

Needs-based planning: the case of Manitoba

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Abstract

Objective: To illustrate the use of needs-based planning in the identification of physician surpluses and deficits and of resource misallocations within a provincial medical system at a time when provincial governments and medical associations across the country are faced with funding constraints for physician services.

Design: For each of 4 regions in Manitoba, the authors analysed residents' rates of physician visits (whether within the resident's own or another region). Residents' need for physician contact was estimated by means of a statistical analysis of the data on contacts in relation to age, sex and health-related indicators, and the rates of visits needed and actually made were compared.

Participants: All Manitoba residents.

Outcome measures: Numbers of generalist physicians (general practitioners, family physicians, general internists and general pediatricians) needed to serve each region, and the extent of physician surplus and deficit in each region.

Results: There appeared to be a surplus of physicians in most of urban Manitoba but deficits in northern Manitoba and some parts of the rural south. General internists and general pediatricians in Winnipeg provide a significant part of the ambulatory care that is provided by general practitioners in other parts of the province. The provincial government currently spends more per resident to provide physician services in areas of physician surplus than in areas of physician deficit, although the patterns are inconsistent.

Conclusions: Needs-based planning is possible. If provinces are intent on controlling physician numbers and expenditures, it makes sense to manage the implications of doing so.

Résumé

Objectif : Expliquer le recours à la planification selon les besoins lorsqu'il s'agit de déterminer les endroits où il y a un excédent ou une pénurie de médecins et où les ressources sont mal affectées dans un réseau provincial de services médicaux en période où les gouvernements provinciaux et les associations médicales provinciales doivent réagir aux restrictions financières imposées dans les services dispensés par les médecins.

Conception : Les auteurs ont analysé dans quatre régions au Manitoba le nombre de visites des citoyens chez le médecin (dans la région du citoyen ou ailleurs). La nécessité pour les citoyens de se rendre chez le médecin a été évaluée par analyse statistique des données sur les visites, compte tenu de l'âge, du sexe et des indicateurs sur la santé, ainsi que du nombre de visites nécessaires comparativement au nombre de visites réelles.

Participants : Tous les citoyens du Manitoba.

Mesures des résultats : Nombre de médecins généralistes (omnipraticiens, médecins de famille, internistes généralistes et pédiatres généralistes) nécessaires afin de servir chaque région et nombre de médecins en excédent ou en pénurie dans chaque région.

Résultats : Il semble y avoir un excédent de médecins dans la plupart des zones



Evidence

Études

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‡ See related articles pages 1227 and 1229

urbaines au Manitoba, mais une pénurie dans le nord du Manitoba et dans certaines zones rurales au sud de la province. Les internistes généralistes et les pédiatres généralistes à Winnipeg fournissent une partie importante des soins ambulatoires dont se chargent les omnipraticiens dans d'autres secteurs de la province. Le gouvernement provincial dépense actuellement davantage par citoyen pour les services dispensés par les médecins là où ils sont trop nombreux et il attribue moins de fonds là où il manque des médecins, mais les caractéristiques ne sont pas constantes.

Conclusion : La planification selon les besoins est possible. Si les provinces veulent contrôler le nombre de médecins et les dépenses, il est logique de voir aux répercussions de cette mesure.

During the 1970s and 1980s the physician supply in Canada grew faster than the Canadian population. Between 1986 and 1991, for example, the number of physicians grew by 15.8%, whereas the population they served increased by only 7.3%.¹ It has long been recognized that this increase is not distributed equally across the country or even within the provinces.

In recent years most provinces have made recommendations and taken initiatives to control the supply and location of physicians. As early as 1989 the Nova Scotia Commission on Health Care recommended a ceiling on the annual growth of expenditures as well as an analysis of the implications of adding new physicians and of capitation and salaried payment systems. In Manitoba there has been a commitment to work toward the "delivery of medical services to Manitobans in a manner that reflects the health and access needs of the population."²

Given the wealth of reports and policies addressing physician numbers and distribution, one might assume that there is substantial expertise in needs-based planning. Yet, in spite of the CMA's call for needs-based planning and its recommended set of planning tools,³ little progress has been made.

In this paper, we report our effort to develop a needs-based planning approach and to illustrate its application in Manitoba. We identified the number of visits needed by different groups (taking into account age and sex, as well as socioeconomic and health characteristics) and compared this need with the actual rate of physician contact. Then, using estimates of the average workload of local physicians, we estimated whether a region was served by too few or too many physicians. Finally, we estimated the money spent by the province for visits to physicians in regions of relative surplus versus those of relative deficit.

Methods

Definition of terms

Generalist physician: General practitioner, family physi-

cian, general internist or general pediatrician. Internists and pediatricians classified as generalists were identified by local experts as having no subspecialty. We further determined that they were certified in no other field, that their most frequently billed tariff was for office visits and that less than 30% of their patients' ambulatory visits involved referrals from other physicians.

Physician visits: Number of ambulatory visits (including office visits, visits to walk-in clinics, and home and emergency department visits) made by residents in 1993-94, regardless of the region where the visit occurred.

Expenditures on physician visits: Based on the fee paid by the province for visits, not including fees paid for laboratory, technical or other services (such as surgery) associated with the visit. Fees paid varied by the type of visit (primary v. consultative care) and by the type of physician providing the care.

Physician workload: Average workloads for ambulatory visits, based on the practices of full-time-equivalent physicians, defined as those earning between the 40th and 60th percentiles.⁴ The workload of Winnipeg physicians was calculated as the weighted average workload of general practitioners, family physicians, general internists and general pediatricians. Outside Winnipeg, only general practitioners were included.

Validity of data: The data for these analyses were taken primarily from claims filed by both fee-for-service and salaried physicians. Thorough checks on the validity of the data were performed. We estimate that between 90% and 98% of ambulatory care is documented through the claims system.⁵

Aggregation level: The data were originally calculated at the level of 54 physician service areas, which were then aggregated into the 4 larger regions referred to in this paper (the North, the Rural South, Brandon and Winnipeg).

Estimating deficits and surpluses

In the absence of evidence-based standards for the number of physicians required by a population, one guide



for estimating need is to examine actual use, averaged across regions with different levels of physician supply.

Table 1 shows the number of ambulatory visits made by residents of the different regions, according to the specialty of the physician contacted. Winnipeg residents received a higher proportion of their ambulatory care from general internists and general pediatricians than non-Winnipeg residents, who received most of their ambulatory care from general practitioners. Similarly, Winnipeg and Brandon residents received a higher proportion of their care from surgeons and other specialists. Incorporating these different delivery patterns into needs-based planning presents a substantial challenge. Our visit-based approach treated all of the regions equally by ignoring the physician's specialty for the purpose of calculating deficits and surpluses. Because generalists delivered care for 89% to 94% of the ambulatory visits by residents of the North and the Rural South and for 79% to 83% of those by Brandon and Winnipeg residents, this approach seemed reasonable, particularly given that issues relevant to planning for specialist physicians have been addressed in a separate project.⁶

To determine the relative surplus or deficit of physicians in each region of the province, we compared the actual rate of physician visits with an estimate of the visits needed for each region. Actual visit rates were determined from the claims routinely filed by both salaried and fee-for-service physicians and included all contacts regardless

of the region in which they occurred. We estimated the need for physician visits for the residents of each region by means of analysis of covariance based on the rate at which Manitobans actually visited physicians in 1993–94. This approach allowed us to adjust for the age, sex and socioeconomic characteristics (as outlined in Appendix 1) of the residents, in accordance with the fact that elderly people, children, women and those in poor socioeconomic circumstances generally have higher contact rates. We also adjusted our estimate of each region's need for physician contact according to the health characteristics of its residents. Overall health was assessed by means of the 5-year rate of premature death (death before age 75 years). This indicator has been described as the best single measure of health status, capturing a population's need for health care.^{7,8} Our method of estimating need for physician visits is based on the principle that, all other things being equal, residents in regions with less healthy populations should have access to more physician contact than those in regions with healthier populations (see Appendix 1 for information about how need was estimated). By comparing actual visit rates with the rates of visits needed, we identified each region as being relatively under- or over-served by physicians. Finally, we determined the average number of visits provided by 1.0 full-time-equivalent generalist physician practising in each region of the province, to estimate the deficit and surplus number of generalist physicians serving each region.

Table 1: Ambulatory visits made by residents of Manitoba in 1993–94 by physician specialty

Specialty	Region; no. of visits/resident*				
	North	Rural South	Brandon	Winnipeg	All regions
General practitioners and family physicians	4.27	3.68	3.62	3.47	3.59
General pediatricians and internists	0.05	0.13	0.37	0.52	0.35
Surgeons	0.13	0.24	0.37	0.38	0.32
Other specialists†	0.12	0.23	0.45	0.69	0.51
Total	4.57	4.28	4.81	5.06	4.77

*Rates are adjusted for age and sex.

†Includes all medical and pediatric subspecialists, psychiatrists, and obstetricians and gynecologists.

Table 2: Characteristics associated with need for physicians*

Characteristic	Region; value of characteristic				
	North	Rural South	Brandon	Winnipeg	All regions
Premature death rate† per 1000 residents	5.03	3.42	3.38	3.58	3.58
Socio-Economic Risk Index ⁹	3.69	0.29	-0.31	-0.24	0.00
% of population aged < 2 yr	7.01	4.22	4.35	4.24	4.41
% of population aged > 75 yr	1.86	7.07	6.27	5.69	5.91
Estimated no. of visits needed per resident per yr	6.27	4.44	3.89	4.19	4.38

*See Appendix 1 for a detailed explanation of the estimation of needed visits.

†Death before 75 years of age.



Results

The Rural South, Brandon and Winnipeg were generally similar to each other and different from the North with regard to factors known to affect the need for physician services (Table 2). The North had a high value for the Socio-Economic Risk Index,⁹ poor health status (reflected in its relatively high premature death rate) and a high proportion of very young residents (less than 2 years of age). Only the relatively low proportion of elderly residents in the North moderated to some degree the high scores on factors influencing the need for physicians. Using the approach described in the methods section (and in more detail in Appendix 1), we estimated the need for physician visits in the North as 6.27 per resident per year, considerably higher than in the other 3 regions.

Table 3 tracks how we moved from our estimate of need for physician care to an estimate of physician deficits and surpluses across the province. The actual visit rate (*A*) included all visits, no matter where they occurred. Thus, if a resident of the Rural South contacted a physician in Winnipeg, the visit was counted as a visit made by a Rural South resident. For each region, we calculated visit deficits or surpluses by subtracting the rate of visits needed (*B*) from the actual visit rate (*A*) and multiplying by the population of the region (*C*). This value (*D*) represents the deficit or surplus of visits to all physicians. The values of *D* for each region were multiplied by the proportion of visits delivered by generalist physicians in that region to yield the “generalist visit deficit or surplus.” The deficit or surplus of visits was converted to the deficit or surplus of gen-

eralist physicians by dividing by the visit workload for generalist physicians in the respective regions. The workloads ranged from 5696 visits per year for generalist physicians practising in Winnipeg to 3504 visits per year for those in the North. (Because of the relatively small number of physicians practising in the North, this estimate of workload may be unstable — in adjacent years we found a variation of 20%. However, physicians working in the North also advised that their workload should be lower because of the need to travel and because they often function more as consultants than as primary care providers.)

We estimated that there was a deficit of 41 generalist physicians serving the North of the province, a deficit of 6 serving the Rural South, a surplus of 8 serving Brandon residents and a surplus of 80 serving Winnipeg residents.

Estimating total number of physicians needed

It is also possible to estimate the total number of generalist physicians needed in each region, by considering the extent to which out-of-region residents seek care in a given region as well as the amount of care that the region's residents seek elsewhere. The first row of Table 4 shows the number of generalist physicians required to provide care to the residents of each region, if all care were to be delivered within the region. The second row shows the number of physicians needed in each region to provide services for out-of-region residents seeking care within the region, and the third row shows the number of physicians required in other regions to provide care to residents seeking care outside their own region. (Since

Table 3: Factors used in estimating physician deficits and surpluses across Manitoba

Factor	Region; value of factor				
	North	Rural South	Brandon	Winnipeg	All regions
Actual no. of visits per resident (<i>A</i>)*	4.04	4.37	4.87	5.06	4.78
Estimated no. of visits needed per resident (<i>B</i>)	6.27	4.44	3.89	4.19	4.38
Population (<i>C</i>)	69 410	356 362	46 297	667 003	1 139 072
Visit deficit (–) or surplus (+) ($D = [A - B] \times C$)†	–154 784	–29 945	+45 371	+580 293	+440 935
% of visits to generalists (<i>E</i>)	93.59	89.17	82.78	78.98	–
Generalist visit deficit (–) or surplus (+) ($F = D \times E$)†	–144 863	–26 702	+37 559	+458 337	+324 309
Generalist visit workload (<i>G</i>)	3 504	4 675	4 707	5 696	–
Generalist deficit (–) or surplus (+) (F/G)†	–41	–6	+8	+80	+41
No. of generalist physicians (full-time equivalent) practising in the region	59.2	257.9	41.8	527.8	886.7
Deficit (–) or surplus (+) as % of current supply	–69	–2	+19	+15	+5

*These rates have not been adjusted for age and sex.

†Except for provincial total, which is a simple sum of the regional values.



physician workloads vary by region, the effect of patient mobility also varies, so the totals for rows B and C are not the same. For example, just under 16 000 visits were made to Winnipeg physicians by residents of the North. This number of visits would have required 4.6 physicians in the North, but because of their higher workload, 2.8 Winnipeg physicians could cover the same number of visits.) Finally, the bottom row of Table 4 identifies the net need for physicians, assuming a continuation of current patterns of care-seeking within and outside each region. Because a great deal of physician care in Winnipeg and Brandon is delivered by general internists and general pediatricians, one could use the existing ratio of general practitioners to other generalists to break down their numbers according to the type of generalist needed. Using the visit-based approach, we estimated that 415 generalist physicians but only 363 general practitioners and family physicians are needed in Winnipeg, given the number of other generalists currently providing care, the need characteristics of Winnipeg residents, the workloads of Winnipeg generalists and the amount of care that non-Winnipeg residents are currently receiving from Winnipeg generalist physicians. To the extent that rural regions are able to recruit physicians and provide their residents with services closer to home, physician surpluses in Winnipeg and Brandon will increase.

Cost implications of a physician surplus

Although interest in controlling physician numbers has grown in proportion to concern about expenditures on physician services, the data linking increased physician numbers to increased costs have been disputed. However, as Fig. 1 shows, the province has been spending more money per resident to provide physician services to residents of Winnipeg and Brandon, regions with a surplus of physicians, than to residents of the Rural South, even though the health status and estimated need for physician visits were similar among residents of these 3 regions (Table 2). For example, expenditures per Winnipeg child were 26% more than those per child in the Rural South,

and expenditures per Winnipeg resident aged 15 to 64 years were 33% higher (Fig. 1). Health status and estimated need for physician visits has been shown to be much greater for residents of the North than for residents of the other regions, and need appears to have some influence on expenditure patterns.

Discussion

The work we have undertaken in Manitoba demonstrates not only that needs-based planning is possible, but also that it can be used to overcome some of the limitations of other approaches. We have used an approach for estimating need with a level of methodologic sophistication and data requirements that may not be available or necessary in other jurisdictions. The multiple linear regression model gave us the capability to estimate need for visits based on the ways in which people actually make use

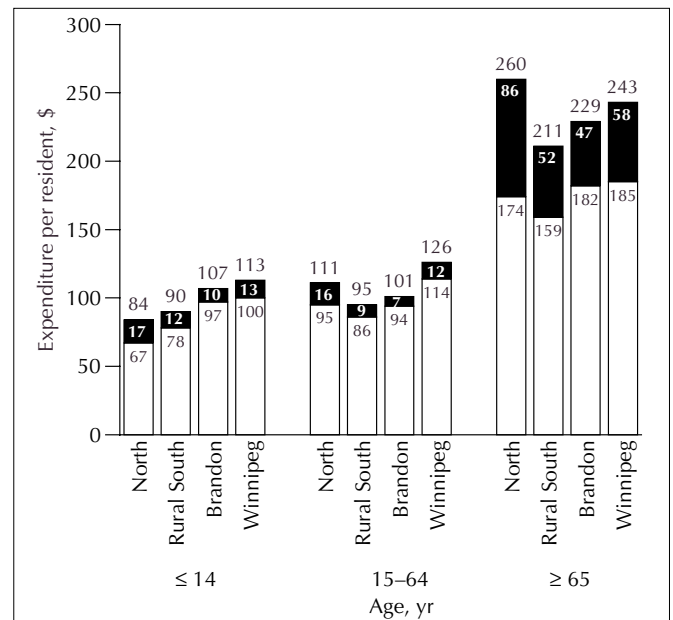


Fig. 1: Ambulatory (open bars) and inpatient (solid bars) expenditures for physician services in Manitoba in 1993-94 by age and region (unpublished data, Manitoba Centre for Health Policy and Evaluation).

Table 4: Estimated numbers of generalist physicians needed to provide care in Manitoba

	Region; estimated no. of physicians needed to provide care				All regions
	North	Rural South	Brandon	Winnipeg	
Residents needing care					
Residents of the region (A)	116	303	32	387	838
Out-of-region residents seeking care in region (B)	4	13	9	37	63
Residents of the region seeking care elsewhere (C)	8	50	3	9	70
Total no. of physicians needed (A + B) - C	112	266	38	415	831



of physicians, incorporating age, sex and socioeconomic status and using the reasonable assumption that residents in poor health require more care than those in good health. This method is much less arbitrary than standard physician-to-population ratios and has permitted us to estimate the need for physician care according to the characteristics of the region's residents.

Having estimated need using this approach, we can also look at simpler methods. For example, 14 of the 54 physician service areas in Manitoba had an estimated need at least 25% higher than the average for the Rural South. Eleven of these areas had premature death rates among the 13 highest in the province. So if only one indicator were available for needs-based planning, premature death would be a good candidate. These results are not an artifact of our method of calculation; most adjustments we made using premature death were relatively insubstantial.⁴ Although the suitability of premature death as a proxy for illness might be questioned, it is strongly associated with self-assessed health, the number of symptoms reported and rates of temporary sickness.¹⁰

We believe that our approach is one of the most sophisticated attempts to date to assess the adequacy of physician supply. By basing our estimate of a region's need for physicians on an empiric assessment of how different groups of people actually used physicians' services, we overcame many of the criticisms of the needs-based planning approach in Britain, which relies on the Jarman index.¹¹⁻¹³ This index was developed by surveying general practitioners about factors that they thought increased their workload, including the proportion of the population less than 5 years of age, and the proportion who were unemployed or living in overcrowded conditions. Information about these factors was then derived from census data and weighted according to the importance that general practitioners gave the factors. However, this approach does not accurately reflect the factors affecting physicians' workload and may have the perverse effect of generating longer list sizes or workloads per physician.¹³

There is no magic formula for calculating the number of physicians required to serve a defined population. Lomas, Barer and Stoddart¹⁴ reviewed the strengths and weaknesses of the various methods for physician resource planning: needs-based, demand-based and use-based approaches. We have used a hybrid approach, which overcomes many of the weaknesses of previous efforts.

Certain factors were not incorporated into our estimates of need for physician contact. For example, regions with growing or declining populations will have different needs projection profiles. However, these could easily be incorporated into the formula for calculating need. Our calculation of workloads for each region should also be reassessed over time. If remote areas are successful in re-

cruting more physicians, physicians in those regions may be able to handle a larger visit workload.

To summarize our conclusions, needs-based planning for physicians is possible and important. The lack of public policy in shaping decisions about physician practice locations has led to a relative surplus of physicians in areas with basically healthy populations and a deficit in areas with greater need for health care. During this time of fiscal constraint, we need to focus on preserving the best features of the Canadian health care system. If provinces are intent on controlling physician numbers and costs, it makes sense to manage the implications of doing so.

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Appendix 1: Estimating need for physician visits with the Socio-Economic Risk Index

The Socio-Economic Risk Index (SERI)⁹ is a composite index of 6 measures of socioeconomic status that mark environmental, household and individual conditions placing residents of a particular area at risk for poor health and hence that are associated with a greater need for health care. The 6 variables were chosen from a pool of 23 for their strong relation to health status and use of health care resources: the proportion of people aged 15 to 24 years who are unemployed, the proportion of people aged 45 to 54 years who are unemployed, the proportion of single-parent households headed by a woman, the proportion of high school graduates aged 25 to 34 years, the proportion of female residents participating in the labour force, and the average value of a dwelling in the area. The first 3 variables are negatively related to health status (high values being associated with poor health), and the last 3 are positively related to health status. For this study, SERI values were calculated for each physician service area on a standardized scale, the provincial average corresponding to a SERI value of 0. Negative values represent areas at lower risk and positive values represent areas at higher risk. For a thorough explanation and discussion of the SERI, see Mustard and Frohlich.⁹

Estimating the need for physician visits

Our analysis of residents' need for physician visits was based on several assumptions: first, that in 1993–94, Manitobans, on average, made visits in a way that reflected the needs of their age, sex and socioeconomic characteristics; second, that people with similar characteristics require a similar number of physician contacts regardless of where they live; and third, that areas with residents in poorer health should have access to more care than areas with healthier residents, all other things being equal.

We used a 2-step process to generate estimates of the need for physician visits in each area, expressed as the average number of visits needed per resident per year (a numeric example is provided in Table A1). Step 1 accounted for factors that have been shown to influence a population's need for physician visits: differences in the age and sex make-up of the population and the socioeconomic characteristics of the area and its residents. The predicted values in step 1 were produced by a multiple linear regression analysis of actual 1993–94 visit rates on the age and sex

distribution and the SERI values for each region (using 21 age groups and including all interaction terms). Essentially, this analysis results in a description of physician visits for the Manitoba population in 1993–94, according to demographic and socioeconomic factors (the model results are available on request from the corresponding author).

The second step modified the predictions from step 1 to account for differences in the health status of areas residents, as measured by premature death rates. This extra step was carried out in recognition of the desirability of providing more visits in areas whose residents were in poorer health, all other things being equal. We modelled the relation between each area's premature death rate and our step 1 estimate of need using simple linear regression, which produced a slope of 0.56 ($p = 0.001$). For areas in which the premature death rate was higher or lower than the provincial average (3.58 per 1000 residents aged 74 years or less) we multiplied the difference between the premature death rate for the area and that for the province by 0.56. The value obtained was then added to (if the death rate was higher than the provincial average) or subtracted from (if the death rate was lower than the provincial average) the need estimate from step 1.

Example of calculation of need values

Residents of Springfield and Grahamdale had similar actual visit rates in 1993–94 (see Table A1), but Springfield's age and sex characteristics and much lower SERI value resulted in a step 1 need estimate that was lower than the SERI value for Grahamdale. In step 2 the good health status of Springfield residents, as indicated by the lower than average premature death rate, resulted in a reduction of the step 1 need estimate to the final need estimate. Grahamdale's above-average premature death rate resulted in an increase from the step 1 need estimate to the final need estimate.

In a few rural areas, physicians provide a relatively small proportion of the primary care contacts (from 17% to 69%). But because these areas have some of the least healthy, highest-need populations in the province, we did not want to exclude them from the analysis altogether. To help counteract the lack of physician visits, nursing station contacts were included in the regressions used to estimate need.

Table A1: Variables used to estimate visits needed by residents of Springfield and Grahamdale, Man.

Variable	Springfield	Grahamdale
Actual no. of visits per resident in 1993–94	4.58	4.51
Socio-Economic Risk Index (SERI)	-0.66	1.74
Step 1 estimate of need (from regression with age, sex and SERI, plus interactions)	3.55	5.63
Premature death rate for area	3.10	4.97
Provincial average premature death rate	3.58	3.58
Adjustment for premature death rate	$(3.10 - 3.58) \times 0.56$	$(4.97 - 3.58) \times 0.56$
Final estimate of visits needed	3.28	6.41