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Beyond counting heads: some methodological issues in measuring geographic distribution of physicians

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The population-to-physician ratio is the most commonly used measure in research and in health services planning. It is a ratio that relates information on physician distribution with information on population distribution. Through an extensive review and assessment of available literature this article focuses on the "number of physicians" and the "number of people." First, how should physicians and patients or potential patients be counted. The second and related aspect is to decide whether or not the number is sufficient. In describing the geographic distribution of physicians, does headcounting suffice or does one have to go beyond counting heads? For example, many researchers have proclaimed the futility of trying to define the optimal population-to-physician ratio. It is important then that the future direction of research in this area go beyond counting heads and address, in a much more comprehensive manner, the complex inter-relationships between physician availability, utilization and health status.

Le nombre d'habitants par médecin est le critère de mesure utilisé le plus souvent en recherche et en planification des services de santé. Ce ratio établit un lien entre l'information sur la distribution des médecins et celle qui porte sur la distribution de la population. Dans le contexte d'une analyse et d'une évaluation poussées des publications disponibles, les auteurs de cet article traitent avant tout du «nombre de médecins» et du «nombre de personnes». Tout d'abord, comment faudrait-il compter le nombre des médecins et des patients ou des patients éventuels? Le deuxième aspect connexe consiste à déterminer si le nombre est suffisant. Lorsqu'on décrit la distribution géographique des médecins, suffit-il de les dénombrer ou faut-il aller plus

loin? Par exemple, beaucoup de chercheurs affirment qu'il est futile d'essayer de définir le nombre optimal d'habitants par médecin. Il importe alors que l'orientation future de la recherche dans ce domaine dépasse le dénombrement et porte de façon beaucoup plus complète sur les interrelations complexes entre la disponibilité des médecins, l'utilisation des services et l'état de santé.

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Introduction

This is the second of 2 articles that seek to explore some of the conceptual and methodological complexities in the study of the geographic distribution of physicians. The first article[1] examined the "geography" aspect of physician distribution. This article looks at how physicians and people within a specified geographic area are, or should be, counted.

It was pointed out in the first article that information solely about where physicians are located is of limited use. What is of interest to most people is the spatial distribution of physicians relative to the spatial distribution of the population. This is why the population-to-physician ratio is the most commonly used measure in research and in health services planning. It is a ratio that relates information on physician distribution with information on population distribution. A typical population-to-physician ratio contains 3 pieces of information: the geographic area within which the physicians and people are located, the number of physicians and the number of people (see Appendix 1). Refinements of the population-to-physician ratio are attempts to conceptually clarify these 3 variables and to measure them more accurately.

"Geographic area" was dealt with in some detail in the first article. The focus of the present article is on "number of physicians" and "number of people." Two aspects of this problem are discussed here. First, how should physicians and patients or potential patients be counted. The second and related aspect is to decide whether or not the number is sufficient: in describing the geographic distribution of physicians, does headcounting suffice or does one have to go beyond counting heads?

This article is based on an extensive review and a critical assessment of the

literature, which includes published and unpublished research studies, working papers and health service planning reports. An extensive literature search and review process was conducted. In particular, we examined how the geographic distribution of physicians was measured by researchers, identified the problems they had encountered and assessed the attempts to overcome these problems. For a more detailed description of the literature search and review process, readers should consult the original study upon which these 2 articles are based.[2]

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Counting physicians

One way to make the population-to-physician ratio more meaningful and useful is to ensure a more accurate enumeration of medical practitioners. This is more than just counting all physicians in an area (which is not usually a difficult task because in Canada all physicians have to register with a provincial/territorial college of physicians and surgeons in order to practise medicine). By checking the list of registered physicians, one can get a fairly accurate picture of the number of physicians in a region. Also, local medical societies usually have a fairly up-to-date count of the number of physicians in the area.

Problems

What and how much do physicians do?

The more arduous task is to find out what the physicians do and how much they do. It is necessary to determine if the physicians are more or less identical in the production of clinical services. The simple population-to-physician ratio does not usually take into consideration such factors as number of hours worked, nonclinical work, productivity, varying activity levels and the effects of age or sex on workload and practice pattern. As a result, the ratio may over- or underestimate the supply of clinical services by physicians. In the final analysis, it is not the number of "warm bodies" that matters. What is important is the production of medical care.

Decline in hours worked

A number of studies have documented the gradual decline in the number of hours Canadian physicians work. For example, according to the 1990 survey on physician resources conducted by the Canadian Medical Association, physicians reported working, on average, 4.1 fewer hours per week in total activities in 1990 than in 1986, and 5.7 fewer hours per week than in 1982. For GPs/FPs, the figures are 44.8 hours in 1990, 46.9 hours in 1986 and 51.5 hours in 1982. This represents a 13% decrease in hours of work in less than 10 years. Specialists reported working 48.5 hours per week in 1990, 4.6 hours less than in 1982.[3] There is also some anecdotal evidence that younger doctors or more recent graduates prefer to work shorter hours in order to have a more "normal" lifestyle. For all intents and purposes, less hours of work, unless counterbalanced by enhanced efficiency, means less human resources available. Surprisingly, of the studies reviewed that examine changes in population-to-physician ratios over time, none has factored the decline in hours of clinical work into the calculations.

Gender composition and retirement factors

In Canada, as well as in many other industrialized nations, the proportion of female physicians in the medical workforce is rising steadily. Currently about half of the students in Canadian medical schools are women. Many studies[4–8] have shown that male and female physicians tend to have different practice profiles and female physicians typically work less hours per week and less weeks per year than their male counterparts. The implications for physician workforce planning and medical practice of the changing sex composition in the Canadian physician workforce have been examined by Adams[9] and Reamy and Pong.[10] It is also known that as physicians approach retirement age they tend to reduce their workload. Additionally, physicians differ in their involvement in nonclinical work such as research, teaching and administration. For example, it has been well documented that physicians affiliated with medical schools tend to spend more time on such activities. Results of the 1997 National Family Physician Survey commissioned by the College of Family Physicians of Canada and conducted by the Centre for Rural and Northern Health Research show that 83.2% of a family physician's time was spent on direct patient care and 16.8% on related activities including research, teaching and administration.[11] Therefore, when examining physician availability, it is necessary to consider the effects of age, sex and type of activity on the production of clinical services.

Specialty mix

Another issue that needs to be considered is specialty mix. Magee[12] has employed specialty mix to derive an index of "rurality." Werner and coworkers[13] have raised concerns about possible errors associated with the use of a single population-to-physician ratio that includes different specialties. The question is whether the physicians included in the denominator of the ratio are sufficiently homogeneous in terms of specialty to permit addition without introducing distortions. If the specialties included are heterogenous and if different regions have very different specialty combinations, the ratios may not be comparable. Their research shows that primary care specialties (i.e., general and family practice, internal medicine, pediatrics, obstetrics/gynecology and general surgery) differ significantly in terms of total hours of work, allocation of time to different activities, productivity and number of patient visits. It may, therefore, be necessary to make adjustments to the denominator, like using weighted averages, as a refinement of the population-to-physician ratio.

Specialty substitution

Related to specialty mix is specialty substitution, which refers to physicians in one specialty providing clinical services that are typically rendered by physicians in other specialties. This is possible because the scopes of practice of different specialties overlap to a considerable extent. Specialty substitution is particularly prevalent in rural communities, where specialists are few and far between. Rural family physicians may perform some medical procedures which, in major urban centres, would typically be done by specialists. Similarly, general surgeons may perform some orthopedic surgeries if orthopedic surgeons are not available locally, internists may do some cardiology work if there are no cardiologists, and so forth. A study by Roos and colleagues[14] has shown the extent of specialty substitution in general surgery in Manitoba. The Saskatchewan Working Group on Physician Need,[15] for example, has acknowledged that noncertified specialists have been a main source of supply of specialist services in that province, particularly in communities other than Regina and Saskatoon. However, few studies have taken the issue of specialty substitution into account when describing physician distribution, possibly due to difficulties in obtaining pertinent and reliable data.

Discipline substitution

A similar problem and an even more daunting task is discipline substitution, which refers to providers in one discipline substituting for those in another. Discipline substitution and the effectiveness of some forms of substitution have been discussed extensively.[16–20] It is well recognized that some of what physicians do can be done by other providers such as audiologists, clinical pharmacists, clinical psychologists, midwives, nurse anesthetists, nurse practitioners, optometrists or podiatrists, in appropriate settings and in collaboration with physicians. As in the case of specialty substitution, the main problem in examining discipline substitution is the lack of reliable and system-wide data that can be used for research and planning purposes. Since most of the aforementioned categories of practitioners do not receive fee-for-service (FFS) reimbursement from provincial health insurance plans, the types and extent of their work that can be seen as substitution for physician services are not officially and systematically recorded, thus making meaningful analysis virtually impossible.

Given the growing interest in primary care reform across the country, which typically includes some form of multidisciplinary collaborative or team practice,[21–23] it may be difficult to ignore the potential effects of discipline substitution. Should a physician working alone and a physician working collaboratively with a nurse practitioner who takes over some of the less complex cases be counted as the same from the perspective of health workforce planning? Some earlier studies suggested that the productivity of physicians could be considerably augmented by teaming up with nurse practitioners. For instance, on the basis of the Burlington controlled trials, Spitzer[24] concluded that physician–nurse practitioner teams could assume responsibility for 41% more patients and increase the volume of services by 24% while holding cost constant. Similarly, in the United States, Golladay and coworkers[25] believed that the productivity of a physician could increase by as much as 74% by using a physician assistant.

The full-time equivalents approach

The above discussion shows the complexity in the seemingly simple task of counting physicians. One approach that has been introduced in order to more accurately reflect the availability of physician resources in an area is the use of the full-time equivalents (FTEs) technique. The use of FTEs is increasingly common in research studies and planning documents, suggesting that more and more people realize the shortcomings of simple headcounts and the need to use

more meaningful measures.[26–28]

Shortcomings of FTE

The national FTE methodology was used by the Federal/Provincial Working Group for the Development and Review of Medical Care Statistical Indicators in 1989 and was deemed to be a more appropriate measure of physician activity. The original calculation of national FTEs was based on fee payment data, which captured the number of services provided and the fee schedules. Because the calculation relied on payment data, the FTEs were problematic in a number of ways. For instance, radiology and laboratory specialists were excluded because most of them were not on FFS. Similarly, other non-FFS physicians and some clinical services that were not funded through FFS were not included in the FTE estimates. A more detailed discussion of the national FTE methodology can be found in the report of the National Ad Hoc Working Group on Physician Resource Planning.[27]

New Brunswick FTE

New Brunswick has introduced a modified FTE methodology with a view to overcoming some of the problems in the national FTE methodology. The New Brunswick methodology is more comprehensive in nature as it includes radiology and pathology and non-FFS payments, which represent about 11% of physician payments in that province. However, some limitations remain. For example, specialty designation is based on certification and not actual profile of practice; uncertified specialists are not captured and all nonclinical services such as community medicine, hospital administration and research are not captured.[29]

Major improvements in the FTE methodology are expected because the Canadian Institute for Health Information will soon be collecting data on non-FFS physicians for those provinces able to provide such data. This would enable, for instance, the inclusion of radiology and laboratory specialists in the FTE calculation. In addition, it will change the base year from 1985/86 to 1992/93 and revise the benchmarks used in the FTE methodology in order to reflect changes in fees over time.[30]

FTEs versus headcounts

The Advisory Panel on the Provision of Medical Services in Underserviced Regions[31] has used both headcounts and FTEs in its analysis. It has found that in 1989/90, 16.8% of GPs/FPs were in rural communities. But this percentage was 18.2% when FTEs were used. Since the rural physician FTE count is higher than the number of GPs/FPs, this suggests that physicians in rural practice were providing more services than average or that they were working longer hours than average. The New Brunswick Department of Health and Community Services[29] has also used the FTE methodology in its physician workforce planning. A comparison of FTEs to the traditional headcounts reveals that the 1078 FTEs in 1989/90 represented 1123 physicians, a difference of 4%. Although the FTE approach is superior to the headcount approach, the former still does not take into consideration such factors as specialty mix, specialty substitution and discipline substitution.

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Counting patients

Even more difficult than counting physicians is counting patients or potential patients. Again, the problem is not so much the enumeration of people in a defined geographic area as it is the estimation of the medical care requirements or utilization by the population. It is well known that certain population groups, such as the elderly and women, consume more medical care than others. It is important, therefore, to make sure that the numerator in the population-to-physician ratio adequately reflects the service consumption patterns of the population, not just the population size. Two communities with an identical number of residents but with different demographic structures and health characteristics could have very different medical care needs or utilization patterns. This is particularly pertinent when analyzing rural and northern regions where the health status of the residents is generally below the national or provincial norm.[32–35]

Refining the ratio

Realizing this, the National Ad Hoc Working Group on Physician Resource Planning,[27] among others, has recommended several improvements to the

population-to-physician ratio methodology, including adjusting the population for age–sex composition. Age–sex standardization can be seen as an initial step in adjusting the numerator of the ratio. Additional adjustments are possible, such as by taking into account variations in health status or morbidity among populations, even though the additional data requirements could be substantial.

The Expert Panel on Physician Resources,[26] in its report on physician workforce planning in Ontario, has adjusted the population component of the population-to-physician ratio by factoring into the calculations all-cause standardized mortality ratios as a proxy for morbidity. The need to take the health status or health care needs of a population into consideration is also implicit in the definition of the Index of Medical Underservice (IMU). IMU is used by the United States federal government to define Medically Underserved Areas. Unlike other measures of underservicing which tend to rely solely on the number of physicians and population size, IMU adds to the primary care physician-to-population ratio a measure of poverty in the area, the age structure of the population and a crude measure of health status or outcome.[36,37]

Roos and colleagues[14] used 3 approaches, including the population-to-general surgeon ratio approach and the population needs-based approach, to analyze the needs for general surgeons in southern Manitoba. The needs-based approach took into account the age structure and various health characteristics (e.g., premature death rate, indices of general health and physical function and a socioeconomic risk index) of the population.

All this represents various attempts to refine and elaborate the population-to-physician ratio for research and planning purposes. Ideally, one should modify both the numerator and the denominator of the ratio in order to more accurately reflect physician distribution, as well as medical care provision and consumption, as exemplified by a study by Coyte and collaborators.[38] In this study of the availability of GPs/FPs in Ontario, Coyte and collaborators have introduced the notion of "physician density," which is the ratio of practice-intensity equivalent GPs/FPs to use-intensity equivalent residents. A "practice intensity equivalent index" is calculated, using age-specific OHIP (Ontario Hospital Insurance Plan) fee service claims in 1990. Not unlike the FTE methodology discussed earlier, this index affords an opportunity to adjust the supply of GPs/FPs to reflect variations in service provision. Similar methods are used to adjust the size of the population for patterns of health care use. While there was on average 1 GP/FP per 1000 people in 1990, densities for individual counties ranged from a low of 0.33 in the Sudbury District to a high

of 1.74 in Frontenac. After adjusting for both practice intensity and the population's utilization patterns, the revised densities ranged from a low of 0.35 in the Sudbury District to 1.61 in Frontenac. Although considerable disparities in GP/FP availability persist, the difference has narrowed by more than 10% after adjustments.

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Identifying physician maldistribution

Thus far, we have studiously avoided using the term "maldistribution" when describing the geographic distribution of physicians. Instead, we have chosen to use the more prosaic phrase "geographic distribution of physicians." This is because, as Ginzberg[39] has cogently pointed out, unless there is a concept of acceptable distribution, the prefix "mal" does not make sense. Something is bad only in relation to something that is not bad. However, there is strong temptation to use the term "maldistribution" when describing the uneven distribution of physicians. Not content with merely describing the geographic distribution of physicians, many studies have made comparisons with respect to the availability of physicians, with a view to identifying doctor-shortage areas or maldistribution. There are 2 main types of comparison: Comparing the population-to-physician ratio in one area with an ideal or optimal ratio and comparing the ratios in 2 or more areas.

Comparing observed distribution with "optimal" distribution

For both research and planning purposes, it is often useful to be able to identify areas or communities as underserviced or experiencing a maldistribution problem. The most common method used is to compare the observed or actual distribution of physicians with some standard that can be an "ideal" population-to-physician ratio, an "optimal" ratio recommended by some experts or authoritative bodies, a "required" number of physicians or an "objective" standard of adequate medical care.

If the number of physicians required to serve the population of an area can be ascertained, it could enhance health service planning capability. The required

number of physicians, along with other data, can then be used to construct various indices. As an illustration, the ratio of the number of FTE physicians who reside in an area to the number of physicians required constitutes an index of distribution of medical resources. The ratio of the number of FTE physicians serving a population to the number required is an index of access to services. Using these indices, Piché[40] has examined physician resources in various regions of Quebec. With an index of distribution of 1.56, the Montreal region has 56% more FTE specialists than are required to serve its population. The Lanaudière–Laurentides and North Shore regions, by contrast, have the fewest FTE specialists with only 40% and 43%, respectively, of the numbers required. On the other hand, regional disparities are considerably less pronounced with respect to GPs/FPs.

Some US and Canadian solutions

In the US, various measures of underservice have been introduced by the federal government. For example, the US Bureau of Health Manpower has defined the Critical Medical Shortage Area as an area that has a ratio of resident population to FTE nonfederal, primary care physicians greater than 4000:1.[41] The Health Professional Shortage Area designation is used to identify locations in which to place physicians under the National Health Services Corps Program. A county, a subcounty unit or an aggregation of counties is seen as underserviced if the population-to-primary care physician ratio in the area is greater than 3500:1.[37]

The Medically Underserved Area designation is used by the US federal government to identify areas where health maintenance organizations could receive federal assistance. The IMU is the mechanism for determining Medically Underserved Area status. The IMU is considered by most researchers as a more sophisticated index than conventional population-to-physician ratios since it takes into consideration 4 factors:

- population-to-primary care physician ratio;
- infant mortality rate;
- proportion of the population aged 65 or over; and
- proportion of the population with an income below the poverty line.

The IMU score for an area is the sum of the weighted value for each factor. Values of the index range from 0 to 100, with lower scores indicating higher

levels of medical underservice. Unlike other designations of underserviced areas, the IMU attempts to measure underservice by considering both medical care demand and supply.[36,42]

Other commonly used criteria include the ratio of 191 doctors per 100 000 population and other specialty-specific ratios recommended by the Graduate Medical Education National Advisory Committee (GMENAC), which used a needs-based approach to define the requirements.[43] In Canada, the most often cited physician "requirements" are those recommended by the National Committee on Physician Manpower,[44] the Federal/Provincial Advisory Committee on Health Manpower[45] and the Royal College of Physicians and Surgeons of Canada.[46] In addition, various provincial ministries of health or task forces have come up with their own recommended population-to-physician ratios for medical workforce planning purposes.

Problems

The problem with identifying an area as overserviced or underserviced by comparing its population-to-physician ratio with an optimal ratio is that nobody seems to know how to objectively set an optimal ratio that accurately reflects local medical care needs. Many experts have proclaimed the futility of trying to define the optimal population-to-physician ratio.

"...[T]here is no easy way — possibly no way — of gaining agreement among the experts, much less among the public, as to the criteria that should be used to assess whether a particular number of physicians is within the range of the social optimum. The answers fall in the complex realm of political economy in which each of many interest groups — the medical profession, the scientific-educational establishment, hospitals, health delivery organizations, federal and state legislators, consumer groups, and still other parties to the debate — has a perspective on the issue limited by their particular concerns and knowledge."[47]

"It is important to state unequivocally at the outset that there is no technically correct or optimum number of physicians... In our view the past and continuing debate over the 'right' or 'optimum' number of physicians (or physician:population ratio) has not been constructive, has perpetuated the myth that better data or methodologies will resolve disagreements and has impeded a long overdue refocusing of attention on more fundamental and logically prior decision about the goals and structure of the health care system itself."[48]

Ratios such as the Critical Medical Shortage Area ratio of 4000:1 are mostly arbitrary in nature and are designed for administrative convenience with very little empirical basis. Even the use of widely endorsed ratios, such as the GMENAC population-to-physician ratios, has been questioned. For example, it has been common practice to apply the GMENAC ratios to local areas. However, as Connor and cohorts[49] have correctly observed, the nation was the unit of analysis in the GMENAC study, but these recommended national ratios are applied by some people to subnational areas with no appropriate adjustments. In Canada, the National Ad Hoc Working Group on Physician Resource Planning[27] has similarly warned against adopting national population-to-physician ratios to local use.

Comparing physician distributions in different areas

Another approach is to compare population-to-physician ratios of different areas. Areas that have a substantially lower ratio than others or that have ratios substantially below the national or provincial norm are often assumed to have insufficient physicians. Alternatively, some may conclude that maldistribution of physicians exists if areas exhibit widely divergent ratios. "Maldistribution" in this case implies that the situation deviates from a normative pattern. Although such comparisons can be done by eyeballing the ratios, researchers have developed more sophisticated indices for this purpose.

Gini Index

While it is easy to distinguish perfect equality from inequality, when one level of inequality is used as a standard to assess another, different measures are needed. The Gini Index and other indices of spatial distribution are often used to assess the difference between two distributions.[50] It is useful to point out that the Gini Index builds on the population-to-practitioner ratio. A Gini Index is merely a descriptor of the relationship of 2 geographic distributions — that of the practitioners and that of the population.[51] The Gini Index has been used to compare geographic distributions of physicians among regions or over time. A prime example is Brown's use of Gini-style indices to evaluate the spatial patterns of health practitioners in Alberta.[52]

Location quotient

Another index is the location quotient, which treats the ratio of physicians in a given geographic unit to the total number of physicians in all geographic units compared to the ratio of population in a given geographic unit to the total population of all geographic units. It signifies whether an area is underserviced or overserviced as compared to all areas. A value of 1.0 means that an area has exactly the number of physicians its population warrants, given its share of the total population. A value of less than 1.0 denotes an under-representation with respect to physicians, while a value greater than 1.0 indicates a situation of over-representation. Anderson and Rosenberg[53] have employed location quotients to study the distribution of physicians in Ontario over time.

Coefficents of variation

Other researchers have used coefficients of variation to quantify inequalities with respect to geographic distribution of physicians. One commonly used approach is to compare the best-served region with the worst-served region within a province/state or country. Another approach, at the level of a province/state, is to compare the population-to-physician ratio in a rural area with that in an urban area.[54]

Problems

Whether the comparisons are between an observed population-to-physician ratio and an optimal ratio or between 2 or more observed ratios, the problem is the same, namely, an objective basis for determining physician requirement or underservice is often difficult to establish. Regional differences in physician supply, in and of themselves, do not provide sufficient grounds for deciding if there is an over- or undersupply of physicians, except in extreme situations. As Morrow[51] has maintained, in order to move from the concept of "unevenness," as revealed by such indicators as the Gini Index, to the concept of "maldistribution," many factors have to be considered. It is of interest to note that in Ontario, the designation of a community as "underserviced" by the Underservice Area Program of the Ministry of Health requires the assessment of several factors in addition to the population-to-physician ratio. These include population size and structure, financial impact analysis, previous recruitment efforts, socioeconomic status of the area, local demand for services and additional health service needs and resources.[55]

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Future directions

The empirical results of the analyses presented by Pitblado and Pong[2] clearly show that physicians in Canada are not evenly distributed and that the uneven distribution is particularly acute with respect to specialist physicians in rural and remote areas. However, it is also argued that the uneven distributions or "maldistributions" that are portrayed are based on assumptions that can be contested and on indices that can be improved with additional data inputs. Designations of physician shortage or maldistribution have to be made against some standards of adequacy. Unfortunately, such universally accepted standards have yet to be developed.

Images presented by population-to-physician ratios may be oversimplified or even misleading. This is because simple headcounts of physicians and people within an arbitrarily defined area often obscure the underlying complexity of the situation. A more realistic assessment of the geographic distribution of physicians requires a better understanding of the conceptual and methodological aspects of measuring physician and population dispersion. The first step in advancing this area of research, as well as policy and program development in rural medical care, is to enhance our ability to more accurately describe the geographic distribution of physicians and to take into account factors that impinge on care-providing and care-seeking behaviours.

There may be no single, "correct" means of examining the geographic distribution of physicians. And there may never be one. It may be far more preferable to focus on goal-specific measures that treat local, relatively small geographical areas in detail and restrict the use of population-to-physician ratios to the analyses of national and provincial/territorial overviews. However, the tools that we do use and that have been reviewed in this and our previous paper[1] must be applied with the knowledge that geography, physician counts and population counts are not simple measures. Future work should include refinements to the concepts of specialty substitution, full-time equivalent, distance in terms of access, and the potential impacts of electronic "travelling" or telehealth. All must address, in a much more comprehensive manner, the complex interrelationships between physician availability, utilization and health status. We are convinced that such work is possible, will be policy-

relevant, will be enabled by the new workforce and health survey databases that are coming on-stream and will be enhanced by continuing critical assessments of our current measures.

In addition, it may be necessary for researchers to communicate with policy-makers and health care planners. It behooves researchers to ensure that policy-makers and health care planners are aware of what a population-to-physician ratio means, how it is derived, its inherent shortcomings and how it should be interpreted. Otherwise, population-to-physician ratios may continue to be used in a simplistic or even erroneous manner.

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