The Practice of Pathology in Canada

Decreasing Pathologist Supply and Uncertain Outcomes

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• ***Context.*—Pathology organizations in the United States are preparing for a new era of health care reform. Trends in the supply of pathologists in Canada's managed care system may provide some useful insights in any analysis and projection of future pathologist needs in the United States.**

***Objective.*—In this study, population-based Canadian databases were used to devise a parameter for physician supply, cancer cases per physician. The trend in this supply parameter for pathologists was compared to that for radiation oncologists.**

***Design.*—The number of Canadian pathologists and radiation oncologists and the annual number of new cancer cases in each of 2 years, 1999 and 2009, were extracted from reliable databases. Cancer cases per pathologist and oncologist were calculated, and relative trends in supply of physicians in both specialties were identified.**

***Results.*—The annual number of new cancer cases increased from 129 300 to 171 000 from 1999 to 2009. The absolute numbers of both pathologists and oncologists also increased in this time period. However, while the increase in the number of radiation oncologists led to an 8.2% decrease in cancer cases per radiation oncologist, the modest increase in the number of pathologists led to an increase of 17.1% in cancer cases per pathologist.**

***Conclusions.*—There is a trend toward a decreasing supply of Canadian pathologists relative to that of cancer demands. This finding confirms an earlier population-based study showing a decreased supply relative to population and number of clinical physicians. It is uncertain whether this decreased supply is a result of appropriate application of new, efficient methods or whether health care has been rationed or adversely impacted. Outcome measures to monitor Canadian pathology practice quality are clearly needed.**

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A variety of pathology organizations in the United States are engaged in an analysis of the current supply of pathologists and future needs.[1] However, the funding models for American medicine and pathology in the future are uncertain. A variety of payment reform models have been proposed or used, including primary care medical home, bundled payments, and partial and full capitation.[2,3] Most recently, another model, the Accountable Care Organization, has received much attention.[3] There is the possibility, perhaps likelihood, that pathology will be practiced within the patient-centered, institutional or system funding or single payer model.[4]

Canadian pathologists have practiced within such a funding model for many years. Pathology laboratories are funded by hospital, regional, or provincial programs that are responsible for patient care within a designated area. A recent Royal College of Physicians and Surgeons of Canada (RCPSC) survey of pathologists showed that approximately 80% of pathologists are retained on salary or contract (S. M. Woodcock, MBA, oral presentation, Nov 15, 2010). Less than 15% of pathologists have any fee-for-service component, although fee-for-service remuneration may supplement salary or contract remuneration in some areas (eg, province of Quebec). In contrast, most clinical physicians are remunerated using the fee-for-service method. No formula or workload measurement system has been adopted and applied throughout the country to determine the optimal pathologist staffing levels for pathology laboratories. Instead, hospitals, regions, and/or provinces attempt to minimize the ''fixed costs'' that laboratory service and pathologist remuneration represent to the overall health care system and to maximize the utilization of existing laboratories. The RCPSC survey identified the fact that frequently, funds that are designated for pathologist remuneration are reallocated to other areas of the laboratory, hospital, or health system if positions remain vacant. In addition, although some local and provincial quality management programs do exist, there is no pan-Canadian quality management program for pathology

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Cancer Cases Per Canadian Pathologist and Oncologist, 1999 Versus 2009					
	1999		2009		
Parameter	Number	Range[c]	Number	Range[c]	% of Change
Population, Canada	30,528,900	—	33,930,800	—	11.1
Physicians, Canada	56 990	—	68 101	—	19.5
Cancer cases[a]	129 300	±100	171 000	±100	32.3 ± 0.2
Pathologists[b]	1117	±34	1261	±38	12.9 ± 6.4
Cancer cases/pathologist	115.8	±3	135.6	±4	17.1 ± 6.5
Radiation oncologists[b]	302	±9	435	±13	44.0 ± 7.3
Cancer cases/oncologist	428.1	±13	393.1	±12	−8.2 ± 5.8

[a] New cases of cancer per year, excluding nonmelanotic skin cancers; data from National Cancer Institute of Canada.
[b] According to Canadian Institute for Health Information Supply, Distribution and Migration of Canadian Physicians data for all practicing pathologists (general, anatomic, neuro-, and hematopathologists) and radiation oncologists, excluding residents and military.
[c] see *Material and Methods* for an explanation of range of uncertainty.

laboratories to provide oversight of or guidelines for pathologist practice.

The trends in the supply of pathologists that have occurred under the current Canadian payment model for pathologists may provide some useful insights for American pathology organizations as they develop projections of future needs for pathologists in an uncertain funding environment. A previous study of Canadian pathologist supply relative to population and numbers of clinical physicians and radiation oncologists has raised concerns.[5] In the current study, a population-based perspective of the trends in pathologist supply in Canada relative to trends in the incidence of cancer was developed. Cancer incidence was chosen as a benchmark because diagnosis, prognostication, and exclusion of this disease is a major component of surgical and cytopathology practice and because reliable pan-Canadian statistical databases are available for analysis. Two questions were posed: has the trend in Canadian pathologist supply kept pace with cancer rates and how does the growth in Canadian pathologist supply compare to that in oncologist supply?

MATERIAL AND METHODS

The average numbers of cancer cases per Canadian pathologist and radiation oncologist were calculated for the years 1999 and 2009. The numbers of Canadian pathologists and radiation oncologists were extracted from the ''*Supply, Distribution, and Migration of Canadian Physicians*'' reports of the Canadian Institute for Health Information.[6] The Canadian Institute for Health Information is a not-for-profit independent organization created by federal, provincial, and territorial governments. Data are verified through cross-reference with databases of the RCPSC and the Collége des Médicins du Québec. Residents, military, nonlicensed, and semiretired physicians are excluded from the database. Pathologists include those practicing general, anatomical, and neuro- and hematopathology specialties. Radiation oncology was chosen as a comparator because it was the only oncology specialty with data available during the time period of this study. The annual numbers of new cases of invasive cancer, excluding nonmelanotic skin cancers, for the 2 years of this study were extracted from the Canadian Cancer Statistics of the National Cancer Institute of Canada, the most comprehensive database for clinical cancer cases in Canada.[7]

We assessed confidence in our results by using a traditional error propagation analysis. In this analysis, we took error to be cumulative in operations involving addition or subtraction and summed in quadrature (ie, square root of the sum of the squares) in operations involving multiplication or division.[8] This allowed the change in a given variable over the 1999 to 2009 period to be characterized as significant if it did not lie within an error of zero. Similarly, relative changes between two variables were characterized as significantly different if they did not lie within one error of each other. As the National Cancer Institute of Canada reports the annual number of cancer cases to the nearest hundredth, we took this as the measure of uncertainty (or range) in the number of cancer cases (ie, ±100). The Canadian Institute for Health Information does not explicitly report an uncertainty (or range) associated with the number of Canadian pathologists and radiation oncologists. Therefore, we conservatively assumed an uncertainty of ±3% in the reported number of practicing pathologists and radiation oncologists in both 1999 and 2009.

RESULTS

The Table shows the annual number of cancer cases, numbers of practicing pathologists and radiation oncologists, and the number of cancer cases per pathologist and radiation oncologist for the years 1999 and 2009. During this decade, the annual number of cancer cases increased 32.3 ± 0.2%. In comparison, the relative increase in the number of practicing pathologists was significantly less than that value (12.9 ± 6.4%), while the relative increase in the number of practicing radiation oncologists was significantly greater than that value (44.0 ± 7.3%). Consequently, pathologists experienced a 17.1 ± 6.5% relative increase in case load during the decade, while radiation oncologists experienced an 8.2 ± 5.8% relative decrease in case load. These data indicate a decreased supply of pathologists and an increased supply of radiation oncologists relative to the growth of cancer cases.

DISCUSSION

A previous study showed that the supply of Canadian pathologists decreased relative to population and numbers of clinical physicians and radiation oncologists during the decade 1998 to 2008.[5] During this time period, the overall supply of physicians increased by 4.8% in order to meet the health demands of an increasingly elderly population. In contrast, the population to pathologist ratio increased by 1.4%, indicating a decreased supply of pathologists. As a result, the clinical physician to pathologist ratio increased by 7.5%, so each pathologist

was ''supporting'' more clinical physicians. Finally, during this time period, the supply of radiation oncologists increased by 11.9%.

This study sought to identify other parameters of pathologist supply in a key area of pathology practice, cancer diagnosis. Canadian pathologists allocate more of their professional time to surgical pathology than to any other laboratory activity. Consequently, although the designation of cancer case load per pathologist as a measurement of pathologist supply is a crude and incomplete measure of pathologist activity, this measure does reflect the predominant daily activity of most pathologists. It does have significant limitations because it does not reflect the specimen load received from nonmalignant diseases, particularly those received from the expanding clinical activities of dermatopathology and renal, gastrointestinal, perinatal, and hepatopathology. Also, this parameter does not measure the major impact on pathology practice brought on by recently adopted and/or expanded screening programs for breast, colon, and prostate carcinoma. Similarly, the clinical pathology service performed by general pathologists, who perform both anatomical and clinical services, is not captured by this measure. It is certain that this measure of cancer cases per pathologist understates the overall workload increase resulting from the combination of malignant, nonmalignant, and clinical pathology. Nevertheless, in the absence of any pan-Canadian workload measurement system, this parameter can be used as a measure, albeit imperfect, of pathologist activity. Of course, this parameter is not inclusive of the increasing case complexity in cancer case reporting and the increasing requirement for quality assurance activities.

The annual numbers of both cancer cases and pathologists increased in Canada during the period from 1999 to 2009, but the relative increase in pathologists was significantly less (Table), resulting in a 17.1% increase in case load during the decade. In contrast, the number of practicing radiation oncologists grew at a higher rate than that of cancer cases, leading to an 8.2% reduction in case load. A comparison of the absolute case load of pathologists with that of radiation oncologists is inappropriate because oncologists focus exclusively on cancer treatment, while pathologists consult on many other nononcologic specimens. What are the possible explanations for the different supply trends of pathologists and radiation oncologists? The practice environment of radiation oncologists is distinctly different from that of pathologists, which has been described above. The Canadian Association of Radiation Oncologists has adopted standards for the practice of radiation oncology, which include maximal annual case loads.[9,10] When the annual case load exceeded those standards, resulting in prolonged waiting times for consultation and management, both the federal and provincial governments adopted uniform measures of waiting times. Financial penalties were applied by the federal government in the event that a province's waiting times for radiation treatment failed to meet benchmarks.[11] This program continues to provide a strong incentive for the funding of both training and practice positions in radiation oncology by the provinces. As previously noted, in contrast to radiation oncology, no pan-Canadian pathology standards or monitoring have been adopted.

Given that the supply of pathologists is decreasing in the absence of any outcome measures, 3 questions remain to be answered: how has this decreased supply occurred; is this decreased supply appropriate in a modern pathology laboratory; and has this decrease had an adverse impact on patient care?

In order to explain how a decreased supply has occurred, it is necessary to give a basic description of Canadian health care for American and non-Canadian readers. In Canada, the principles for universal health care and provision of a single payer health care system are embedded at the federal level, whereas the provinces (ie, states) are responsible for the actual provision and funding. With few minor exceptions, all pathology services are designated as essential and insured services within the single payer system. Because insured services cannot be purchased by any health care consumer outside of the health care system, a controlled market has been established.

Within this controlled market, pathologist supply is determined by 3 interrelated mechanisms: the funding of permanent positions, the availability of new pathologists, and the residency choice by medical students.

The single payer is the sole funder of all permanent pathologist positions. Both the number and attractiveness of permanent pathologist positions are determined either directly by provincial health agencies or indirectly through delegated regional health authorities or hospitals. Salary and contract arrangements, rather than fee-for-service, are widely preferred by provincial agencies. Any increment in the number of salaried or contracted pathologist positions is provided by the hospital, region, or province only after discussions or negotiations with pathologists or laboratory chiefs. Such increments frequently lag or do not match case volume and complexity growth. No pan-Canadian data are available, so it is not possible to determine vacancy rates for existing pathologist positions. Anecdotal evidence suggests that most pathology laboratories in metropolitan areas throughout Canada have few vacancies but that positions in rural areas are less attractive, resulting in persistent challenges in recruiting pathologists to these areas.

Provincial health agencies are also the sole funders of residency training positions. This provides an opportunity to match pathologist supply through the creation of new pathologists with anticipated provincial needs. The RCPSC, a body created by the federal government, oversees training requirements and is responsible for certifying specialists throughout Canada. Most practicing pathologists of both Canadian and international medical origins have been certified by the RCPSC following completion of residency training, in whole or in part, within RCPSC programs. (Until very recently it was uncommon for international pathologists to immigrate and obtain a practice license through a provincial licensing body without at least some RCPSC residency training.) Provinces attempt, with varying success, to tailor the number of residency positions to anticipated provincial needs and strategic plans. However, certified pathologists are still free to move throughout Canada, subject to provincial (state) licensing requirements, as is the practice in the United States.

The third determinant in the supply of pathologists is the attractiveness of the career of pathology to medical students. In 2009, 2349 Canadian and 211 international and American medical graduates applied to the Canadian Resident Matching Service for a first-year residency

position. Data from this program indicated that pathology is less attractive to medical students than other specialties and family medicine.[12] In 2009, 9 of 33 pathology positions (27%) for Canadian applicants of the Resident 1 match were vacant after the first iteration, which was twice the vacancy rate for all disciplines combined (13.5%). Trends appear to be similar among international graduates, only 0.8% of whom chose any pathology discipline in the first iteration match of 2009. Following a second iteration match for both Canadian and international medical graduates, 2 of 33 positions (6%) remained unfilled. In 4 of the 6 years from 2004 to 2009, pathology positions remained unfilled. Of the 71 Canadians who applied to any pathology program in 2009, only a single person applied to only the pathology discipline. A recent Canadian study has shown that pathology is often not even considered as a career among final-year medical students.[13] There are numerous factors that can influence students' career choices. This study suggests that a lack of professional autonomy may be an additional factor of increasing importance for the career of pathology.

Is this decreased supply appropriate for modern pathology practice, or has it had an adverse impact on patient care? This study does not provide data to examine the relative contributions of appropriate, more efficient methods that have been adopted by Canadian pathologists to handle larger average case loads and the inappropriate rationing of care and increasing workloads. Just as in the United States, there have been a number of laboratory trends that could have led to greater efficiencies, including the widespread use of pathologist assistants, the adoption of new information technology and lean production, the consolidation of laboratories and creation of large regional systems, and subspecialization. In the RCPSC survey, 56% of pathologists stated that the subspecialization of pathology reporting was occurring within their laboratory. On the other hand, there are instances of lengthening turnaround times, inability to access subspecialist consultations, and difficulty in the implementation of the College of American Pathologists (CAP) synoptic reporting lists. For example, the RCPSC survey also identified the fact that increasing workload was the number one challenge facing the pathology profession, yet two-thirds of laboratories had not defined workload limits or norms. There are no data from this study or, indeed, from any available Canadian sources to determine whether the decreased supply of pathologists has had an adverse impact on cancer care. Whether recent significant and widely reported misadventures in surgical pathology can be regarded as ''sentinel events'' indicating underlying systemic failures secondary to decreased pathologist supply is unknown.[14–16]

Because no definite conclusion can be drawn regarding the appropriateness and impact of decreased pathologist supply, it is premature to conclude that Canada's managed care system has had an adverse effect on pathology services, but outcome measures specific to pathology practice are clearly needed to monitor the ongoing quality of pathology practice.

Can our new parameter, cancer cases per pathologist, be used to compare staffing levels between jurisdictions or countries? Because pathologists' duties vary among different systems, extreme caution should be exercised in making such comparisons. For example, pathologists in the United States frequently are trained in both anatomic and clinical pathology, and many pathologists subsequently have responsibilities in the clinical laboratory. In contrast, most pathologists and laboratory medicine specialists in Canada qualify and practice in only a single discipline (eg, hematopathology, microbiology, or anatomic pathology). Numbers of both new and practicing general pathologists, the Canadian specialty most comparable to the anatomic and clinical pathology (AP/CP) program seen in the United States, are diminishing rapidly.

In summary, this study has developed a Canadian population-based parameter, annual cancer cases per pathologist and radiation oncologist, to measure physician supply. In contrast to the trend in radiation oncologist supply, the average cancer case load for pathologists has increased significantly during the last decade. This finding is consistent with previous population-based data that concluded Canadian pathologist supply is decreasing. It is uncertain whether this decreased supply is a result of appropriate application of new, efficient methods or whether pathology services have been rationed and health care adversely impacted. Data indicate that during the last decade, resources for clinical physicians have been increased disproportionately to those for pathologists, resulting in a growing gap. These trends in pathologist supply in Canada's single payer system cannot be immediately translated to the complex situation and choices facing health care and laboratories in the United States. Our data do suggest that as American pathology organizations develop models for predicting pathologist supply in a new era of managed care, they must consider the possibility, or likelihood, that managed care can lead to significant downward pressures on the supply of pathologists.

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References

1. College of American Pathologists. House of Delegates agenda books and reports: Spring 2011 House of Delegates minutes. http://www.cap.org/apps/docs/house_of_delegates/draft_hod_mins_11.pdf. Accessed August 29, 2011.

2. Seton Hall University School of Law. Health reform watch: a guide to accountable care organizations and their role in the Senate's health reform bill. Health Law and Policy Program Weblog. http://www.healthreformwatch.com/2010/03/11/a-guide-to-accountable-care-organizations-and-their-role-in-the-senates-health-reform-bill/. Accessed August 29, 2011.

3. Fisher ES, Staiger DO, Bynum JPW, Gottlieb DJ. Creating accountable care organizations: the extended hospital medical staff. *Health Affairs*. 2007;26 (1): w44–w57.

4. Remsen N. Governor Shumlin signs health care reform bill. *Burlington Free Press*. May 26, 2011. http://pqasb.pqarchiver.com/burlingtonfreepress/access/2359123331.html?FMT=ABS&FMTS=ABS:FT&type=current&date=May+26%2C+2011&author=Nancy+Remsen&pub=The+Burlington+Free+Press&edition=&startpage=n%2Fa&desc=Gov.+Shumlin+signs+health+care+reform+bill. Accessed August 29, 2011.

5. Pollett AP, Lajoie G, Colgan TJ. Canadian laboratory physician supply: falling behind. *Can J Pathol*. 2011;3(1):12–17.

6. Canadian Institute for Health Information Website. http://www.cihi.ca/CIHI-ext-portal/internet/EN/TabbedContent/spending+and+health+workforce/workforce/physicians/cihi010672. Accessed August 29, 2011.

7. Canadian Cancer Society. Canadian cancer statistics. http://www.cancer.ca/Canada-wide/about%20cancer/Cancer%20statistics/Past%20statistics.aspx?sc_lang=en. Accessed August 29, 2011.

8. Taylor, JR. *An Introduction to Error Analysis*. 2nd ed. Sausalito, CA: University Science Books; 1997.

9. Canadian Association of Radiation Oncologists. CARO Manpower report: manpower study report (1999). http://www.caro-acro.ca/Assets/Publications/CARO+Manpower+Report+1999.pdf?method=1. Accessed August 29, 2011.

10. Wong F. Canadian Association of Radiation Oncologists—Definition of Radiotherapy Waiting (September 22, 2000). http://www.caro-acro.ca/Assets/Publications/

Manpower+and+Standards+of+Care+in+Radiation+Oncology+Committee+-+Definition+of+RT+Waiting+-+September+2000.pdf?method=1. Accessed August 29, 2011.

11. Canadian Institute for Health Information. Wait times in Canada—a comparison by province, 2011. March 2011. https://secure.cihi.ca/estore/productSeries.htm?pc=PCC395. Accessed August 29, 2011.

12. Canadian Resident Matching Service. Reports and statistics 2009. http://www.carms.ca/eng/operations_R1reports_09_e.shtml. Accessed August 29, 2011.

13. Hung T, Jarvis-Selinger S, Ford JC. Residency choices by graduating medical students: why not pathology? *Hum Pathol*. 2011;42(6):802–807.

14. Ontario Ministry of Health and Long-Term Care. *Report of the Investigators of Surgical and Pathology Issues at Three Essex County Hospitals: Hotel-Dieu Grace Hospital, Leamington District Memorial Hospital and Windsor Regional Hospital, July 2010*. http://www.health.gov.on.ca/en/public/publications/ministry_reports/surgical_pathology_issues/docs/surgical_pathology_issues.pdf. Accessed August 29, 2011.

15. Government of Newfoundland and Labrador. *Commission of Inquiry on Hormone Receptor Testing, 2009*. http://www.releases.gov.nl.ca/releases/2009/health/Volume1_Investigation_and_Findings.pdf. Accessed August 29, 2011.

16. Department of Health, New Brunswick. *Response to: Commission of Inquiry into Pathology Services at the Miramichi Regional Health Authority*. February 2009. http://www.gnb.ca/0051/pub/pdf/2009/5998e.pdf. Accessed August 29, 2011.