Anesthesia Practice

Analysis of anesthesia physician resources: projected Ontario deficit in 2005

Homer Yang MD CCFP FRCPC,*
Robert Byrick MD FRCPC,†
Neil Donen MB CHB FRCPC‡

Purpose: To clarify the recent perception of shortfalls in anesthesia physician resources, two models were used to assess these resources in Ontario, Canada.

Methods: Two models, demand-based and benchmarking, were used. In the demand-based model estimated future supply and attrition were obtained from information on Ontario Ministry of Health funded trainees. Data from the Canadian Residents Matching Service and the Association of Canadian University Departments of Anesthesia were also used. Current demand was identified from a telephone survey of Departments of Anesthesia in ten Ontario cities. The number of anesthesia practitioners in Ontario was estimated from the 1996 Canadian Anesthesiologists' Society Physician Resource Database (CASPRD) in the demand-based model. In the benchmarking model, using Alberta as the closest published analogue to Ontario, the annual specialist growth rate in Ontario since 1986 was calculated in the literature as 2.8%/yr for 1986-1994. The number of anesthesiologists in Ontario from the 1986 CASPRD was used to calculate need based on that growth rate. Results are compared with population to anesthesiologist (P/A) ratios calculated from Statistics Canada population data and physician numbers from CASPRD.

Results: A shortfall in the number of anesthesiologists has been identified. The P/A ratio worsened by 17.6% from 1986 to 1996. The demand-based model indicated that the shortfall is increased from a current deficit of 40 to 68 by 2005, using CASPRD. Benchmarking showed that the estimated shortfall in 1994 was 131.

Conclusion: This conservative approach indicates that the shortfall in anesthesiologist physician resources will worsen by 2005.

Objectif : Illustrer la récente observation de la pénurie de médecins en anesthésie en utilisant deux modèles pour évaluer les ressources en Ontario, Canada.

Méthode : Deux modèles, l'un basé sur la demande et l'autre, un seuil de référence, ont été utilisés. Dans le modèle basé sur la demande, l'estimation des futurs effectifs et des départs volontaires a été obtenue à partir de renseignements de la liste des médecins en formation du Ministère de la Santé de l'Ontario. Les données du Canadian Residents Matching Service et de l'Association des départements d'anesthésie des universités canadiennes ont été aussi utilisées. La demande actuelle a été vérifiée par téléphone auprès des Départements d'anesthésie de dix villes de l'Ontario. Le nombre de praticiens en anesthésie en Ontario a été estimé à partir de la Canadian Anesthesiologists' Society Physician Resource Database (CASPRD) pour le modèle basé sur la demande. Dans le modèle de référence, en utilisant l'Alberta comme analogue connu se rapprochant le plus de l'Ontario, l'augmentation annuelle du nombre de spécialistes en Ontario depuis 1986 a été calculée d'après la documentation comme étant de 2,8 % pour la période de 1986-1994. Le nombre d'anesthésiologistes en Ontario fourni par le CASPRD depuis 1986 a été utilisé pour calculer les besoins sur la base de ce taux d'augmentation. Les résultats ont été comparés avec les ratios de la population par rapport aux anesthésiologistes (P/A) calculés selon les données de Statistiques Canada sur la population et selon le nombre de médecins fourni par le CASPRD.

Résultats : On a constaté une pénurie d'anesthésiologistes. Le ratio P/A s'est dégradé de 17,6 % de 1986 à 1996. Le modèle basé sur la demande a indiqué que la pénurie s'accroîtra d'un déficit actuel de 40 à un déficit de 68 en l'an 2005, selon le CASPRD. Le modèle de référence a montré que la pénurie estimée en 1994 a été de 131.

Conclusion : Cette méthode conservatrice indique que la pénurie de médecins anesthésiologistes sera plus grave en 2005.

From the Departments of Anesthesia, McMaster University,* Hamilton, University of Toronto,† and University of Manitoba.‡
Address correspondence to: Dr. Homer Yang, Department of Anesthesia, McMaster University, 1200 Main St W., Hamilton, Ontario, L8N 3Z5 Canada.
Accepted for publication September 26, 1999

ANESTHESIA physician resources, although essential for surgical services planning, have not been studied in a comprehensive manner. Between 1986 and 1991, it was perceived that the number of anesthesiologists exceeded need.[1] However, by 1996, Donen *et al.* projected a future crisis in providing anesthesia services in Canada based on a national survey of Canadian anesthesia providers,[2] sponsored by the Canadian Anesthesiologists' Society. It was suggested that the specialty of anesthesia respond by using innovative methods to address specifically the volume and type of anesthesia services required and the number of providers needed. However there are no examples of such methods applied to the specialty. In 1998, many hospitals in Ontario noted a shortage of anesthesiologists. Yet, in the same year in an analysis to assess Canadian physician resources with respect to the aging population, anesthesia was not considered.[3] Moreover, as recently as 1997, the Ministry of Health in Ontario (MOH) released a list of preferred specialties for postgraduate training of re-entrant physicians from family practice which did not include anesthesia. This dichotomy prompted the present examination of the anesthesia human resource issue in Ontario.

A traditional measure of physician human resource needs is a global index: the population to physician ratio in a given region. Global measures simply count the number of providers and the regional population and do not consider changes in the scope of practice, varying practice styles, regional differences in services provided and the demographics of either the population or of the providers. These factors are dynamic and can change rapidly over time. Ryten has argued that "the rate of growth of physician supply can by no stretch of the imagination be deduced or extrapolated from past trends in total numbers of physicians".[4] She emphasized the need to study the "dynamics" of the human resource issue, i.e. the rates of addition and depletion of physicians, if projections are to be meaningful.

Here, currently available data are used to examine two alternative models of anesthesiologist resource planning in Ontario: demand-based physician resource planning and benchmarking. The demand-based planning model attempts to address some dynamic factors, such as emigration, aging providers, retirements and part-time physicians. The benchmarking approach, on the other hand, aims to emulate the physician human resources available within an index region, which is deemed to have excellent care based on its population health index. These models are compared with the population/anesthesiologist (P/A) ratio and assessed to see if they give similar or substantially different estimates of the future need for anesthesiologists in Ontario. The limitations of these two models are also explored.

This study represents a retrospective pilot examination of these models, as applied to the anesthesia human resource issue in Ontario. It is an initial attempt to understand the limitations of using data about populations and anesthesiology services and transposing this information into predictions of future need.

Methods

In Ontario, all anesthetics are administered by physicians. The majority of anesthetics are administered by specialist anesthesiologists with Royal College of Physicians and Surgeons of Canada (RCPSC) certification. For the purposes of this study, only specialist anesthesia physician resources are examined and anesthesiologists are physicians with RCPSC certification.

Global Index: Population to Anesthetist Ratio

The population/anesthesiologist (P/A) ratio was calculated with data obtained by surveys of the Canadian Anesthesiologists Society[2,5] in both 1986 and 1996.

Demand-based model: 1998-2005

This model was based on the estimated future supply and currently identified demand for anesthesiologists. "Future supply" is the number of new anesthesiologists that will be added into the physician resource pool between 1998 and 2005. "Demand" was based on an estimated "current deficit" and "future attrition" in the same period. Mathematically, the relationship is defined as follows:

Future surplus (or deficit) = future supply – (current deficit + future attrition)

The future supply of anesthesiologists in Ontario was calculated as the number of postgraduate anesthesia trainees who could be licensed for civilian practice after completing RCPSC certification. This includes those in Ministry of Health (MOH) funded training positions and physicians recruited to the province through other paths as of the Spring of 1998. Since 1993, non-MOH funded positions are primarily held by trainees with obligations outside of Ontario after completing RCPSC certification (foreign trainees who return to their country of origin or Department of National Defence rainees with military obligations). Future MOH-funded trainees who expect to complete training between 1998 and 2005 were divided into two cohorts: 1998-2002 and 2003-2005. Members of the first group (1998-2002) are already in Ontario residency training programs. The number of trainees in this group was obtained by direct contact with all

anesthesia residency program directors. The latter cohort (2003-2005) was estimated, assuming that the number of postgraduate positions remains constant between 2003 and 2005. This estimate was based on the number of postgraduate trainees finishing in 2002. Since 1993, postgraduate positions have been filled through the Canadian Residents Matching Service (CaRMS); every year, individuals not matched in the first iteration would be entered into a second match. Since transfers out of postgraduate training programs (cross-overs to other specialty programs) are known to occur and MOH- funded positions are not always filled, the numbers for 2003 to 2005 were adjusted based on historical CaRMS results.[6]

Under Ontario licensing requirements as of March 1998, recruits, other than recent Canadian medical school graduates, were rarely available and few other trainees were able to enroll in postgraduate training programs. Cross-over from other specialty training programs was rare and the number of re-entry positions through the Ontario Medical Association and the MOH program was limited. Based on the Canadian Anesthesiologists' Society Physician Resource Database (CASPRD)[2] (see below) recruitment paths for practising anesthesiologists as of 1996 included many re-entrants and non-North American trained anesthesiologists. However, since 1993, under new licensing requirements, international graduates are only licensed to practise medicine in Ontario under unusual circumstances. For these reasons, recruitment through other paths as of Spring 1998 was considered negligible in this model.

Data on Ontario anesthesiologists currently providing service were extracted from the CASPRD dataset and those with Royal College certification were identified as the number of anesthesiologists practising in Ontario. The CASPRD was assembled from a mail survey of all anesthesiologists practicing in Canada as of December 1995, based on the Canadian Anesthesiologists' Society (CAS) registry, billing records and the provincial physician registries. Individual birth dates in the CASPRD were compiled by cross-referencing the CAS registry, the Canadian Medical Association (CMA) master database and the mail survey responses. Initial non-respondents were sent an additional mail-out followed by telephone calls or direct contacts to encourage responses.

To gain an estimate of the current deficit, a telephone survey of ten Ontario cities was conducted in Spring 1998. The Departmental Anesthesiologists-in-Chief of individual hospitals were contacted in Barrie, Thunder Bay, Sault St. Marie, Sudbury, Orillia, London, Hamilton, Kingston, Toronto and Ottawa. Over 50% of the anesthesiologists in Ontario, according to the CASPRD study, practise in these cities. The sole survey question was, "does your institution need to recruit any anesthesiologists immediately?"

Future attrition was based on estimated retirement and early retirement/illness. The ages of practicing anesthesiologists were obtained in an aggregate fashion from the 1996 CASPRD.[2] "Retirement" was assumed to occur when an anesthesiologist reached the age of 65 yr. The number of retirees between 1996 and 2005 would be the number of anesthesiologists in Ontario aged 55 or over in the 1996 CASPRD. The estimated number of retirees between 1998 and 2005 was calculated as a linear proportion of the total number of retiring anesthesiologists between 1996 and 2005. "Early retirement/illness" included anesthesiologists taking early retirement, leaves of absence and those on long-term or temporary disability. The number was estimated to be 1% of practicing anesthesiologists per year, based on the 1996 CASPRD data on early retirement. Since the number of physicians in Ontario increased between 1996 and 1999, using the number of practicing anesthesiologists in 1996 gives a slightly lower estimate.

Benchmarking Model: 1986-1994

In a recent article examining physician resource planning in Canada, two provinces (Alberta and Saskatchewan) were identified as "reasonable benchmarks for assessment of the adequacy of the other provinces' physician resource supplies".[3] These provinces were selected as index regions, based on the population in the two provinces which scored well on indicators of population health: age-standardized mortality rates and medium to low potential years of life lost.

Based on the derivations used by Roos *et al.*,[3] we used the province of Alberta as the benchmark or index region to compare with Ontario in our analysis. As mentioned above, anesthesia was not considered in her evaluation. Anesthesia is a specialty that serves the entire spectrum of age groups: from the neonate to the elderly. It was assumed, therefore, that anesthesiologist needs parallel changes in growth components of the entire population. The overall annual specialist growth rate since 1986 was calculated by Roos *et al.* for each province[3] and adjusted to meet the benchmark of Alberta. The population growth in each province was also factored into her analysis. For Ontario, she estimated an "annual percentage change" for specialists of 2.8%/yr for the eight year period between 1986 and 1994.[3]

The number of anesthesiologists in Ontario, identified by the 1986 CAS survey[5] was used as a baseline. Since Roos' study referred to 1986 to 1994, our analy-

sis focussed on the same time period. The annual percentage change of 2.8%/yr multiplied by the eight year interval was applied to the baseline number of practitioners using this methodology. This estimates the number of anesthesiologists who would be expected to practise in Ontario in 1994.

Results

Population/anesthesiologist (P/A) ratio

The P/A ratio in Canada changed from 12,639 in 1986 to 13,583 in 1996. In Ontario the P/A ratio worsened from 12,168 to 14,316, despite an increase in the number of specialist anesthesiologists during the same decade. This worsening occurred because of a 23.5% increase in the population, from 9,113,500 to 11,252,400 over the decade, with only a 4.9% increase in the number of specialist anesthesiologists (from 749 to 786). This results in the Ontario P/A ratio changing by 17.6% from 1986 to 1996, compared with a 7.5% change in the P/A ratio nationwide.

TABLE I Age Distribution in the CAS Physician Resource Database

Age (yr)	*CASPRD 1996*
<35	7.9%
35 - 44	37.7%
45 - 54	28.6%
55 - 64	18.8%
65 +	7.0%

TABLE II Exiting Postgraduate Trainees (MOH Funded Positions)*

1998	26
1999	28
2000	33
2001	31
2002	22
Total	140

* Non-MOH trainees excluded since unlikely to obtain licence to practise.

Demand-based Model: 1998-2005

In 1996, the anesthesia providers identified in Ontario numbered 786 from the CASPRD database. Of the 786 anesthesiologists identified in Ontario, 463 (58.9%) responded to the CASPRD survey. The age distribution of Ontario's anesthesiologists is shown in Table I, indicating that approximately 25% of physicians providing anesthesia services were aged 55 or over in 1996.

a) Future Supply: The number of MOH funded postgraduate trainees expected to complete training between 1998 and 2002 was 140 (Table II). The estimated number of MOH funded positions between 2003 and 2005 (assuming no change from current funding levels) was 72, or 24 trainees per year for three years. Since 1993, unfilled positions after the first iteration of the CaRMS match were generally filled after the second match. However, trainees who came to anesthesia on the second match did transfer out of anesthesia to other specialties. Such "crossover" residents amounted, on average, to 6.4% of the total anesthesia training positions in Ontario. The estimated number of anesthesia trainees graduating is therefore reduced by 14 between 1998 and 2005.

b) Current Deficit: In the telephone survey conducted in 1998, we identified an immediate need for at least 40 anesthesiologists in Ontario (Table IV).

c) Future Attrition: In the CASPRD, birth dates were available for 770 (98%) of the 786 anesthesiologists in Ontario. Two hundred and three (25.8%) were aged 55 or over. "Retirement" between 1998 and 2005 was estimated to be 162 (8/10 of 203). "Early retirement/illness" was 1% of the 786, or 8 per year. Between 1998 and 2005, it was estimated that there will be 64 (8 × 8) anesthesiologists who will take early retirements, long-term or temporary leave of absence. Table V summarizes the supply and demand estimates based on these assumptions. These calculations show a shortfall of 68 anesthesiologists in Ontario by the year 2005.

TABLE III CaRMS Results, Anesthesia Programs in Ontario

	1st Match		*2nd Match*		*Transfers Out*	
	Positions Filled	*Unfilled (% of Total)*	*Positions Filled*	*Unfilled (% of Total)*	*after 2nd Match*	*% of Total*
1993	20 of 27	25.9%	7 of 7	0.0%	3 of 7	11.1%
1994	26 of 30	13.3%	4 of 4	0.0%	1 of 4	3.3%
1995	30 of 32	6.3%	2 of 2	0.0%	0 of 2	0.0%
1996	27 of 32	15.6%	5 of 5	0.0%	3 of 5	9.4%
1997	19 of 24	20.8%	5 of 5	0.0%	2 of 5	8.3%
AVG		16.4%		0.0%		6.4%

Benchmarking Model

The number of anesthesiologists in Ontario was 749 in 1986. The estimated percentage change for specialists in Ontario between 1986 and 1994, as calculated by Roos *et al.* (Roos) was 22.4% or 2.8%/yr for eight years. This serves as the benchmark for comparison to the index region, Alberta. Applied to the number of anesthesiologists, 917 (749 × 22.4%) anesthesiologists would be expected in Ontario by 1994. This represents an increase of 168 physician anesthesiologists. However, in 1996, there were only 786 specialist anesthesiologists identified in the CASPRD, an increase of only 4.9% from the 1986 baseline. During this time, (1986-96) the population of Ontario increased from 9,113,500 to 11,252,400 (23.5%).

Discussion

Ontario's population/anesthesiologist ratio has worsened in the past decade. In this analysis, two models, demand-based and benchmarking, were used to examine the current state of anesthesia physician resources. The results of the demand-based model also allowed projections of anesthesia physician resources through the year 2005. Both demand-based and benchmarking methodologies showed that there is a current shortage of anesthesiologists in Ontario. The demand-based model also showed that this shortage will not be reduced if we rely only on new postgraduate trainees. Using the demand-based model and the CASPRD data, the estimated deficit is expected to increase from the current 40 identified positions to 68 by the year 2005. Using the benchmarking approach, the estimated shortfall in 1994 was 131.

In the demand-based model, by limiting the analysis to specialist physician providers, it is assumed that the current practice pattern continues. It was assumed that all postgraduate trainees would complete their training and succeed in the examination process for RCPSC certification. At recent national examinations, 97% of Canadian postgraduate trainees were successful therefore this assumption appears to be reasonable. In the estimate of "current deficit", ten centres were sampled, accounting for the majority of shortages, although there are vacancies in several other smaller cities and towns. Therefore, the identified current deficit is likely low. In the "early retirement/illness" estimates, the number of anesthesiologists practicing in 1998 was not available, therefore the number from the 1996 CASPRD was used, likely providing a low estimate. The use of 1% per year is very close to the figures provided by Ryten *et al.*[4] Specialty-specific net gain or loss in physician numbers due to international emigration/immigration and interprovincial movement were assumed to be balanced. Recent data suggest that there continues to be a net outmigration of physicians to the United States,[4] however no data regarding anesthesiologists were available. With current licensing restrictions on foreign-trained medical graduates, immigration is negligible. Donen *et al.* suggested that there is a national shortage of anesthesiologists and, therefore, that Ontario hospitals will have difficulty recruiting large numbers of providers from other Canadian provinces.[2] The current provincial aim is to be self-sufficient, providing adequate physicians for the future. A net in-migration would create further shortages in other provinces and should not be viewed as a long-term solution. It should be kept in mind that in this demand-based model, current levels and patterns of health care utilization are used as proxy for future demand.

The benchmarking model used the choice of index region (Alberta) as determined by Roos *et al.*[3] It was assumed in the benchmarking model that anesthesia is a factor in determining the overall population health index and anesthesiologists in that region are optimal-

TABLE IV Current known vacancies for Specialist Anesthesiologists in Ontario*

	March 1998
Barrie	1
Hamilton	7
Kingston	2
London	6 - 7
Orillia	1
Sault St. Marie	3
Sudbury	4
Thunder Bay	1
Toronto	15
Total	40

* Telephone survey.

TABLE V Estimated cumulative needs of Specialist Anesthesiologists by Year 2005

Demand		*Supply*	
Retirement (age > 65 yr)	162	Postgraduate Trainees 1998 - 2002	140
Early Retirement/Illness (age < 65 yr) (1% per year)	64	Postgraduate Trainees (2003 - 2005: 3 x 24 per yr)	72
Current Deficit (March 98, Ontario)	40	Transfers out (after 2nd Match: 212 x 6.4%)	-14
Total	266	Total	198

ly utilized. In addition, in such population-based data, it is assumed that the number of anesthesiologists increases in parallel with the total number of specialists (2.8%/yr).

No existing model can account for the complexities of unanticipated changes in practice patterns within a specific specialty. Donen *et al.* noted an increase in the scope of practice over the decade 1986-96;[2] use of a demand-based or benchmarking approach in 1986 could not have taken the recent growth in preoperative assessment clinics or pain management that require anesthesiologists into consideration. Clearly a more sophisticated model is needed to incorporate all facets of a speciality such as anesthesia where services are essential to hospital management and cross all traditional areas of expertise.

Although the estimated deficits found here are probably low, this conservative approach revealed an increasing deficit through the year 2005 with both models. Both methods agree with the widening population/anesthesiologist ratio, and anticipate a continuing shortfall in number of anesthesia providers.

Acknowledgments

The authors would like to acknowledge the editorial assistance of Dr. Kris Wilson-Yang who commented usefully on the text.

References

1 *Watanabe M.* Physician resource planning: quest for answers. Clin Invest Med 1994; 17: 256–67.
2 *Donen N.* Canadian Anaesthetists' Society Physician Resource Database 1996. Physician Resources Committee, Canadian Anesthesiologists' Society. Toronto.
3 *Roos NP, Bradley JE, Fransoo R, Shanahan M.* How many physicians does Canada need to care for our aging population? CMAJ 1998; 158: 1275–84.
4 *Ryten E.* None is too many — it's time to discard this bankrupt physician supply policy for Canada. ACMC Forum 1998; 31: 8–17.
5 *Anonymous.* Canadian Anaesthetists' Society Physician Resource Database 1986. Physician Resources Committee, Canadian Anesthesiologists' Society. Toronto.
6 The annual first iteration results are available through CaRMS, 151 Slater Street, Suite 802, Ottawa, Ontario, Canada, K1P 5H3 and the second iteration results between 1993 and 1997 were compiled through the Education Committee, Association of Canadian University Departments of Anesthesia (ACUDA).