# Rural Health Infrastructure in Ontario, Canada

A Rapid Review

## Suggested Citation

## About the Spatial Determinants of Health Lab

Work in the Spatial Determinants Lab focusses on the study of inequities in human health outcomes and determinants of health in small places and small spaces. Despite decades of universal healthcare for many countries around the world, there remain pronounced inequities in the social determinants of health, health outcomes, and in environmental exposures. These systemic differences are manifest between social groups and across a range of factors such as income, education, and ethnicity. At the same time, health inequities are spatially evident, with differences between countries, regions, communities, and neighbourhoods. Understanding the relationships between social processes, geography, and human health is the focus of our Lab.

We are located in the Department of Health Sciences, Carleton University, Canada.

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## Key Evidence:

- Rural regions are composed of unique and diverse communities.

- There are inequities in access to healthcare services for these individuals residing in rural Canada.

- Major systemic change cannot occur without addressing access inequities to health infrastructure.

- Currently in Canada, there is a lack of systematic evidence-based for rural health-care infrastructure planning at national or provincial levels.

- Consistent and reliable investments in infrastructure are essential for rural health research funding to reflect the realities of rural healthcare.

## Policy Recommendations:

- There should be consistency in Ontario as to how health infrastructure is proposed and funded as it is currently highly dependent on the organization, type, community, and funding source.

- Repairs and upgrades to hospital infrastructure are not often documented in advance, but rather publicized when the infrastructure is available for public use, leaving gaps in the knowledge of the development process of health infrastructure.

- Evidence-based (rather than opinion-based) population feedback should be sought on health infrastructure needs, and the value of new infrastructure developed.

# 1. Public Health Topic

Rural regions are composed of many unique and diverse communities where health behaviours, health literacy, perceived health, and health outcomes vary between widely[1]. In general, rural populations in Canada are characterized as generally older, less affluent, and are faced with more health issues than their urban counterparts. While this may be the case in the aggregate, there are a diversity of communities across Canada with wide variation between and within rural places. Almost one-fifth of Canadians (18%) live in rural communities yet they are persistently faced with on-going challenges recruiting and retaining family physicians and other health-care professionals, maintaining infrastructure for health service provision, and adapting health policies developed for urban environments into rural settings[2]. These challenges, among others, contribute to inequities in access to healthcare services for these individuals residing in rural Canada.

It is recognized that major systemic change is needed to improve health outcomes for communities in rural or remote areas, but that this cannot occur with addressing access inequities to health infrastructure such as hospitals, mental healthcare, and telehealth services [3].

## 2. Current Knowledge

Currently in Canada, there is a lack of systematic evidence-based rural health-care planning at national or provincial levels. The lack of this rural-focused planning proves challenging for the development of rural health infrastructure. As it is recognised that the needs of rural communities differ from their urban counterparts, rural communities need rural-based solutions. These solutions will allow rural communities to develop regional capacity to innovate, experiment, and discover what works for their needs(2).

Provincially, the Ontario Ministry of Health and Long-Term Care recognizes the need for the renewal of health care infrastructure and facilitates the *The Health Infrastructure Renewal Fund* to address regional address renewal needs on a priority basis(4). However, such policies are often guided by urban health-care models which may be ill-suited or have negative impacts in rural communities(2).

Advocacy for the need for rural health research funding resulted in a pre-budget submission being made in August 2018 to the federal government to enable rural and remote communities to carry out rural health research through the use of infrastructure funding. In June 2019, the Canadian Institutes of Health Research (CIHR) announced that it is undertaking a strategic planning consultation with input from stakeholders across Canada(2). These investments are essential in order for rural health research funding to reflect the realities of rural healthcare(2).

It's unclear exactly what kind of evidence, and exactly how and when it is used, to support the development of rural health care infrastructure. From initial research, it seems that a wide variety evidence is consulted from personal anecdotes to in-depth and specific budget requirements. The objective of this rapid review is to understand what types of evidence are used to identify and support policy development for rural health infrastructure.

# 3. Public health policy question

The objective of this review is to evaluate the evidence that is currently used to identify the need for rural health infrastructure development and implementation in Ontario, Canada. This review provides evidence to inform policymakers about the issues with infrastructure development in rural and remote areas of Ontario.

The main question guiding this inquiry was:

> *How can we visualize rural health inequities via an open-access spatial data visualization tool in a way that allows users to examine rural health inequities and health system access and that gives stakeholders access to a strong evidence base for identifying and supporting policy development in rural health?*

A further sub-question was developed to guide the research process and answer the main question:

> *What is type of evidence used to support or identify needs for rural health development?*

# 4. Synthesis of findings

## Setting

Out of (n=49) documents included in this review, most (n=20) were set in Ontario. Many (n=14) were written in a national context for Canada as a whole (n=14), and one document was set at an international level (including Canada, Australia, USA and UK) (n=1). The setting of the included documents is further explained by Table 1.

**Table 1. The setting and frequency of included documents (n=49)**

| Setting | | Frequency |
|---|---|---|
| **Total** | | 49 |
| **Specific Ontario Communities or Health Centres** | | 7 |
| | Bridgepoint Active Healthcare, Toronto, Ontario | 1 |
| | Hanover & District Hospital | 1 |
| | Kincardine South Bruce Grey | 1 |
| | Lakeridge Health Hospital, Oshawa | 1 |
| | Muskoka/Algonquin, Ontario | 1 |
| | Ontario (specifically Muskoka Algonquin region) | 1 |
| | Ontario (specifically, Durham Region) | 1 |
| **Specific LHINs** | | 5 |
| | North West LHIN | 3 |
| | Toronto LHIN | 1 |
| | Waterloo Wellington LHIN | 1 |
| **Specific rural or remote regions of Ontario** | | 2 |
| | Northern and rural communities in Ontario | 1 |
| | Remote and underserviced areas | 1 |

There were many documents that were produced by specific Ontario Communities or Health Centres and Local Health Integration Networks (LHINs). There were few documents that were produced by rural or remote regions of Ontario (n=2).

## Population

Most of the documents included in this review were targeting specific geographic regions (n=26) ranging from specific communities or health centres in Ontario, to Canada as a country. Many documents were written for professional audiences (n=13) such as healthcare professionals or public

servants for the Federal government. Few articles were targeted to healthcare professionals in rural, remote, or northern communities (n=2). Documents that were set in a specific Ontario LHIN (see section 4.1 Setting) all targeted those residing within the corresponding jurisdiction. There was one document that specifically targeted First Nations communities in Canada. For details, see Table 2.

**Table 2. The population affected and frequency of included documents (n=46)**

| Population | | Frequency |
|---|---|---|
| **Total** | | 46 |
| **Region** | | 26 |
| | Specific Ontario Communities or Health Centres | 10 |
| | Canadians | 6 |
| | Ontarians | 5 |
| | Canadians or Ontarians residing in rural, remote, or northern communities | 4 |
| | Residents of Canada, Australia, USA and UK | 1 |
| **Profession** | | 13 |
| | Healthcare professionals in Ontario | 8 |
| | Healthcare professionals in rural, remote, or northern communities | 2 |
| | Healthcare professionals in Canada | 2 |
| | Governmental agencies/institutions, public servants | 1 |
| **Ontario LHINs** | | 5 |
| | North West LHIN community members | 3 |
| | Individuals residing in Waterloo Wellington LHIN region | 1 |
| | Ontario LHINs | 1 |
| **Indigenous** | | 1 |
| | First Nations communities in Canada | 1 |
| **Other** | | 1 |
| | Intermediaries within Ontario, New Zealand, and Scotland's mental health system | 1 |

# Evidence type

For this section of the synthesis, documents were analyzed by answering the following question:

> *What do the included documents tell us about what evidence <u>authors</u> used to support or identify needs for rural health development?*

## *Population Feedback*

Many of the included documents used population feedback as evidence for supporting or identify needs for rural health development. For example, the Ministry of Health and Long-Term Care launched an extensive public engagement process across the province of Ontario to help inform their action plan *Patients First: Action Plan for Health Care* in addition to other forms of evidence. Local healthcare setting also used this form of evidence. Muskoka Algonquin Healthcare conducted stakeholder engagement with hundreds of staff and community members to obtaining feedback on their acute care sites(5).

## *Statistics*

Many of the included documents used statistics as a means to justify the need for healthcare infrastructure. These statistics varied greatly from epidemiological rates of diseases i.e., Alzheimer's disease, obesity, to data on health status (i.e., clinical outcomes & QOL), to stats related to social determinants of health such as, % of Canadian households in core housing need and wastewater treatment (6), to institution-specific indicators (i.e., hospital wait times, % Alternate Level of Care Beds)(7). Butler et al. (2018) document the strengths and challenges of using administrative health data in a multi-jurisdictional context (8). They compared data from five separate provincial healthcare data systems, to report on provincially comparable mental health and addiction services performance indicators: regular access to a primary care physician, first contact was in an emergency department, physician follow-up after hospital, suicide rate, suicide attempts, and mortality rates. Butler et al. concluded that an awareness of contextual variation is needed for the indicators to have meaningful impact on mental health policy and practice decisions(9).

### *Industry-specific Standards*

In an infrastructure-specific context, Infrastructure Canada uses "Departmental result indicators" to gauge whether they have hit the targets set out in the yearly Departmental Plan(10). These can include things like dollars spent in a particular areas such as, "Total annual investments from all levels of government in infrastructure projects supported by INFC" or can be expressed as a percentage such as "Percentage of municipalities that strengthened their asset management practices as a result of federal funding" and "Percentage of Canadians living within 400 metres of a transit station or stop"(10).

Infrastructure Canada compares yearly targets to "Actual Results" from the previous three years (2015–16, 2016–17, and 2017–18). Other evidence includes: "Canada's Core Public Infrastructure survey" stats on accessibility standards, and qualitative indicators such as "Implementation status and oversight of major bridge projects" which is measured on a binary scale of YES/NO.

### *Finances*

Many of the documents use financial information to support or identify needs for rural health development. This includes information is often reported at the institutional or community-level such as the expenses, operating costs, capital summary of a hospital or community health centre. Which financial information is used and collected varies by institution. Some authors use their own relative indicators, such as Lakeridge Health's "Balanced Budget", while others are more objective, i.e., cost per weighted case(11).

The Hospital Accountability Planning Submission (HAPS) documentation is designed to clarify expectations between hospitals and LHINs to provide support and consistency across the province(12). Within the *HAPS user guide* there is an explanation of the two components of health system funding reform; the Health Based Allocation Model (HBAM) and Quality Based Procedures funding (GBP). HBAM is an evidence-based formula that uses clinical and financial information to redistribute a fixed funding amount annually based on the number of patients in an institution and the complexity of their care(12). GBP serves to facilitate the adoption of clinical practices and funding decisions are made based on impact on practice variation, cost, feasibility/infrastructure for change, availability of evidence and impact on transformation(12).

### Rural-specific Indicators

There were many documents that used rural-specific indicators to support or identify needs for rural health development. HealthForceOntario's *Northern and Rural Recruitment and Retention Initiative Guidelines* are based on a Rurality Index of Ontario (RIO). RIO is derived from population, travel time to a basic referral centre and travel time to an advanced referral centre(13).

The MOHLTC's Rural and Northern Health Care Framework/Plan (2011) cites rural access indicators such as the role of hospitals as the default primary care provider where other services are not available is a further challenge within the continuum. This indicator can be used to explain why hospitalization rates tend to be higher in rural and northern areas, and can support the strategic directions and guidelines that will assist the MOHLTC and LHINs to address access to care in rural, remote and northern communities(14).

In a report published by Waterloo Wellington LHIN (2010), authors conduct a rural-focused quantitative analysis of socio-demographic data, health status indicators, and service utilization rates to confirm local rural health challenges related to age profile, socio-economic status as measured by income and education levels, and service gaps for comprehensive primary care, etc. Authors note that lack of access coupled with higher rates of socio-economic disadvantage and a higher burden of illness and injury among rural residents is consistent with the "Inverse Care Law" identified in national studies of rural health(15).

### Institution-specific Plans

In a health-specific context of the Annual Business Plan 2019-2020(8), Lakeridge Health monitors indicators related to their yearly targets. Examples include: Time to inpatient bed, Clinical Information System Implementation, Team Engagement Score, and % of reported WeCare incidents that have an accident prevention plan identified and documented within 21 days of being reported.

### Government Acts or Laws

Some reports use government acts or laws in order to justify or support the need for health infrastructure development. In the MOHLTC's *Patients First: Action Plan for Health Care* authors state the Patients First Act, 2016 and Bill 87, Protecting Patients Act, 2016, as a way to justify their progress with the action plan. The Patients First Act was passed in 2016 and helps patients and families

get better access to integrated health care systems to help improve their experience and to deliver higher-quality care. Bill 87 supports modernization of the community laboratory sector(7).

**Table 3. Evidence types of included documents (n=47)**

| Evidence types | Frequency |
|---|---|
| Population feedback | 10 |
| Statistics | 8 |
| Industry-specific standards | 7 |
| Finances | 6 |
| Rural-specific indicators | 6 |
| Institution-specific plans | 5 |
| Government Acts or Laws | 4 |
| Academic articles | 3 |
| High speed internet | 3 |
| Qualitative indicators | 2 |
| Other | 2 |
| Professional opinion | 1 |

## Interventions

For this section of the synthesis, documents were grouped into four categories based on setting and type of publication including 1) Hospitals and Health Units, 2) Local Health Integration Network (LHIN), 3) Academic Articles and 4) Government reports (see Table 4). They were further analyzed to summarize the types of interventions used for the development of health infrastructure.

**Table 4. The document type and frequency of included documents**

| Document Type | | Frequency |
|---|---|---|
| Hospital and Health Units | | 8 |
| | Lakeridge Health | 2 |
| | Hanover and District Hospital | 1 |
| | Kincardine South Bruce Grey Health Centre | 1 |
| | Muskoka Algonquin Health Care | 2 |
| | University Health Network | 1 |
| | St. Francis Memorial Hospital | 1 |
| Government Documents | | 22 |
| | Infrastructure Canada | 4 |
| | Government of Canada | 4 |
| | Ontario Ministry of Health and Long-Term Care (MHLTC) | 11 |
| | Government of Ontario | 3 |
| Local Health Integration Network(s) | | 6 |
| | Ontario LHINs | 2 |
| | North-West LHIN | 3 |
| | Waterloo-Wellington LHIN | 1 |
| Academic Articles | | 15 |
| **Total** | | 51 |

### *Hospitals and Health Units*

Interventions used by hospitals and health units in Ontario varied throughout the literature examined. Many of the reports examined developed interventions focused on the redevelopment or expansion of existing health infrastructure. This is often sought after due to the aging physical infrastructure, population growth within a community and the commitment to providing the highest quality of care to patients(16). Prior to implementing these changes, the hospital or health unit often conducts research within their organization with hospital staff, patients, and community members to obtain feedback on

their presumed plans(11). This outreach often results in recommendations in which the organization will incorporate into their infrastructure development plan.

Infrastructure development was also reported to replace aging infrastructure within a hospital, such as electrical, air-handling units and sprinkler systems(17). As noted in a report from Muskoka Algonquin Healthcare, the process of updating or building new health infrastructure is lengthy, as it is not uncommon for hospitals to spend 10 or more years proceeding through the Ministry of Health's planning stages even prior to the start of construction(5). Interestingly, some hospital and health units described various green initiatives that have been incorporated into their strategic planning to decrease energy consumption and greenhouse gas emissions while still maintaining their standards of care for patients(18).

### Local Health Integration Networks (LHINs)

The reports obtained from the Ontario LHINs consisted of ideas similar to other reports examined in this review. The literature showed that LHINs focused much of their interventions around community engagement campaigns to obtain ideas, feedback and stories from community residents to assist in supporting the LHINs health infrastructure development plans. The LHINs have developed many strategic communication strategies to obtain feedback from those of all demographics, including booths at community events, community workshops, as well as social media campaigns(19,20). The Waterloo-Wellington Local Health Integration Network organized and conducted a rural health working group within their community to identify and address gaps in rural health service delivery for residents in the WWLHIN(15). The data obtained from these campaigns conducted by the LHINs do not necessarily impact direct infrastructure development, but they do however identify top priorities according to their communities.

### Academic Articles

Of the academic articles examined in this review, many analyzed the challenges and gaps that exist within the current systems and procedures of developing health infrastructure in Ontario and Canada. Much of these studies were community based qualitative studies interviewing participants, conducting focus groups or having participants participate in health programs. One academic article further examined the role of accountability of stakeholders and other members thus ensuring the provision of

health programs and services within the geographical regions(21). Researchers also use interventions such as facilitating community health programs to identify future program adaptation and improvements(22). Though there are many interventions that researchers can develop and use to identify challenges or advantages of certain interventions, their findings are useful evidence to either support or refute health infrastructure development.

## *Government Reports*

Governmental reports from both the federal and Ontario's provincial government focused on a variety of health infrastructure needs in rural communities including managing projects, funding for research, and financial incentives for health care professionals. For example, Infrastructure Canada developed a planning or asset management project with communities across Canada including rural communities(10). These plans however include all public infrastructure and are not limited to just health infrastructure(10). Infrastructure Canada additionally develops initiatives focused to rural and northern communities with interventions to grow their economies, build stronger and more inclusive communities and help safeguard the environment and health of Canadians(23). Infrastructure Canada has also identified the need for targeted initiatives within Indigenous communities in Canada as there is awareness that their issues must be met using a unique approach(24). For example, the 2016 Government of Canada budget allocated $319.9 million over 5 years to build, repair or renovate First Nations health infrastructure including health centres, nursing stations and substance use treatment centres which has increased in recent years' budgets(25).

Another branch of government, Health Canada, has also implemented the First Nations and Inuit eHealth Infrastructure Program to support the development of technology systems to improve Inuit and First Nations healthcare(26). The GOC and MOHLTC has also identified the need to improve high speed internet access for all Canadians to deliver universal connectivity(27). With emerging telemedicine and e-health initiatives, this seems to be of priority to governmental agencies in recent years.

The Government of Ontario has also developed interventions in the form of research funding specified to promote research, knowledge translation and similar initiatives to address complex health issues in

Ontario (28)[,1]. The MOHLTC also provides financial incentives eligible to physicians who establish a full time practice in an eligible rural community in Ontario(13).

## Outcome Measures

### *Hospitals and Health Units*

As many hospital and health unit reports obtained in this study were provisions of future planning, there was very little evidence to show the results of their planning. As noted previously in this report, infrastructure development can take upwards of 10 years. Outcomes of infrastructure development can often be found in business plans such as the Lakeridge Health Annual Business Plan 2019-2020 (8).

### *LHINS*

Interventions held by the Ontario LHINs often report the outcomes of their outreach through reports and community campaigns. The results of outreach campaigns held by the North West LHIN and the Waterloo-Wellington LHIN were the identification of priority areas according to the community members themselves, as seen in Table 5. (15,20) Priorities areas identified that were common to both reports included mental health and addiction services, primary care, specialist care, services for seniors, and community support services(15,20).

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[1] Note the former Health System Research Fund has been reprofiled as the Applied Health Evidence Program

**Table 5. Priority areas identified by NW LHIN and WW LHINs through outreach campaigns**

| North-West LHIN Priority Areas | Waterloo-Wellington LHIN Priority Areas | Priority Areas Identified for Both Regions |
|---|---|---|
| Home and community care<br>Long-term care<br>Hospital service<br>Sub-region care<br>Chronic disease management and prevention<br>Digital health<br>Indigenous engagement and inclusion<br>French language services<br>SDOH<br>LHIN roles/responsibilities<br>Palliative care | Acute Care Facilities/Services<br>Generic Access to Services<br>Wait Times<br>Lack of Transportation Options<br>Ambulance/EMS<br>Affordable/Supportive Housing<br>Lack of Coordination across LHIN Borders<br> Health Human Resource and Funding Issues | Mental Health & Addiction services<br>Primary Care (and access to primary care)<br>Specialist care (and access to specialist care)<br>Services for seniors<br>Community Support Services |

The Waterloo-Wellington LHIN went further to suggest possible interventions or solutions to combat the priority areas identified. The question asked to community members involved was: *How can we make our local health system more responsive to the needs of rural residents?*

**Table 6. Themes identified by WW LHIN residents on how to better respond to the needs of rural residents.**

| Waterloo-Wellington LHIN System Response |
|---|
| More Rural-focused Planning<br>Greater Awareness of Services<br>More Coordinated Services & Partnerships<br>Using System Navigators<br>Redevelopment & Better Use of Rural Hospitals<br>Improve Access to Services<br>Improve Transportation<br>Increase Supply of Health Professionals & Innovative HHR Strategies<br>Cross-LHIN Planning<br>More Effective Communication<br>Utilize Information Technology |

## *Government Reports*

The Government of Canada initiates and supports many health infrastructure plans, some specifically focusing on rural, remote and Indigenous communities. As per *Canada's Long-Term Infrastructure Plan* developed by Infrastructure Canada, the government has set to regularly track and report infrastructure investments to allow Canadians to see how these investments impact their lives(6). Outcomes from these reports include health related issues such as affordable housing, child care and sustainable infrastructure(6). For example, through funds allocated in the Government of Canada's annual budget, there have been 208 reported health infrastructure related projects completed or ongoing, with 166 First Nations communities directly benefiting from this (As of June 30, 2020) (25). The Government of Canada has also recently promised to track the progress towards their strategy for high-speed internet access(27).

The Rural and Northern Healthcare Framework/Plan developed by the MOHLTC has identified the health status and challenges of rural, remote and northern communities in Ontario. They were grouped into the following categories; 1)Service-related access challenges, 2) resource-related access challenges, 3)inter-sectoral and cross-jurisdictional challenges, 4)transportation challenges, 5)planning challenges and 'other' challenges(29). The panel advising additionally provided strategies and guidelines to support LHINs and MOHLTC in the decision making and planning process for health services and facilities.

## *Academic Articles*

Results and outcomes drawn from academic articles provided suggestions for improving current practices of the healthcare system in rural communities in Ontario and Canada. Vinden & Ott suggest a national strategy to make community practice for surgeons in underserviced areas more attractive by changing renumeration practices, have a nationally coordinated locum system, and enhancing training in communities(30). Similarly, Kulig, Kilpatrick, Moffat et al. suggest educational opportunities, financial incentives and enhanced infrastructure for the workplace to support families as means of addressing the recruitment and retention of rural nurses(31).

Articles also addressed the issue of accountability to maintain rural health infrastructure and programming long term and highlighted the requirements for strong leadership and governance. It was

identified that securing sustainable funding and infrastructure support is a major barrier in maintaining health care services in rural and remote communities. Funding partners must understand the importance of their roles and succession in planning and take an active and consistent role. It was also emphasized the need for funding flexibility to respond to emerging needs specific to rural communities(32). The strategies suggested in academic articles can be further used to inform current practices in the health care system.

## Subpopulation Differences

Documents were analyzed for their mention of subpopulation differences. If documents mentioned how health infrastructure or policy initiatives effected a subpopulation or used community feedback from these populations, they were included. Indigenous, rural, and remote subpopulations were mentioned the most.

### *Indigenous Populations*

13 documents explicitly mentioned Indigenous populations. In a Community Engagement Report by the North West LHIN (2018), authors note Indigenous engagement and inclusion as one of the priority areas. In another community engagement report published by the North West LHIN, authors collected feedback both through in-person stakeholder and community engagement sessions and increased support for Indigenous communities was identified as a top priority(19). A 2018 Interim Report on Canada's Economic Strategy Tables published by Innovation Science Economic Development Canada identified the importance of access to high-speed internet so that the benefits of digital health and data can Indigenous and low SES individuals/communities(33).

### *Rural and Remote Populations*

13 documents explicitly mentioned rural and/or remote populations. In the aforementioned Community Engagement Report by the North West LHIN (2018), rural communities were explicitly mentioned with regard to rehabilitative services; participants want to see more access to rehabilitative services offered in rural and remote communities. Other areas of importance raised included an increased number of locums for smaller, rural communities(19). Infrastructure Canada's 2019-20 Departmental Plan explicitly mentions rural communities in regard to leading work to increase high-speed broadband coverage in rural Canada(10). Health Force Ontario's *Northern and Rural*

*Recruitment and Retention Initiative Guidelines* is focused on providing services only for those in rural and remote communities in Ontario(13).

### First Nations Populations

13 documents explicitly mentioned First Nations populations. A 2014 Information/Progress update by the Government of Canada on Investing in Health Infrastructure specifically focuses on First Nations communities in Canada(25). Initiatives from a federal or provincial (MOHLTC) government level address First Nations populations. Community-level and institution-specific documents did not mention First Nations populations specifically.

# 5. Implications for organizations

There is no one "guideline" for developing new health infrastructure in rural regions of Ontario. The criteria, process, and funding of such projects is dependent on the organization which seeks to develop new health infrastructure, the type of infrastructure being planned, the community where it will be located, and the funding source being targeted. The development of new health infrastructure is a time-consuming process, which can take upwards for 5-10 years dependent upon many factors. This review also indicated that many hospitals within Ontario consistently need repairs and upgrades to their infrastructure to provide a level of care for their patients that aligns with their organization's mandate. These processes are not often documented in advance, but rather publicized when the infrastructure is available for public use, leaving gaps in the knowledge of the development process of health infrastructure.

One major tendency was the popularity of opinion-based population feedback. Public engagement campaigns and opinion surveys were conducted through various governmental, municipal and public organizations. This tendency for evaluation to occur locally aligns with the notion that rural communities and community members are often advocates for their own health care services.

Another trend was that the type of evidence used for health infrastructure planning varies greatly by institution and setting. Much of the evidence used is primary data collected at a local level or developed using industry-specific standards. Additionally, most documents analyzed in this review target specific geographic regions as the literature is developed by communities, community health centres, or

organizations such as LHINs themselves. There appears to be far less responsibility by larger funding organizations such as the provincial and federal government, with community organizations themselves initiating the process of planning and developing new infrastructure.

Though researchers searched explicitly for documents referring to "rural health infrastructure", only some documents explicitly mentioned rural or remote health issues. Proportionate to this was the number of documents that mentioned Indigenous populations. These two populations are heavily linked, which was reiterated throughout this literature review. This analysis identified the need for a more rural-focused lens for developing health infrastructure as rural health issues and Indigenous health issues vary greatly from urban issues.

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# 7. Methodological Appendix

We conducted a narrative synthesis for this review given the heterogeneity of document sources related to our primary question. The search for evidence was divided up amongst all members of the research team, each assigned to extract documents from one of the following sources: Scopus, PubMed, Google Scholar, Canadian governmental documents (i.e., official statistics, reports, briefing notes, protocols, developed models or frameworks, etc.), and Ontario local organizational reports (i.e., reports published by health units/LHINs, public hospital reports, etc.). Search terms used, as well as inclusion and exclusion criteria can be seen in Figure 1. In total, 78 documents were yielded during the first stage of the literature search.

## Literature Search Criteria

All included data were extracted by authors using Mendeley Reference Management Software. Two members of the research team then further reviewed and analyzed the 78 identified papers of which 27 were removed for not meeting the inclusion criteria leaving a total of 51 documents to be analyzed. Included literature comprised of 11 documents published by Ontario's Ministry of Health and Long-term Care (MOHLTC), four documents published by Infrastructure Canada, six documents published by Ontario Local Health Integration Networks (LHINs), three documents published by the Government of Ontario, 15 academic articles, four documents published by the Government of Canada, and eight documents published by Ontario Health Units or Hospitals.

| Terms used in search: | Rural OR Remote |
| --- | --- |
| | Health infrastructure OR health care infrastructure OR build environment |
| | Hospitals OR community health centres OR health services OR rural research centres |
| | Funding |
| | Policy development OR policy decisions |
| | Planning OR guidelines |
| | Canada OR Ontario |
| Inclusions and Exclusions: | Inclusion: Discussing health infrastructure, Canadian, publicly accesible, published in english, focus on rural geography |
| | Exclusion: Published prior to 2010, referring to specific provinces outside of Ontario, focus only on health programs |

**Figure 1: Literature Search Criteria**

Data was then critically analyzed further by two members of the research team. The authors extracted data about the following: publication year, type of report, setting, population affected, evidence used to identify need for health infrastructure, interventions, outcomes, and sub-population differences. Each of these categories were further summarized to develop recommendations for policy and practice.

## Limitations

The definitions of health infrastructure used for this review were very broad. Researchers wanted to encompass as many disciplines and contexts as possible. For this reason, the search strategy was set to include keywords that would yield a high number of articles related to such an interdisciplinary subject. See search strategy above for more details.

There were 5 members of our research team members collecting documents using a variety of data bases; Scopus, PubMed, Google Scholar, Canadian governmental documents (i.e., official statistics, reports, briefing notes, protocols, developed models or frameworks, etc.), and Ontario local organizational reports (i.e., reports published by health units/LHINs, public hospital reports, etc.).

This approach resulted in a varied source of documents in which to conduct our review. This variation acted as a limitation in terms of synthesizing our results. We aimed to combat this by cross-analyzing our findings on Interventions and Outcomes Measures by the document type in which they were found. In doing this we can understand the impacts of health evidence on the interventions and outcomes measures by each institution on in way that is meaningful and does no conflate results across various document types.

For other variables it was deemed more appropriate to stratify our results across the entire sample (n=51). This was done to emphasize the *frequency* of each Setting, Population, Evidence type, or mention of Subpopulation Differences across all documents.

Researchers understand that though unconventional, they have approached the analysis as a narrative synthesis so that the information can be organized and translated to the appropriate audience.