities. Combined with the unique health needs of rural residents, this results in unique challenges for service provision for rural communities (9). There are consistent disparities in the health of rural Canadian populations compared to urban populations (4). Although almost 20% of Canadians live in rural areas, only 12.8% of family physicians and 2.2% of specialist physicians are considered rural health professionals. However, the number of family physicians per capita is likely inflated; Shah et al. (10) highlights that just over 2/3 of primary care physicians were actively providing care according to a 2014/15 estimate. In Ontario, there were 9.58 family physicians listed per 10,000 people, however only 6.03 per 10,000 capita actively had patients enrolled.

A key priority to meet Canada's health and social policy agenda is the requirement for equitable access to primary and secondary health services for rural populations (11). Most rural health research in Canada has focused on measuring patterns of health outcomes or modelling access to a narrow range of services, health conditions, or within specific regions (12,13). However, access is a multifaceted concept, and understanding individual barriers depends highly on locational context, including community socioeconomic conditions, economic and employment patterns, policy environments, and transport availability – all of which can vary geographically between communities and regions (14,15). Importantly, rural areas are not all the same and there is variation both *within* and *between* rural regions and rural communities. As such, we conceptualize access to health and care services as primarily a geographic problem, where *space* and *place* must be explicitly included in analytic and modelling approaches.

Modelling access to rural health services in Canada is hampered by incomplete availability of essential geographic and attribute data (16), and rural geography is often poorly considered in the literature, usually treated as a dichotomous variable or masked by data aggregation (17). Due to the methods of data collection and comparatively small populations, rural communities are either grouped together with urban centres for data collection or combined with other types of rural areas and treated as a homogeneous whole. Incomplete data sources include such basic information as locations and travel time to hospitals, locations and attributes of primary care physicians, or number of long-term care beds in approved facilities. Additionally, there are significant methodological issues with the use of inappropriate geographic units of analysis, such as the well-documented (18) limitations in using Postal Codes to geographically locate individuals and facilities (usually the only *geographic* variable on administrative files) (4).

As highlighted, there is limited understanding of the spatial modelling approaches used in this research setting in Canada, and this scoping review aims to identify these modelling practices, and develop a profile of the methods used, definitions of rurality used, data included in the analysis, and categorize the types of care, diseases included, and populations studied in the current body of literature.

A preliminary search of PROSPERO, MEDLINE, the Cochrane Database of Systematic Reviews, and *JBI Evidence Synthesis* was conducted and no current or in-progress scoping reviews or systematic reviews on the topic were identified. A recent review was conducted in Australia (19), however our scoping review will be unique as there are no current reviews of models used to measure access to rural health and care services in a Canadian context. Additionally, the Australian review did not categorise the data sources used or summarize the statistical calculations used in the various methods. Conducting this review will help us understand the modelling approaches to analyse potential access barriers for rural health services used by rural researchers in Canada and elsewhere.

## 2. Review Question

What spatial analytic models are used to examine geographic access to rural health and care services in Canada?

## 3. Inclusion Criteria

*Participants*

This review will consider studies that evaluate access to health and care services in Canada, focusing on those who reside in rural or remote communities, or access health services in those areas.

*Concept*

This review will examine spatial and geographic models used to analyze access to rural health and care services in rural or remote Canada. Those who study rural issues are familiar with the lack of agreement on the definition of "rural" and there are several definitions employed in Canada, not all of which are comparable. Researchers often start with the "rural and small town" definition of rurality which defines urban centres as those with a population of 10,000 or more, and the rural population as those living in towns and municipalities outside the commuting zone of an urban centre (20). In comparison, the Canadian Census defines urban areas as those with a population size of at least 1,000 and population density of 400 or more people per kilometre, while rural areas are the sparsely populated lands outside urban areas (20). Metropolitan area and census agglomeration Influenced Zones (MIZ) were created using aspects of the "rural and small town" and census "rural areas" definitions. However, as urban centre boundaries are expanded to include outlying rural areas for administrative purposes, there are continuity and accuracy issues with this definition.

Recently, Statistics Canada developed a more refined measure of rurality via Index of Remoteness (IOR), which is a continuous measure of the relative remoteness of Canadian communities (Census Subdivisions) based on size and proximity to service and population centers (21). Using the IOR scale, a rurality index was developed for the purposes of data analysis, by systematically dividing the IOR into an ordinal variable (16,21).

No matter the definition of rurality employed, recognising differences *between* and *within* rural and remote communities is essential. In this regard, Stark et al. (22) recognise the necessity of combining technical (geographic) definitions with social distinctions in order to construct a more accurate portrayal of the different types of rurality in Canada and how those populations experience our health care system. In this review, we will further identify the various definitions of rurality and the methods used to quantify them.

*Context*

This review will consider studies that focus on the Canadian population, and which pay particular attention to residents of rural or remote settings, whether on their own or within a broader context.

*Types of Sources*

This scoping review will consider quantitative, qualitative, and mixed methods study designs for inclusion. In addition, systematic reviews, theses, and dissertations will be considered for inclusion in the proposed scoping review.

## 4. Methods

*Search Strategy*

The search strategy will aim to locate published primary studies, reviews, reports, theses, and dissertations. A specialist research librarian and primary reviewer completed an initial limited search of PubMed and CINAHL to develop the search strategy. The text words contained in the titles and abstracts of relevant articles and the index terms used to describe the articles were used to develop a full search strategy PubMed (see Table 1). The search strategy, including all identified keywords and index terms, will be adapted for each included information source. The reference lists of articles selected for review will be screened for additional articles to include.

All articles published in English and French, which are the only languages expected to be used in this context, will be included. Articles published from database inception the present will be included as the literature on this topic is limited and there is no benefit to narrowing the date range of the search. The databases to be searched include CINAHL via EBSCO, PubMed, ProQuest, Scopus, Web of Science and Dissertations and Theses Global.

*Source of Evidence Selection*

Following the search, all identified records will be collated and uploaded into reference management software and duplicates removed. Following a pilot test, titles and abstracts will then be screened by at least 2 independent reviewers for assessment against the inclusion criteria for the review. Potentially relevant papers will be retrieved in full, and their citation details imported into Covidence (24). The full text of selected citations will be assessed in detail against the inclusion criteria by 2 independent reviewers. Reasons for exclusion of full-text papers that do not meet the inclusion criteria will be recorded and reported in the scoping review. Any disagreements that arise between the reviewers at each stage of the selection process will be resolved through discussion or with a third reviewer. The results of the search will be reported in full in the final scoping review and presented in a Preferred Reporting Items for Systematic Reviews and Meta-analyses for Scoping Reviews (PRISMA-ScR) flow diagram (25).

**Table 1.** Search strategy. Retrieval results from PubMed (via NLM) on Dec. 12, 2022.

| Search | Query | Records retrieved |
|---|---|---|
| #1 | "geospatial"[All Fields] OR "spatial"[All Fields] OR "model"[All Fields] OR "GIS"[All Fields] OR "map"[All Fields] OR "travel"[All Fields] OR "distance"[All Fields] | 3,427,832 |
| #2 | "models, spatial interaction"[MeSH Terms] OR "Spatial Analysis"[MeSH Terms] OR "Travel"[MeSH Terms] OR "Geographic Information Systems"[MeSH Terms] | 53,430 |
| #3 | #1 OR #2 | 3,435,548 |
| #4 | "rural"[All Fields] OR "ruralities"[All Fields] OR "rurality"[All Fields] OR "rurally"[All Fields] OR "ruralness"[All Fields] OR "rurals"[All Fields] OR "rural*"[All Fields] OR "remote"[All Fields] OR "remotely"[All Fields] OR "remoteness"[All Fields] OR "remotes"[All Fields] OR "isolated"[All Fields] OR "isolation"[All Fields] OR "rural"[Title/Abstract] OR "remote"[Title/Abstract] OR "isolated"[Title/Abstract] OR "non-urban"[Title/Abstract] | 2,381,289 |
| #5 | "Rural Population"[MeSH Terms] OR "Rural Nursing"[MeSH Terms] OR "Rural Health Services"[MeSH Terms] OR "Rural Health"[MeSH Terms] OR "hospitals, rural"[MeSH Terms] OR "Rural Population"[Mesh] | 104,794 |
| #6 | #4 OR #5 | 2,381,289 |
| #7 | "access*"[Title/Abstract] OR "availab*"[Title/Abstract] OR "access"[All Fields] OR "accessed"[All Fields] OR "accesses"[All Fields] OR "accessibilities"[All Fields] OR "accessibility"[All Fields] OR "accessible"[All Fields] OR "accessing"[All Fields] OR "barrier*" [All Fields] OR "measur*"[Title/Abstract] OR "analys*" | 12,284,057 |
| #8 | "Health Services Accessibility"[Mesh] OR "health care quality, access, and evaluation"[MeSH Terms] | 8,563,411 |
| #9 | #7 OR #8 | 16,515,981 |
| #10 | "Canada"[MeSH Terms] | 178,389 |
| #11 | "canad*"[Title/Abstract] OR "British Columbia"[Title/Abstract] OR "Colombie Britannique"[Title/Abstract] OR "alberta*"[Title/Abstract] OR "Saskatchewan"[Title/Abstract] OR "manitoba*"[Title/Abstract] OR "Ontario"[Title/Abstract] OR "Quebec"[Title/Abstract] OR "Nouveau Brunswick"[Title/Abstract] OR "New Brunswick"[Title/Abstract] OR "Nova Scotia"[Title/Abstract] OR "Nouvelle Ecosse"[Title/Abstract] OR "Prince Edward Island"[Title/Abstract] OR "Newfoundland"[Title/Abstract] OR "Labrador"[Title/Abstract] OR "Nunavut"[Title/Abstract] OR "NWT"[Title/Abstract] OR "Northwest Territories"[Title/Abstract] OR "Yukon"[Title/Abstract] OR "Nunavik"[Title/Abstract] OR "Inuvialuit"[Title/Abstract] | 197,783 |
| #12 | #10 OR #11 | 268,016 |
| #13 | #3 AND #6 AND #9 AND #12 | 2,582 |

*Data Extraction*

Data will be extracted from papers included in the scoping review by independent reviewers using Covidence software. The data extracted will include specific details relevant to the review question including geographic location, service under study, diseases or conditions included, population studied, analytic methodology, data included, and specifics of spatial models employed. Any disagreements that arise between the reviewers will be resolved through discussion or with a third reviewer. Authors of papers will be contacted to request missing or additional data where required.

*Data analysis and Presentation*

A PRISMA flowchart of the study selection process will be completed based on the selection criteria of the study. First, duplicates will be removed, then studies that do not meet the study population, context and criteria based on the abstract will be excluded, then studies that do not meet these requirements based on the full text of the article will be removed. In the end, articles that are selected will be manually reviewed for other potential studies. We will summarise these studies by year, topic (type of care or disease group), Aboriginal consideration, categorisation of methods used (barriers, accessibility, or diseases), and data (spatial, health, socio-demographic) used. As this topic is focussed on spatial models, we will also integrate evidence mapping tools into outputs. This includes geographic mapping of included study locations (Province, Region, or Community) by condition, population studied, and services considered.

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