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Defining rurality: a General Practice Rurality Index for Canada

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Abstract

An instrument for measuring the rurality of Canadian general practice is needed to provide a standard of comparison that can be used by researchers, educators, administrators and rural physicians. After reviewing the relevant literature and identifying possible variables, the author proposes a General Practice Rurality Index (GPRI) for Canada. Six of the variables identified

were chosen to be part of the GPRI: remoteness from a basic referral centre, remoteness from an advanced referral centre, drawing population, number of general practitioners, number of specialists and presence of an acute care hospital. Each variable was weighted, and their values were summed on a 100-point scale. The Canadian GPRI is a preliminary model, and further study is needed to determine its validity and reliability.

Résumé

On a besoin d'un moyen de mesurer la ruralité de la pratique générale au Canada afin d'établir une norme de comparaison que pourront utiliser les chercheurs, les éducateurs, les administrateurs et les médecins ruraux. Après avoir effectué une recension des écrits pertinents et repéré des variables possibles, l'auteur propose un indice de la ruralité de la pratique générale (IRPG) pour le Canada. Six des variables définies ont été choisies comme éléments constituants de l'IRPG : éloignement d'un centre de consultation de base, éloignement d'un centre de consultation avancée, population desservie, nombre d'omnipraticiens, nombre de spécialistes et présence d'un hôpital de soins actifs. On a pondéré chaque variable et fait le total sur une échelle de 100 points. L'IRPG canadien est un modèle préliminaire et il faut l'étudier davantage pour en déterminer la validité et la fiabilité.

widely accepted and validated definition of "rural" in the context of medical practice has not yet been developed in Canada. Such a definition is urgently needed. It has been said that "a lack of a definition inhibits the ability to forge cohesive political coalitions, impedes a description of the distinctive health care needs of rural populations, and obstructs the search for solutions to the problems of rural dwellers."[1]

Rural dwellers include rural physicians who are practising in a significantly different environment with distinctly different practice patterns from their urban colleagues.[2,3] They have a need to be recognized for this distinctiveness,[4,5] they have unique educational objectives, and they may need special support to maintain a sustainable practice and lifestyle in rural areas.

An evidence-based definition of rural medicine would facilitate research leading to improvement in the education and recruitment of rural physicians, the decision-making of government and the health care of rural citizens. This paper proposes such a definition in the form of a General Practice Rurality Index (GPRI).

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Review of the scientific literature

Other indices of rurality

Two independent searches of the MEDLINE database were undertaken, one going back to 1992

and the other to 1982, to look for definitions or indices of "rural." There was little material on this subject.

Sociologists in the United States have developed a number of methods for measuring rurality, one of which is the Connectedness Index outlined by Cleland and Mushlitz.[6] This index used 10 variables, including proximity to a metropolitan area, population growth rate, level of education, type of employment, family income, level of retirement and number of locally published newspapers. A complex mathematical formula was used to weigh the variables.

Rousseau, in a review of various definitions of rurality in the United Kingdom,[7] concluded that the term "rural" encompasses a wide range of communities: affluent, deprived, agricultural, industrial, stable, mobile and others. She summarized that "it is difficult to choose any one feature which captures the essence of rurality."

The Montana State University Rurality Index showed that only 2 variables were needed to produce results comparable to those of other, more detailed rural health care indices.[1] These 2 variables were distance to nearest emergency care and population. Distance was given twice the weight of population, which was given a negative value.

Practice profiles

Physicians' perceptions as to whether or not they were engaged in rural practice were surveyed by Hartlaub and Gordon[8] in the United States. They found that most physicians living and working in a "non-urban population centre of less than 25,000" felt that they were in a rural practice.

Hays and associates,[3] working in Queensland, Australia, developed a "sampling framework" for rural and remote doctors and surveyed 311 of these doctors to compare their training and practice profiles with those of 142 city doctors. They found that doctors who were more than 80 km or 1 hour's travel time from the nearest, most frequently accessed hospital and support services were significantly more likely to practise a wide range of clinical and procedural skills and use a wide range of procedural clinical equipment and were more likely to have restricted access to health and community services. They also found differences in the practices of "remote" doctors, those more than 300 km or 3 hours' travel time from support services. Local area population was a better predictor of these differences than individual town population.

A more statistically rigorous study was that by Britt and colleagues,[2] who surveyed 231 full-time Australian general practitioners. The practices were randomized and stratified in advance according to location in metropolitan or large (population greater than 15 000), medium (population 5000 to 15 000) or small (population less than 5000) country towns. The doctors recorded the details of all patient encounters in two 1-week periods separated by an interval of 6 months. Country general practitioners were more likely to be older, male and in solo practice. Access to medical specialists and other support services decreased in proportion to population. Country general practitioners were more likely to do hospital and procedural work, especially

emergency surgery, anesthesia and obstetrics. Counselling and preventive medicine such as Papanicolaou smears were less common in smaller towns, but treatment of musculoskeletal complaints was more common. Doctors in the smallest, most remote towns wrote fewer prescriptions, requested fewer tests and made fewer referrals. Further research in this area is currently underway (Dr. R. Strasser, director, Monash University Centre for Rural Health, and professor of rural medicine, Moe, Australia: personal communication, 1997).

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List of possible variables

There would appear to be numerous differences between rural and urban medical practices that could potentially be measured. Some of these are described here in 6 broad categories.

Health care facilities, staff and equipment

The type of hospital and associated facilities can vary significantly. It might be important to know if the community has a pathology laboratory, a medical imaging centre, an intensive care unit, a psychiatric ward or a functional operating room and the appropriately trained staff to provide services in these facilities.

Number of physicians

The numbers of community general practitioners and specialists are reduced in rural areas and would be indicators of on-call frequency and consultative support.

Remoteness and availability of transportation

The distance from higher level medical services and educational, social, political and cultural centres is obviously a very important factor. Access to air, road and water transport is closely related to this factor.

Paramedical support

The presence and level of training of nonphysician health care professionals in the community constitute an important variable.[3] A nursing triage system can reduce the disruption caused by phone calls and the frequency of emergency call-outs for rural physicians. Midwives can share the obstetric workload, community nurses can relieve some house call duties, mental health counsellors can reduce the demands of counselling patients, and public health nurses can provide routine immunization and patient education programs. Physiotherapists, dietitians, occupational therapists and others have important roles in patient care but may not be available in small towns. The capabilities of the ambulance service are also critical in determining whether the rural physician must accompany patients during transfers.

Social factors

Social factors are varied and are not adequately addressed by the research. Many family and

social opportunities are not available in rural and remote centres. Housing is likely to be less plentiful and less marketable than in urban centres. There will probably be fewer school and course choices for students. Postgraduate educational facilities may be absent or very limited. Continuing medical education opportunities for physicians are likely to be infrequent. There may be fewer employment options for a doctor's spouse, as well as fewer child care options. The local retail and service industry may be limited and relatively expensive. Amateur arts and culture groups may be present, but access to professional performances and teaching will likely be restricted. Amateur sports may be present to some extent, but again, access to quality facilities, professional coaching and major league teams may be relatively poor. Most Christian churches are established in larger rural Canadian towns but often not in the smallest communities. Rarely will one find a synagogue or other non-Christian place of worship.

Population

Population appears to be inversely related to the availability of many of the services mentioned above. Rural populations are more scattered, may have lower average incomes and may have significant subpopulations with specific health care needs.

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Variables used in the GPRI and how they are scored

The inclusion of all of these variables could generate a very accurate and highly sensitive rurality index but at the expense of being unwieldy and impractical. The GPRI is therefore based on the premise that the degree of restriction in access to most facilities and services and the particular practice profile of rural physicians can be predicted by the following 6 weighted variables: remoteness from a basic referral centre, remoteness from an advanced referral centre, population, number of general practitioners, number of specialists and presence of an acute care hospital (Table 1). The assignment of points to each of the 6 variables takes into consideration their relative importance. A 100-point scale has been chosen because it allows flexibility to finely adjust the relative weights as a result of future research. It is also intuitively easier to compare communities on a percentage scale: the higher the score, the more rural the community.

Remoteness from closest advanced referral centre (25+ points)

A measure of remoteness first necessitates a standard definition of the urban community with which the rural community is being compared. Only then can distances be measured. An advanced referral centre is defined in Table 2.

In their proposed sampling framework, Hays and associates[3] used 80 km or 1 hour's surface travel time from support services as the minimum distance to qualify as rural. Thompson and McNair[9] used 50 km or 30 minutes' travel time because "multiple trauma patients should be taken directly to the nearest hospital for stabilization, unless a higher level of care is available within 30 minutes by ground." Communities were considered "remote" if they were outside the

200-km limit of a helicopter air ambulance service[9] or were at a minimum distance of 300 km or 3 hours' travel time by road.3 This distance would also be reaching the limit of a comfortable 1-day return trip by road for elective services.

It would be logical to use actual travel time to the referral centre, but this cannot be easily or objectively measured. An alternative is to use road distances, but not readily apparent on maps are significant hazards such as road surface, terrain, weather and wildlife, which can greatly increase rural travel time. Some rural communities may have a road link only in winter. To accommodate some of these situations, the GPRI assumes that unpaved roads would be travelled at half the speed of travel on highways, and distances on such roads should therefore be multiplied by 2 (Table 2).

For communities in which the usual method of travel is by air, this distance can be measured "as the crow flies." Obviously air travel is faster than travel by road, but other factors such as mustering time for the crew, travel time for the plane from its home base, and time for the patient to travel to the airport, be moved on and off the plane, and transferred from destination airport to receiving hospital can make this mode of transport quite slow. Consequently, air distances are not adjusted downward in this index but are considered equivalent to road distances.

Where ferries or water taxis are the usual transportation, distances are covered more slowly and may involve inflexible schedules and delays in loading and unloading the vessel, which could result in speeds approximately one-quarter of the speed of road travel. For these reasons, water distance is multiplied by 4 in the GPRI.

Rather than use of a threshold approach to rating distance in the GPRI, a simple mathematical formula is proposed (Table 1). Such a formula gives a smooth, direct, linear relation between distance and score and would be fairer for communities just below a threshold value.

Remoteness from the closest basic referral centre (25+ points)
It is assumed that a basic referral centre will have a hospital with surgical services available 24 hours per day, as well as medical imaging capability, such as CT, nuclear medicine and Doppler ultrasonography. The presence of certain key specialists in the basic referral centre may indicate such a basic level of service (Table 2).

The basic referral centre is included in the GPRI to reflect the importance of such centres in the medical care of patients from communities that are very remote from the closest advanced referral centre. For this reason, remoteness from a basic referral centre is given twice as much value as distance from an advanced referral centre (Table 1). Distance of more than 500 km from a basic centre and more than 1500 km from an advanced centre would make remoteness more than 50% of the score. This heavy weighting is thought to be justified for the few communities that will fit this criterion.

Remoteness is considered the most important variable in determining rurality, so there is no limit on points in this category.

Drawing population (up to 20 points)
There is no agreement as to what population size qualifies as rural. General practitioners usually provide primary care for people outside the statistical town boundaries. For this reason, the concept of a drawing population or local health area should be used, rather than just the population of the town (Table 2).

The GPRI assumes that there is a direct relation between population and the level of services in the community. Threshold levels used in research have ranged between 5000 and 30 000.[2,3,9] A formula that allows 1 point for every 2000 population below 40 000 achieves a reasonable distribution of scores (Table 1).

Population is given a weight of 20% in the GPRI. The availability of many services is directly related to population, but too much weight on this variable would diminish the more important role of remoteness. Some small communities may be within a short commuting distance of large cities, so should be relatively lower on the rurality scale than bigger, more remote places.

Number of general practitioners (up to 20 points)
The number of doctors working in a given community determines the workload and call-sharing potential, as well as the general feeling of isolation. Surveys have shown that isolation and sharing call with only 1 other physician were significant factors in the consideration of physicians planning to leave rural practice.[5,10] This variable may be independent of remoteness and population.

The GPRI assumes that the highest comfortable call frequency is 1 in 4. To allow for 1 person to be away, this level necessitates at least 5 full-time physicians to be working in the community. Therefore, points are awarded in inverse proportion to the number of general practitioners, with a maximum for the solo rural doctor and the minimum for communities with more than 5 physicians.

For practical purposes, the GPRI assumes that all community general practitioners are doing primary care and are sharing in after-hours call (Table 2). If this is not the case, it is assumed to be a mutually agreeable arrangement among the practitioners in the community.

The number of general practitioners is given a weight of 20% in the GPRI to reflect the importance of this factor relative to the other variables (Table 1). There must be 8 or fewer doctors to score more than 2 points, and a solo doctor scores 20 points.

Number of specialists (up to 10 points)
The number of specialists is directly related to population size;2,11 therefore, one can assume that

the more specialists working in the community, the less rural it is. As for general practitioners, the GPRI uses an inverse relation between rurality and the number of specialists (Table 1). The type of specialist is clearly relevant, but the GPRI assumes that where there is a specialist earning a living, there must be a demand for that service. This in turn would reduce some general practice responsibilities.

This variable is given a weighting of only 10% because it is assumed to be less important to rural general practitioners than the number of general practitioners, the size of the community and the degree of remoteness.

Presence of an acute care hospital (up to 10 points)
Britt and colleagues,[2] in a survey of 3 states in Australia, found that 90% of general practitioners in the smallest towns reported a hospital within 25 km. General practitioners are more likely to practise near a hospital, and those in rural areas are more likely to treat their patients in a hospital. Facilities such as "diagnostic and treatment centres," nursing stations and Red Cross outposts do not generally have inpatient beds so should not be considered hospitals.

The presence of a hospital in a rural community is assumed to indicate that general practitioners are significantly involved in hospital work, possibly including surgery, obstetrics and anesthesia. Physicians who work in rural hospitals are likely to manage more difficult patient problems for longer periods of time than those who do not have access to a hospital. In these hospitals, general practitioners must often participate on medical advisory and other administrative committees.

Therefore, the presence of a hospital on the GPRI scale is a rural credit, albeit a small one (Table 1). Too much weight on this variable would diminish the weight given to physicians practising in remote outpatient facilities.

Where specialists are present, the GPRI assumes that they consult on and treat hospital patients, thereby reducing the hospital responsibilities of the general practitioners. Therefore, this credit is reduced by the number of specialists.

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Discussion

In applying the GPRI, a suggested threshold for "rural" is 10 points. This threshold would exclude all advanced referral centres and some basic referral centres that are within 500 km of the indexed community. Some large (population greater than 40 000), remote basic referral centres could score more than 10 points, and further research of physician practice profiles may establish that these communities should be considered rural.

The score on the GPRI that is considered a threshold for rurality will depend on who is using the

scale and for what purpose. The Society of Rural Physicians of Canada may decide to use a low threshold to be as inclusive as possible in its membership. Governments may decide on a higher threshold for the disbursement of limited funds. Researchers should agree on a common threshold for comparative purposes.

A number of variables were not included in the GPRI that could prove important and should undergo further study.

Population to doctor ratio: This ratio is easy to calculate from the data already gathered and may be an indirect measure of workload. Dissatisfaction with clinical workload[12] and relatively lower financial reimbursement for these heavier workloads10 have both been shown to be major considerations of rural physicians planning to leave their practices. It is not certain if these considerations are also applicable to urban physicians.

Population density: Rural areas are less densely populated than urban areas. The impact of this lower density on general practitioners may be greater travel distances for house calls or responsibility for satellite clinics at significant distances from the home community.

Population demographics: For example, average family income may be lower in rural areas. There may be a difference in the average age of rural and urban populations. Consideration should perhaps be given to special-needs populations such as native Canadians.

Telecommunications: New technology such as fax machines and live satellite video in rural areas has improved the quality of the traditional "telephone consultation." The use of these devices in Canada may reduce the sense of rural isolation and the need for patient transfers.

The GPRI unfortunately does not address the needs of rural specialists. A universal index for all physicians would be more complicated to construct because variables such as population size and numbers of doctors depend on the nature of each specialty. However, it is hoped that this GPRI will serve as a model for the future development of a specialist rurality index.

The main hypothesis of this paper, that the degree of restriction of access to most facilities and services is proportional to the size and remoteness of the community, remains to be fully tested. Further research using this index will perhaps lead to the addition of new variables or the elimination of some of those already in use. The weight of the variables will likely be refined. Further studies may also validate or refute some of the approximations regarding the measurements of distance and population. That these few variables will produce an accurate measure of what rural physicians actually do needs to be proven in the Canadian contxUnfortunately, there is no "gold standard" for comparison.

The next logical step would be a comprehensive and statistically sound survey of Canadian physicians' practice patterns, their access to medical and other services, and the impact of location

on their lifestyle. The GPRI should be used to generate random samples of rural and urban physicians to be surveyed. Differences in practice and lifestyle could then be correlated with the GPRI. Such a study might be expected to validate the scale or lead to further improvements.

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Conclusions

This paper has outlined a preliminary model for a Canadian General Practice Rurality Index (GPRI). Further study is needed to determine its validity and reliability. It provides a framework for further research in rural medical practice and rural health care. Hopefully, it will become a widely accepted instrument for measuring the rurality of general practice in Canada.

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