

# A look at the thoracic surgery workforce in Canada: how demographics and scope of practice may impact future workforce needs

Sean C. Grondin, MD, MPH\*  
 Colin Schieman, MD†  
 Elizabeth Kelly, BSc, MSc\*  
 Gail Darling, MD‡  
 Donna Maziak, MD§  
 Moné Palacios Mackay, DDS,  
 MSc, PhD¶  
 Gary Gelfand, MD, MSC\*

From the Divisions of Thoracic Surgery, Department of Surgery at the \*University of Calgary, Calgary, Alta., †McMaster University, Hamilton, the ‡University of Toronto, Toronto, the §University of Ottawa, Ottawa, Ont., and the ¶Department of Family Medicine, University of Calgary, Calgary, Alta.

Preliminary data for this work were presented at the annual meeting of the Canadian Association of Thoracic Surgeons in Victoria, BC, Sept. 11–13, 2009. Follow-up data were presented at the annual meeting of the Canadian Association of Thoracic Surgeons in London, Ont., Sept. 15–18, 2011.

Accepted for publication  
 Aug. 10, 2012

**Correspondence to:**  
 S.C. Grondin  
 Foothills Medical Centre  
 1403 29th St. NW  
 Room G 33 D  
 Calgary AB T2N 2T9  
 sean.grondin@albertahealthservices.ca

DOI: 10.1503/cjs.008412

**Background:** The purpose of this study is to describe the demographics, training and practice characteristics of physicians performing thoracic surgery across Canada to better assess workforce needs.

**Methods:** We developed a questionnaire using a modified Delphi process to generate questionnaire items. The questionnaire was administered to all Canadian thoracic surgeons via email ( $n = 102$ ) or mail ( $n = 35$ ).

**Results:** In all, 97 surgeons completed the survey (71% response rate). The mean age of respondents was 47.7 (standard deviation 9.1) years; 10.3% were older than 60. Ninety respondents (88.7%) were men, 95 (81.1%) practised in English and 93 (76%) were born in Canada. Most (90.4%) had a medical school affiliation, with an equal proportion practising in community or university teaching hospitals. Only 18% of respondents reported working fewer than 60 hours per week, and 34% were on call more than 1 in 3. Three-quarters of work hours were devoted to clinical care, with the remaining time split among research, administration and teaching. Malignant lung disease accounted for 61.2% of practice time, with the remaining time equally split between benign and malignant thoracic diseases. Preoperative testing (49.4%) and insufficient operating time (49.5%) were the most common factors delaying delivery of care. More than 80% of respondents reported being satisfied with their careers, with 62.1% planning on retiring after age 60.

**Conclusion:** This survey characterizes Canadian thoracic surgeons by providing specific demographic, satisfaction and scope of practice information. Despite challenges in obtaining adequate resources for providing timely care, job satisfaction remains high, with a balanced workforce supply and demand anticipated for the foreseeable future.

**Contexte :** Cette étude a pour but de décrire les caractéristiques démographiques, de formation et de pratique des chirurgiens thoracique au Canada afin de mieux cerner les besoins en effectifs.

**Méthodes :** Nous avons mis au point un questionnaire à l'aide d'une méthode Delphi modifiée pour générer les questions. Nous avons envoyé le questionnaire à tous les chirurgiens thoraciques canadiens par courriel ( $n = 102$ ) ou par la poste ( $n = 35$ ).

**Résultats :** En tout, 97 chirurgiens ont répondu au sondage (taux de réponse de 71 %). L'âge moyen des répondants était de 47,7 (écart-type 9,1) ans; 10,3 % avaient plus de 60 ans. Quatre-vingt-dix répondants (88,7 %) étaient des hommes, 95 (81,1 %) exerçaient en anglais et 93 (76 %) étaient nés au Canada. La plupart (90,4 %) étaient rattachés à une faculté de médecine ou, en proportion égale, exerçaient dans des centres hospitaliers communautaires ou universitaires. Seulement 18 % des répondants ont déclaré travailler moins de 60 heures par semaine et 34 % étaient « sur appel » plus d'un jour sur 3. Les trois quarts des heures travaillées étaient consacrées aux soins cliniques et le temps restant se répartissait entre la recherche, les tâches administratives et l'enseignement. Le cancer du poumon a occupé 61,2 % du temps de pratique, le reste du temps se répartissant également entre diverses maladies thoraciques bénignes et malignes. Les épreuves préopératoires (49,4 %) et le manque de temps opératoire qui leur est accordé (49,5 %) figurent parmi les principaux facteurs qui retardent les chirurgies. Plus de 80 % des répondants se sont dits satisfaits de leur carrière et 62,1 % prévoient prendre leur retraite après l'âge de 60 ans.

**Conclusion :** Ce sondage a permis de dégager les caractéristiques des chirurgiens thoraciques canadiens en fournissant des données démographiques spécifiques, leur

taux de satisfaction et la portée de leur pratique. Même s'il leur est difficile d'obtenir toutes les ressources nécessaires pour prodiguer les traitements en temps opportun, leur satisfaction au travail demeure élevée et l'offre et la demande semblent équilibrées en regard des effectifs et des besoins prévus pour l'avenir prévisible.

In the 1970s, cardiothoracic surgery in Canada was formally split into the subspecialties of thoracic and cardiac surgery by the Royal College of Physicians and Surgeons of Canada.<sup>1</sup> This division was made because the Royal College recognized that the scope of practice of general thoracic surgery was markedly different from that of cardiac surgery. Although the scope of practice for thoracic surgeons in Canada has previously been broadly defined, little information exists about the "true" scope of practice and demographics of surgeons performing thoracic surgery procedures in Canada today.<sup>2</sup> The development of an accurate workforce planning strategy by governmental agencies and the Canadian Association of Thoracic Surgeons (CATS) has been limited by this lack of data.

Accurately forecasting workforce requirements has become increasingly important in recent years, as government agencies work to ensure appropriate resource allocation and as specialty societies attempt to predict workforce needs. Determining workforce needs for surgeons is a complex process that is influenced by several factors, including the age and sex of active surgeons, estimates of migration by active surgeons in and out of jurisdictions, rates of surgical procedures, current and future scope of practice and overall population growth and aging.<sup>3</sup>

Using a self-report questionnaire, we sought to describe the demographic, training and practice characteristics of physicians performing thoracic surgery across Canada. A secondary goal of the study was to assess surgeons' opinions on issues related to thoracic surgery workforce and education. We anticipate that these data will provide valuable information for physician workforce assessment and planning in Canada.

## METHODS

### *Study design*

We conducted a survey to better characterize the demographic, training and practice characteristics of physicians performing thoracic surgery across Canada. We sought participation from all surgeons (general surgeons, cardiovascular surgeons, vascular surgeons and thoracic surgeons) who perform part-time or full-time thoracic surgery. We consulted surgeons who were the heads or representatives from major thoracic surgery centres in each province to obtain the names of surgeons performing thoracic surgery in their provinces. Surgeons in all provinces were surveyed. Currently, there are no surgeons performing thoracic surgery in the 3 territories (Northwest Territories, Yukon and Nunavut), and therefore these

regions were excluded. The project was reviewed and funded by CATS.

### *Survey methodology*

A literature review did not produce any suitable validated instruments, therefore we developed a questionnaire de novo. A preliminary list of items was produced by the study coordinator (S.C.G.), and a modified Delphi process was used to generate and reduce additional items. Owing to the small population size, face and content validity were addressed by soliciting 1 or more thoracic surgeons in each province to provide feedback on the questionnaire content. The final survey included 45 multiple choice, Likert-type and open-ended items were organized under the headings "demographics," "education and training," "current practice," "work hours and time off," "practice income," "scope of practice," "job satisfaction and future practice plans," "workforce and recruitment," "Royal College" and "CATS."

We used SurveyMonkey to construct the web-based questionnaire and to electronically distribute an invitation to all surgeons with email addresses available ( $n = 102$ ). Printed versions of the survey were mailed to surgeons without available email addresses ( $n = 35$ ). The survey was available from May 6 to June 30, 2009. To enhance face validity, a cover letter of support from the president of CATS was included. Responses were collected anonymously and pooled. To maximize the number of valid responses for each question, respondents were not required to answer all questions in the survey. For some questions, respondents were given an "other" option with an open-ended text box.

We sent 3 general reminder emails to surgeons. In addition, personalized reminder emails were sent to nonresponders before the survey was closed. One additional paper survey was sent to each nonresponding surgeon 2 weeks after the first mail-out. Paper responses were collected for a total of 8 weeks. Surveys were available in both English and French.

### *Statistical analysis*

We downloaded raw and coded responses from SurveyMonkey.com. Data were verified by a data coordinator (E.K.) before importing them into SPSS software version 15.0 for analysis. The primary analysis was a descriptive summary, including calculation of frequencies, means and standard deviations (SDs) where appropriate. We calculated Cronbach  $\alpha$  to assess internal consistency reliability

of scales measuring the same construct. Two group comparisons were performed using 2-tailed independent *t* tests; multiple group comparisons were performed using 1-way analysis of variance (ANOVA).<sup>4</sup>

## RESULTS

A total of 137 surgeons performing thoracic surgery procedures in Canada were identified. Surveys were sent to all identified surgeons either by email using SurveyMonkey.com or by mail. The response rate was 87% (89 of 102) online and 23% (8 of 35) by mail, for a total response rate of 71%. Of the 97 responses, 4 were incomplete. Only completed survey questions were used in the analysis and, unless otherwise specified, an *n* value of 97 was used for the analysis. Of the total respondents, the largest number of surgeons resided in the provinces of Ontario (38.1%), followed by Quebec (21.6%), British Columbia (12.4%) and Alberta (7.2%).

### Demographics and medical training

Table 1 demonstrates the demographic data of respondents including age, sex, language (*n* = 95) and country of birth (*n* = 93). Interestingly, more than 65% of surgeons performing thoracic surgery in Canada are younger than 50 (mean 47.7, SD 9.1) years, with only 10.4% older than 60 years. Thoracic surgeons in Canada are predominantly men, practise in English and are Canadians by birth. The United States, England and India were each reported as birth countries by 3.2% of respondents.

More than 90% of respondents (*n* = 95) completed medical school and general surgery training in Canada. More than 80% of respondents completed thoracic sur-

gical training in Canada, 11.7% trained in the United States and 4.2% trained in England. Of the Canadian-trained surgeons, more than 90% were certified in thoracic surgery by the Royal College.

On average, respondents (*n* = 94) completed 6.9 years of clinical training and 1.2 years of research training after medical school graduation, with 45.6% having or currently completing an advanced degree, such as a Master's degree (31.2%). Interestingly, 77 of 95 (81.1%) respondents felt that both the length of training they completed and the length of training that is currently required of thoracic surgery residents in Canada are appropriate.

### Current practice characteristics of respondents

Based on a 5-point Likert-like scale (1 = not at all important, 2 = somewhat unimportant, 3 = neither important nor unimportant, 4 = somewhat important, 5 = very important), the factors most commonly reported as being somewhat or very important in the decision about where to practice was the reputation of the surgeons (mean 3.7, SD 1.2), the collegiality of work partners and/or colleagues' practice locations (mean 4.5, SD 0.9) and the hospital/clinical resources available (mean 4.0, SD 1.0), including operating time and equipment (Table 2). Internal consistency reliability of the scale was high, with a Cronbach  $\alpha$  value of 0.84. The factors most commonly reported as somewhat or very unimportant were the on-call frequency

**Table 1. Demographic characteristics and training information for thoracic surgeons in Canada**

Characteristic	No. (%) <sup>*</sup>
Age, mean (SD) yr ( <i>n</i> = 96)	47.7 (9.1)
Age distribution yr ( <i>n</i> = 96)	
< 40	17 (17.7)
40–50	46 (47.9)
51–60	23 (24.0)
> 60	10 (10.4)
Male sex ( <i>n</i> = 97)	86 (88.7)
Practising in English ( <i>n</i> = 95)	77 (81.1)
Country of birth is Canada ( <i>n</i> = 93)	71 (76.3)
Education in Canada ( <i>n</i> = 95)	
Medical school	86 (90.5)
General surgery	88 (92.6)
Thoracic surgery	79 (83.2)
Training after medical school, mean (SD) yr ( <i>n</i> = 94)	
Clinical	6.9 (1.3)
Research	1.2 (1.1)
SD = standard deviation. <sup>*</sup> Unless otherwise indicated.	

**Table 2. Current practice response rates**

Characteristic	No. (%)
Affiliation with medical school, <i>n</i> = 94	
Full-time academic faculty appointment	37 (39.3)
Clinical faculty appointment	38 (40.4)
Part-time or volunteer faculty	10 (10.6)
No academic faculty appointment	9 (9.6)
Hours spent working per week, <i>n</i> = 95	
≤ 40	1 (1.1)
41–50	3 (3.2)
51–60	13 (13.7)
61–70	26 (27.4)
71–80	17 (17.9)
81–90	20 (21.1)
> 90	15 (15.8)
Thoracic surgery on-call frequency, <i>n</i> = 94	
1:1	9 (9.6)
1:2	23 (24.5)
1:3	31 (33.0)
1:4	18 (19.1)
1:5	7 (7.4)
> 1:5	6 (6.4)
Surgeons' satisfaction with income, <i>n</i> = 94	
Dissatisfied	28 (29.8)
Neither satisfied nor dissatisfied	14 (14.9)
Satisfied	43 (45.7)
Very satisfied	9 (9.6)

(mean 2.8, SD 1.4) and the research resources available (mean 2.9, SD 1.4). Financial remuneration was considered somewhat or very important by 44 of 95 (46.3%) respondents.

Of 94 surgeons who responded, 81 (86.2%) indicated that other surgeons performed thoracic surgery at their institutions, with a mean of 2.3 (SD 1.1) surgeons at each centre. Forty-three (45.7%) practise in community hospitals, and 35 (37.2%) practise in university teaching hospitals. Thirty-eight (40.4%) respondents practise at a hospital with thoracic surgery residents, and 85 (90%) respondents had some affiliation with a medical school or university. Two-thirds of respondents were involved in research activities — either clinical (49.2%) or clinical combined with basic science or epidemiological research (30%).

Seventy-eight of 95 (82.1%) respondents work more than 60 hours per week, including administrative duties, research, clinical practice, teaching and on-call hours. One-third of respondents were on call 1 in 3, while 34.1% were on call more frequently. More than 80% of respondents took 3–6 weeks of personal vacation time in 2008, whereas 2.1% reported no time off and 10.5% reported 1–2 weeks off. Most respondents (60%) took more than 7 days off for continuing medical education. Although most respondents (55.3%) were satisfied or very satisfied with their current income, 29.8% were dissatisfied. Nearly one-third of respondents (30.9%) were a part of an alternate funding plan (AFP). Of those surgeons who were not a part of an AFP, one-third were considering or negotiating an AFP.

*Scope of practice and resources*

At the time of the survey, 64.5% of surgeons performed

thoracic surgery exclusively, whereas 18.3% performed thoracic and general surgery (Table 3). Three-quarters of respondents' total professional time was devoted to clinical care and surgery. The remaining time was evenly distributed among research, administration and teaching duties.

Malignant lung disease accounted for the majority of respondents' thoracic surgery clinical practice time (61.2%). The remaining time was fairly evenly divided among benign lung disease, benign esophageal disease, malignant esophageal disease and other thoracic diseases.

With respect to operating days per week, most surgeons (62.8%) operated 1.5 or 2 days per week. Most respondents (62.0%) felt that their current operative case loads were appropriate; however, more than one-third (35.9%) felt that their current operative case loads were insufficient. It was not clear whether this was because of low clinical volume, lack of resources or other reasons. The factors causing delays in delivery of care that were most frequently rated as "always" or "very often" were delays in preoperative testing (49.4% combined) and insufficient OR time (49.5% combined).

To estimate the scope of operative procedures being performed, we asked the survey respondents to report which of 19 operative procedures they performed as the primary surgeon in the 4 months preceding the survey. The 19 procedures were selected to represent a broad scope of thoracic surgery practice (Table 4). The most commonly performed procedures over the 4-month period (Jan. 1, 2009, to Apr. 30, 2009) were open lobectomy and mediastinoscopy

**Table 3. Scope of practice for Canadian thoracic surgeons**

Characteristic	Scope
Description of clinical practice, no. (%) n = 93	
Exclusively thoracic surgery	60 (64.5)
Thoracic and general surgery	17 (18.3)
Thoracic and vascular surgery	8 (8.6)
Thoracic and cardiac surgery	3 (3.2)
Thoracic and critical care	5 (5.4)
Percent estimate of professional time devoted to each area of practice, mean (SD) n = 95	
Clinical care and surgery	75.0 (16.8)
Administration	11.2 (9.8)
Teaching	10.3 (6.5)
Research	8.4 (8.5)
Other (e.g., practice management)	6.3 (9.9)
Percent estimate of thoracic surgery practice devoted to each disease group, mean (SD) n = 93	
Malignant lung disease	61.2 (16.2)
Malignant esophageal disease	12.9 (9.5)
Benign lung disease	11.3 (8.5)
Benign esophageal disease	10.4 (9.9)

SD = standard deviation.

**Table 4. Number of thoracic surgeons who performed at least 1 of the following procedures over a 4-month period before the survey (Jan. 1, 2009, to Apr. 30, 2009), n = 97**

Procedure	No. (%)
Open lobectomy	97 (100)
Mediastinoscopy	97 (100)
Open esophagectomy	81 (83.5)
Gastric cancer resection	65 (67.0)
Open repair of giant paraesophageal hernia (chest or abdominal approach)	65 (67.0)
Laparoscopic antireflux repair	54 (55.7)
VATS lobectomy	53 (54.6)
Superior sulcus tumour resection	53 (54.6)
Thoroscopic sympathectomy	50 (51.5)
Minimally invasive esophageal myotomy	45 (46.4)
Tracheal surgery	37 (38.1)
Laparoscopic repair of giant paraesophageal hernia	32 (33.0)
Surgery for pectus deformity	31 (32.0)
Extrapleural pneumonectomy for mesothelioma	29 (29.9)
Pleurectomy/decortication for mesothelioma	25 (25.8)
Endobronchial ultrasound	22 (22.7)
First rib resection	22 (22.7)
Minimally invasive esophagectomy	21 (21.6)
Lung transplantation	11 (11.3)

VATS = video-assisted thoracoscopic surgery.

(100%), followed by esophagectomy (83.5%). Further analysis confirmed that about one-third of surgeons performed more than 4 cases of open lobectomy per month and 1–2 open esophagectomies per month. Conversely, lung transplantation (11.3%), minimally invasive esophagectomy (21.6%), first rib resection (22.7%) and endobronchial ultrasound (22.7%) were performed by the fewest respondents during this same time period.

### Job satisfaction and retirement planning

More than 80% of respondents reported being satisfied or very satisfied with their careers (Table 5). Most staff surgeon respondents (80%) were either “definitely not” moving or “unlikely” to move in the next 2 years. The average age of consultant surgeons was 47.7 (SD 9.1) years, and most respondents (62.1%) indicated that they planned to retire between the ages of 61 and 70 years, whereas one-fifth (20.0%) planned to retire between the ages of 51 and 60 years. Recent economic factors contributed to 22% of surgeons planning to delay retirement.

### Workforce and recruitment

More than 50% of respondents felt there was an appropriate number of thoracic surgeons practising in their geographic region. Conversely, one-third of respondents felt there were too few surgeons. Most respondents (58.5%) felt that a combination of measures should be used to estimate thoracic surgery workforce requirements, whereas 24.5% indicated that using the ratio of 1 thoracic surgeon per X population was the most useful measure to predict workforce needs. Most respondents (51.1%) felt that 1 thoracic surgeon per 250 000 people was the most appropriate ratio for full-time thoracic surgeons:population in Canada. No respondents felt that the ratio should be greater than 1:500 000. Most respondents (55.7%) reported that their hospitals were not currently recruiting a new surgeon, but roughly the same proportion (58.3%)

planned to recruit a new surgeon in the next 2–5 years. A large number of respondents were neutral about whether training programs are currently training too many or too few thoracic surgery residents. Respondents most strongly agreed with the statements indicating that CATS should play a role in workforce planning and should create and maintain databases of staff and residency positions in Canada.

### DISCUSSION

The purpose of the Thoracic Manpower and Education study was to solicit feedback from all practising thoracic surgeons in Canada to accurately describe their demographic, training and practice characteristics and to seek opinions on issues related to education, scope of practice and workforce needs. Using survey methodology, a snapshot of the population of thoracic surgeons was obtained, suggesting that most surgeons are satisfied with their overall careers and scope of practice, and that most surgeons feel that the current number of practising thoracic surgeons in Canada is appropriate.

One of the strengths of the present study is that an iterative Delphi technique and trained survey experts were used to develop the questionnaire. This approach ensured that the survey addressed important issues for Canadian surgeons and maximized the accuracy of responses. It was also important to capture information from all surgeons performing thoracic surgical procedures. By selecting representatives from each province, we were able to identify and obtain contact information for all surgeons in provincial jurisdictions across Canada and minimize the likelihood of missing potential survey contributors who might have part-time thoracic surgery practices.

The overall response rate was 71%, which suggests that the survey results are representative of the population of practising thoracic surgeons in Canada. A response bias may, however, have occurred, as the nonresponders were primarily from the paper survey group. It is possible that surgeons not using email technology are older individuals, which may have skewed the response population to appear younger. Another potential weakness of this study is that it represents only a snapshot of thoracic surgery practice in Canada. Although there is the potential for change in the thoracic surgery workforce owing to the migration of active surgeons in and out of regional health care jurisdictions, this is not supported by our data, as 80% of respondents indicated they were unlikely to move within 2 years. Regardless, to our knowledge, this survey represents the first attempt in Canada to gather important information on current thoracic surgery issues.

This survey demonstrates that most current practising thoracic surgeons are men (90%) and are trained in Canada (90%). These data suggest that Canadian training programs have been successful in training adequate numbers

**Table 5. Job satisfaction and future practice plans**

Measure	No. (%)
Current career satisfaction, <i>n</i> = 94	
Very dissatisfied	1 (1.1)
Dissatisfied	10 (10.6)
Neither satisfied nor dissatisfied	4 (4.3)
Satisfied	39 (41.5)
Very satisfied	40 (42.6)
Planned age of retirement, <i>yr</i> <i>n</i> = 95	
40–50	1 (1.1)
51–55	6 (6.3)
56–60	13 (13.7)
61–65	35 (36.8)
> 65	30 (31.7)
Undecided	10 (10.5)

of Canadians to support the needs of the population. Given that more than 50% of medical students currently enrolled in Canadian medical schools are women, the imbalance between male and female thoracic surgeons in general should be further explored.<sup>5</sup> In this study, more than 65% of surgeons performing thoracic surgery in Canada are younger than 50 years, and only 10% are older than 60 years. This is in contrast to cardiac surgeons in Canada and the United States.<sup>6,7</sup> These latter groups report that more than half of the surgeons practising in that specialty are older than 55 years, and that 73% of the American workforce is expected to retire by 2019.<sup>6,7</sup> This reportedly older cohort forms the premise for many arguments predicting a severe manpower shortage of cardiac surgeons in Canada and the United States by 2020.<sup>6,8</sup> Given the younger cohort of attending thoracic surgeons in Canada, there does not appear to be an impending workforce shortage of thoracic surgeons in Canada, at least not in the near future. However, with regionalization and current surgical training, it is predicted that more, if not most, thoracic surgeons will practise exclusively thoracic surgery in the future, whereas 35% of thoracic surgeons in Canada currently have mixed practices. It is difficult to anticipate the impact this will have on workforce requirements in the future.

Most surgeons reported spending more than 8 years in training after medical school, with 45% possessing advanced degrees. More than 80% of respondents felt that both the duration of their training and the duration of training that is currently required of thoracic surgery residents in Canada are appropriate. Similar opinions were obtained from Canadian thoracic surgery residents and cardiothoracic surgery residents in the United States, who also agreed that the duration of training was appropriate and was not a factor in selecting a career in thoracic surgery.<sup>4,9</sup> These findings suggest that the current model of training in Canada, with the requisite completion of a 5-year general surgery residency followed by 2 additional years in thoracic surgery, is not excessive and is endorsed by the majority of the thoracic surgery community as providing the necessary training to obtain competency in the specialty.<sup>10</sup>

The scope of practice for thoracic surgery in Canada was first defined at a CATS consensus conference in 2001.<sup>2</sup> The expert panel at this conference proposed that the scope of practice include the diagnosis and management of diseases of the lungs, pleura and foregut, with care ideally being delivered at regional health centres by at least 2–3 fully certified thoracic surgeons. These centres would preferably be linked to a cancer treatment centre and a trauma unit. The survey suggests that attempts to regionalize thoracic surgical care in Canada have been successful, with more than 85% of surgeons performing thoracic surgery in groups of 2 or more surgeons. The majority of surgeons (90.4%) have some affiliation with a medical

school or university, and an approximately equal number of respondents practise in community hospitals or university teaching hospitals. This model of regionalized care is important for reducing duplication of resources and establishing multidisciplinary groups with expertise in thoracic cancer and trauma care. Evidence suggests that such high-volume assessment and operative teams improve patient outcomes and quality of care.<sup>11,12</sup> Furthermore, these centres that support a core group of thoracic surgeons help support surgeons in maintaining a good work–life balance by allowing an appropriate on-call schedule and allowing time off for continuing medical education. Additional efforts are necessary to refine regionalized models, as two-thirds of staff surgeon respondents reported working between 61 and 90 hours per week, with more than 50% reporting a 1 in 3 or 1 in 2 call schedule. These observations are important as we try to avoid surgeon burnout and promote thoracic surgery to the next generation of medical students and residents.

Our survey results confirm that most thoracic surgeons are primarily oncologic surgeons, in that more than 75% of clinical practices focus on the management of thoracic cancers. This underscores the importance of linking thoracic surgery groups with comprehensive cancer care centres.<sup>13</sup> Although most respondents felt their current operative case loads were appropriate, nearly half identified insufficient operating time as a factor delaying the delivery of care. The effect of smoking cessation programs and computed tomography screening programs on workload remains to be determined. Identifying operating room resources and preoperative testing as key factors in delaying cancer care is important for future resource allocation by local government health agencies. Thoracic surgeons need to generate accurate data to support resource allocation.

The outlook for the thoracic surgery workforce in Canada remains favourable. More than 80% of respondents reported being satisfied or very satisfied with their careers, with most staff surgeons (80%) reporting that they were unlikely to move in the next 2 years. These data, coupled with the relatively young age of practising surgeons and the reported retirement plans of respondents, suggest that currently there is no workforce shortage of thoracic surgeons in Canada, nor will there be a shortage in the foreseeable future.

### *Future directions*

Currently, CATS is carefully reviewing the data from this study. The data demonstrate clear differences in practice patterns between thoracic surgeons and cardiac surgeons in Canada and cardiothoracic surgeons in the United States. In addition, CATS is supporting a workforce study to assess long-term workforce needs for thoracic surgery in Canada.

## CONCLUSION

This survey characterizes surgeons performing thoracic surgery in Canada by providing specific demographic, satisfaction and scope of practice information. Despite challenges in obtaining adequate resources for providing timely care, job satisfaction among thoracic surgeons remains high, with little surgeon migration anticipated. A number of factors were identified that may impact on job opportunities for trainees in the future, including the relatively young age of the current thoracic surgery workforce and the expected age of retirement among practising surgeons. Although it is anticipated that 10% of thoracic surgeons may retire over the next 5–10 years, no workforce shortage of thoracic surgeons in Canada is foreseen at this time. Currently, CATS is supporting an ongoing workforce study to assess long-term provincial and national workforce needs in an effort to ensure timely comprehensive patient care and the appropriate allocation of training opportunities across the country now and in the future.

**Acknowledgements:** This study was made possible by a financial grant from the Canadian Association of Thoracic Surgeons. The authors would like to acknowledge the editorial assistance of Ms. Catherine MacPherson in the preparation of this manuscript. G. Darling is supported by the Kress Family Chair in Esophageal Cancer.

**Competing interests:** None declared.

**Contributors:** S. Grondin, C. Schieman, G. Darling, M. Palacios Mackay and G. Gelfand designed the study. S. Grondin acquired and analyzed the data, which was also analyzed by E. Kally, D.E. Maziak and M. Palacios Mackay. S. Grondin and C. Schieman wrote the article. All authors reviewed the article and approved its publication.

## References

- Mulder DS, McKeally MF. The education of thoracic and cardiac surgeons: a Canadian initiative. *Ann Thorac Surg* 1995;60:236-8.
- Darling GE, Maziak DE, Clifton JC, et al. The practice of thoracic surgery in Canada. *Can J Surg* 2004;47:438-45.
- Roos NP, Fransoo R. How many surgeons does a province need, and how do we determine appropriate numbers? *Healthc Manage Forum* 2001;14:11-21.
- Schieman C, Kelly E, Gelfand G, et al. Thoracic surgery training in Canada according to residents: The Thoracic Surgery Resident Survey, of the Canadian Thoracic Manpower and education Study (T-MED). *J Surg Educ* 2010;67:325-34.
- Burton KR, Wong IK. A force to contend with: the gender gap closes in Canadian medical schools. *CMAJ* 2004;170:1385-6.
- Vanderby SA, Carter MW, Latham T, et al. Modeling the cardiac surgery workforce in Canada. *Ann Thorac Surg* 2010;90:467-73.
- Sheimin R, Ikonomidis JS. Thoracic surgery workforce: Report of STS/AATS thoracic surgery practice and access task force — snapshot 2010. *J Thorac Cardiovasc Surg* 2012;143:39-46.
- Grover A, Gorman K, Dall TM, et al. Shortage of cardiothoracic surgeons is likely by 2020. *Circulation* 2009;120:488-94.
- Ouzounian M, Hassan A, Teng CT, et al. The cardiac surgery workforce: a survey of recent graduates of Canadian training programs. *Ann Thorac Surg* 2010;90:460-6.
- Edwards J, Kelly E, Schieman C, et al. Do new thoracic surgeons feel ready to operate? Self-reported comfort level of thoracic surgery trainees and junior thoracic surgeons with core thoracic surgery procedures. *J Surg Educ* 2011;68:270-81.
- Finley CJ, Jacks L, Keshavjee S, et al. The effect of regionalization on outcome in esophagectomy: a Canadian national study. *Ann Thorac Surg* 2011;92:485-90.
- Finley CJ, Bendszak A, Tomlinson G, et al. The effect of regionalization on outcome in pulmonary lobectomy: a Canadian national study. *J Thorac Cardiovasc Surg* 2010;140:757-63.
- Sundaresan S, Langer B, Oliver T, et al. Standards for thoracic surgical oncology in a single-payer healthcare system. *Ann Thorac Surg* 2007;84:693-701.