

# CHAPTER 4

## Healthy rural communities responding to climate change and ecosystem disruption

*When adaptation actively incorporates local and traditional resources, it allows communities to prevent, respond, and recover from climate-induced outcomes relatively independently, without over-reliance on external support.*

### Chapter Four Highlights

- *Adequate emergency preparedness enhances resilience against climate change-driven environmental disruptions and mitigates the health impacts for B.C.'s rural population which makes up about 14% of the total population [2,18,19].*
- *The overarching reality of rural health care is that it is more generalist in nature. Rural health practitioners thrive when they expand their scope of practice and are able to respond to a broader range of health problems.*
- *Generalists with enhanced skills are important for rural health services stability and adaptation as meeting the needs of the population can be achieved locally.*
- *Telehealth is a powerful rural health services adaptation strategy that enhances access to care.*



## Authors

Diane Kim<sup>1</sup>, Sila Rogan<sup>1,2</sup>, Elyse Tsang<sup>1</sup>, Arlin Cherian<sup>1</sup>, Stefan Grzybowski<sup>1,2\*</sup>

\*Corresponding author, Dr. Stefan Grzybowski: [sgrzybow@mail.ubc.ca](mailto:sgrzybow@mail.ubc.ca)

<sup>1</sup> Rural Health Services Research Network of BC, Department of Family Practice,  
University of British Columbia

<sup>2</sup> Centre for Rural Health Research, Department of Family Practice, University of  
British Columbia

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Adaptation to ecosystem disruption is achieved through developing sustainable ways of living and efficient responses against its impacts. In chapter 3, we explored adaptation at the global, national, and provincial levels, but adaptation is also important to build community-level resilience. Australia's National Strategy for Disaster Resilience defines a resilient community as "one whose members are connected to one another and work together in ways that enable it to function in the face of stress and trauma" [1]. When adaptation actively incorporates local and traditional resources, it allows communities to prevent, respond, and recover from climate-induced outcomes relatively independently without over-reliance on external support. This creates a self-sustainable system against ecosystem disruption and leads to increased resilience and decreased vulnerability.

## ■ Introduction

# Planning for climate-resilient communities in British Columbia

However, it is important to recognize that every community has unique characteristics and faces unique challenges. For example, communities of B.C. face different climate outcomes, such as drought, forest fire, or flood, due to their unique geography. Similarly, communities may possess different resources, such as local knowledge of environment, or access to public services thus making it difficult to lay out a universal climate adaptation model. To address this issue, the Torrens Resilience Institute of Australia created a basic framework to categorize various community characteristics into physical, procedural, and social enablers of community resiliency

ADAPTATION TO ECOSYSTEM DISRUPTION IS ACHIEVED through developing sustainable ways of living and efficient responses against its impacts. In chapter 3 we explored adaptation at the global, national, and provincial levels, but adaptation is also important to build community-level resilience. Australia's National Strategy for Disaster Resilience defines a resilient community as "one whose members are connected to one another and work together in ways that enable it to function in the face of stress and trauma" [1]. When adaptation actively incorporates local and traditional resources, it allows communities to prevent, respond, and recover from climate-induced outcomes relatively independently, without over-reliance on external support. This creates a self-sustainable system against ecosystem disruption and leads to increased resilience and decreased vulnerability.

However, it is important to recognize that every community has unique characteristics and faces unique challenges. For example, different regions of B.C. face different climate outcomes, such as drought, forest fire, or flood, due to their unique geography. Similarly, communities also possess different resources, such as social connectivity, knowledge of environment, or access to public services thus making it difficult to lay out a universal climate adaptation model. To address this issue, the Torrens Resilience Institute of Australia created a basic framework to categorize various community characteristics into physical, procedural, and social enablers of community resiliency [2]:

- Physical enablers include infrastructures to support communities' physiological needs and safety, such as health care, food and water, utilities, and transportation.
- Procedural enablers are the presence of information, experiences, and strategies that guide policy makers and community members into effectively utilizing the existing physical enablers. This category includes risk analysis, cultural and traditional knowledge, and emergency response policies.
- Social enablers encompass community cohesion and motivation, which span across a sense of unity, shared values, willingness to overcome challenges, and respected local leadership.

B.C. has taken initiative in strengthening the above resilience enablers. For example, the Public Infrastructure Engineering Vulnerability Committee (PIVEC) Protocol was adopted for climate change risk and vulnerability assessment of major provincial infrastructures. This protocol goes through systemic reviews of future potential climate change events and estimates a community's adaptive capacity [3,4]. For example in 2018, the Nanaimo Regional General Hospital underwent a climate change vulnerability assessment to identify potentially vulnerable building systems, future medium- and high-risks, and appropriate recommendations [5]. Other climate change risk analyses done through the

PIVEC protocol includes the Xwu'nekw Park sea dike in Squamish, wastewater treatment plant in Tofino, stormwater management system in Nelson, and the Coquihalla Highway [6].

In addition, the First Nations Health Authority (FNHA) has implemented the Indigenous Climate Health Action Program (ICHAP) to actively utilize Indigenous leadership and knowledge in building climate resiliency. The program provides funding for community-driven action projects that foster the population's health and wellbeing [7]. Similarly, the federal government provides Indigenous Community-Based Climate Monitoring Funds to its Indigenous partners. The Ulkatcho Indian Band is one of B.C.'s 2019-2020 funding recipients for a project that builds monitoring capacity for changes in their agriculture, which is a significant part of their tradition [8]. The Salt Spring Island community has also demonstrated strong social enablers; a concern for sustainability and preservation of their watershed led to a collective action against extensive logging and land clearance. This resulted in a series of partnerships between the government and the Salt Spring Island Watershed Protection Alliance (SSIWPA), in which the local SSIWPA members provide input based on community's needs in related policies [9,10]. For more examples, the federal Climate Action Map provides an overview of climate adaptation strategies in B.C. [11].

Communities are complex systems with multidirectional relationships and key health determinants spanning across their physical, social, environmental, and cultural characteristics [12–15]. Each community must be examined as a unique entity when determining climate change health vulnerability and resiliency, rather than 'units for top-down intervention' receiving centralized responses [12]. Community collaboration with other stakeholders from the Rural Coordination Centre of BC (RCCbc)'s Pentagram Plus Partnership (Figure 1) will therefore be important in developing climate change-resilient health systems. Integration of technology and bridging digital divides, such as through telehealth, will also be an important point of consideration [16]. Strengthening rural health services can be accomplished through 4 adaptation strategies:

- 1 • Evaluating community risks and **strengthening** emergency preparedness.
- 2 • **Supporting** the education and recruitment of generalist health care providers.
- 3 • **Integrating** synchronous and asynchronous mechanisms of patient and provider support through telehealth.
- 4 • **Building** systems to train generalists in enhanced skills training.

This chapter will explore each in detail with consideration of its implementation in rural, remote, and Indigenous communities.

## HEALTH ADMINISTRATORS

First Nations Health Authority  
Provincial Health Services Authority  
Island Health  
Vancouver Coastal Health  
Fraser Health  
Northern Health  
Interior Health  
Providence Health  
BC Women's Hospital  
Specialists of BC  
Society of General Practice

HealthMatch BC  
Worksafe BC  
Insurance Corporation of BC  
Unions  
Veteran Affairs

(General Practice Services Committee (GPSC), Shared Care, Specialist Services Committee (SSC), Joint Standing Committee on Rural Issues (JSC))

## POLICY MAKERS

College of Family Physicians of Canada  
Health Employers Association of BC  
BC College of Nursing Professionals  
College of Physicians and Surgeons  
Canadian Medical Protective Association  
Physicians Services Committee

Doctors of BC  
Divisions of Family Practice  
\*Joint Collaborative Committees  
(GPSC, JSC, SSC, Shared Care)

Ministry of Health  
Ministry of Mental Health and Addictions  
College of Midwives  
BC Midwifery Association  
BC Nursing Union  
Nurses and Nurse Practitioners of BC  
BC Emergency Health Services

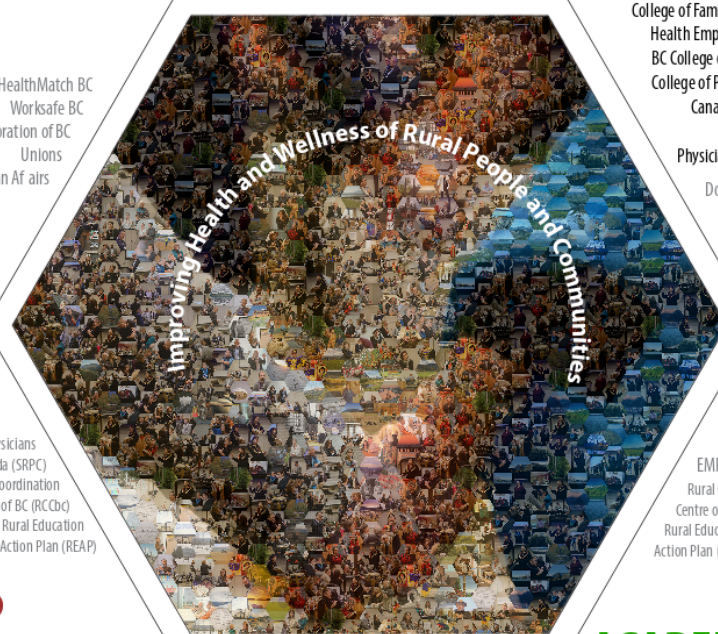
## COMMUNITIES

Patients  
BC Municipalities  
First Nations Communities  
Community Organizations and Foundations  
First Nations Health Council  
BC Rural Health Network  
BC Patient Safety and Quality Council

Society of Rural Physicians of Canada (SRPC)  
Rural Coordination Centre of BC (RCCbc)  
Rural Education Action Plan (REAP)

## LINKED SECTORS

Industries with vested interest in health (e.g., forestry, oil and gas, mining, etc.)  
Non-profits (e.g., hospital auxiliaries)  
BC Rural Centre  
Institute of Health System Transformation and Sustainability



## HEALTH PROVIDERS/ PROFESSIONALS

Allied Health Care Professionals  
Physicians  
BC Ambulance  
Shared Care

EMR Vendors  
Rural Coordination Centre of BC (RCCbc)  
Rural Education Action Plan (REAP)

## ACADEMIA

Rural Scholars  
UBC Health  
Faculty of Medicine, UBC  
Selkirk College Rural Pre-Med Program  
Learners, teachers, and researchers  
University of Northern BC Health Research Institute  
Rural Scholars  
UBC Midwifery Program  
Centre for Rural Health Research  
BC Academic Health Science Network  
Health Sciences and Social Science Faculties at universities and colleges across BC

Figure 1. Pentagon Plus Partnership model from the Rural Coordination Centre of BC (RCCbc). Rural Coordination Centre of BC (2020). Retrieved from: [https://rccbc.ca/wp-content/uploads/2020/06/Partnership-Pentagon-Plus\\_June2020.png](https://rccbc.ca/wp-content/uploads/2020/06/Partnership-Pentagon-Plus_June2020.png)

According to the World Health Organization (WHO), the aim of emergency preparedness is to “strengthen the capacity of governments, organizations, institutions and communities to withstand a disaster or emergency situation” [17]. This includes natural hazards and infectious disease outbreaks including COVID-19. Adequate emergency preparedness enhances resilience against climate change-driven environmental disruptions and mitigates the health impacts for B.C.’s rural population which makes up about 14% of the total population [2,18,19].

## ■ Section 1

# Evaluating community risks and strengthening emergency preparedness

However, it is important to recognize that every community has unique characteristics and faces unique challenges. For example, different regions of B.C. face different climate outcomes, such as drought, forest fire, or flood, due to their unique geography. Similarly, communities possess different resources, such as social connectivity, knowledge of environment, or access to public services thus making it difficult to lay out a universal climate adaptation model. To address this issue, the Torrens Resilience Institute of Australia created a basic framework to categorize various community characteristics into physical, procedural, and social enablers of community resiliency



## What is emergency preparedness?

According to the World Health Organization (WHO), the aim of emergency preparedness is to “strengthen the capacity of governments, organizations, institutions and communities to withstand a disaster or emergency situation” [17]. This includes natural hazards and infectious disease outbreaks including COVID-19. Adequate emergency preparedness enhances resilience against climate change-driven environmental disruptions and mitigates the health impacts for B.C.’s rural population which makes up about 14% of the total population [2,18,19].

## Climate change-driven natural disasters in rural British Columbia

Identifying the likelihood and severity of natural disasters is a fundamental step to emergency preparedness. This entails community- and region-specific risk assessments based on geographic data [20]. For example, the Canadian Centre for Climate Modelling and Analysis Regional Climate Model (CanRCM4) is a tool that illustrates regional climate projections analysis for mitigation and adaptation planning [21]. Based on geographical characteristics of B.C., some of the most prominent threats include forest fires and floods.

Forest fires are expected to increase in frequency and severity across B.C. Land area burned from the record-breaking 2017 wildfire season was 40% greater than the previous record in 1958, with approximately 65,000 people evacuated and many more exposed to the hazardous smoke [22,23]. Environment and Climate Change Canada and the

University of Victoria jointly reported that anthropogenic climate change amplifies the risk of wildfires in B.C. and increases burned areas by 7-11 times. With progressing climate change, they have warned that wildfires will continue to intensify – in 2018, more than 1.3 million hectares of land were destroyed, immediately surpassing 2017’s record [22,24].

Forest fires can have both short- and long-term health consequences, such as inflammation of the respiratory system, impaired lung development in children, and psychiatric disorders [25]. Simultaneous presentation of these health conditions can put significant pressure on local health care. The increasing incidence and associated costs therefore make wildfire management an important aspect of health services adaptation [22].

For example, the City of Rossland which is located in the Kootenay Rockies Region is vulnerable to wildfires, especially during dry summers. This community has received \$255,000 through the Fall 2019 Community Innovation Grant by the Columbia Basin Trust to expand public education, including training community leaders and hosting FireSmart events, for the FireSmart Community Recognition Program [26,27]. FireSmart



BC is based on the national FireSmart program to build wildfire resiliency through seven main disciplines, such as education, emergency planning, and interagency cooperation [28,29]. An increasing number of B.C.'s communities are now being recognized as FireSmart, with more than 20 added in 2019 alone [30].

In addition, coastal regions face increased risk of storm surges and floods, as B.C. contains more than 27,200 km of shoreline facing the Pacific Ocean. This poses immediate environmental and health emergencies in affected rural communities [31]. To aid in flood preparations based on detailed, region-specific information, Natural Resource Canada provides CanCoast which is an ArcGIS geospatial database for coastal hazard risk analysis and adaptation planning. It combines factors such as sea level, wave height, and ground ice content to derive coastal sensitivities in the face of climate change [31,32].

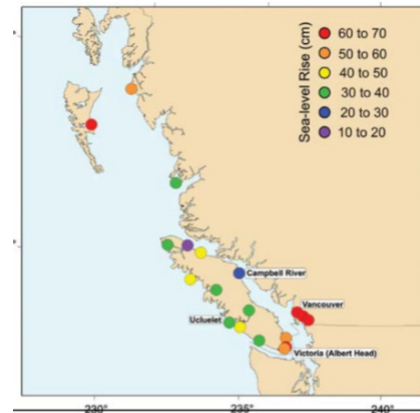


Figure 2. Projected sea-level rise along the coast of B.C. by the year 2100. Natural Resources Canada (2016). Retrieved from: [https://www.nrcan.gc.ca/sites/www.nrcan.gc.ca/files/earthsciences/files/pdf/NRCAN\\_fullBook%20%20accessible.pdf](https://www.nrcan.gc.ca/sites/www.nrcan.gc.ca/files/earthsciences/files/pdf/NRCAN_fullBook%20%20accessible.pdf)

The City of Courtenay in the Comox Valley District is located in Vancouver Island, and floods are Courtenay's main climate vulnerability. This rural community has developed independent risk assessment and management strategies, such as the Integrated Rainwater Management Plan for stormwater pipes, catch basins, wetlands, and rivers. They have been awarded \$150,000 in 2019 through the BC Community Emergency Preparedness Fund for flood risks assessments and response planning. Aqua Dams and manhole blocking systems were also implemented to physically contain and manage rainwater flow [31,33,34].



Figure 3. Flood mitigation strategy in Courtenay, B.C. City of Courtenay (2016). Retrieved from: <https://www.courtenay.ca/assets/City-Hall/Annual-Reports/Courtenay%20Ann%20Report%202015.pdf>

With projections of increased natural disasters in B.C., lack of emergency preparedness can make communities uninhabitable and cause severe physical and mental health

disruptions. Emergency preparedness strategies, provincial guidelines, and toolkits aid in strengthening climate resiliency for rural health services. The following section will explore these in further detail.

## **Emergency preparedness adaptation for health services**

Addressing acute health outcomes of climate events should entail evidence-based assessments of community-specific vulnerabilities. This includes exposure to disasters, socioeconomic status, prevalent health conditions, population demographics, and available public services [35,36]. A recent report on Community Health and Climate Change (2020) mapped community-level health vulnerability index to four hazards of climate change: summer temperatures, wildfire smoke events, ground level ozone pollution, and coastal and river flooding. The vulnerability index was formulated based on three elements: exposure, sensitivity, and adaptive capacity. However, the preliminary results from the study are only available for Vancouver Coastal and Fraser Health regions [35]. Development of such resources for the rest of the province will underpin the development of rural health services adaptation strategies.

Climate disasters result in sudden surges of hospital admissions and patient visits [37,38]. In these circumstances, geographic isolation and limited transportation infrastructure make it hard for rural communities to depend on centralized health services for support. Rural emergency preparedness must recognize this limitation and focus on maximizing local services capacity. For example, rural communities have experienced greater increases in the number of nurse practitioners compared to nurses and physicians as a result of the Nurse Practitioners for British Columbia (NP4BC) program implemented in 2012 [39]. These nurse practitioners have served as local resources and have filled gaps in primary health services within rural populations. This suggests that allocating a broader scope of practice to nurse practitioners in rural B.C. will be a practical adaptation strategy centered on building local services capacity. Ultimately, this will enable communities to respond to spikes in acute conditions immediately, and maintain continuity of care, especially for those with chronic illnesses such as chemotherapy for cancer, dialysis for renal failures, and mental health therapies [40,41].

Investigating the adaptive capacity of hospitals is also crucial for disaster management. Historically, simulation models in general health care have aided resource allocation and hospital designs [42–44]. For rural emergency preparedness, the focus should be on optimizing less than 100 beds and even less regularly functioning operating rooms [39]. Other considerations include low staffing, limited life-support devices, and greater distance to nearby hospitals [45,46]. However, simulations in this context are more challenging because disaster response capability depends on multiple factors for which data is not readily available. Also, the extent of hospital or transportation damage

that determine post-disaster health care capacity is often unpredictable. Developing rural-specific simulation models that take these into account is an important future task for climate adaptation.

Furthermore, volunteerism can supplement rural emergency preparedness. The United Nations Office for Disaster Risk Reduction (UNDRR)'s Sendai Framework emphasized the role of volunteers in providing pragmatic guidance and collective participation in disaster management [47]. This is especially powerful in rural and Indigenous communities with a strong sense of unity. A series of case studies concluded that Indigenous values, such as unity, hospitality, and relationship, are cultural enablers of volunteering, and that volunteerism in Indigenous communities is necessary for long-term adaptive capacities [48]. Volunteering also serves as a method of therapeutic healing by allowing community volunteers to become active players in their own recoveries, rather than passive victims. Positive impact on self-image and community cohesion have additional long-term implications, such as tighter-knit communities and increased engagement in public concerns [49].

Disaster Psychosocial Services (DPS) Program is an example of a volunteer-based emergency service. Professional and para-professional volunteers from organizations such as the BC Association for Social Workers, Police Victim Services of BC, and Canadian Association for Spiritual Care are deployed to the communities to provide emotional, psychological, and practical social support. The program also offers psychological first aid training to communities' first responders to enhance local emergency response capacity, thereby increasing community mental health and resiliency [50].



Photo by Pixabay from Pexels



## Emergency preparedness for infectious diseases

In early 2020, the COVID-19 pandemic highlighted a need for rural community preparedness to respond to infectious disease outbreaks. As climate change becomes more extreme, changes to the transmission of and exposure to infectious diseases such as COVID-19, are inevitable [51]. A warmer climate has already changed the distribution and incidence of vector-borne diseases. For example, the occurrence of Lyme disease in Canada has increased as a result of temperature-driven expansion to tick ranges [52]. Emergency preparedness for infectious disease is critical for future rural health services planning.

The United States' Centers for Disease Control and Prevention (CDC) recommends that communities prepare for an infectious disease outbreak by assessing their susceptibility to the potential infectious diseases as well as their community's social vulnerability index which includes factors such as housing, transportation, socioeconomic status, housing,



race and ethnicity, and language [53]. In disease-specific susceptibility assessments, communities should account for some of the distinct features of the disease, including its modes of transmission and its effect on the most at-risk population. According to the CDC, some actions communities and health service planners can take in the development of an infectious disease emergency response plan include [53]:

- Developing a response plan that is adjusted to meet the needs of the populations served, such as the elderly, people with disabilities, and substance users.
- Develop plans in collaboration with other health care providers and jurisdictions.
- Plan for effective and efficient supply chain management.
- Develop appropriate measures for the safe and fast transport of rural residents to urban centres in case a higher level of care is required.
- Increase availability and quality of telehealth services to reduce risk of infection.
- Health Care providers should work to foster trust and credibility within the community when sharing the response plan and related information on infectious diseases by:
  - » Assuring that messaging is culturally appropriate.
  - » Assuring that messaging is accessible and shared in a manner appropriate for people with disabilities.
  - » Providing translation in multiple languages as necessary.

Much can be learned from COVID-19 responses for developing sustainable infectious disease emergency preparedness measures that meet the needs of rural communities. In B.C., work is underway to develop a collaborative framework that ensures that the health care needs of rural communities are met during the COVID-19 pandemic [54]. The framework is developed by the provincial government, in collaboration with FNHA, Northern Health Authority, and the Provincial Health Services Authority. It includes measures to meet the immediate needs of communities, as well as to promote sustainable change to the emergency response capacities of rural communities.



*Photo by A320Captain from Flickr*

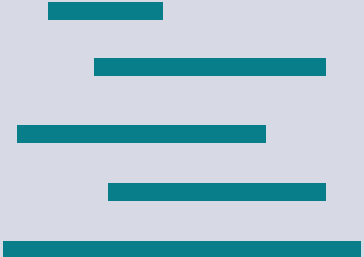
Highlights of these measures relevant to rural health services planning in B.C. include:

Improving medical transport so rural residents can have access to urgent care when needed.



Supporting culturally safe testing and pandemic protocols that are co-developed with First Nations organizations.

Providing rural residents with the information they need to decide where they receive care.



Contact tracing that respects the privacy of members of smaller communities.

Improved telehealth access and quality.

According to the World Health Organization (WHO), the aim of emergency preparedness is to “strengthen the capacity of governments, organizations, institutions and communities to withstand a disaster or emergency situation” [17]. This includes natural hazards and infectious disease outbreaks including COVID-19. Adequate emergency preparedness enhances resilience against climate change-driven environmental disruptions and mitigates the health impacts to B.C.’s rural population which makes up about 14% of the total population [2,18,19].

## ■ Section 2

# Generalism and rural health

However, it is important to recognize that every community has unique characteristics and faces unique challenges. For example, different regions of B.C. face different climate outcomes, such as drought, forest fire, or flood, due to their unique geography. Similarly, communities also possess different resources, such as social connectivity, knowledge of environment, or access to public services thus making it difficult to lay out a universal climate adaptation model. To address this issue, the Torrens Resilience Institute of Australia created a basic framework to categorize various community characteristics into physical, procedural, and social enablers of community resiliency

## Reasons why Generalism is fundamental to rural health responsiveness to climate change and ecosystem disruption

Rural health care is different from urban and suburban models of care; different primarily because of the defining elements of rural and remote communities, including low population density and distance from other communities. The overarching reality of rural health care is that it is more generalist in nature. There is not enough population to support specialist and sub specialist models of care. The Royal College of Physicians and Surgeons of Canada defines Generalism as “breadth of practice... and collaboration with the larger health care team in order to respond to patient and community needs” [55]. Rural health practitioners thrive when they expand their scope of practice and are able to respond to a broader range of health problems. This is true for general surgeons and internists as much as for family doctors and nurses.

Rural communities also create an ideal context for physicians and nurses to acquire and practice enhanced skills. These enhanced skills can and do include generalists with maternity, surgical, anaesthesia, cancer care, newborn care, and a host of other skills. The Canadian Journal of Rural Medicine publishes a regular series titled “The Occasional... Procedure” [56]. These procedures include dislocated shoulder reductions, removing a nasal foreign body, or repairing a lacerated nail bed. There is a widely held recognition that rural generalists not only have to practice a wide range of skills but also be prepared to practice outside of their personal expertise on occasion. This is well described in a recent publication led by Jill Konkin (2020) in *BMJ Open*, titled “Exploration of rural physicians’ lived experience of practising outside their usual scope of practice to provide access to essential medical care (clinical courage): an international phenomenological study” [57]. The argument has been made that rural health care access challenges can be addressed by better transport. For instance, helicopters and air ambulances can be made available and ready to dash in and save patients when life or limb is threatened, and surface travel alternatives can be made available to address fewer pressing situations. While access to transport can theoretically mitigate some rural health emergencies, weather and uncontrollable circumstance all too often leave local providers to manage with the contingencies. Therefore, availability and accessibility to local care provided by generalists with enhanced skills and supported by virtual care support is now seen as essential. Local generalists interact with local patients more frequently due to their broad scope of practice, which enables them to create strong relationships with the community and provide effective education for climate resiliency. They can also identify the most prominent risks and avoidable morbidities through examining the lifestyle, primary industry, climate risks, major age groups, and underlying health problems of the community and prepare the local health care system accordingly. As such, generalists can be framed as “front line witnesses to the social dimensions of health, critical to access



to the health system and key to long-term health outcomes” [58-60].

## Generalism in medical school curricula

Despite its importance in not only rural health care but the entire health care system, Generalism often goes unrecognized over specialist practice in medical education. While mandatory clinical rotations expose students to various branches of specialism, Generalism is not highly regarded in the halls of education and academia. As a result, the current curricula not only decrease students’ awareness but also interest in rural generalist practice. Recognizing that positive experiences in rural settings during undergraduate education are some of the strongest factors for professional entry into rural practice, increase in exposure to generalist practice can foster interest in the field amongst future physicians [61].

As the only institution in the province of British Columbia that educates physicians, there is obligation and social accountability for the University of British Columbia to produce generalist physicians who are trained to meet the needs of rural and remote B.C. One of the ways in which the province trains rural practitioners is through the UBC Medicine Northern Medical Program (NMP), in partnership with the University of Northern British Columbia (UNBC). The program provides opportunities for students to gain rural perspectives through exposure to regional hospitals, Indigenous health centers, and smaller health facilities [62]. For example, the FNHA, Northern Health Authorities, NMP and the Health Arts Research Centre established the First Nations Community Education Program. This program allows students to closely engage with northern Indigenous communities to develop cultural competency, understanding of Indigenous health, and opportunity for cultural exchange while increasing primary care access for the population [63]. Similarly, other distributed sites of UBC Faculty of Medicine undergraduate education include the Island and Southern Medical Programs.



Figure 4. The University of Northern British Columbia (UNBC) Campus. Image provided by courtesy of UNBC. No changes made. Retrieved from: <https://www.unbc.ca/image-galleries/916/unbc-campus-photos>

## Increasing environmental literacy in health care

Eco-medical literacy is “the ability to access, understand, integrate and use information about the health-related ecological effects of climate change to deliver and improve medical services” [64]. Physicians must enhance their environmental literacy to strengthen their natural leadership role in influencing the health system towards responding to climate change and ecosystem disruption. To empower and equip physicians in responding to climate health outcomes, education is essential throughout medical training including undergraduate programs, residency training, and continuing professional development. For example, climate change awareness and environmental literacy can be incorporated to meet the objectives of existing undergraduate curricula [64]. Climate change and health can be seen as an integration of major educational components such as public health, clinical practice, pathophysiology, and statistics. Climate-related health outcomes can be embedded into case-based learning, where students are presented with individual or community level situations where health is impacted by climate change, and discuss potential preventive and remedial approaches [65]. For instance, the Health and Environment Adaptive Response Task (HEART) Force was established in 2016 by the Canadian Federation of Medical Students (CFMS) to increase awareness of climate change and environmental health [66]. The CFMS HEART has developed 12 core competencies in climate change and planetary health education to incorporate in all Canadian medical schools. These include displacement of vulnerable populations, changing infectious disease burdens, emergency disaster risk, and Indigenous health [67]. The first evaluation of its curricula was conducted in 2019 by students and faculty members [68]. Findings revealed a clear push from students and faculty for the continued integration of planetary health into the curriculum which supports the need for national formalization of climate and environmental-related education within Canadian medical schools.

Some of the current barriers to advancing environmental literacy within rural health care include an overloaded curriculum, the prioritization of traditional learning objectives, a lack of developmental resources and climate change expertise, dismissive attitudes towards the relevance of sustainability in clinical practice, and an underlying bias towards reductionist approaches of care [64,65,69]. Uprooting these challenges will require collective action across healthcare education systems. The Education for Sustainable Healthcare (ESH) curricula suggests three integrated strategies for driving meaningful change: adopting a systems-thinking approach, engaging with stakeholders through storytelling, and transforming vision into reality [70]. These practices will further equip healthcare providers in becoming adaptive leaders for planetary health action.

## Incorporating Indigenous cultural practice

In addition to eco-medical literacy, knowledge of local traditions is useful in providing holistic generalist care. With a generalist philosophy guiding the provision of community-centered service, there is potential to explore innovative ways to promote the population's wellbeing. Incorporating Indigenous traditional healing is an example of such an approach [71]. This includes healing circles, ceremonies, traditional diets such as fish, wild nuts and berries, and local herbal medicines [72]. The Canadian Cancer Society and FNHA recognize cultural practice as beneficial for mental wellness and restoring balance for Indigenous people, reaping superior long-term outcomes for patients. When complemented by Western medicine through Generalism, traditional practice can strengthen the connection between communities, their environment, and local health services [71,72].

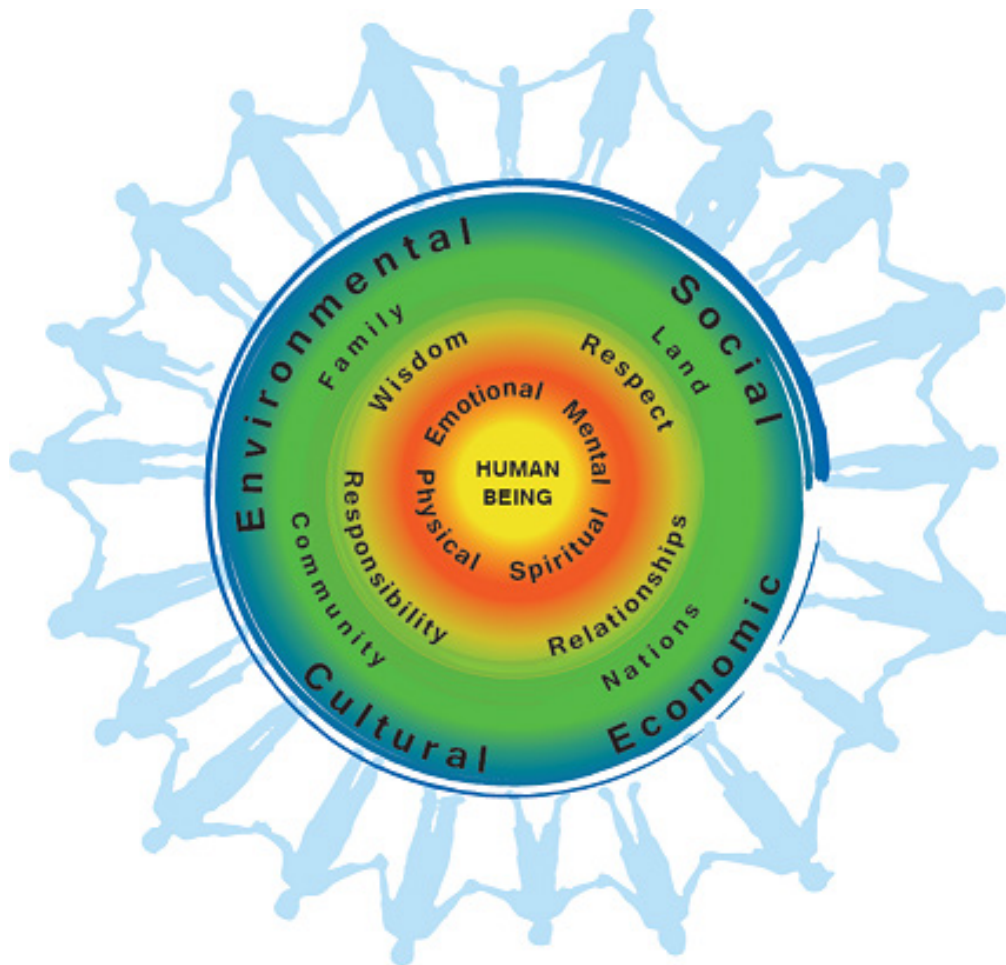


Figure 5. First Nations perspective on health and wellness tool. First Nations Health Authority. Retrieved from: <https://www.fnha.ca/wellness/wellness-and-the-first-nations-health-authority/first-nations-perspective-on-wellness>

According to the World Health Organization (WHO), the aim of emergency preparedness is to “strengthen the capacity of governments, organizations, institutions and communities to withstand a disaster or emergency situation” [17]. This includes natural hazards and infectious disease outbreaks including COVID-19. Adequate emergency preparedness enhances resilience against climate change-driven environmental disruptions and mitigates the health impacts for B.C.’s rural population which makes up about 14% of the total population [2,18,19].

## ■ Section 3

# Enhanced skills

However, it is important to recognize that every community has unique characteristics and faces unique challenges. For example, different regions of B.C. face different climate outcomes, such as drought, forest fire, or flood, due to their unique geography. Similarly, communities also possess different resources, such as social connectivity, knowledge of environment, or access to public services thus making it difficult to lay out a universal climate adaptation model. To address this issue, the Torrens Resilience Institute of Australia created a basic framework to categorize various community characteristics into physical, procedural, and social enablers of community resiliency



## Enhanced skills in rural and remote British Columbia

Generalist health care providers can extend their practice to offer more specialized care through enhanced skills. Generalists with enhanced skills are important for rural health services stability and adaptation as meeting the needs of the population can be achieved locally rather than patients having to travel to access services in referral centres or waiting for the periodic visits of specialists doing community visits. The level of enhanced skills that are appropriate and sustainable in a specific rural community depends on the size and demographics of the population and the expected frequency of the need for the enhanced skills. This has been estimated for maternity services in rural British Columbia [73].

About 25 years ago, B.C. instituted regionalized care which is associated with the strengthening of centralization of care in regional referral centres [68]. This is especially pronounced in procedural services such as surgery, anesthesia, and maternity care [74–76]. In association with regionalization, there has been the closure of more than 20 small rural maternity services forcing parturient women to travel away from their homes to give birth [74,77]. Loss of local caesarean section services in a rural community could result in the proportion of women able to safely deliver locally being reduced from 85% to 40% if the intrapartum services were able to remain open at all [77]. Loss of local surgical and anaesthesia services can further compromise local trauma and emergency care [76]. As climate change and ecosystem disruption progresses, it is anticipated that the need for sustainable local generalist services and enhanced skills will only increase.

## Enhanced skills competency in rural health care

Enhanced skills training offered to general practitioners are specific and diverse. From geriatrics, Indigenous health, obstetrics, emergency medicine, to anesthesia and surgery, generalists can choose their field of training based on their community's demands. To ensure quality training, enhanced skills programs are required to meet the standards set by The College of Family Physicians of Canada (CFPC). After the acquisition of Certificate of Added Competence (CAC) credentials, maintenance of competency requires adherence to guidelines and continuing professional development [78].

At UBC, the Department of Family Practice provides training in Enhanced Skills in two categories [79]:

- Category 1 includes main specialties with the national curriculum set by CFPC, including family practice anesthesia, health care of the elderly, obstetrical surgical skills, and palliative medicine.

- Category 2 allows more flexibility for generalists to tailor their training to specific interests. Some of the programs include addiction medicine, global health, HIV/AIDS, and women's health.

Reflective of these efforts, evidences suggest that generalist practice with enhanced skills provide safe, acceptable, and cost-efficient care, especially to rural communities [80–82]. A review of the literature finds no evidence suggesting superior outcomes of simple surgical procedures in urban centers over rural hospitals in Canada [83,84]. For high-income countries such as Canada, Australia and the United States, The Lancet Commission, in 2015, found that for basic procedures, such as caesarean delivery and appendectomy treatment, outcomes were as good in rural communities as in urban centres [85]. As such, they have recommended “task-sharing” between specialists and generalists with basic surgical, obstetrical, and anesthetic care as a solution to address global shortages of specialists, especially in rural and remote regions. They suggest that this solution will bring quality care and good outcomes to patients even when specialists are not locally available [85,86].

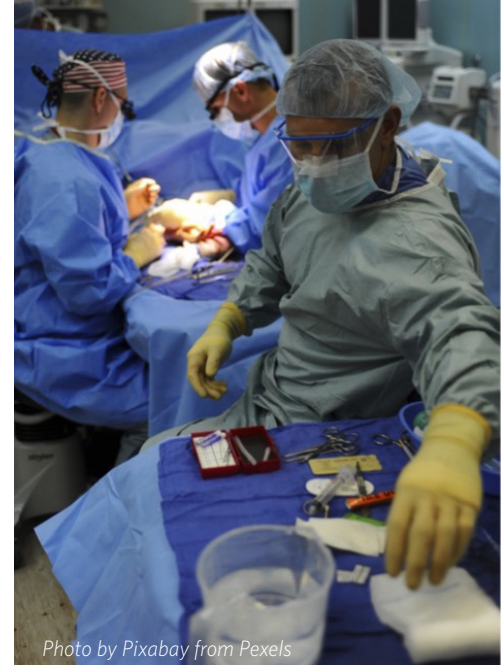


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### Importance of locally provided care

With the predicted increases in morbidities and adverse health outcomes associated with worsening climate change and ecosystem disruption, generalists with enhanced skills can underpin the sustainability and adaptability of local health services and decrease the need for patient transfers. Local care by itself is shown to have numerous benefits for patients:

- With physical distances and environmental circumstances such as weather hindering a transfer, rural patients can face critical delays until definitive treatment is available. Increased access to local healthcare protects communities' right to health, which the WHO outlines as accessibility, equitable, and timely quality of care [87]. For example, diagnostic services such as ultrasound can be provided locally even in the emergency department using a portable probe and be not only cost-effective, but allow prompt diagnosis of acute presentations [88,89]. Procedural services such as colonoscopy, appendectomy, and immediate trauma care, can also significantly decrease delays in treatment and produce comparable or better outcomes compared to patients presenting with similar problems being referred and transferred to regional centres [82,90,91].
- Displacement from home and familiar care providers can be stressful for patients which can evoke insecurity, anxiety, and miscommunication, leading to additional distress. Patients preferred continuity of care from local generalists who understand

their needs over specialist care from an unfamiliar hospital. Patients are also more likely to experience effective communication and culturally-relevant care when it is provided locally [75].

- Financial burdens from the cost of transport, missing work, or adjusting for children at home can exacerbate the delayed timing of care [92].
- Enhanced skills and consequent enhanced local services can mitigate this problem significantly in selected situations.
- Many rural patients not only end up making several trips to distant hospitals for needed care, but are often required to undertake significant travel on the day of the procedure, which can negatively affect their recovery process [75]. Local care allows flexibility in hospital admission and discharge that are tailored towards patient wellbeing, potentially producing better health outcomes.

## Identifying community-specific health needs

Defining a service dependant population and identifying their needs for health services is foundational to planning. Being able to meet the needs of that population efficiently is important for climate-resilient health services [76]. Given the wide variety of potential illnesses associated with climate change and ecosystem disruption augmenting an already replete range of clinical conditions that affect rural people, a clear understanding of necessary services and annual estimated patient volumes are essential for generalists to determine the enhanced skills training needed. It is also important for health authorities to determine the sustainability of services, especially when they require additional infrastructure or budget. For this, a holistic examination, including population size and demographics, burden of disease, geographic isolation, and access patterns to referral centers is necessary on a community-by-community basis.

Visualization of complex data to identify long-term trends and regional disparities within the health care system and at community level is essential. This can also facilitate communication between the pentagram partners, such as the health authorities and the public [93]. For example, the Rural Birth Index (RBI) project at the UBC Center for Rural Health Research (CRHR) actively utilized this approach to determine rural health needs. Through a multidimensional regional analysis combining geospatial mapping with census data, utilization data, and health outcomes, the RBI systematically measures need for local maternity services and parametrizes that need against a projected appropriate and sustainable level of local services [94].

Quantifying the need for services of a rural population in an objective and systematic way allows health service planners to balance specialist, generalist, and enhanced generalist

care to not only plan specific services, but ultimately to enhance rural community health service resiliency to climate change and ecosystem disruption. Through appropriately fine-tuning local health care, we will be able to provide better alternatives for patients and the environment. Strengthening Generalist models of care and enhanced skills are important health care adaptation strategies that are central to evolving rural services in the face of the challenges ahead. These issues must be further discussed amongst the pentagram partners for appropriate government support, education for physicians, and increasing the resiliency of rural communities.



(WHO), the aim of emergency preparedness is to “strengthen the capacity of governments, organizations, institutions and communities to withstand a disaster or emergency situation” [17]. This includes natural hazards and infectious disease outbreaks including COVID-19. Adequate emergency preparedness enhances resilience against climate change-driven environmental disruptions and mitigates the health impacts to B.C.’s rural population which makes up about 14% of the total population [2,18,19].

## ■ Section 4

# Telehealth

However, it is important to recognize that every community has unique characteristics and faces unique challenges. For example, different regions of B.C. face different climate outcomes, such as drought, forest fire, or flood, due to their unique geography. Similarly, communities also possess different resources, such as social connectivity, knowledge of environment, or access to public services thus making it difficult to lay out a universal climate adaptation model. To address this issue, the Torrens Resilience Institute of Australia created a basic framework to categorize various community characteristics into physical, procedural, and social enablers of community resiliency

## Telehealth as an important climate change adaptation strategy

Telehealth is defined as the use of digital and telecommunication technologies in providing health care remotely and is a powerful rural health services adaptation strategy [95]. With the COVID-19 outbreak and the associated restrictions on travel and patient transport, virtual health care has dramatically increased in demand. This trend is likely to continue as it has been met with wide acceptance and positive support.

Listed below are examples of how telehealth enhances access to care and in turn contributes to building healthy and resilient communities [95]. Specific examples include:

- The remote management of chronic diseases which can improve the quality of life and increase the independence of rural patients who might otherwise lack access to care.
- Remote public health education which can increase knowledge, thereby reducing health vulnerability and increasing adaptation capacity.
- Virtual family visits during long-term hospital stays which allow patients to remain connected with their community while enhancing cultural support and psychological wellbeing.
- Enhanced access to remote diagnostics and specialist consultations which increase access for patients in remote communities and can increase the resilience of communities' health care systems.

Given the importance of telehealth in the face of climate change and ecosystem disruption, the next section will examine the practical applications of telehealth in rural communities.

### Clinical applications of telehealth

Telehealth use is well established for various specialities in rural Canada, including orthopedics, oncology care, and daily hemodialysis rounds. The COVID-19 pandemic has necessitated a dramatic expansion of telehealth services across the spectrum of patient and physician support including advanced support in response to critical conditions [96]. In British Columbia, the RCCbc provides a suite of Real-Time Virtual Support (RTVS) services in areas such as primary care, emergency medicine, pediatrics, and maternity care. The Rural Urgent Doctor in-aid (RUDi) is a real-time support for physicians needing a second opinion. Physicians experienced in rural and emergency medicine are available 24/7 through Zoom and phone [97]. The First Nations Virtual Doctor of the Day is a virtual support network for Indigenous communities in Island Health and Northern Health Authorities intended to provide primary care in regions with a lack of local health care providers. Patients can call to book an appointment with a physician trained to provide



Figure 6. FNHA First Nations Virtual Doctor of the Day Poster. Retrieved from: <https://www.fnha.ca/Documents/FNHA-First-Nations-Virtual-Doctor-of-the-Day-Poster-C.pdf>

culturally safe care [98,99].

The benefits of telehealth are significant for Indigenous communities as access to care is one of the most significant determinants of health gaps between non-Indigenous and Indigenous Canadians [100]. Telehealth can mitigate the issues of transportation and long wait times which can increase the efficiency of care [101,102]. In addition, providing virtual care as a form of house call or through local community clinic services can keep patients within their social support network during treatment. This approach can support a respect for an integration of allopathic medicine into the cultural and traditional values and lifestyle of Indigenous people [103].

Another important use of telehealth is its utility in provision of mental health services to rural communities. The COVID-19 pandemic has only added further layers of stress to the context of increasing evidence of climate change and the economic challenges of rural community life. Telepsychiatry services can respond in a

timely way to rural need for mental health care [104]. The Ontario Telemedicine Network reported that as far back as 2013, 71% of their provincial therapeutic areas of care was dedicated to mental health [105].

## Next steps in telehealth: Overcoming the challenges

With the growing consequences of climate change, the progression of the COVID-19 pandemic, and the projected increases in rural telehealth needs, there are a number of important challenges and gaps that need to be considered. Listed below are some key issues that need to be considered in implementing telehealth services in rural communities:

- The digital divide in internet access may limit the feasibility of telehealth services. For example, between 2019 to 2020, download speed in urban Canada was up to 11.7 times faster than that of rural [106]. Shortages in other core internet infrastructures and equipment will exacerbate this barrier [107,108].
- Patient-physician communication challenges may be amplified by telehealth resulting in delays in diagnosis and definitive treatment. Learning the utility of new modes of communication both synchronous and asynchronous will need to be supported by appropriate evidence and training [109].
- Issues of cultural sensitivity need to be considered in telehealth communication strategies and appropriately integrated.
- Financial issues related to the associated change in practice model may impact local

healthcare workers [110].

- Preparation for rural practice enabled by telehealth will impact education and training at the undergraduate- and postgraduate-level.

Telehealth is a multi-faceted, innovative technology that may produce significant benefits to patient care in rural communities. Further research should consider effective implementation strategies and continuous quality improvement to ensure that telehealth can develop as one of the major responses in rural health services to climate change.

# Conclusion

Rural health services adaptation is an important part of enhancing rural resiliency. Community partnerships between the health care providers and community leaders will be crucial to enhancing the resiliency of rural communities to climate change and ecosystem disruption. In the next chapter, we will delve into the role of community voice and youth-centered partnerships in more detail.

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