# Profile of the cardiovascular specialist physician workforce in Canada

The Canadian Cardiovascular Society Workforce Project Steering Committee*

**The Canadian Cardiovascular Society Workforce Project Steering Committee. Profile of the cardiovascular specialist physician workforce in Canada. Can J Cardiol 2002;18(8): 835-852.**

The Canadian Cardiovascular Society conducted a comprehensive survey of 2267 cardiovascular specialist physicians in Canada to profile the type of services provided, physician workloads and expectations of future practice patterns. The survey snapshot of these activities was supplemented with data from the Canadian Institute for Health Information on historical numbers of physicians and key procedure volumes, and the Canadian Medical Association's template for estimates of the future supply of physicians. Together, these data sources highlight the growth in procedure volumes that has exceeded the growth in the supply of cardiovascular specialist physicians.

**Key Words:** *Canadian health system; Health care delivery; Health policy; Population health*

## Tableau de l'effectif médical spécialisé en soins cardiovasculaires au Canada

La Société canadienne de cardiologie a mené un sondage exhaustif auprès de 2 267 médecins spécialisés en soins cardiovasculaires au Canada afin de dresser le tableau des services fournis, de la charge de travail des médecins et des attentes concernant la pratique future. Les renseignements ainsi recueillis ont été complétés par des données historiques de l'Institut canadien d'information sur la santé quant au nombre de médecins et des principales interventions ainsi que par le modèle de l'Association médicale canadienne pour évaluer l'offre future de médecins. Selon toutes ces sources de données, l'augmentation du volume d'interventions a été supérieure à la croissance de l'offre des médecins spécialisés en soins cardiovasculaires.

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Cardiovascular disease (CVD) is the leading cause of death for more than one-third of Canadians. For those who survive, heart disease has a major impact on an individual's quality of life, often leading to chronic pain or discomfort, activity restriction, disability and/or unemployment (1).

The prevalence of heart disease is expected to increase. A recent report predicted that there will be a 50% increase in the number of Canadians with heart disease and stroke over the next 25 years, and further stated that the burden of care will be more than the health care providers can handle unless action is taken to manage the supply (2).

Across Canada, cardiovascular service providers are under increasing pressure to meet the needs of a growing and aging population. Patients are facing unacceptably long waiting times for consultations and procedures. Care providers are carrying heavy and unsustainable workloads.

Federal and provincial governments have also come to recognize the risks facing health care in Canada. As they begin to develop human resource policies to manage these risks, they are turning to industry associations and societies to provide context for this work. The Canadian Cardiovascular Society (CCS) had already recognized that human resource planning was a key challenge facing cardiovascular care in the near and long term. To produce credible and meaningful information and recommendations to governments, the CCS undertook to study to understand better the supply of, and demand for, these services and procedures in Canada, and to develop recommendations regarding the supply of these health care professionals.

The CCS recognizes that both the demand for cardiovascular services and the human resources available to deliver these services are important components in making recommendations on the delivery of care. Thus, this project was organized in phases to develop an understanding of both the supply of, and demand for, services. The Workforce Project described in the present paper addresses only the supply side of the equation. The full report of the Workforce Project is available on the CCS Web site at www.ccs.ca.

Specifically, the goal of the Workforce Project was twofold. The first aim was to profile the cardiovascular workforce and develop recommendations regarding the supply of these health care professionals required to provide appropriate care to Canadians. The second aim was to provide national and regional overviews of the profession's current activities.

Although many health care professionals work together to deliver cardiovascular services, limitations of time and resources caused the CCS to limit the current analysis to cardiovascular specialists, including cardiologists, cardiac surgeons, cardiac anesthesiologists and general internists for whom cardiology is a significant part of their clinical practice.

## METHODS

The Workforce Project was conducted under the overall guidance of a Steering Committee that included representation from each of the subject cardiovascular specialist physician groups and from across Canada, and from the Canadian Medical Association (CMA). The role of the Steering Committee was to provide overall guidance for the work and to assist as local champions where required.

**Survey of cardiovascular specialist physicians**

A key element of the Workforce Project was a survey of cardiovascular specialist physicians. The survey polled active physicians across Canada on topics related to the type of services provided, physician workloads and expectations of future practice patterns. Through its representatives on the Steering Committee, the CMA assisted in the development, distribution and analysis of the survey based on the CMA's extensive experience with physician surveys.

The CMA's Masterfile as of June 2001 was used as the starting point in developing a mailing list of target physicians. This list is based on data collected from the provincial licensing bodies, individual members and certifying bodies, and includes all physicians with a valid Canadian address as of January 2001. The specialty designation in these lists is based on certification by the Royal College of Physicians and Surgeons of Canada.

Most of the surveys were mailed on June 15, 2001. In total, 2267 surveys were sent, including those sent to the following groups.

- Eight hundred ninety-five cardiologists, as identified by the CMA mailing list.
- Two hundred seventy-five cardiovascular and thoracic surgeons, as identified by the CMA mailing list.
- Five hundred twenty-four general internists. The CMA mailing list did not identify general internists for whom cardiovascular services are a significant part of their clinical work. Thus, the Steering Committee agreed to sample one in four internists for this survey. The CMA provided a randomly generated subset for the survey.
- Five hundred seventy-three cardiac anesthesiologists. The CMA mailing list identified anesthesiologists, but did not have an indication for cardiac anesthesiologists because this is not a formally recognized subspecialty. To identify the subset of cardiac anesthesiologists within the larger group, surveys were sent only to anesthesiologists associated with cardiac surgical centres.

Of the 2267 surveys that were mailed in May, 1050 were returned. To calculate response rates, 121 physicians were removed from the total sample for one of the following two reasons:

- Incorrect address. All response rates should be interpreted as the proportion of surveys returned of all surveys for which the CMA Masterfile had valid addresses.
- The physician was identified by a local champion as being outside of the target physician group (eg, a resident or a thoracic surgeon who does not perform cardiac surgery).

**TABLE 1**
**Response rates by specialty and by region**

| | Total sent* | Number of responses | Response rate (%) All physicians | Cardiac surgeons | Cardiologists | Anesthesiologists | Internists |
|---|---|---|---|---|---|---|---|
| British Columbia | 277 | 128 | 46 | 64 | 64 | 46 | 21 |
| Alberta | 189 | 94 | 50 | 73 | 61 | 38 | 43 |
| Prairie provinces | 140 | 43 | 31 | 47 | 41 | 30 | 17 |
| Ontario | 757 | 396 | 52 | 65 | 64 | 49 | 30 |
| Quebec | 663 | 254 | 38 | 45 | 44 | 35 | 19 |
| Atlantic provinces | 120 | 68 | 57 | 56 | 63 | 77 | 41 |
| Total | 2146 | 983 | 46 | 58 | 55 | 42 | 27 |

**Includes the adjustments noted in the body of the text*

Of the remaining 2146 surveys, 983 responses were recorded, for a response rate of 46%. Of these 983 surveys, 152 surveys were not valid (eg, the physician was retired), leaving 831 valid surveys.

This response rate compares favourably with the response rates of other surveys of similar size and scope, including the CMA's annual physician survey (42% in 2001), and that of the Canadian Psychiatric Association (45%). The very high response rate for this survey reflects the importance of this work to the cardiovascular workforce.

The response rates by specialty and by region are provided in Table 1.

Eight hundred thirty-one valid surveys were input and analyzed. Over one-half of the valid surveys were from cardiologists. The breakdown of the responses by specialty is presented in Table 2. Of the total 819 respondents who provided information about sex, 701 (86%) were male and 118 (14%) were female.

In any survey, the reliability of the results depends on the response rate. With 831 valid responses, the results shown for the entire sample are 95% accurate (ie, 19 times out of 20) within 3.4%. The more detailed the breakdown of categories (eg, by age or by region), the less confidence one has in the resulting analyses.

**TABLE 2**
**Distribution of respondents by specialty**

| Certified specialty | Respondents: Number of valid responses | Percentage of total sample |
|---|---|---|
| Cardiology | 436 | 52.5 |
| Anesthesiology | 150 | 18.1 |
| Cardiac surgery* | 108 | 13.0 |
| Internal medicine | 94 | 11.3 |
| Pediatric cardiology | 38 | 4.6 |
| No specialty indicated | 5 | 0.6 |
| Total | 831 | |

**Includes cardiovascular and thoracic surgery*

**National physician database**

The Workforce Survey provided valuable information on how cardiovascular specialist physicians spend their time, and the pressures they perceive in their work environment. However, because the survey data only provide a snapshot at one point in time, the results do not provide a basis for analyzing trends in the workforce.

To supplement the survey results, the CCS asked the Canadian Institute for Health Information (CIHI) to conduct several analyses using the National Physician Database (NPDB). Specifically, the CIHI was asked to provide data from the NPDB for physician counts, full-time equivalents, and procedure and consultation volumes. These data were requested for each province, and all but one province agreed to participate. These additional data facilitated the validation of some of the survey results and provided a basis for identifying trends in the workforce.

The data provided by the CIHI must be interpreted carefully. For example, the results include only procedures and services that were remunerated on a fee-for-service basis. Any services provided under a different method of compensation (eg, alternative funding plan) were not included. The CIHI source was unable to provide information on internists.

**Estimating future supply**

An important part of understanding the supply of physicians is to look at workforce additions and exits over time and to estimate the future supply of these resources.

The CCS used the CMA supply model (courtesy of Lynda Burke at the CMA) for developing estimates of the future supply of cardiologists and cardiac surgeons over the next 20 years. This model allows the Workforce Project to produce estimates of the number of cardiovascular special-

**TABLE 3**
**Number of physicians* per 100,000 population, by region and by specialty**

| | 2001 population | Internists | Cardiologists | Cardiac surgeons | Cardiac anesthesiologists |
|---|---|---|---|---|---|
| Atlantic provinces | 2,372,043 | 6.91 | 2.32 | 0.93 | 1.05 |
| Quebec | 7,410,504 | 5.56 | 4.74 | 0.90 | 2.12 |
| Ontario | 11,874,436 | 7.04 | 2.70 | 0.92 | 1.41 |
| Prairie provinces | 2,165,817 | 7.57 | 1.39 | 0.92 | 2.49 |
| Alberta | 3,064,249 | 7.31 | 2.19 | 0.65 | 2.06 |
| British Columbia | 4,095,934 | 7.23 | 1.73 | 0.90 | 2.59 |
| Canada† | 31,081,887 | 6.74 | 2.88 | 0.88 | 1.84 |

**Based on the Canadian Medical Association Masterfile as of June 2001 – it includes all registered physicians, whether full-time, part-time or inactive; †The Canada total includes the territories*

ists under a number of supply scenarios, depending on assumptions made around key variables.

## RESULTS

### Cardiovascular specialist workforce

Cardiovascular care draws on the expertise of health care professionals across the entire continuum of care from primary prevention to rehabilitation and secondary prevention. Although the Workforce Project limited its scope to the study of specialist physicians, the delivery of quality care can only be achieved with an appropriate supply of all cardiovascular professions.

By far the largest cardiovascular specialist group is the cardiologists. To become certified in cardiology, a physician must first complete general medical training, then complete three years of internal medicine, followed by another three years of subspecialty training in cardiology. 'Community cardiologist' is a term that is often used to refer to cardiologists whose practice is based outside a tertiary care facility. These cardiologists generally receive referrals from primary care physicians when CVD is suspected. They oversee the diagnosis, treatment and rehabilitation for cardiac patients, and refer their patients to other cardiac specialists for some procedures. Many cardiologists take additional subspecialty training to perform highly specialized diagnostic and therapeutic procedures (eg, diagnostic catheterizations, percutaneous coronary interventions [PCI], electrophysiology studies). Often, these specialized programs can extend another year or two after cardiology.

The cardiac surgical team is led by the cardiac surgeon. Until recently, cardiac surgery was included in the subspecialty of cardiovascular and thoracic surgery. The conventional approach to becoming certified in cardiac surgery has been to obtain certification in general surgery, which is a five-year program, and subsequently spend two years in cardiac surgical training. Most centres in Canada still have this format, while some have adopted an alternative format that allows the candidate to begin a six-year cardiac surgical program immediately after medical training. Most centres offer a period of time for academic endeavours, including advanced degrees. This option may extend the total training to seven or eight years.

Cardiac anesthesiology is not recognized as a formal subspecialty by the Royal College of Physicians and Surgeons of Canada. However, most cardiac anesthesiologists have received further anesthesia training in cardiac surgery and invasive monitoring techniques such as transesophageal echocardiography. When asked about their areas of practice, only one-third (32%) indicated cardiac anesthesiology as their primary area of practice, although most of them (84%) do practice cardiac anesthesiology. Based on a further analysis of how the typical workweek is spent, cardiac anesthesiologists reported a median of only 10 h/week spent providing adult cardiovascular patient care. Two-thirds (66%) reported spending fewer than 20 h/week, which suggests that most of these specialists are not dedicated full-time to cardiac anesthesiology.

In Canada, general internists also play a key role in the delivery of cardiovascular care. Many internists take on cardiovascular patients either because of an interest in developing a practice in this area, or because there are no cardiologists in the available area (particularly in smaller communities) to provide this care. Internists provide a median of 24 h/week of adult cardiovascular care. The proportion of their workload that is devoted to cardiovascular care highlights the importance of adequate training for these specialists in achieving and maintaining competence in providing cardiovascular services.

**Current supply of cardiovascular specialist physicians:** A commonly used measure of the supply of physicians within a geographical area is the physician to population ratio. Using the CMA Masterfile data, this ratio was calculated by region and by specialty, and expressed as the number of specialist physicians per 100,000 population.

This ratio does not provide any indication of the demand for specialist services and is, therefore, not an indicator of the adequacy of the supply of physicians. It does,

**TABLE 4**
**Number of physicians per 100,000 population, by region and subspecialty**

| | 2001 population | Cardiologists* | Interventional cardiologists | Electrophysiologists† |
|---|---|---|---|---|
| Atlantic provinces | 2,372,043 | 2.32 | 0.38 | 0.13 |
| Quebec | 7,410,504 | 4.74 | 0.65 | 0.18 |
| Ontario | 11,874,436 | 2.70 | 0.37 | 0.19 |
| Prairie provinces | 2,165,817 | 1.39 | 0.60 | 0.05 |
| Alberta | 3,064,249 | 2.19 | 0.39 | 0.23 |
| British Columbia | 4,095,934 | 1.73 | 0.40 | 0.12 |
| Canada‡ | 31,081,887 | 2.88 | 0.46 | 0.17 |

**Based on the Canadian Medical Association Masterfile as of June 2001; †Cardiac Care Network survey of electrophysiology departments June 2001. A supplement to the Consensus Panel on Arrhythmia Management Procedures in Ontario, Final Report and Recommendations, submitted to the Ontario Ministry of Health and Long-Term Care, October 2001 by the Cardiac Care Network of Ontario. ‡The Canadian total includes the territories*

however, provide an indication of the distribution of resources among regions. As shown in Table 3, most specialties show a significant variation from region to region.

For cardiologists, this ratio was found to vary significantly by region, with the Prairie provinces reporting the lowest ratio at 1.39 cardiologists per 100,000 population, which is approximately one-half of the national average of 2.88.

For cardiac surgeons, the ratio was found to be relatively constant across Canada, ranging from 0.90 to 0.93 cardiac surgeons per 100,000 population, except in Alberta, where the ratio was 0.65.

The Canadian ratio for cardiologists compares well with ratios for most European countries (eg, France, Germany and Scandinavia), which report a ratio of between 2.0 and 3.0 cardiologists per 100,000 population. Although some countries have much higher or lower ratios (eg, Italy at eight per 100,000 population and the United Kingdom at 0.8 per 100,000 population), these differences can be explained in part by differences in definitions and the approach to practice. For example, in the United Kingdom, the term 'cardiologist' is reserved for a highly trained specialist, usually with a further research degree (3).

The following two sources of survey data were used to provide insights into the distribution of two subspecialties of cardiology within Canada.

- In 2001, the Cardiac Care Network (CCN) of Ontario brought together a consensus panel on Arrhythmia Management Procedures (the present panel). This panel conducted a survey of 18 electrophysiology laboratories in Canada, June 2001, to create a snapshot of human resources and procedure volumes. The survey results were reported in summary form in the panel's final report, and was provided in detail to the participating laboratories.

- The Workforce Project conducted a survey in the autumn of 2001 of all laboratories in Canada that provide interventional cardiology.

Based on the results of these two surveys, the number of subspecialists per 100,000 population was calculated. As shown in Table 4, the distributions of these subspecialties in cardiology also show discrepancies by region. The ratio for interventional cardiologists ranges from 0.37 in Ontario to 0.65 in Quebec. The ratio for electrophysiologists ranges from a low of 0.05 in the Prairie provinces (the very low ratio for the Prairie provinces is partly due to the lack of these services in Saskatchewan) to a high of 0.23 in Alberta.

## CARDIOVASCULAR SERVICES

This section provides an overview of how cardiovascular services are delivered in Canada, with a focus on the specific activities of the specialist physicians. It also describes how the survey respondents are remunerated for providing these services.

### The typical week

Cardiovascular specialist physicians spend an average (median) of 40 h/week on patient care. For the purpose of the present report, patient care includes adult and pediatric cardiovascular patient care (including diagnostic and therapeutic procedures, postoperative care and noncardiovascular patient care).

The median number of hours per week dedicated to adult cardiovascular patient care varies by specialist group from 10 h for anesthesiologists to 24 h for internists to 40 h for cardiologists and cardiac surgeons. These medians show that cardiologists and cardiac surgeons are dedicated to cardiovascular patient care, whereas anesthesiologists and internists also provide services for noncardiovascular patients.

The balance of cardiovascular specialists's time (approximately 27% of their reported hours worked) is spent on nonclinical activities such as teaching and research, administration, professional development and continuing medical education, and other activities, as shown in Figure 1.

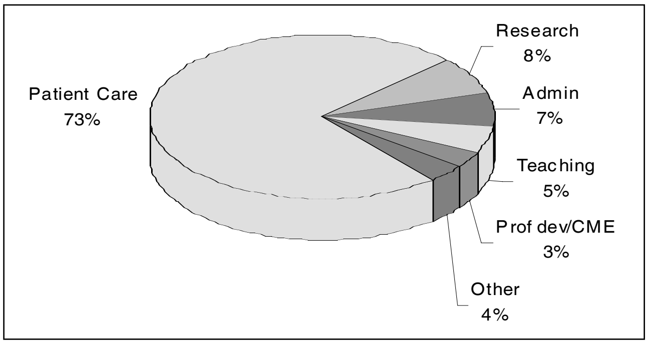



**Figure 1)** *Average distribution of time by week, all respondents. Admin Administration; CME Continuing Medical Education; Prof Dev Professional development*

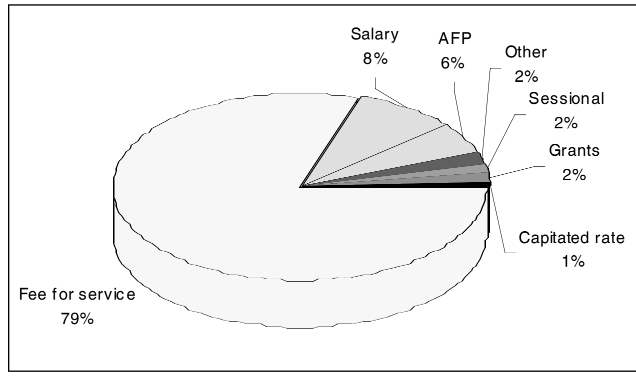



**Figure 3)** *Mean percentage of income from all sources, all respondents. AFP Alternative funding plan*

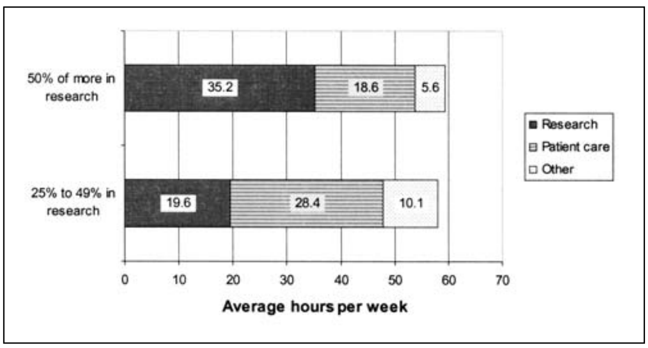



**Figure 2)** *Distribution of time by physicians reporting 25% or more time devoted to research, for all specialties*

Teaching, research and other nonclinical responsibilities consume between 21% and 30% of the total hours available across all specialties and all regions. This percentage of total hours is the equivalent of approximately the full workload of one in every four physicians in the workforce. The need for these nonclinical activities must be taken into consideration in planning for physician resources.

The survey also asked respondents to indicate which specialty areas best described their work and/or practice. Respondents were asked to rank the areas, with 1 being the highest rank. Of the total number of respondents, 31% reported that they had some research responsibilities, 12% had some administrative responsibilities and 7% had other nonclinical responsibilities.

Physicians who reported a significant research commitment also have high demands on their time for patient care and other responsibilities, as shown in Figure 2.

- Twenty physicians who reported spending 50% or more of their time on research in an average week also reported spending another 18 h on patient care and another 6 h on other activities. Thus, in addition to almost one full week of research activities (ie, 35.2 h), these physicians also commit another 24 h (the equivalent of three 8 h days) to patient care and other activities.

- Another 51 physicians who reported spending between 25% and 49% of their time on research also reported an average commitment of 28 h for patient care and 10 h for other activities. Thus, these physicians also commit an average of almost one full work week (ie, 38.5 h) to clinical and other activities, in addition to the 20 h of research each week

**Remuneration for services:** Physicians were asked what proportion of their professional income over the past 12 months was received from various sources. As shown in Figure 3, fee for service remains the most significant form of remuneration for cardiovascular specialist physicians, accounting for an average of 79% of the total income from all sources. Salary is next at an average of 8%.

An analysis of sources of professional income by type of income revealed the following.

- Seventy-four per cent of all physicians reported that they receive more than 75% of their professional income from fee for service. All but 11% of physicians receive some form of fee for service.

- Salary accounts for 25% or less of professional income for 90% of respondents.

- Although research activities are reported to consume an average of 8% of a physician's weekly workload, 87% of physicians reported that they do not receive any grants for research or other related activities. Only 12% reported receiving up to 25% of their professional income from this source.

- Five per cent of respondents reported that 76% or more of their professional income was received through an alternative funding plan.

- Cardiac surgeons (3%) and anesthesiologists (1%) were far less likely to have received research grants than were internists (14%) or cardiologists (20%).

The regional breakdowns provide the following insights into the different health care funding policies by province.

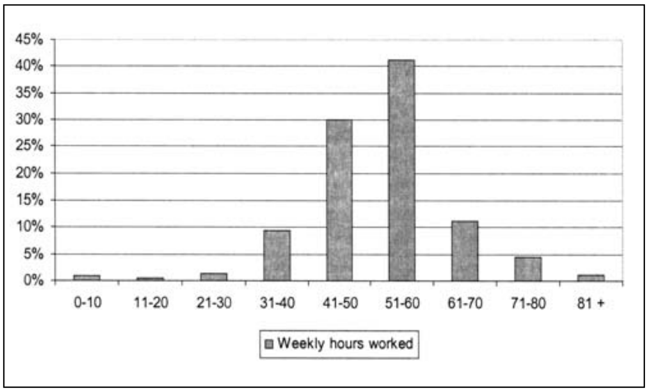



**Figure 4)** *Distribution of number of hours worked per week excluding on-call*

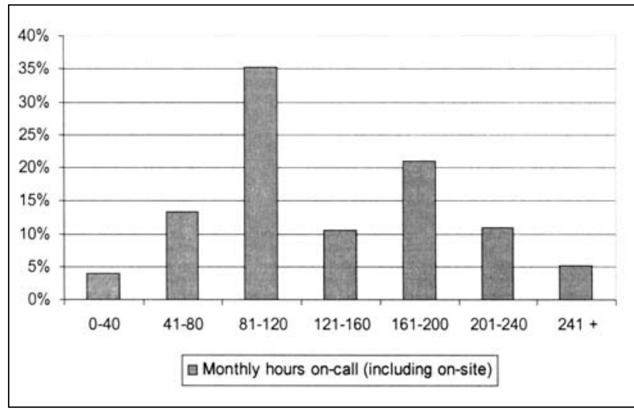



**Figure 5)** *Distribution of number of hours on-call per month, for all respondents*

- In the Atlantic provinces, 27% of physicians reported receiving no income from fee for service, compared with the national average of 11%. In contrast, 16% reported receiving 100% of their income (24% received more than 75%) from an alternative funding plan.
- The Prairie provinces were the most likely to receive income from sessional or hourly fees (32% received income from this source, compared with a national average of 7%).
- Similarly, physicians in the Prairie provinces were the least likely to have received research or other grants. Ninety-four per cent reported no income from this source, compared with a national average of 87%. Physicians in Quebec were the most likely to receive research or other grants, with 19% reporting that up to 25% of their income derived from this source.

## PHYSICIAN WORKLOADS

The previous section presented the results of the survey relating to the types and volumes of services provided, and how physicians are remunerated for these services. In this section, the focus moves into the individual physicians with a look at the typical work week of cardiovascular specialists in Canada.

### Hours worked

Physicians were asked to think of their workload as the following two major types of commitment.

- The number of hours worked per week excluding on-call and weekend time.
- For physicians who reported having been on-call or shared call responsibilities, of the hours on call each month:
  - the number of hours during which the physician is onsite; or
  - the number of hours during which the physician is obligated to be available but is not onsite.

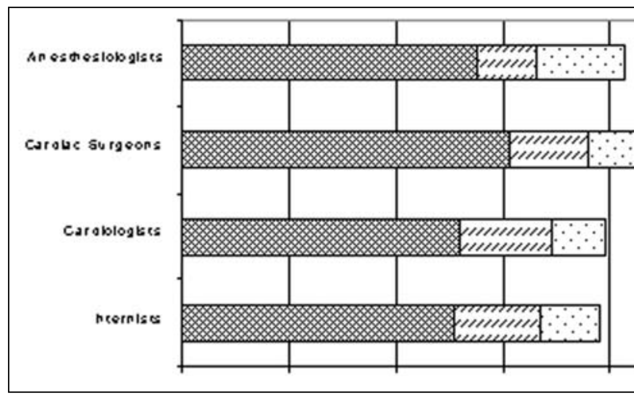


**Figure 6)** *Average hours worked per week by specialty*

Figure 4 shows the distribution of all respondents according to the number of hours reported as worked in a typical workweek (excluding on-call). As shown in the chart, 41% of respondents work between 51 and 60 h/week, with another 17% working more than 60 h/week (excluding on-call).

The on-call workload was measured for a typical month rather than for a week because on-call schedules are generally based on a cycle that is easier to interpret on a monthly basis than on a weekly basis (eg, one day in three, one day in six).

The distribution of the number of hours on call per month is provided in Figure 5. As shown in the Figure, the median number of on-call hours is 120 h/month (the equivalent of one 24 h day in six days). The median number of on-call hours spent onsite in a typical month is 50 h.

Cardiac surgeons reported the longest work week, with an average of 102 h in total, of which 61 h were during weekdays and an additional 15 h were spent onsite during their on-call time (Figure 6).

### Patient care activities

**Wait times for consultations:** The procedural volumes and consultations described in the previous section provide a

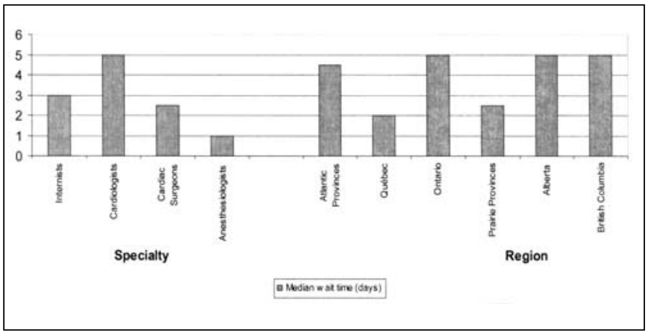



**Figure 7)** *Median wait time for urgent referrals, by specialty and by region*

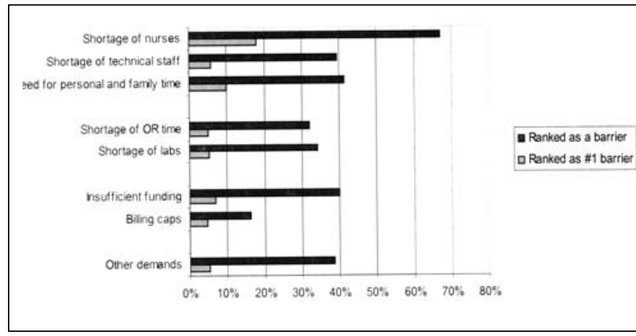



**Figure 9)** *Barriers to increasing workload, for all respondents*

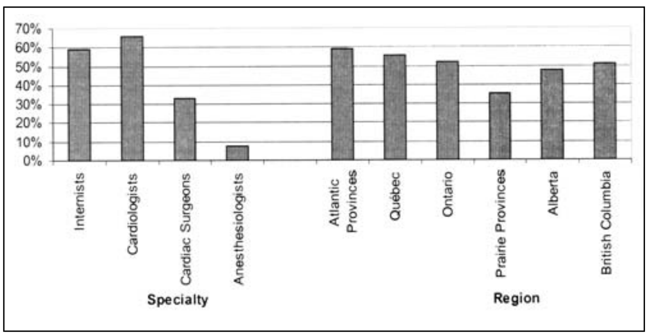



**Figure 8)** *Percentage of respondents who reported an increase in wait times over the past 12 months, by specialty and by region*

snapshot of the types of work that these professionals are performing and some indication of the volumes of work. However, volumes alone provide only one indication of the overall workload.

To understand better some of the capacity pressures on the delivery of cardiovascular care, physicians were asked about waiting times for referrals and barriers to increasing their workload.

Survey participants were asked the following question: "If a physician contacts your office today with a referral, how long would the patient wait until the first consultation with you?" Respondents were asked to provide an estimate for both urgent referrals (in number of days) and for nonurgent referrals (in number of weeks).

Cardiologists reported the longest median wait times for urgent referrals, with one-half of them reporting that urgent patients must wait five days or longer for a first consultation. Physicians in Ontario, Alberta and British Columbia also reported a median wait time of five days, as shown in Figure 7. Physicians in Quebec (two days) and the Prairie provinces (2.5 days) had the shortest median wait times.

The results were similar for nonurgent referrals, with 50% of the cardiologists reporting that a patient with nonurgent status must wait eight weeks or longer for a first consultation. Physicians in the Atlantic provinces, Alberta and British Columbia also reported a median wait time of eight weeks.

Fifty-two per cent of respondents reported that average wait times for consultations with them had increased over the past 12 months. Cardiologists (66%) had the highest tendency to report an increasing wait time, followed closely by internists (59%). The results varied somewhat by region, from a low of 35% of physicians in the Prairie provinces reporting an increase in average wait times to a high of 59% in the Atlantic provinces (Figure 8).

**Barriers to increasing workload:** Survey respondents were asked "If all supporting resources were in place, would you increase your patient care workload?" Fifty-six per cent of respondents answered no.

Of the 44% of respondents who said they would, 65% cited the shortage of nurses as a barrier to increasing their patient care workload. The need for personal time was also cited by 44% of respondents as a key barrier, as shown in Figure 9.

An analysis of responses by specialty provided the following insights.

- The shortages of nurses and operating room time were acute for the cardiac surgeons (83%) and anesthesiologists (90%).
- Internists were the most likely to cite the need for personal and family time (80%) as a barrier to increasing workload than the total sample (41%).
- Cardiologists were the most likely to cite billing caps (25%) as a barrier compared with the total sample (16%).

An analysis by region provided the following additional insights.

- Physicians in British Columbia were most likely to rank the shortage of nurses as the number one ranked barrier (34%) compared with the total sample (18%). No physicians in Alberta ranked this barrier as the number one barrier. They did, however, cite a shortage of technical staff as the number one barrier (15%).

- The Prairie provinces (25%) and Ontario (28%) were the least likely to report insufficient funding as a barrier compared with 45% or more physicians in all other regions.

- Ontario physicians were the most likely to cite billing caps (26%) as a barrier, followed by the Atlantic provinces (21%) and Quebec (12%).

- Physicians in the Atlantic provinces were the most likely to cite need for personal and family time (53%) as a barrier to increasing their workload.

**Trends in workload**

To supplement the survey results, the CCS asked the CIHI to conduct several analyses using the NPDB. These additional data facilitated the validation of some of the survey results, and provided a basis for identifying trends in the workforce.

The data provided from the NPDB is for the 10-year period from the fiscal years 1989/90 to 1998/99. The fiscal year ends March 31. Because the most recent data are from 1998/99 (already three years old), any trends that might have developed over the past three years are not evident in the tables presented.

This data source facilitated the analysis of only two of the four identified cardiovascular specialties: cardiac surgeons and cardiologists.

**Trends in the supply and workload of cardiac surgeons:** Within the NPDB, there is no single category that captures all cardiac surgeons. To focus solely on surgeons who actively practice as cardiac surgeons, the analysis was limited to physicians (excluding anesthesiologists) who received payment for a procedure classified as a coronary artery bypass graft (CABG) in the National Grouping System (NGS), regardless of the plan payment specialty indicated in the provincial data.

The number of CABG procedures (NGS code 036) was used as an indicator of the overall demand for the services provided by cardiac surgeons.

Based on the fee-for-service data provided by the CIHI, the number of CABG procedures grew by 74% over the 10-year period. During the same period, the number of cardiac surgeons grew by only 16%, resulting in a 50% increase in the average number of procedures from 90 procedures in 1989/90 to 135 in 1998/99.

Although these procedures are not the total workload of the cardiac surgeon, they are believed to be a significant component of that workload. However, before a definitive assessment can be made on the capacity to absorb further increases in average procedure volumes, a full analysis of other relevant trends needs to be undertaken. Such an analysis might look at, for example, trends in average length of these procedures and the ability to reassign other current responsibilities to other health care professionals.

**Trends in the supply and workload of cardiologists:** Due to changes in specialty codes over time, some significant changes in the specialty categories have occurred during the 10-year period studied. For example, in the early to middle 1990s, codes for some subspecialty fields such as cardiology did not exist or did not include all physicians with a subspecialty in cardiology. As a result, the CIHI was able to provide a 10-year series of procedure volumes and physician counts for cardiologists only in Quebec.

The number of cardiologists in Quebec has been relatively stable, showing only 5% growth in total numbers over the 10-year period. The number of cardiologists in 1998/99 (336) is almost the same as the number in 1992/93 (337).

In contrast, the volume of major consultations for which a fee-for-service payment was received grew by 20% over the same 10-year period, resulting in a 14% higher average number of consultations per cardiologist in Quebec. Volumes reported for electrocardiograms performed by cardiologists grew by 11% during the same period.

The more specialized services examined showed significantly higher total growth, ranging from 75% for cardiac catheterizations (NGS code 112), to an almost twofold increase in coronary angioplasty (NGS code 037), to an almost eightfold increase in the insertion of pacemakers (NGS code 038) over the 10-year period. Growth rates for the highly specialized services cannot be assumed to be representative of the overall growth in need for cardiology services. However, they do highlight that the need for cardiologists who have the training to deliver these specialized procedures has increased dramatically over the study period.

## FUTURE EXPECTATIONS

The preceding sections provided an overview of the activities and workload that cardiovascular specialist physicians are experiencing today. This section looks at how either the practice patterns or the number of specialists are expected to change, based on responses to questions about their intentions over the next two years.

**Workforce movements**

All physicians were asked to think about their intentions over the next two years, and to indicate their intentions from a list of options. Within these options were three responses that would indicate whether the physician was intending to:

- continue to practice at the same location;

- leave the Canadian cardiovascular workforce (ie, leave Canada to practise in another country, leave the practice of medicine or retire); or

- move within the Canadian workforce (ie, relocate practice within the province or to another province, leave Canada to train or change the scope of medical practice).

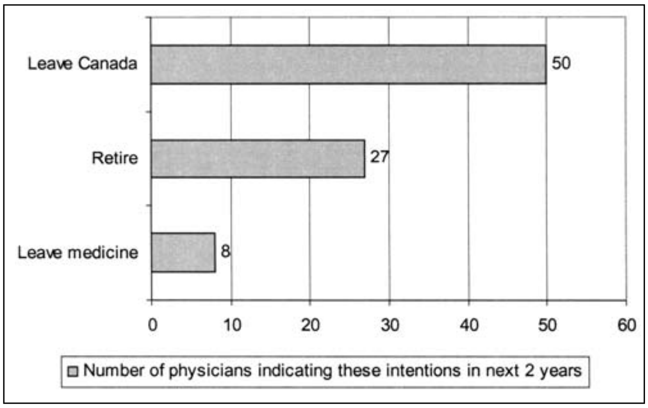



**Figure 10)** *Intentions to leave the workforce within two years, all respondents, n=831*

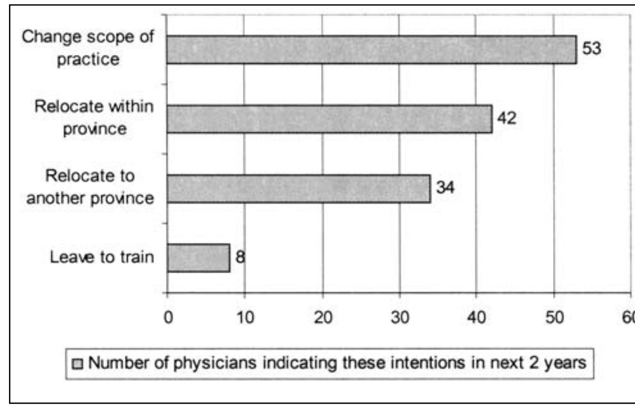



**Figure 11)** *Intentions to move within the workforce within two years, all respondents, n=831*

Each respondent was asked to indicate all of the above options that applied. Because 105 of the 831 respondents checked more than one option, the results should be interpreted with caution because they are not necessarily additive, but do provide an indication of how this workforce is evaluating its options for location of work.

The next two sections look at movements out of and within the Canadian cardiovascular specialist physician workforce as reported on the survey.

**Leaving the Canadian workforce:** As shown in Figure 10, 85 respondents (10.2%) indicated an intention to leave the workforce within two years. Fifty of these respondents (6% of the total respondents) indicated an intention to leave Canada to practise medicine elsewhere (eg, in the United States).

A further analysis of the responses showed that the propensity to leave the workforce varies with physician characteristics, as follows.

- Younger physicians are at much greater risk of being lost to other countries. Ten per cent of physicians 40 years and younger reported an intention to leave Canada to practise elsewhere within the next two years.
- Cardiac surgeons were the most likely to indicate an intention to leave Canada (7.4%) or to leave the practice of medicine (3.7%). Internists (2.1%) were the least likely to leave Canada.
- The two specialties that indicated the highest intention to retire were general internists (10.6%) and cardiac surgeons (8.3%). These findings are consistent with the age distributions for these specialties as described later in this report.
- Physicians in British Columbia reported the highest intentions (13.2%) to leave Canada. Physicians in the Prairies (2.9%) and Alberta (3.8%) were the least likely to indicate an intention to leave Canada within the next two years.

**Movements within the Canadian workforce:** The preceding section describes the responses that related to leaving the workforce. This section presents the responses that indicated movements that would not reduce the total workforce, including:

- relocating the practice within the province;
- relocating the practice to another province;
- leaving Canada to train in another country (assumed to be returning to Canada after the training is complete); and
- changing the scope of the medical practice.

As shown in Figure 11, 137 (16.5%) respondents indicated an intention to move or change their practice scope within the Canadian workforce within the next two years. Most responses to the change in scope of practice related to a reduction in workload (n=11), moving from hospital practice to private practice (n=7) or taking on more administrative and research responsibilities (n=5).

A more detailed analysis of the responses resulted in the following findings.

- Not surprisingly, people 40 years of age and younger are the most likely to consider relocating within Canada (14.5%) or leaving Canada for more training (2.3%).
- Cardiac surgeons are most likely (9.3%) to move from one province to another, and internists are the most likely to indicate that a change in scope of practice is on the horizon (10.6%).
- Physicians in the Prairie provinces are most likely (14.7%) to move out of province but within Canada, and physicians in Alberta are least likely (0%) to move out of province.

Although the physicians indicating a move from one province to another would not leave the Canadian workforce, the loss would be felt in the province from which the physician is moving. The regional impacts can be more clearly isolated by looking at the total number of physicians who indicated that they intended to leave the province or the country, or retire within the next two years. As shown in Figure 12, the Prairie provinces (23.5%) and British Columbia (20.8%) have the highest risk of loss to the provincial workforce, and Ontario has the lowest (8.8%). Note, however, that these charts only show exits, and do not in any way indicate which provinces might stand to benefit from migration out of another province.

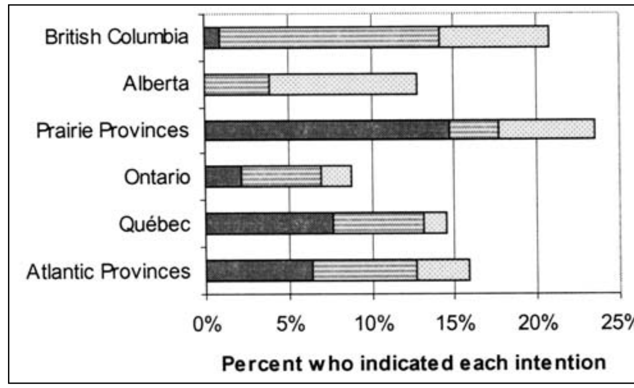



**Figure 12)** *Intentions to leave the provincial workforce within two years, by region*

**Personal intentions for clinical workload**

Physicians were asked to indicate their personal plans for their clinical workload over the next two years. Almost one-third (31%) of respondents indicated a desire to reduce their clinical workload. This compares with only 10% who expressed an intention to increase their clinical workload. Workload intentions varied with many characteristics.

- As expected, the intentions to increase workload decrease with age. Eighteen per cent of physicians aged 40 years and younger expressed an intention to increase their clinical workload, compared with 3.5% of physicians over 60 years of age who had the same intention.
- Cardiac surgeons were the most likely to indicate an intention to increase their workload (26.2%), and were the least likely to indicate an intention to reduce their workload (23.4%).
- Physicians in Alberta were the least likely to indicate an intention to increase their workload (5.2%) and the most likely to indicate an intention to reduce their workload (37.7%).

**Barriers to reducing personal workload**

Respondents were asked if they would like to reduce their personal workload. Of the 831 participants, 498 (59.9%) said they would like to reduce their personal workload.

These 498 physicians were then asked to describe the barriers to decreasing their workload. Of the physicians who wanted to decrease their workload, 74.3% reported clinical obligations as a barrier to reducing their workload.

**Age distributions**

An analysis of the distribution of physicians by age within specific specialties highlights how the aging of the physician population does not affect all specialties similarly. Using the CMA Masterfile as it was during January 2001, the CMA calculated the percentage of physicians over the age of 55 years (ie, potentially within 10 years of retirement) in each specialty.

- Internists are the oldest population with 40% over 55 years of age.
- Cardiac surgeons are the second oldest population with 33% of their respondents over 55 years of age.

The survey responses revealed a distribution similar to that of the CMA analysis, except for the cardiac anesthesiologists. Only 9% of participating cardiac anesthesiologists reported being older than 55 years of age. This difference may be attributable in part to the different sample (ie, all anesthesiologists versus cardiac anesthesiologists). Indeed, using CIHI data such that any anesthesiologist who billed for a cardiac procedure was classified as a cardiac anesthesiologist, this subset of physicians was comparable with the survey sample, with 9% being reported by the CIHI as over 55 years of age in 1998/99.

## FUTURE SUPPLY OF CARDIOVASCULAR SPECIALIST PHYSICIANS

An important part of understanding the supply of physicians is to look at the workforce additions and exits over time and to estimate the future supply of these resources.

**The CMA physician resource evaluation template**

The CMA Physician Resource Evaluation Template allowed the Workforce Project to study estimates of the number of cardiovascular specialists under a number of supply scenarios, depending on assumptions made around key variables. Some of the key sensitivities were highlighted or reinforced through the Workforce Survey.

The supply model involves looking at historical trends in the additions to and exits from the Canadian physician workforce. Additions to the workforce will include exits from postgraduate training programs, immigration of physicians from abroad to Canada and recruitment of international medical graduates to Canada.

Losses from the supply of physicians arise from migration out of Canada (eg, to the United States or overseas), retirement and death.

Based on the historical experience of these variables, the evaluation template provides an estimate of the number of physicians expected to be practising in Canada each year over the next 20 years. Where available, the historical experience is based on the specialty being studied (eg, cardiology). However, for some variables the sample size is too small to provide a reliable trend for the projection. In such cases, the national rates by age and sex for a larger group of physicians (eg, internists) were used.

**Limitations of the evaluation template**

The evaluation template is a very useful tool for understanding trends in the supply of physicians. However, this type of methodology has a few limitations.

First, the projections are based on historical experience. To the extent that historical experience turns out to be a poor indicator of future events and trends, the template tends to over- or underestimate the future supply. For example, if physicians currently retire from active practice at 65 years of age, and if physicians begin to retire much younger, then the supply would be overestimated. It is incumbent on the user of the model to test the effects of a variety of scenarios.

Second, the nature and degree of future policy initiatives are unknown. Health care human resources is very topical at the policy level, and it is entirely possible that new and effective policies to recruit physicians from abroad will contribute to building the supply of physicians in Canada. Even though many new training positions have been announced, it remains to be seen how many of these positions will actually be allocated to cardiovascular specialties.

Because of the relatively small numbers of physicians in some provinces and some specialties, it is difficult to apply this template to specific provinces or specialties. Further, estimating the impact of interprovincial migration is a difficult task at best and involves such small numbers (relatively speaking) that it would not be possible to develop reliable projections for these movements.

To provide a context for the trend in physician supply developed with this template, the results are expressed as the number of physicians per 100,000 population. This measure provides an indication of whether the growth in the supply of physicians is keeping pace with the growth in the Canadian population. Although this measure is often used to evaluate the supply of physicians, it has limitations.

- Because the model only projects the supply of physicians, it cannot be used to assess the adequacy of the supply. This measure is not an indicator of whether the current ratio of physicians to population is appropriate or not. Therefore, any change in that ratio must be interpreted with caution.

- The supply projection does not incorporate any assumptions about how care will be delivered in the future. Thus, advances in technology or procedures may cause the need for physicians to increase or decrease within subspecialties.

- A third limitation relates to the aging of the population. Over the next 20 years, many of Canada's baby boom population will be turning 65 years of age, at which age the incidence of CVD increases significantly. Even once a ratio is determined to be appropriate, that ratio is only appropriate for a population with specific age, sex and health characteristics. As these characteristics change (eg, with the aging of the baby boomers), the appropriateness of this ratio will also change.

The template does, however, provide an excellent indication of trends in the supply, relative to the overall population. If there is any evidence that the number of physicians is inadequate today (eg, heavy workloads, long wait times to see specialists), then any decrease in this ratio would be cause for concern.

Estimates were produced only for cardiologists and cardiovascular and thoracic surgeons, because the CMA did not have a methodology for identifying internists who specialize to some degree in cardiology or for identifying cardiac anesthesiologists. A summary of the assumptions and of the estimated future supply is provided in the next two sections.

**Estimates of the future supply**

**Future supply of cardiologists:** As noted in the preceding section, the projection of the supply of cardiologists to the year 2021 was based on an analysis of historical trends, combined with policy and other factors that will cause the future trends to differ from historical experience. Key assumptions related to future supply include the following.

- The estimated number of new cardiologists entering the workforce has been adjusted to reflect recent increases in funding for more spaces in undergraduate and postgraduate training. Specifically, the model is based on the assumption of 30 postgraduate exits in 2001 (compared with 23 to 37 exits from 1995 to 2000), rising to 35 by 2008.

- The ratio of female to male cardiologists has been increasing. The estimates are based on the assumption that this ratio will continue to rise until 2008, at which time approximately 50% of the postgraduate exits are assumed to be female.

- Many cardiologists continue to practice beyond the age of 65 years. It has been assumed that this trend will continue.

- The migration patterns are assumed to be consistent with historical experience.

A summary of the specific assumptions used to estimate trends in the supply of cardiologists (ie, entries into and

**TABLE 5**
**Summary of assumptions used in the Canadian Medical Association (CMA) projections of the cardiovascular specialist physician workforce in Canada**

| Assumption | Basis of the assumption | Cardiology | Cardiovascular thoracic surgery |
|---|---|---|---|
| Base stock | CMA Masterfile active physicians, effective date January 2001 | 889 physicians with valid ages (includes pediatric cardiologists) | 288 physicians |
| Moving abroad | Based on longitudinal data compiled by CIHI, based on age/sex distribution | 11 physicians/year | Six physicians/year |
| Retirement | Age/sex-specific rates for all cardiologists and for all surgeons, respectively (three-year average) | | |
| Death | National (all physician) age/sex-specific rates | | |
| Postgraduate exits | Based on recent output (excluding re-entry) as per CAPER, plus known changes in number of training positions | Climbs from 30 in 2001 to 32 in 2007 | 9 in 2007; 2008 to 2021=10 (20% female) |
| Re-entry exits | Estimated based on recent CAPER data | 2 | 1 |
| Returns from abroad | Based on CIHI longitudinal data (based on a proportion of internists for cardiology and based on a proportion of cardiovascular and thoracic surgeons for cardiac surgeons) | 6 | 3 |
| IMGs with prearranged employment | | 1.5 | 0 |

*CAPER Canadian post-MD Education REgistry; CIHI Canadian Institutes for Health Information; IMG International medical graduates*

exits from the workforce) and the source for key assumptions are provided in Table 5.

In the base case scenario described above (and in Table 5), the model produces an estimate of 2.87 cardiologists per 100,000 population in 2002, rising to 3.36 in 2021. This gradual increase in the ratio is the continuation of a historical trend. The comparable ratio was 2.43 in 1994 (the historical trend is based on January data, whereas the 2001 and projections for 2002 to 2021 are based on June data – the difference in the resulting calculations is negligible).

The CMA projections also highlight how this workforce is aging. Nineteen per cent of cardiologists (approximately one in five) are over 55 years of age in 2001. Based on the model described above, it is estimated that over 34% (approximately one in three) will be over 55 years of age by 2021.

Because of this aging of the workforce, the estimate of future supply is highly sensitive to the assumption around retirement age. If all cardiologists were to retire no later than 65 years of age, the ratio decreases immediately in 2002 to 2.78 cardiologists per 100,000 population, and then rises slowly to 3.04 by 2021. Retirement at 60 years of age drops the ratio to 2.67 in 2021; retirement at 55 drops the ratio even lower to 2.24 in 2021 (Figure 14).

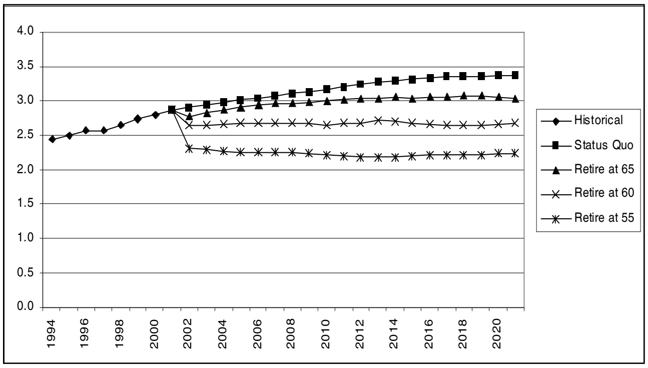



**Figure 14)** *Estimate for cardiologists, Canada, 2001 to 2021. The number of physicians per 100,000 population per year are listed*

### Future supply of cardiac surgeons

The methodology for projecting the supply of cardiac surgeons is the same as the methodology described in the preceding section for cardiologists. Key assumptions related to future supply include the following.

- The estimated number of new cardiac surgeons entering the workforce has been adjusted to reflect recent increases in funding for more spaces in undergraduate and postgraduate training. Specifically, the model is based on the assumption that there will be nine postgraduate exits by 2007 (compared with between eight and 14 exits from 1995 to 2000), rising to 10 by 2008.
- Twenty per cent of postgraduate exits are assumed to be female.
- Some cardiac surgeons continue to practice beyond the age of 65 years. It has been assumed that this trend will continue.

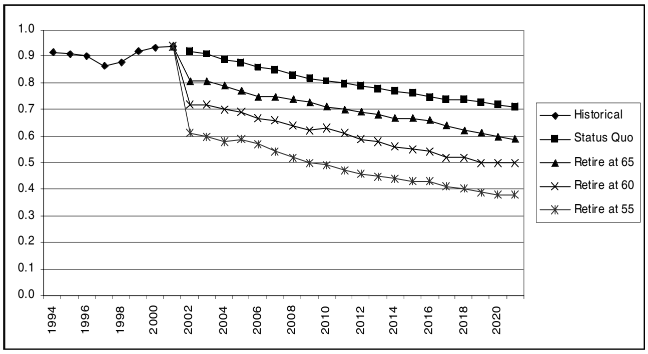



**Figure 15)** *Estimate of Cardiac Surgeons, Canada, 2001 to 2021. The number of physicians per 100,000 population per year are listed*

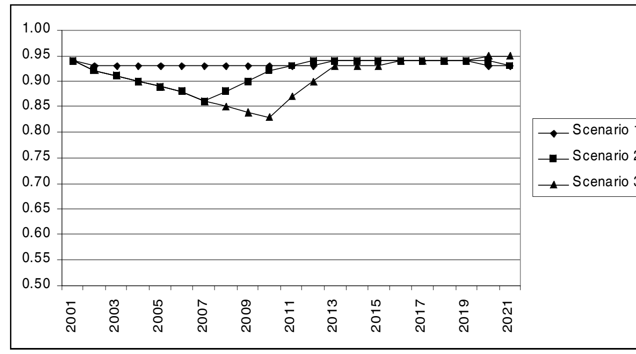



**Figure 16)** *Estimate for postgraduate exit scenarios for cardiac surgeons, Canada, 2001 to 2021. The number of physicians per 100,000 population per year are listed*

- The migration patterns are assumed to be consistent with historical experience.

A summary of the specific assumptions used to estimate trends in the supply of cardiac surgeons (ie, entries into and exits from the workforce) and the source for key assumptions are provided in Table 5.

In the base case scenario described above, the model produces an estimate of 0.94 cardiac surgeons per 100,000 population in 2002. Unlike the cardiologist per population ratio, the ratio for cardiac surgeons has not been steadily increasing over the past few years. Indeed, this ratio fell as low as 0.87 in 1997 before climbing back to 0.94 in 2001. (The historical trend is based on January data, whereas the 2001 and projections for 2002 to 2021 are based on June data – the difference in the resulting calculations is negligible.)

The CMA projections also highlight how this workforce is aging. Thirty-two per cent of cardiac surgeons (approximately one in three) were over 55 years of age in 2001. Based on the model described above, it is estimated that over 46% (almost one in two) will be over 55 years of age by 2021.

Because of this aging of the workforce, the estimate of future supply is highly sensitive to the assumption of retirement age. If all cardiac surgeons were to retire no later than 65 years of age, the ratio decreases immediately in 2002 to 0.81 cardiologists per 100,000 population, and then decreases further to 0.59 by 2021. Retirement at 60 years of age drops the ratio to 0.50 in 2021; retirement at age 55 years drops the ratio even lower to 0.38 in 2021 (Figure 15).

Assuming that there is no current surplus of cardiac surgeons in Canada, and that the need for cardiac surgical services will not decrease over the next 20 years, the decline in the population ratio projected over that period is cause for concern.

A sensitivity analysis was conducted to understand better how many new cardiac surgeons would be needed to maintain the physician to population ratio at a constant level throughout the projection period. The following three separate scenarios were developed that show how many postgraduate exits are needed throughout the projection period to maintain the status quo.

- Scenario 1. High and sustained number of postgraduate exits. For scenario 1, it was assumed that the number of postgraduate exits in 1998 (14 exits) was sustained for 2001 and beyond. This scenario is not feasible because there are not enough trainees in the system to achieve these exit rates. It is designed to highlight how much a delay can affect the ability to manage these resources long term.

- Scenario 2. High short term exits to 'catch up' with the demand. For scenario 2, it was assumed that the number of postgraduate exits was raised from the base case assumption of 10/year to 20/year for the years 2007 through 2010. This rate could only be achieved by reallocating existing postgraduate training positions, or by bringing in more international medical graduates or both during this period. For the remaining years of the model (2011 to 2021), it was assumed that 14 cardiac surgeons would graduate each year.

- Scenario 3. Very high short term exits to 'catch up' with demand. Scenario 3 is similar to scenario 2 except that the number of exits is assumed to be 25/year for the three years from 2010 to 2012. This scenario assumes that there would be no increase in postgraduate practice exits until the new undergraduate enrolment increases that have already taken place (or have been announced) have worked their way through the postgraduate training system, and that a much greater proportion of these will go to cardiac surgery than is the case today. After 2012, the number of exits is reduced to 15/year for the remainder of the projection period.

In each of the scenarios described above, the ratio of cardiac surgeons is approximately 0.94 by 2021. The difference between the scenarios is in how low the ratio goes before it recovers to the 2001 level. As shown in Figure 16, the first scenario (which is not feasible) shows a relatively steady ratio. The longer the delay in achieving higher exit rates, the lower the ratio will fall before it recovers. In scenario 2, the ratio reaches its lowest point of 0.86 in 2007. In scenario 3, the ratio falls to 0.83 in 2010 before climbing back to 0.94 in 2016.

These scenarios highlight how the long training period required for these medical specialties drives the need to provide additional training spaces sooner rather than later.

**Growth in demand compared with growth in supply**

The following section provides an indication of the expected growth rate in the number of cardiologists and cardiac surgeons practising in Canada relative to the growth rate of the population.

In early 2000, the Heart and Stroke Foundation of Canada and the CCS jointly funded a research project led by Dr David K Foot to isolate and quantitatively assess the impact of population aging on the burden of CVD in Canada. The projections of demand were based on the assumption that only population size and age distribution would change over time. Accordingly, technology, practice styles and the current population needs by age and sex were held constant (4).

Although the paper is unpublished, the CCS Workforce Project was given permission to use the results of that work in this report. Specifically, the paper provided projections of the average number of CVD hospitalizations and of key procedures (eg, CABG) per year for five-year periods, beginning in 2001 to 2006, and continuing to the period 2021 to 2026 (unpublished data). The projection methodology used was the same as that reported in a similar study by Dr Foot published in the *Journal of the American College of Cardiology* (2).

To compare the CMA estimates of future supply of physicians with Dr Foot's projections of future hospitalization and procedural volumes, the activity volumes were restated as a ratio to the population. This calculation allowed the growth rate in activity (adjusted for population growth) to be compared with the growth rate in physician supply (also adjusted for population growth). Total CVD hospitalizations were used as an indicator of the growth in overall workload for cardiologists, and CABG volumes were used as an indicator of the growth in overall workload for cardiac surgeons.

Figure 17 shows the projected CVD hospitalizations and cardiologists per 100,000 population at five-year intervals from 2001 to 2021. As shown in the Figure, the number of CVD hospitalizations per 100,000 population is projected to grow by 39% over the 20-year period, compared with a total growth of 17% in the number of cardiologists per 100,000 population. Although the number of cardiologists continues to grow during the period, it grows at a slower rate than the projected growth in hospitalizations.

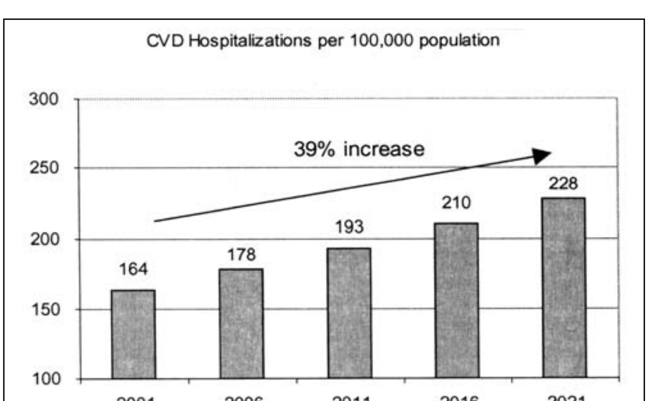
The differential growth rates do not necessarily mean that the supply of cardiologists will become inadequate to meet the need for services. CVD hospitalizations were used as an indicator of the overall growth in the burden of CVD in Canada. However, it is not entirely clear how hospitalizations drive workload, or will drive workload in the future. For example:

- The hospitalization projections isolate only the age impact, and do not take into account any potential changes in risk factors in the Canadian population or the impact of an increasing average age of cardiovascular patients over the projection period.

- The current relationship between hospitalizations and physician workload could be materially affected by changes in patterns of practice and/or the model of care.

The differences in these growth rates do suggest, however, that there may not be sufficient supply to meet the care need during this period. It is important to develop a better understanding of these relationships to facilitate human resource planning.

Figure 18 shows the same information as Figure 17, except that it compares the projected volumes for CABGs and the number of cardiac surgeons, both adjusted for



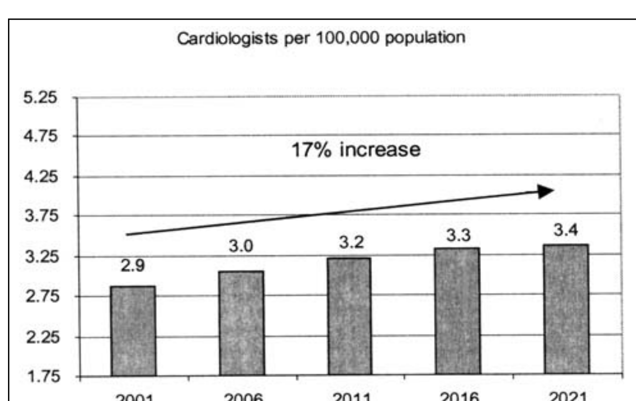




**Figure 17)** *Number of hospitalizations for patients with cardiovascular disease (CVD) (left) and cardiologists (right) per 100,000 population, per year, from the years 2001 to 2021. Data are from reference 4 and the Canadian Medical Association physician resource evaluation template*

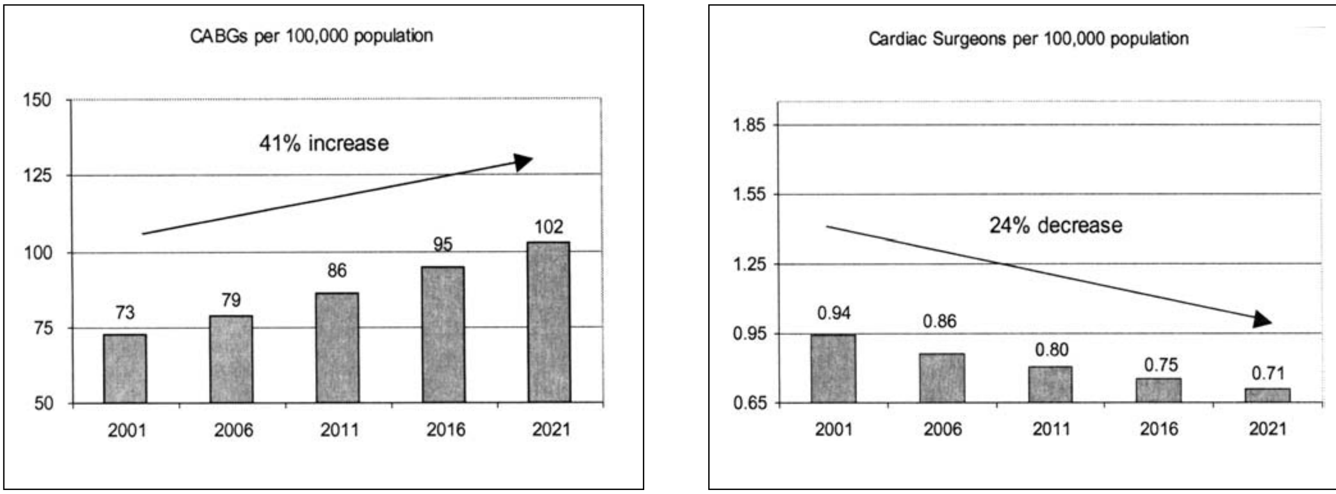



**Figure 18)** *The number of coronary artery bypass grafts (CABGs) (left) and cardiac surgeons (right) per 100,000 population per year, for the years 2001 to 2021. Data are from reference 4 and the Canadian Medical Association physician resource evaluation template*

growth in population. As shown in Figure 18, the volume of CABGs per 100,000 population is expected to grow by 41% over the next 20 years, based on current trends in the use of CABG for revascularization. In contrast, the number of cardiac surgeons per 100,000 population is projected to decline over the same period. As the need for service per 100,000 population increases over this time frame, the number of cardiac surgeons available per 100,000 population to provide those services is decreasing.

The relationship between the need for revascularization (as measured in this example by CABG procedures) and the need for cardiac surgeons is not necessarily a direct relationship. Over the past 10 years or so, PCIs have been increasingly used as an alternative to CABG for some types of revascularization. As evidence of this trend, the CCN reported a 27% increase in the number of angioplasty cases completed in Ontario during the six-month period from April to September 2001 compared with the same period one year earlier. During the same period, the volume of cardiac surgeries also increased by 4% (5). Although the need for cardiac surgeons may not grow in proportion to the need for revascularization, the need for interventional cardiologists (who perform PCI) is expected to grow substantially. Regardless of whether the revascularization is accomplished with a CABG or a PCI, the need for these procedures is still a significant burden on care providers.

The differences in growth between the volume of demand (as measured by hospitalizations and procedures) and the number of physicians available to meet that demand do not necessarily mean that the workload of individual physicians must increase to meet the need for services. Advances in technology and changes to how care is delivered may increase – or decrease – the total patient load that an individual physician can reasonably carry. Similarly, changes in the CVD risk factors, which have been assumed to be constant in this analysis, may cause an increase or decrease in the total need for services.

For example, it has been established that increased knowledge, better monitoring and improved procedures are contributing to keeping CVD patients alive longer. Over a longer lifetime, an individual patient will make more visits to the cardiologist (ie, more visits per patient). If a cardiologist is already working at capacity, an increase in the number of visits per patient will force a reduction in the number of patients that a cardiologist can handle. Although the total workload of the cardiologist is unchanged, the total number of patients (ie, patient load) that one cardiologist can see is decreased. Foot et al (2000) estimated that the average physician patient load in cardiovascular medicine in the United States has declined by more than one-third from 1980 to 1995 (2).

These findings suggest that further research and analysis are required to understand better the expected demand for care and to explore appropriate options for meeting this demand.

## DISCUSSION

### Key findings

**High workloads:** There are strong indications from many lines of evidence that the workload of cardiovascular specialist physicians is heavy and increasing.

- The median weekly commitment is 55 h/week. In addition, the median on-call commitment is 120 h/month, of which 50 h are onsite.

- Wait times are high (eg, five-day median wait for an urgent referral), and over one-half (52%) of participating physicians report that wait times have increased over the past 12 months.

- Over the 10-year period from 1989/90 to 1998/99, the number of CABGs performed by cardiac surgeons on a fee-for-service payment plan grew by 74%. During the same period, the number of cardiac surgeons grew by only 16%, resulting in a 50% increase (from 90 to 135 procedures) in the average number of CABG procedures per cardiac surgeon.

**Need for a systems approach:** The delivery of cardiovascular care requires resources from the entire system. For physicians who still have the capacity and the desire to increase their workload, 67% identified a shortage of nurses as a major barrier to increased workload; 39% cited technician shortages.

Solving the physician human resource problems alone is not sufficient to make more capacity available. Infrastructure was also cited as a barrier to increasing capacity, including:

- laboratory and procedure room availability (34%);
- operating room time (32%);
- insufficient funding (40%).

Due to the very long lead time to train in these subspecialties, delays in addressing these system stresses are not acceptable.

**Attrition from the workforce:** The aging of the physician population is also worrisome, especially for internists and cardiac surgeons. Thirty-five per cent of the internists who responded to the survey were over 55 years of age (ie, within 10 years of retirement). Twenty-nine per cent of cardiac surgeons were over 55 years of age. If no action is taken to increase materially the number of cardiac surgeons in Canada, it is projected that, by the year 2021, over 46% (ie, almost one in two) cardiac surgeons will be over 55 years of age.

Retirement is not the only risk to this population. Of the 831 respondents, 85 (10.2%) indicated an intention to leave the cardiovascular workforce (ie, retire, leave medicine or leave Canada to practise elsewhere) within the next two years. The physician groups most at risk include cardiac surgeons and physicians under 40 years of age.

**The internist as cardiovascular specialist:** Internists have a significant role in the delivery of cardiovascular care, especially in smaller communities. It is important that they be adequately trained in cardiovascular care.

The internists who participated in the survey reported the oldest age distribution of the specialties. Thus, there is concern that access to secondary care in smaller communities may be at risk as these physicians retire from the workforce.

**Other human resource planning considerations:** Research and teaching consume approximately one-quarter of all hours worked by cardiovascular specialist physicians. This means that the equivalent of approximately one in four specialist physicians is devoted to nonclinical responsibilities. In estimating the appropriate number of physicians required to maintain quality of care, the analysis must look to more than just clinical responsibilities (eg, consultations and procedures) to determine the need for human resources.

## RECOMMENDATIONS

The research and analysis conducted for the Workforce Project involved the examination of the supply side of the equation in the delivery of cardiovascular care. This investigation is only the first step in planning for cardiovascular human resources. The second key element is to develop a better understanding of the expected need for these services in the future.

**Recommendation 1**

It is recommended that the CCS take a leading role in advocating for a needs assessment that provides the requisite information to identify and quantify the need for cardiovascular services in Canada.

Understanding the need alone is not enough. Prudent human resource planning also involves developing a better understanding of alternatives in the delivery of care to ensure that these scarce resources are being used as effectively as possible.

Once the supply, the demand or need, and the delivery of care are mapped out, policy makers can assess with certainty whether there is a significant gap between supply and demand, and how that gap might change over time.

**Recommendation 2**

It is recommended that the CCS take a leading role in advocating for a study of models for the delivery of cardiovascular care in Canada.

The analysis documented in this report provides a snapshot of the current supply of cardiovascular specialist physician resources. This profile must be periodically updated to provide trending indicators on supply and demand.

As shown by the physicians' comments, the delivery of cardiovascular care requires many more resources than just the physicians. Shortages in nurses were especially noted as a barrier to using the existing capacity more effectively. The tracking of human resources and indicators of potential imbalance between supply and demand must include other professions (eg, nurses, technicians) to understand the system issues and how all human resources are interdependent in the delivery of quality care.

**Recommendation 3**

It is recommended that the CCS take a leading role in advocating for the establishment of a cardiac human resources database. Such a database should include:

- numbers by profession;
- indicators of supply/demand balance; and
- other relevant information.

The database should be maintained on an ongoing basis.

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## APPENDIX 1
## Members of the Canadian Cardiovascular Society Workforce Project Steering Committee

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