REVIEW

Innovations in health service organization and delivery in northern rural and remote regions: a review of the literature

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ABSTRACT

Objectives. To identify and review innovations relevant to improving access, quality, efficiency and/or effectiveness in the organization and delivery of health care services in rural and remote areas.

Study design. Literature review.

Methods. Key bibliographic databases that index health research were searched: MEDLINE, EMBASE and CINAHL. Other databases relevant to Arctic health were also accessed. Abstracts were assessed for relevancy and full articles were reviewed and categorized according to emergent themes.

Results. Many innovations in delivering services to rural and remote areas were identified, particularly in the public health realm. These innovations were grouped into 4 key themes: organizational structure of health services; utilization of telehealth and ehealth; medical transportation; and public health challenges.

Conclusions. Despite the challenges facing rural and remote regions, there is a distinctly positive message from this broad literature review. Evidence-based initiatives exist across a range of areas – which include operational efficiency and integration, access to care, organizational structure, public health, continuing education and workforce composition – that have the potential to positively impact health care quality and health-related outcomes.

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INTRODUCTION

In Canada, health policy dictates that all residents have reasonable access to health care services without any financial or other barriers (1). However, in reality, issues still exist in accessing health care services particularly in rural and remote communities. The poor health status of those living in rural and remote regions compared to their urban counterparts has been well-documented in the literature (2–4). Life expectancy is shorter in rural and remote regions than in urban areas (5). For example, the life expectancy for Inuit in Canada is about 10 years lower compared to the national average (4).

Disparities in the health status of rural and remote Canadian communities are directly related to their distance from urban centres (6). In addition, there has been widespread closure of rural hospitals in some provinces leading to premature deaths (5). The farther away the community is, the worse the health status of the population. Rural and remote area residents have access to a small range of service providers and typically have to travel long distances to urban centres in order to receive specialized care (5). For patients and family members, this travel poses a great financial and emotional burden as families and often communities must find ways to cope when these members who may be parents, wage earners or community leaders are absent.

One issue impeding access to care is the recruitment and retention of health care personnel to rural and remote areas. This problem has been explained, in part, by an increased workload and burnout, the lack of educational opportunities and less access to professional support in remote areas (7). In 2002, the widely cited Romanow Commission in Canada proposed that funds should be used to attract and retain health care professionals as well as to support innovative ways of delivering health care services in rural areas (3). These issues are not unique to Canada, having also been reported in the United States, New Zealand and Australia (5). Clearly, the issues in northern rural and remote settings are both serious and striking.

To our knowledge, a broad capture of the literature on innovation of health service delivery and organization for rural and remote populations has not previously been reported. The objective of the current literature review was to identify innovations relevant to improving access, quality, efficiency and/or effectiveness in the organization and delivery of health care services in northern rural and remote areas. This review was part of a larger project examining the possible redesign of the health care system in Nunavut; however, it is anticipated that this synthesis will be relevant to other circumpolar jurisdictions as well.

MATERIAL AND METHODS

A review of the literature on service delivery and organization for rural or remote regions was conducted. Three bibliographic databases that index health research were searched from 1950 to 2009: MEDLINE, EMBASE and CINAHL. Other databases relevant to Arctic health were also accessed (http://www.arctichealth.org/). An initial set of keywords were identified by the research team to inform the search strategy. This resulted in 5 distinct literature searches, based on 5 main areas of interest: (1) innovations in practice/policy; (2) human resources in health care; (3) innovations in health care delivery; (4) specific disease/conditions; and (5) operational efficiency in health care. In each case a rural or remote filter was included and both Inuit and non-Inuit study populations were targeted.

While the intent was not to conduct a full systematic review, a set of inclusion criteria for abstract review was developed to capture relevant articles: rural or remote focus; empirical studies preferably with an evaluation component; and some "innovation" in policy, organization, service delivery or human resource. Innovation was defined as a new effective practice of delivering health services to an otherwise underserved remote or rural population. Only articles in French and English were reviewed, meaning a small number of abstracts, primarily from Scandinavian countries, were omitted (n<20). The full search strategy for each area of interest is available from the authors upon request.

Although we did not use a formal grading system, the quality of papers was assessed to ensure that only studies with strong internal and external validity were included. Articles that met our inclusion criteria were categorized according to major themes. Within each theme, a detailed review of papers continued until saturation was reached (i.e., once we were no longer finding new messages within a given theme, further review of articles was stopped). Finally, initial themes identified were in some cases reorganized or combined, resulting in a final set of themes reported herein. In total, across the 5 topic areas, 5,154 non-duplicative abstracts were found. Based on the inclusion and language criteria, 383 abstracts were kept and full papers were obtained for review.

RESULTS

Four key themes were identified from this literature review: organizational structure of health services; utilization of telehealth and ehealth; medical transportation; and public health challenges, including mental health. Articles came from a range of countries and jurisdictions within those countries; we did not limit the review based on geography beyond the requirement of a given innovation or design issue to be addressed within a rural or remote location.

Organizational structure of health care services

The organizational structure, scope and roles refer to the "theoretical" description of how services are delivered. This description is based on information provided in job description documents, in administrative guidelines or any other formal documents that outline what activities are to be performed. This can be contrasted with what is really happening or how the system is actually working in practice. Much of the evidence about innovations in the organizational structure of health services in rural and remote areas was either about redefining nurses' roles or different models of care delivery. In delivering services in rural and remote areas, the ability of organizations to be flexible in who and how services are delivered to the community is paramount.

A subtheme found within the literature was that actual activities often do not match formal role descriptions. A study conducted in Australia examined the quality of care in rural regions and reported that the role and practice of nurses working in remote communities was advanced and expanded (8). Expanded practice refers to practices and procedures that are not normally considered to be within the nurses' scope of practice. For example, remote area nurses were expected to manage and coordinate the needs of the chronically ill, provide advanced clinical care for acute and urgent presentations, and conduct population-based disease prevention programs. While a vast amount of literature refers to an increasing role for nurses in rural and remote settings, the variance between roles and activities

is not limited to the nursing profession. Raven (9) reported on an Australian initiative to expand the role of paramedics in rural and remote areas. The report emphasized that expanding paramedic practice roles should be guided by the needs of the community.

The redefinition of roles according to activities can in itself give rise to alternative organizational structures; however, defining roles according to activities instead of professional designation is not without its challenges. Elsom et al. (10) surveyed mental health nurses regarding their expanded practice roles in rural Australia. The most often identified barrier to expanded nurse practice was the medical profession, identified by more than 85% of respondents. For example, physicians may resist accepting nurses' expanded roles because this could reduce their income if they are compensated under fee-for-service; as well, physicians may question whether nurses are adequately trained to fulfill these roles.

In redefining roles, specific consideration should be given to chronic disease management. Evidence shows that by improving chronic disease management in the areas of diabetes, asthma and mental health, outcomes can be improved and resource needs can be addressed. The one critical element of disease management that is usually an issue within rural and remote communities is the continuity of care. An Australian study that examined the integration of health care services in a rural setting found that asthma led to higher mortality, hospital admissions and readmissions (11). These poor outcomes were usually related to under-treatment, misdiagnosis and poor control as a result of the absence of a regular practitioner. Another Australian study examined the cost impact of improved diabetes care for high-risk individuals living in remote communities (12). Four years

after the implementation of the program, the annual cost savings exceeded the cost of running the program. Therefore, while traditionally defined roles acted as a barrier to the continuity of care, the reorganization of services provided an opportunity to address the efficiency of the organization and the effectiveness of care delivery, which was chronic disease management in this case.

Studies have linked the organization of health care services to telehealth and ehealth. Once new roles have been established, practitioners' qualifications may need to be enhanced. This can be accomplished in two ways: (1) by using telehealth to fill in the gaps or (2) by using ehealth for professional development. Dooley et al. (13) presented a descriptive case study of successful obstetric care in a remote health care centre – the Sioux Lookout Meno Ya Win Health Centre – in Ontario. In this centre, prenatal care such as consultations and mid-semester assessments were provided by nurses with telephone access to on-call physicians. These assessments made by nurses reduced the need for patients to travel from their remote settings to distant centres.

Another subtheme identified within the theme of organizational structure was the retraining of staff or the reorganization of health services. Wakerman et al. (14) reported on a systematic review of primary health care delivery models in rural and remote areas in Australia. The authors developed a typology of 5 primary health care (PHC) models based on different geographical contexts, population size and remoteness of the region. Based on their review of the literature, the authors created a conceptual framework of service requirements and enablers for sustainable PHC in rural and remote communities (14). Three enablers were identified: supportive policy that ensures

sustained funding; coordination of policy and funding across national and state governments; and community readiness for involvement in planning and monitoring health service activity. The essential service requirements focused on staffing requirements, funding, governance, management and leadership, linkages and infrastructure (14). Their paper can serve as a blueprint for assessing primary health care organization in rural and remote communities.

Similarly, Humphreys (15) provided an overview of the literature discussing optimal primary health service delivery models for rural and remote areas in Australia. Key findings were that in order to provide optimal health services in rural and remote communities there is a need to understand drivers underpinning health care provision (e.g., changing demographics and epidemiology, workforce changes, fiscal constraints and the role of technology), a need to look across all aspects of health service delivery simultaneously, and a need to focus on primary health care as the first point of contact with the health system. The researchers concluded that since a "one size fits all" approach does not exist, the focus on rural and remote communities should be on developing strategies to ensure that key service requirements and community needs are met rather than on the actual model configuration.

We identified two areas of care where the structure and/or the organization of services were specifically studied. Eagar et al. (16) assessed a new model of palliative care service delivery that was implemented in rural Australia. Aspects of the palliative model that worked most effectively for the patients were weekly case conferences, on-call nursing roster, patient-held records and shared protocols and procedures. Noticeable improvements were identified in service delivery in that patients no longer found fragmented service delivery and variable after-hour coverage, but instead found greater continuity of care. Homoe et al. (17) examined a new model of care in Greenland for chronic otitis media in the Inuit population. A mobile ear surgery option was examined as an alternative to travelling to Denmark for treatment in a high-tech hospital. This longitudinal study found that success rates were lower than in high-tech centres but mitigating factors such as the length of untreated disease likely influenced these outcomes. While opportunities to improve the service were identified, the researchers expressed that the results were acceptable relative to the challenges of travel or no treatment at all.

Overall, the evidence related to this theme was mostly around the effective expansion of the scope of practice of nurses and other health professionals working in rural and remote areas. An international review of research on nursing in rural settings confirmed this finding. Griener et al. (18) explained that because of professional isolation in remote areas, nurses are likely to assume an expanded or advanced practice role to fill in the gaps caused by a shortage of medical professionals. However, this expanded role is not always legitimized and comes with a greater need for continuing education. While some studies suggests that the redistribution of tasks to nurses is appropriate, this cannot be based solely on availability of personnel or on cost considerations (19). To the best of our knowledge, there is very limited literature addressing primary health care staffing models as it relates to community size or the health needs of the community. A recent scoping review found that past research has focused almost exclusively on staffing models within the acute care sector and within the profession of registered nurses (20).

Utilization of teleheath and ehealth

Telehealth or telemedicine is the use of communication and information technology to provide and support the delivery of health care when participants are separated (21). Fundamentally, telehealth is about leveraging the available human resources for greater impact through either making the service provider more accessible to patients or facilitating the work of service providers by providing them with better information. The evidence on telehealth has mainly consisted of evaluations of some form of health service delivered through telecommunications. Evaluations have tended to focus on one or more of the following attributes: (1) the feasibility of utilizing telehealth in the given setting; (2) how patients feel about being treated through the use of telehealth; (3) how clinicians feel about delivering services this way; and (4) the cost relative to face-to-face service delivery.

Based on the literature reviewed, the strongest evidence supporting the use of telehealth comes from the fields of dermatology (22,23), psychiatry (24,25), radiology (23,26) and geriatric care (27,28). There is also evidence that telehealth can be an effective tool in after-hours triage (29). For this purpose, the use of images from mobile phone cameras was found to significantly increase diagnostic confidence in a vast majority of cases and was found to be acceptable to patients. Furthermore, telemedicine has also been shown to be effective in monitoring the daily activities of patients with Parkinson's disease (30).

Some studies address the relationship between telehealth and patient transport. One study examined the impact of an expansion of telehealth services on patient transport. The results suggested that the reduction in the number of medical evacuations was substantial. Aarnio et al. (31) conducted a study of the use of telehealth for surgical consultation with 50 patients in rural Finland. They found that all but one of the 50 patients avoided travelling to a regional hospital because of the teleconsultation. In another study, Bowater (32) found that in approximately 75% of teleconsultations, patient transfer was avoided between an isolated mining town in Western Australia and the city of Perth. As well, a study by Johnson et al. (26) saw tele-ultrasound services in rural Alberta reducing transfer to an urban centre by 42%.

Telehealth has been found to be most productive as a complement to existing services rather than a substitute, meaning that there is a place for telehealth in the continuum of care but that telehealth should not go beyond this role. For example, an evaluation by Gorman et al. (28) on patient satisfaction with geriatric assessments demonstrated that high levels of satisfaction were explained in part by the fact that all patients were also seen in person by a geriatrician for at least part of the care pathway.

The role of ehealth has been largely focused on the delivery of information or some form of ongoing monitoring. Ehealth has been defined as "health services and information delivered or enhanced through the Internet and related technologies" (33). Ehealth was shown in many studies to be a well-received and useful medium for delivering education to providers (34,35) and to patients (36). Ehealth can be a powerful and efficient tool in adjusting the skills of the workforce necessitated by whatever changes to the model of service delivery will ultimately be suggested and in the implementation of these changes. Some of the literature has focused on the use of ehealth to train health workers in remote areas and on programs to facilitate continuing education for health workers in isolated communities. Chang et al. (37) examined a continuing education initiative to develop nurses' mental health knowledge in rural and remote areas in Australia. The collab-

orative education initiative was jointly developed between a government department, a rural university and local health service partners. The initiative included a combination of courses, written material, audio-taped material and video presentation. The project was rated favourably among participants and was said to represent a cost-effective and convenient method of enabling rural and remote nurses to update and improve their mental health nursing skills. Norbye (38) reported on a continuing education initiative in rural Norway, whereby lectures via video-conference, local workshops and local day seminars were conducted in a coordinated manner. This education program was successful as it provided professional development at a minimal cost.

Curran et al. (39) suggested that tele-education could be a best practice approach to improving continuing education access, as were regional continuing education activities and self-directed learning programs. Heath et al. (40) described the development, implementation and evaluation of interprofessional continuing education designed to enhance rural mental health capacity in Newfoundland. Within this program, videoconferencing was used for training. Key themes that emerged from the qualitative evaluation of the education program included the benefits of an interactive process, expert leadership, diverse range of professionals, personal relevance and the importance of interprofessional interaction and exchange.

Medical transport

Medical air transport is necessary when required services are not available locally and there are no other means of transportation. There are 2 types of air transport patients: emergency (e.g., trauma) and non-emergency (e.g., CT scan). Medical air transport is a very expensive mode of service delivery. Creery et al. (41) estimated the costs associated with infant bronchiolitis in the Baffin region of Nunavut to be between \$1,148 and \$7,981 for travel from the home community to Iqaluit and from \$9,776 to \$23,346 for travel from Iqaluit to Ottawa for a total cost of \$10,924 to \$42,251 (year 2000, CAD \$). As for the value received from this spending, few studies have assessed the cost-effectiveness of using this mode of transportation. One study from Finland (42) found that the overall health benefits of helicopter emergency services in relation to costs were marginal because services did not have a beneficial impact. It must be noted that this applied specifically to an emergency response service and that this result was significantly affected by the fact that in 40% of cases the mission was aborted. In their estimation, patients benefited from only 7.6% (45 out of 588) of all missions of helicopter emergency medical services and the benefit was almost always related to early Advanced Life Support care on-scene and not to rapid patient transport to definitive care. Regarding frequency of use, an Australian study (43) calculated that on average about 6.5% of the rural and remote population used the service each year for trauma and acute illnesses.

There were no studies found that reported on programs specifically designed to reduce the use of medical air transport or to control costs. Typically, studies on medical transport were descriptive. Vesterbacka and Eriksson (44) described a rural ambulance helicopter service in Sweden and concluded that in most cases this service was preferable to ground transportation. Sollid et al. (45) reviewed the impact of the air ambulance service on head injuries within northern Norway. The researchers found that most patients with severe traumatic brain injury were transported by air and through this approach were able to achieve short interhospital transfer times despite long geographical distances. Furthermore, the researchers

concluded that this finding was in accordance with experience from other rural regions of the world. These findings confirm that in large geographic areas, air transport is the fastest way to reach care and therefore the best way to offset the variations in accessibility between urban and rural settings.

Public health challenges

This section highlights some key studies that report on effective interventions to address public health concerns in remote or rural communities. For example, McDonald et al. (46) reported on a systematic review of hygiene and public health interventions on health outcomes for Aboriginal children living in remote Australian communities. Strong evidence was found regarding the effect of education on hand washing with soap to prevent diarrheal disease among children. It was found that children living in households that received plain soap and encouragement to wash hands had a 53% lower incidence of diarrhea. As would be expected, water supply and sanitation were also found to have an impact on disease. Building on this work, the same authors conclude in another paper that multifaceted interventions, such as improved housing, reduced overcrowding and hygiene promotion are likely to have the greatest impact on health outcomes (47). As with many public health interventions, the cost of a coordinated program focused on hand washing is minimal; however, the political will, dedicated staff time and potential cultural sensitivities may stand as potential barriers to implementation.

The high prevalence of childhood obesity in rural and remote communities has been well documented. Two well-known diet and exercise programs, aimed at remedying childhood obesity within rural and remote regions, have been reported in the literature. First is an Australian intervention program called "Be Active Eat Well" (48). This program focused on building community capacity to promote healthy eating and physical activity in children 4–12 years of age. The program had multiple strategies aimed at reducing weight, such as nutritional education, physical activity and lifestyle/behaviour modification. Overall, the program was shown to reduce unhealthy weight gain in a safe and effective manner and at a reasonable cost of approximately $50 per child. A second program, from New Zealand, was the APPLE project (A Pilot Programme for Lifestyle and Exercise), which focused on encouraging lifestyle-based activities with simple dietary advice (49). Community Activity Coordinators were employed within a rural school to encourage children to be more physically active every day and increase the opportunities for activity beyond that already currently provided in the school curriculum. The researchers found that by employing these part-time Community Activity Coordinators, there was increased participation in physical activity and a reduction in unhealthy weight gain in primary school aged children compared to control sites that did not implement this program.

Willows et al. (50) investigated anemia and iron status in Inuit infants from northern Quebec. The researchers found anemia to be a major concern in Inuit infants and suggested a systematic screening program for iron deficiency using hemoglobin or serum ferritin tests by 6 months of age. They also suggested that parents should be counselled to feed their infants iron rich solids and iron fortified cereals starting at 4–6 months of age and that breastfeeding should be encouraged while low-iron formula and cow's milk should be discouraged.

In Finland, the North Karelia project demonstrated tremendous success in improving cardiovascular and other non-communicable disease outcomes over 3 decades (51). The project demonstrated that well-planned community-based programs can have a substantial impact on lifestyle and risk factors.

Smoking and alcohol abuse are additional serious concerns in remote areas. Programs initiated in remote regions have demonstrated success in reducing smoking rates and addressing chronically high alcoholism. A study conducted in a rural Norwegian municipality found that adolescent smoking could be dramatically reduced with the implementation of school-grade specific intervention strategies (52). Students were targeted with anti-smoking lessons each year from Grades 6 to 9. The intervention was able to lower the rate of daily smoking by 80% and 50% fewer cigarettes were smoked by daily smokers. The results indicated that multipronged, early and continuous interventions are required and should include model learning, inverted group pressure and a prospect of reward. While a full-scale review of smoking cessation and reduction programs is beyond the current scope of this paper, the key point is that dedicated programs have been used with success. In terms of alcohol abuse, Jorgensen et al. (53) examined harm minimization strategies used with teenage drinkers in a rural Danish community. The researchers reported that teenagers could help each other minimize alcohol related harm. Consequently, peer groups may be seen as an important resource for moderating the harms of excessive alcohol use and for health promotion initiatives.

Mental health is particularly sensitive to the continuity of care; however, small isolated communities may have difficulty supporting full-time mental health workers. Wexler and Goodwin (54) examined factors leading to Inupiat youth suicide and found that adults tend to identify boredom as the primary reason for youth suicide, whereas youth attribute suicide to stress. The researchers suggest that these differing perspectives need to be considered when developing effective youth suicide prevention strategies. In another study, Wexler (55) reported that individuals from northwest Alaska link youth suicide with historical oppression, loss of Inupiaq culture and current manifestations of these realities in alcoholism, abuse and neglect. He then suggests that the dialogue within these communities must be changed to discuss current forms of oppression rather than focusing solely on past forms.

Procter (56) conducted a review of the literature on self-harm and suicide among Aboriginals living in rural Australia. The review found that communities with more established structures, community programs and institutions experienced much lower rates of suicide. Other strategies reported as being successful included hiring life promotion officers to work with at-risk youth; introducing culturally appropriate public-health informed interventions; listening to community-led responses; building trust with Aboriginal health workers; connecting youth to supports; and inviting Aboriginal community members to work alongside mental health nurses. Similarly, Headey et al. (57) reviewed 156 projects funded under Australia's national suicide prevention strategy which commonly targeted youth, Aboriginal and Torres Strait Islander people, and people living in remote or rural communities. The researchers highlighted the importance of programs understanding contextual factors and individual needs, drawing on sound evidence, developing multi-faceted strategies, achieving stakeholder support, and employing capable staff.

DISCUSSION

Through this literature review we were able to find many innovations in, or related to, the organization and delivery of health care services within northern rural and remote areas. One striking feature of the studies identified in this review is the many commonalities in rural and remote health care jurisdictions. While any specific context will undoubtedly have its own nuances and issues, predominant themes in the literature included the need for cultural sensitivity, local capacity development and community-led programming.

A theme that emerged from the literature was the reorganization in the delivery of services through the expansion of professional roles or the retraining of staff. We found that the roles of nurses was advanced and expanded and that actual activities do not match formal role descriptions. Lauder et al. reported that rural and remote nurses in Australia undertook the roles of both nurse and general practitioner, even when this went against nursing regulations (58). A solution to the variance between roles and activities would be the adoption of a policy of "interchangeability" in which what matters is that the person occupying a given role can practice confidently rather than focusing on which professional entity should have a right to fulfill a given role (58). In practice, this means that roles would become aligned with actual activities (and not vice versa). This, in turn, would have implications for the compensation system, possibly increasing fairness as compensation aligns more with responsibilities and less with professional designation.

As well, the redefinition of roles according to activities can give rise to alternative organizational structures. Lauder et al. proposed a "root and branch" restructuring of primary care services. This redesign would see family nurse practitio-ners as well as GPs as the first point of contact with the health care system in rural and remote communities, and family health nurses (FHNs) as the main care provider. This model would expand the typical role of FHNs, which focuses on health promotion, disease prevention, rehabilitation and providing care for those who are ill in the final stages of life (59). In turn, this reorganization of services would lead to increased efficiency in health care delivery.

Another theme identified was the utilization of telehealth and ehealth to provide and support the delivery of health care. The results indicate that telehealth has been found to aid health professionals in the delivery of care to rural and remote regions. Telehealth services have been largely effective as a supplement to existing services. Evidence supporting the use of telehealth was found in numerous clinical fields; however, one clinical area that was not found in our primary review but which we have acknowledged is otolaryngology. In Alaska, the need for timely ear, nose and throat (ENT) evaluations was identified. The Alaska Native Medical Center in collaboration with the Alaska Federal Healthcare Access Network developed a store-and-forward technology that allows each village clinic to forward a video otoscope ear image, tests or scanned documents to a provider. Information for specific cases are transmitted to ENT specialists who then provide a response to the initiating provider (60,61). The results of the initiative were greater efficiency and reduced wait times.

The use of telehealth and ehealth has also been found to be effective in expanding the knowledge of health professionals by providing educational opportunities to these regions that would have otherwise not been available. From this review, there seems to be a place for telehealth and ehealth in delivering good quality care.

A third theme identified was the use of medical air transport when services were not available within the region and there was no other means of transportation. The studies assessed confirm the important role of medical air transport in remote settings but also show that (1) concerns around the value-added of air transport are not unusual and (2) there are no evidence-based guidelines on which services should be provided locally as opposed to being accessed by air transport or how to select patients for emergency air evacuation. Thus, no framework currently exists to assess whether there is over- or underutilization of this service.

In our view, the area for greatest potential impact in remote regions is the area of public health where, internationally, many specific programs have been administered and evaluated with a high degree of success. This would include, but is not limited to, health promotion programs aimed at alcohol and smoking cessation, obesity and physical activity, oral health, hygiene and suicide prevention. While it is naive to think that these challenges can be easily dealt with, the overwhelming message from the literature is that dedicated programs, often at a low cost, can have major positive impacts. Clearly, remote regions have an opportunity to make large-scale innovations by turning attention to the area of public health while at the same time continuing to strengthen the delivery and organization of primary health care services. In an article on primary health care renewal in Canada, Hutchison (62) points out that governments need to articulate a clear primary health care policy direction at the regional and provincial/territorial levels based on collaborative processes of policy development and stakeholder engagement.

As with any study, there are certain limitations that should be noted. First, with a broad literature review of this nature, the trade-off was less detail in specific areas. As such, for some specific subthemes that emerged, we were only able to touch the surface when in fact a more in-depth analysis is needed. Second, this was not a systematic review. While there was a defined set of inclusion criteria, our purpose was not to find every article on a wide range of topics but rather to find exemplary articles that could speak to the topics at hand. However, the caution is that while we attempted to provide both sides of any given story, in some cases important papers may have been missed which could suggest important alternative courses of action. In order to mitigate this problem, we relied on the expertise of our research team and a broader advisory group that provided comments on this work. Third, a review of this nature can only find *potential* solutions. Context, history, politics and current structures and behaviours all contribute to what is actually possible. Despite literature suggesting clear areas for application, as is often the case in rural and remote regions, the key question is most likely one of actionability.

Conclusion

Despite the identification of many challenges facing northern rural and remote regions, there is a distinctly positive message from this broad literature review targeting potential health care innovations. Evidence-based initiatives exist across a range of areas including operational efficiency and integration, application of telehealth and ehealth, organizational structure, public health, continuing education and workforce composition that have the potential to positively impact a number of health-related outcomes. The only area that emerged from this review with less promising results was medical transport, and in that area there is a clear need for further research. This work provides a broad survey from the literature on innovations in the organization and delivery of health services

in northern rural and remote regions – the next and most critical step is to use this information to enhance care.

Conflict of interest statement
No conflicts to declare.

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