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COMMENTARY

Rural Pandemic Preparedness: The Risk, Resilience and Response Required of Primary Healthcare

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Abstract: Pandemic situations present enormous risks to essential rural primary healthcare (PHC) teams and the communities they serve. Yet, the pandemic policy development for rural contexts remains poorly defined. This article draws on reflections of the rural PHC response during the COVID-19 pandemic around three elements: risk, resilience, and response. Rural communities have nuanced risks related to their mobility and interaction patterns coupled with heightened population needs, socio-economic disadvantage, and access and health service infrastructure challenges. This requires specific risk assessment and communication which addresses the local context. Pandemic resilience relies on qualified and stable PHC teams using flexible responses and resources to enable streams of pandemic-related healthcare alongside ongoing primary healthcare. This depends on problem solving within limited resources and using networks and collaborations to enable healthcare for populations spread over large geographic catchments. PHC teams must secure systems for patient retrieval and managing equipment and resources including providing for situations where supply chains may fail and staff need rest. Response consists of rural PHC teams adopting new preventative clinics, screening and ambulatory models to protect health workers from exposure whilst maximizing population screening and continuity of healthcare for vulnerable groups. Innovative models that emerge during pandemics, including telehealth clinics, may bear specific evaluation for informing ongoing rural health system capabilities and patient access. It is imperative that mainstream pandemic policies recognize the nuance of rural settings and address resourcing and support strategies to each level of rural risk, resilience, and response for a strong health system ready for surge events.

Keywords: pandemic, rural primary healthcare, risk assessment, preparedness, rural system, outbreak, hazard; COVID-19

Introduction

World-wide, primary healthcare (PHC) is the foundation of an accessible and cost-effective health system.[1] Strong PHC strongly underpins the achievement of the Sustainable Development Goals, particularly those related to health and equity, in rural communities worldwide.[2] However, when it comes to pandemic responsiveness, including the current global effort against COVID-19, the nuance of the rural PHC pandemic context is somewhat hidden. The focus of clinical interventions has been on urban and metropolitan locations (somewhat driven by the disease infection, severity and mortality rates that may occur in high-density areas). Despite this, there is a difference with respect to pandemic planning and action in rural areas.[3] In

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particular, describing the role and function of rural PHC teams in such emergencies has the potential to inform rural health system preparedness to all-nature of hazards of biological, chemical and radio nuclear varieties, whether naturally occurring or not.[4]

Our aim was to draw on our collective expertise in rural public health, clinical and academic knowledge, to provide a commentary as to our perceptions of the activity and experiences of the rural PHC sector during the COVID-19 pandemic. We considered this would be applicable for informing future pandemic policy and planning and ensuring that national responses are tailored to rural contexts. We particularly drew on experiences from Canada and Australia, as two countries with similar health systems, geography, and rural population distributions. In order to do this, we first discussed the pandemic response we observed in our own country's rural and remote communities to draw out three themes representing interacting phases that were common in both countries: risk, resilience and response. The working definitions for these are summarised in Table 1 and explored in the paper as follows.

Risks to Rural Communities

Despite the recognition that effective pandemic management requires specific attention to at-risk populations, there is very little literature concerning the nature of risk for rural populations.[4,5] Although many rural people are affected by COVID-19 around the world, the focus tends to centre on population risk and disease severity in high-density urban communities. Anecdotally, much of the media coverage about case counts and deaths also revolves around urban areas and city hospitals, with limited demarcation of what is going on in rural places. Despite this, nearly half the global population lives rurally and has specific risks related to transmissible infections (Table 1).[6]

Many rural communities entered the current pandemic already chronically under-serviced, facing inadequate healthcare infrastructure, limited clinical resources and equipment, and healthcare personnel shortages (56% lacking critical healthcare access).[7–10] With respect to their populations, rural communities include more aged, First Peoples and socio-economically disadvantaged people, many with higher levels of pre-existing chronic illnesses.[8] Some rural and First Peoples face extreme socio-cultural barriers related to access to healthcare as well as housing, basic services and digital infrastructure, affecting lower levels of health service access and use relative to their needs.[11,12] Pre-existing unmet needs may exacerbate pandemic risks unless the healthcare response is adequate, culturally and socially relevant.

Further, despite the concept that rural communities are safe from pandemic exposures, the high levels of interaction between rural communities, with metropolitan areas and with international communities is an important factor to consider within pandemic policies. Some rural communities have strong patterns of using fly-in fly-out workers and short-term rotating locum staff.[13–15] In Australia and Canada, around 40% and 30% of the rural medical workforce is overseas-trained, many of whom visit their home country and have regular family visiting.[16,17] Moreover, in rural communities, goods and services are often traded in a relatively informal economy through local entrepreneurship and reciprocity as a vital part of sustainable development.[18] Commodities available in one community may not be in another, only reinforcing travel between communities. Rural populations may also rely on more multi-site employment (intra-rural and rural to urban) and educational models, including boarding schools, posing other infection risks.[19,20] Rural locations may also experience significant numbers of people visiting holiday homes (sometimes to get away from pandemics 'hot spots'), as well as mobile tourist groups including many "grey nomads", people who are post-retirement, taking lengthy holidays, some of whom may be trapped in rural locations by border closures during a pandemic.[21,22] Together, the patterns of rural mobility increase the threat that rural communities will be exposed to infectious diseases, with potentially dire consequences unless specifically acknowledged and managed.

With respect to the risk of community transmission, the conditions in rural areas may pose particular challenges. First Peoples have high rates of short-term inter and intra community movement patterns within regions (around 39 trips per year, often related to kinship), and are subject to over-crowded housing (18.3% of housing considered not adequate for the number of people per dwelling).[23,24] Mainstream policies to promote or mandate self-isolation during pandemics may be impractical to implement and work against the goal of reducing the rate of infection in rural and remote settings. Instead, rural communities may need to identify specific ways to respectfully adjust normal community movement patterns and consider ways to provide safe sheltering options for isolating unwell people. These considerations must address the social, economic, and cultural determinants of health in order to be effective.

Table 1 Conceptualizing Risk, Resilience and Response of Rural Primary Care to Pandemic Situations

Phases	Working Definitions (Drawn from WHO Framework) (4)	Key Examples from Rural Settings	Key Examples from Urban Settings
Risk	The potential for harm from the threat/hazard.	More aged, First Peoples and socio-economically disadvantaged people. Chronically under-serviced, with higher rates of chronic illness and limited clinical resources and equipment and health personnel. Communities of a high fly-in-fly-out workforce over diverse borders, high levels of overseas-trained health workers. Inter-community sharing of goods and services. Multi-site employment, boarding schools, tourists and particular industries. Host of a number of holiday homes and roving tourists. Inter-personal interaction between community members and mobility between First Peoples visiting family/kin on-country. Co-location of hospitals and aged care services. Over-crowded personal spaces (housing), make it challenging to isolate unwell people. Risk communication challenges, related to lower education levels, different language groups and potential stigma of illness.	Diverse population with greater access to employment, education and health services. Mostly within city population movement, using a higher proportion of locally available healthcare workers. Visitors may include more "short-stay" individuals, often related to employment. Fewer students leaving home to attend rural boarding schools. Large gatherings more common, high-density community and over-crowded communal spaces and office buildings that need to be managed. Hospitals, a potential source of exposure. Risk communication tailored to more educated population.
Resilience	The potential of the system and population to withstand possible ill-effects from the threat/hazard.	Small generalist clinical PHC teams often the only healthcare available and may have higher workload. Less hospitals, fewer hospital beds and limited high dependency care infrastructure. PHC teams work within a network of services over large geographic catchments including logistics of patient travel. Higher workload on smaller PHC teams including for the administrative burden of pandemic management, worry about exposure and managing conflicting roles related to managing the negative consequences of the pandemic (eg mental health and domestic violence) on community members who are personal contacts and friends. Higher turnover of rural PHC staff more common. Pandemic related burnout and staff isolation policies could have major impacts on PHC team capacity. Lack of PPE resources and limited assurance of baseline and scaled up supplies if needed them – pressure to find own solutions. Adequate testing and treatment options necessary but communication about supply chains may be weak. New patient retrieval and transfer systems may be necessary requiring negotiation. Rural hospitals may need to implement short-term treatment options.	Highly differentiated and specialised PHC and hospital clinical workforce. Extensive technical clinical infrastructure varying across levels of care. Community self-assured about getting care they need when need it, with extensive overflow capacity locally. Within-city networks and transfers rapid. Administrative staff capacity sound. Policies already tailored to setting so easier to apply. Long-term staff and staffing stability. Less staff burnout and impact of staff isolation policies as overall numbers of trained health workers and PHC teams greater. Stockpiles required, but supply chains turn on more rapidly.

(*Continued*)

Table 1 (Continued).

Phases	Working Definitions (Drawn from WHO Framework) (4)	Key Examples from Rural Settings	Key Examples from Urban Settings
Response	The health intervention/s to mitigate and specifically target the threat/hazard.	PHC teams providing differentiated services and triaging. Adjust service platform, adopting new preventative clinics, screening and ambulatory models. New models like telehealth suited to rural settings with expansion to telephone, rapidly reaching more patients across geographic catchments and protecting limited health worker numbers. Potential surge capacity offered by telehealth strongly enabling. Accessing the right mobile medical devices to enable telehealth models to work well may be challenging. Utility of telehealth may be unique, with blend of phone and video use different from in the city (fit to patient, provider and infrastructure) stability of PHC staff and ensuring approachability and acceptability of care, as a dimension of health service access.	Differentiated services emerge across teams and organisations. Preventative clinics, but ambulatory models less common. Telehealth increases convenience and may be easier to implement as population accustomed to technology, has reasonable internet connection and relevant infrastructure.

Notes: Working definitions drawn from World Health Organization. Rapid risk assessment of acute public health events. Geneva: WHO, 2012. Available from: https://www.who.int/csr/resources/publications/HSE_GAR_ARO_2012_1/en/. Accessed 1 June 2020.[4]

Perceived and real risks may be exacerbated unless risk communication accounts for the lower education levels of rural populations, different language groups and the potential stigma related to illness in rural and remote communities. Failing to do so may also reduce perceived risk and compliance with public health information and negatively impact health service use.[25,26]

Finally, in rural areas, health services may be co-located with other human services, in multipurpose centres, which operate as part of networked and integrated service models that aim to support health and human services for people as close to home as possible.[27] These potentially place long-term aged care residents within proximity of infectious patients, warranting site-specific risk assessment and adjustment. Mindful of different risks in rural settings, mainstream policies for health services, border control, population monitoring, self-isolation and closure of essential services require rural tailoring.

Rural Resilience

The mainstream population health and health service resilience to COVID-19 has largely centred on building hubs for testing, upscaling tracing and isolation activity along with building hospital service capacity including equipment and intensive care unit beds. But rural resilience relies on the availability of strong qualified PHC teams covering services most relevant to the population's needs.[28,29] The focus on strong PHC is essential as most rural towns have small (<10 bed) (minimal high dependency care), or no hospitals and more remote communities rely on community clinics, nursing stations or visiting primary healthcare teams (Table 1).[29–32] These are connected to a network of rural hospitals some distance away by road or air, demanding rural people undergo significant personal travel or use retrieval services.[29,32] When patients need higher-level care elsewhere, this imposes substantial financial, cultural and emotional burden on rural people whereby the PHC team aims to optimise prevention and early intervention to mitigate infection and minimise the need for patients to travel.[33]

Resilience is challenging as many rural PHC teams are small and need to sustain a high workload and strong community leadership during a pandemic response. An Australian national survey of general practitioners (GPs) working during the COVID-19 pandemic identified that GPs in rural areas were more likely to maintain or increase patient numbers relative to GPs based in urban areas (where patient numbers dropped).[34] This may be because small rural PHC teams absorb any pandemic clinical services on top of their normal workload with few buffers from other doctors in town. Further, there may be a much higher administrative burden on PHC leaders to digest and implement rapidly evolving policies and guidelines. These policies may be inadequately tailored to the rural context. One study identified that guidelines from various official agencies involved in healthcare may be in direct conflict with each other, making it challenging to interpret the correct course of local action needed.[35] A real-time system allowing rural PHC staff to pose questions and receive rapid answers (such as the one recently set up by project ECHO, University of New Mexico, USA), may be suitable to use within each nation's pandemic response.

Potential impacts on the mental health and fatigue levels of PHC staff are also probable in rural settings. Although there are no rural-specific figures, a national cross-sectional survey of Australian doctors during the COVID-19 pandemic identified that 11.5% of GPs reported felt "tense, restless, nervous or anxious or unable to sleep at night because his/her mind is troubled all the time" a lot more than usual.[34] Some stressors may be concerns about being exposed to infection as a frontline healthcare worker, despite the strength of screening and triaging processes. Of all occupations, healthcare practitioners have the highest likelihood of exposure to diseases.[36] Other stressors relevant to rural PHC teams may relate to any overlapping and conflicting patient–provider relationships they may experience around rising rates of community mental illness, job losses and poverty, domestic violence or crime during pandemic periods.[37] These may have strong effects on rural healthcare workers whose professional lives are intertwined with their personal connections to people in their community.

Resilience in rural areas strongly depends on local PHC teams spending time analysing the strengths and opportunities of their local healthcare networks and patching any gaps. This may require the development of new collaborative frameworks to build resilience in various regions or local populations.[38] To some extent, these depend on the level of pre-existing community trust they have and their relationships with other health services. This is enabled when primary healthcare workers have been working in the same area for some time. However, for many small rural and remote communities, poor stability of the workforce is a threat to resilience. PHC staff turnover is more common in more remote locations than in regional and urban centres and there is a stronger reliance on locum or other short-term staff (for example, in Australia's remote primary care clinics only 20% of nurses continue to work in the same remote clinic 12 months after commencing).[39,40]

In the event of pandemic responses becoming quite protracted, rural resilience may also be threatened by the potential burnout of rural PHC workers, a group that already works more hours and has higher turnover than its urban counterparts.[41] Burnout threatens rural community health and local health system leadership because of the small number of health workers in rural settings.[37,42] Surge policies to provide additional staffing to rural PHC teams could be activated early in pandemic situations to embed more capacity of "super-numeri" staff within the response, and enable viable rosters for PHC workers to get enough rest. This arrangement also serves to allow any exposed/unwell staff to undergo self-isolation, without impacting the rest of the team and the community's access to care.

Whilst states/provinces and nations clamber to find enough personal protective (PPE) and other infection control equipment during pandemics, this infrastructure becomes increasingly centred on large hospitals and cities facing the most progressive levels of illness. This may leave many rural PHC providers unprotected, sometimes with no assurance they will get PPE. The lack of PPE poses a critical threat in rural settings where the pool of available PHC workers is precariously small and serves an undifferentiated caseload of infectious and non-infectious people dispersed across large geographic catchments. If sufficient protective equipment cannot be obtained, then rural PHC teams strongly depend on non-contact treatment methods and community support for making their own protective gear or using home-grown methods of sterilizing.[43] Ideally, some assurance by government that sufficient baseline supplies and any scaled up resources will be provided where needed, would buffer the resilience of individual PHC units. In the same vein, an additional resilience factor for rural communities is having access to adequate clinical testing capabilities and relevant treatments. A study of the perspectives of First Nations Peoples about the 2009 influenza pandemic identified that "supplies" (ordering, maintaining and providing pandemic supplies) were a key "overlooked" aspect of existing pandemic plans.[44]

Finally, rural resilience depends on PHC teams and the community having specific advice about sensible systems for patient retrieval for higher level care. PHC teams are well placed to understand the best pathways for patient transfer but this may require government support for negotiating the guarantee of transport and higher-level services accepting unwell rural patients. Feeling resilient depends on knowing that this plan will allow for situations where the local caseload may rapidly rise. Such continuity business planning has been described as essential in other pandemics.[45] Meanwhile, other research has identified that those communities with rural hospitals, should bolster their capabilities to manage infected individuals for interim periods, where transferring acutely unwell patients to larger centres is not feasible, nor immediate enough.[3]

Response

The healthcare response to COVID-19 has anecdotally been portrayed in the media as hospital care. However, in rural areas, the response phase related to PHC teams introducing of a differentiated range of treatment services for infectious and non-infectious members of the community as well as adopting new preventative clinics that are readily accessible by rural populations (Table 1). This often involves delivery of more ambulatory clinical services, including new in- and out-of-clinic services, collaborating with community public health services and introducing innovative triaging and testing systems for unwell people. Unlike urban models which are fixed, rural PHC services are highly needs-based and flexible and this is exacerbated in line with emerging pandemic and local conditions.[46] Other than treating regular clients and managing potentially infectious patients, new or re-vamped preventative clinics may be needed, including targeted vaccination clinics, prescription services by phone and advanced care planning. These serve to better position the community and free up the available primary resources for responding to new infectious cases. There is some potential that these add to the service loads of rural PHC teams, and this should be explored and linked to the notion of workforce surge needs.

Historically, many governments have restricted funding for telehealth to non-primary care doctors, such as referred specialist medical services which are the least accessible medical service in rural areas.[47] However, new government policies during the COVID-19 pandemic in Australia and Canada started to fund rural PHC teams to use telephone and video consultations. This funding is in recognition of the role that telehealth plays in PHC in non-contact healthcare for protecting health workers and the community from infection. In rural settings, it has also provided a potential option to surge rural workers to overcome staff shortages, staff isolation (due to exposure) and border closures. Telehealth availability, funded in phone and video formats, has provided for unprecedented capacity to grow and diversify models of PHC services fit for rural communities, using a wider choice of platforms of choice. Further, the flexibility to deliver services via video- or –phone assists to deliver consultations through a simple base of interaction where this is a better fit.

As a model, telehealth, and the blend of phone and video used, still requires evaluation within the rural context to establish where it offers the most utility for providers and patients. This is because its long-term use may require a significant change in management effort and the redesign of existing models of care.[48] It is imperative that such models do not add excessive demand for mobile technology and at-home medical devices that rural and remote people and rural PHC teams may find hard to access. More work is needed to determine the proportion and nature of PHC services that fit telehealth delivery and how these are optimally complemented with in-person consultations. Rural PHC teams and rural health services researchers are possibly best placed to explore this topic given they have the most in-depth knowledge of the dynamic and complex environment of rural and remote settings.

In the rural system, the capacity to overlay telehealth largely depends on the stability of a trained PHC workforce in rural areas, their equipment and adequate broadband internet services. One national cross-sectional survey during COVID-19 identified that GPs in the most disadvantaged areas, and GPs in rural areas used less telehealth.[34] This perhaps reiterates the imperative of understanding the context of use in rural areas. Like in urban areas, telehealth is a potential adjunct service in rural areas. But it may have less capacity or more dire consequences if replacing face-to-face services for disadvantaged and socially isolated groups in the community. This is because in rural settings, there are likely to be differences in the patient's approachability and acceptability of online health services including for aged, disadvantaged, culturally diverse and First Peoples and seeing the doctor may provide better quality of care and social contact (and therefore health benefit).[49]

The potential for digital inequalities (at the supply and demand side) is an important issue for rural communities to adopt technology-based healthcare solutions.[50] Many rural places continue to lack stable internet service networks, particularly when more people may be working or self-isolating at home during pandemic periods. A high proportion of rural areas may experience broadband connectivity issues resulting in weak or no access to the

Internet meaning that phone-calls remain a central back up system.[51,52] Further, some rural communities may incur high costs associated with high-speed broadband Internet use as another limitation.[51]

In conclusion, the specific needs of rural communities may inadvertently be overlooked within rapid mainstream pandemic planning. However, these communities have widely different contexts from urban settings. This commentary highlights that specific preparation is needed for addressing nuanced rural risks, building community resilience, and fostering a coordinated and supported rural PHC response. Critically pandemics present an enormous risk to a small critical mass of rural PHC teams, and the communities they serve. This is particularly in relation to their smaller staffing and infrastructure, serving a diverse population with higher pre-existing healthcare needs. This perspective identifies clear opportunities to continue to future-proof rural PHC systems for surge events.

Ethics

This article did not require ethical review as it used available published literature.

Disclosure

The authors report no conflicts of interest for this work.

References

1. Starfield B, Shi L, Macinko J. Contribution of primary care to health systems and health. *Millbank Quarterly*. 2005;83(3):457–502. doi:10.1111/j.1468-0009.2005.00409.x
2. United Nations. *Sustainable Development Goals*. New York: UN; 2015.
3. Patey C, Asghari S, Norman P, Hurley O. Redesign of a rural emergency department to prepare for the COVID-19 pandemic. *CMAJ*. 2020;192(19):E518–E520. doi:10.1503/cmaj.200509
4. World Health Organization. *Rapid Risk Assessment of Acute Public Health Events*. Geneva: WHO; 2012:1–44.
5. Itzwerth R, Moa A, MacIntyre R, Plant A. Australia's influenza pandemic preparedness plans: an analysis. *J Public Health Policy*. 2018;39(1):111–124. doi:10.1057/s41271-017-0109-5
6. United Nations Department of Economic and Social Affairs Population Division. *The World's Cities in 2018 – Data Booklet*. New York: UN; 2018:1–29.
7. International Labour Organization. *Global Evidence on Inequities in Rural Health Protection: New Data on Rural Deficits in Health Coverage for 174 Countries, ESS Document No.47*. Geneva: ILO; 2015:1–83.
8. Australian Institute of Health and Welfare. Rural and remote health. 2018; Available from: https://www.aihw.gov.au/reports/rural-health/rural-remote-health/contents/rural-health., Accessed 20 July 2020.
9. Moyimane MB, Matlala SF, Kekana MP. Experiences of nurses on the critical shortage of medical equipment at a rural district hospital in South Africa: a qualitative study. *Pan Afr Med J*. 2017;28:1–8. doi:10.11604/pamj.2017.28.100.11641
10. Viscomi M, Larkins S, Sen Gupta T. Recruitment and retention of general practitioners in rural Canada and Australia: a review of the literature. *Can J Rural Med*. 2013;18(1):13–25.
11. Australian Institute of Health and Welfare. *Rural, Regional and Remote Health: Indicators of Health Status and Determinants of Health. Rural Health Series No. 9. Cat. No. PHE 97*. Canberra: AIHW; 2008.
12. First Nations Information Governance Centre. *National Report of the First Nations Regional Health Survey Phase 3: Volume Two*. Ottawa: FNIGC; 2018:1–168.
13. House of Representatives Standing Committee on Regional Australia. *Cancer of the Bush or Salvation for Our Cities? Fly-In, Fly-Out and Drive-In, Drive-Out Workforce Practices in Regional Australia*. Canberra: The Parliament of the Commonwealth of Australia; 2013.
14. Morris R. *Scoping Study: Impact of Fly-In Fly-Out/Drive-In Drive-Out Work Practices on Local Government*. Sydney: Australian Centre of Excellence for Local Government; 2012:1–24.
15. O'Sullivan B, Joyce C, McGrail M. Rural outreach by specialist doctors in Australia: a national cross-sectional study of supply and distribution. *Hum Resour Health*. 2014;12(1):1–10. doi:10.1186/1478-4491-12-50
16. O'Sullivan B, Russel D, McGrail M, Scott A. Reviewing reliance on overseas-trained doctors in rural Australia and planning for self-sufficiency: applying 10 years' MABEL evidence. *Hum Resour Health*. 2019;17(1):1–9. doi:10.1186/s12960-018-0339-z
17. Dumont J-C, Zurn P, Church J, Le Thi C. *International Mobility of Health Professionals and Health Workforce Management in Canada: Myths and Realities: OECD Health Working Paper No. 40*. France: OECD World Health Organization; 2008:1–120.
18. Battino S, Lampreu S. The role of the sharing economy for a sustainable and innovative development of rural areas: a case study in Sardinia (Italy). *Sustainability*. 2019;11(3004):1–20. doi:10.3390/su11113004
19. Green MB, Meyer SP. An overview of commuting in Canada: with special emphasis on rural commuting and employment. *J Rural Stud*. 1997;13(2):163–175. doi:10.1016/S0743-0167(97)83095-1
20. Chmielinski P. Labour markets for rural population: commuting and migration abroad. *Econom Agriculture*. 2013;60(3):511–521.
21. Weeden A. Do you have a right to go to the cottage during the coronavirus pandemic? In: *The Conversation*. The Conversation Media Group Ltd Melbourne; 2020.
22. Hillman W. Grey Nomads travelling in Queensland, Australia: social and health needs. *Ageing Soc*. 2013;33(4):579–597. doi:10.1017/S0144686X12000116
23. National Collaborating Centre for Aboriginal Health. *Housing as a Social Determinant of First Nations, Inuit and Métis Health*. British Columbia: NCCFAH; 2017:1–16.
24. Memmott P, Long S, Thomson L. *Mobility of Aboriginal People in Rural and Remote Australia*. Australian Housing and Urban Research Institute; 2006:1–6.
25. Stormacq C, Van den Broucke S, Wosinski J. Does health literacy mediate the relationship between socioeconomic status and health disparities? Integrative review. *Health Promot Int*. 2018;34(5):e1–e17. doi:10.1093/heapro/day062
26. Lewis NM. Placing HIV beyond the metropolis: risks, mobilities, and health promotion among gay men in the Halifax, Nova Scotia region. C. *An Geogr*. 2015;59(2):126–135.
27. Nancarrow SA, Roots A, Grace S, Saberi V. Models of care involving district hospitals: a rapid review to inform the Australian rural and remote context. *AustHealth Rev*. 2015;39(5):494–507.
28. Carey TA, Wakerman J, Humphreys JS, Buykz P, Lindeman M. What primary health care services should residents of rural and remote Australia be able to access? A systematic review of "core" primary health care services. *BMC Health Serv Res*. 2013;13(178):1–8. doi:10.1186/1472-6963-13-178
29. Macleod M, Browne A, Leipert B. Issues for nurses in rural and remote Canada. *Aust J Rural Health*. 1998;6(2):72–78. doi:10.1111/j.1440-1584.1998.tb00287.x

30. Saberi V. *Thesis: Future of Smaller Rural Public Hospitals*. Southern Cross University; 2015.
31. Peiris D, Wirtanen C, Hall J. Aeromedical evacuations from an east Arnhem land community 2003–2005: the impact on a primary health care centre. *Aust J Rural Health*. 2006;14(6):270–274. doi:10.1111/j.1440-1584.2006.00828.x
32. Garne D, Perkins D, Boreland F, Lyle D. Frequent users of the Royal Flying Doctors Service primary clinic and aeromedical services in remote New South Wales: a quality study. *Med J Aust*. 2009;191(11):602–604. doi:10.5694/j.1326-5377.2009.tb03344.x
33. Nagarajan K. Rural and remote community health care in Canada: beyond the Kirby Panel Report, the Romanow Report and the federal budget of 2003. *Can J Rural Med*. 2004;9(4):245–251.
34. Scott A. *The Impact of COVID-19 on GPs and Non-GP Specialists in Private Practice*. Melbourne: ANZ-Melbourne Institute Health; 2020:1–20.
35. Charania NA, Tsuji LJS. Government bodies and their influence on the 2009 H1N1 health sector pandemic response in remote and isolated First Nation communities of sub-Arctic Ontario, Canada. *Rural Remote Health*. 2011;11(3):1781.
36. Baker M, Peckham T, Seixas N. Estimating the burden of United States workers exposed to infection or disease: a key factor in containing risk of COVID-19 infection. *PLoS One*. 2020;15(4):e0232452. doi:10.1371/journal.pone.0232452
37. Erwin C, Aultman J, Harter T, Illes J, Kogan RCJ. Rural and remote communities: unique ethical issues in the COVID-19 pandemic. *Am J Bioeth*. 2020;1–4. doi:10.1080/15265161.2020.1764139
38. BC Government News. Helping rural, remote and Indigenous communities respond to COVID-19. 2020; Available from: https://news.gov.bc.ca/releases/2020PREM0020-000725., Accessed 20 July 2020.
39. McGrail MR, Humphreys JS. Geographical mobility of general practitioners in rural Australia. *Med J Aust*. 2015;203(2):92–97. doi:10.5694/mja14.01375
40. Russell D, Zhao Y, Guthridge S, et al. Patterns of resident health workforce turnover and retention in remote communities of the Northern Territory of Australia, 2013–2015. *Hum Resour Health*. 2017;15(1):1–12. doi:10.1186/s12960-017-0229-9
41. McGrail MR, Humphreys JS, Joyce C, Scott A, Kalb G. How do rural GPs' workloads and work activities differ with community size compared with metropolitan practice? *Aust J Prim Health*. 2012;18(3):228–233. doi:10.1071/PY11063
42. Worley P. Always one doctor away from a crisis! *Rural Remote Health*. 2004;4(2):1–3.
43. Fisher EM, Williams JL, Shaffer RE. Evaluation of microwave steam bags for the decontamination of filtering facepiece respirator. *PLoS ONE*. 2011;6(4):e18585. doi:10.1371/journal.pone.0018585
44. Charania N, Tsuji L. A community-based participatory approach and engagement process creates culturally appropriate and community informed pandemic plans after the 2009 H1N1 influenza pandemic: remote and isolated First Nations communities of sub-arctic Ontario, Canada. *BMC Public Health*. 2012;12(1):268. doi:10.1186/1471-2458-12-268
45. Itzwerth R, McIntyre R, Shah S, Plant A. Pandemic influenza and critical infrastructure dependencies: possible impact on hospitals. *Med J Aust*. 2006;185(S10):S70–S72. doi:10.5694/j.1326-5377.2006.tb00712.x
46. Selby-Nelson E, Bradley JM, Schiefer RA, Hoover-Thompson A. Primary care integration in rural areas: a community-focused approach. *Family Syst Health*. 2018;36(4):528–534. doi:10.1037/fsh0000352
47. Sabesan S, Senko C, Schmidt A, et al. Enhancing chemotherapy capabilities in rural hospitals: implementation of a telechemotherapy model (QReCS) in North Queensland, Australia. *J Oncol Pract*. 2018;14(7):e429–e437. doi:10.1200/JOP.18.00110
48. Smith AC, Thomas E, Snoswell CL, et al. Telehealth for global emergencies: implications for coronavirus disease 2019 (COVID-19). *J Telemed Telecare*. 2020;26(5):309–313. doi:10.1177/1357633X20916567
49. Levesque J-F, Harris M, Russell G. Patient-centred access to health care: conceptualising access at the interface of health systems and populations. *Int J Equity Health*. 2013;12(1):1–9. doi:10.1186/1475-9276-12-18
50. Park S. Digital inequalities in rural Australia: a double jeopardy of remoteness and social exclusion. *J Rural Stud*. 2017;54:399–407. doi:10.1016/j.jrurstud.2015.12.018
51. McMahon R, O'Donnell S, Smith R, Walmark B, Beaton B, Simmonds J. Digital divides and the 'First Mile': framing first nations broadband development in Canada. *Int Indigenous Policy J*. 2011;2(2):1–18. doi:10.18584/iipj.2011.2.2.2
52. Jewell LM, Mathias KL, Pilon A, et al. *A Jurisdictional Scan of the Programs and Services Available to Support the Community Reintegration of IRCS Youth in Northern Saskatchewan*. Saskatoon: University of Saskatchewan Centre for Forensic Behavoural Science and Justice Studies; 2016:1–224.