

Using administrative databases to measure waiting times for patients undergoing major cancer surgery in Ontario, 1993–2000

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Purpose: To determine how long patients in Ontario waited for major breast, colorectal, lung or prostate cancer surgery in the years 1993–2000. **Methods:** “Surgical waiting time” was defined as the interval from date of preoperative surgeon consult to date of hospital admission for surgery. We created patient cohorts by linking appropriate diagnosis and procedure codes from Canadian Institutes of Health Information data. Scrambled unique surgeon identifiers were obtained from Ontario Health Insurance Plan data. Changes in median surgical waiting times were assessed with univariate time-trend analyses and multilevel models. Models were controlled for year of surgery and other patient (age, gender, comorbid conditions, income level, area of residence) and hospital level characteristics (teaching status, procedure volume status). **Results:** Compared with 1993, median surgical waiting times in the year 2000 increased 36% for patients with breast cancer (to 19 d), 46% with colorectal (to 19 d), 36% with lung (to 34 d) and 4% with prostate cancer (to 83 d). Multilevel models confirmed significant increases in waiting times for all procedures. There were no concerning or consistent differences in waiting times among the categories of hospitals and patients examined. **Discussion:** There were significant increases in surgical waiting times among patients undergoing breast, colorectal, lung or prostate cancer surgery in Ontario over years 1993–2000. Administrative databases can be used to efficiently measure such waits.

Objet : Déterminer combien de temps des patients de l’Ontario ont attendu avant de subir une chirurgie majeure contre un cancer du sein, du poumon, de la prostate ou un cancer colorectal entre 1993 et 2000. **Méthodes :** Le temps d’attente avant la chirurgie a été défini comme étant l’intervalle entre la consultation préopératoire avec le chirurgien et l’admission à l’hôpital pour la chirurgie. Nous avons créé les cohortes de patients en reliant les codes de diagnostic et d’intervention appropriés tirés des données de l’Institut canadien d’information sur la santé. Des identificateurs codés uniques ont été obtenus pour les chirurgiens à partir de données sur le Régime d’assurance-maladie de l’Ontario. Les changements au chapitre du temps d’attente médian avant la chirurgie ont été évalués au moyen d’analyses à une variable des tendances temporelles et de modèles multiniveaux. Les modèles tenaient compte de l’année au cours de laquelle la chirurgie a été pratiquée et des caractéristiques des patients (âge, sexe, comorbidité, revenu, lieu de résidence) et des hôpitaux (hôpital d’enseignement, volume d’interventions). **Résultats :** En 2000, les temps d’attente médians avant chirurgie chez les patients ayant subi une intervention contre un cancer du sein (19 j), un cancer colorectal (19 j), un cancer du poumon (34 j) ou un cancer de la prostate (83 j) étaient considérablement plus longs que ceux enregistrés en 1993, qu’ils dépassaient de 36 %, 46 %, 36 % et 4 %, respectivement. L’utilisation des modèles multiniveaux a démontré que ces constatations étaient significatives pour toutes les interventions. L’examen des groupes d’hôpitaux et de patients n’a pas révélé de différences préoccupantes ou régulières au chapitre du temps

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d'attente. **Conclusion :** Nos constatations sur l'accroissement significatif des temps d'attente avant une chirurgie contre le cancer du sein, du poumon, de la prostate ou le cancer colorectal en Ontario au cours de la période de 1993 à 2000 indiquent que les bases de données administratives peuvent servir à mesurer efficacement ces périodes d'attente.

Lengthy waits for cancer services may harm patients by causing psychological distress¹⁻³ or lessening the effectiveness of available treatments.⁴⁻⁷ Waiting times for surgery are of particular relevance, since for most patients with cancer the cornerstone of curative therapy is surgical extirpation of the offending lesion.⁸ Moreover, in countries such as Canada, where cancer is a leading cause of death and disability, problems with access to cancer treatments likely run parallel to problems with general access to medical care.

There is a paucity of information on actual waiting times for cancer surgery in most jurisdictions. Currently in a number of Canadian provinces patient waiting lists are being created for cancer and most other major surgeries.⁹⁻¹⁰ Such efforts are important, since it is probable that policy-makers and administrators will only respond to perceptions of worrisome delays when perceptions are corroborated by data. But surgical waiting lists require considerable resources to maintain, and are subject to gaming or poor management by physicians; implicit assumptions that patients will welcome the chance to be referred to regions with shorter waits or even better outcomes are not necessarily true.¹¹⁻¹⁶

Administrative databases at the provincial level may provide a more efficient method of assessing waiting times. Such databases contain comprehensive information on all patients treated within a given geographic area.¹⁷ In our study we used such Ontario hospital discharge data and physician billing data to determine how long patients in Ontario waited for breast, colorectal, lung or prostate cancer surgery in years 1993 to 2000. We also determined how hospital and patient characteristics influenced waits for cancer surgery.

Methods

We defined surgical waiting time as the interval between 2 key events for patients undergoing major cancer surgery (for breast, colorectal, lung or prostate cancer): the date of the preoperative consult by the surgeon who does the surgery, and the date of admission to hospital for the operative procedure. It is during this interval that a surgeon will request test results and consults from other specialists to assist in treatment decisions, as well as operating-room time.

As sources of data, we used databases of the Canadian Institute for Health Information (CIHI) and the Ontario Health Insurance Plan (OHIP) from *fiscal years* 1991 through 2000. The CIHI database contains information on all patients discharged from Ontario hospitals. The OHIP database contains billing information from individual clinicians across the province. OHIP officials routinely assess billing patterns and audit individual clinicians to ensure billing accuracy. Researchers have reported¹⁸⁻²¹ that these databases contain accurate and comprehensive information for many data fields, such as major diagnoses, major procedures, admission date, length of stay and discharge status of patients.

Deyo and colleagues' validated modification²² of a comorbidity index for the ICD-9-CM database was used to define comorbidity. Postal Code Conversion File Plus (Ottawa: Statistics Canada; 2001) incorporates Canadian census data from 1996; we used PCCF+ to link postal codes for all patients to household income (adjusted for household size) and rural versus urban place of residence. Patient cohorts were divided into 5 income levels — high, high-medium, medium, low-medium and low —

each of which contained approximately equal numbers of patients. Calculations for hospital procedure volume considered the administrative merging of institutes over time. Teaching hospitals were affiliated directly with a medical school.

Linking relevant CIHI diagnosis and procedure codes allowed the identification of patients with breast, colorectal, lung or prostate cancer who were treated with major extirpative surgery in 1993 through 2000. Patients were assigned to the *calendar year* in which they were admitted to hospital for surgery. For each diagnosis and for each patient only the first admission for major cancer surgery was used, thereby decreasing the likelihood of measuring waits for recurrent cancer surgery. Patients from the CIHI cohorts were then linked to OHIP data by means of unique patient identifiers: encrypted health card numbers. An OHIP procedure bill was accepted as the definitive cancer surgery bill if the billing date was during, 7 days prior to, or 7 days after the CIHI date of admission. Finally, preoperative consult bills were linked to surgical procedure bills via encrypted unique physician identifiers, which are attached to all OHIP bills.

We limited our time window for pre-surgery consult to 4 months for patients with breast, colorectal or lung cancer, to avoid including pre-surgery consults for other unrelated surgical issues. For patients with prostate cancer we extended this to 12 months, since many consults occurred more than 4 months before surgery. For patients with 2 or more consults in the relevant time window we selected the consult closest to surgery as our anchor point, though we also assessed how selecting the first consult would affect the results.

Patients were excluded from the

study if their consult occurred the day prior to or during the hospital admission; we speculated that such a waiting time was for emergency surgery. For all cancer sites but the breast, if the length of hospital stay was ≤ 1 day and the patient was discharged alive, the admission was excluded since we judged that recovery from major cancer surgery could not have occurred in such a short time. Patients treated at Southeastern Academic Medical Organization hospitals were also removed; with the initiation of an alternate funding plan for physicians in 1994 the accuracy and comprehensiveness of OHIP billing is likely incomplete.²³ Patients with cancer in any site(s) except prostate were excluded if they received chemotherapy or a consultation with a radiation oncologist within 4 months before surgery.

We used descriptive, univariate and multivariate analyses of data. All tests of hypothesis were 2-sided and significant if $p \leq 0.05$. Univariate regression was used to examine linear time trends in numerous patient and outcome measures, including median surgical waiting times. Multivariate multilevel linear models were designed to consider clustering of the patient data at the hospital level.²⁴ Year of surgery and log-transformed surgical waiting time were independent and dependent variables, respectively. Other covariates of inter-

est included patient demographics (age, gender, income level and area of residence) and comorbid conditions, and hospital teaching status and procedure volume levels. Residual analyses were performed to assess normality. When a propensity was noted for hospitals with high versus low procedure volumes to be teaching centres, we measured for interactions among the hospital teaching and procedure-volume groups. All analyses were done with Stata (version 6.0, Stata Corporation, College Station, Tex.) and SAS (version 8.2, SAS Institute Inc., Cary, NC).

The study received ethics approval from the Sunnybrook and Women's College Health Sciences Centre Research Ethics Board.

Results

We linked 95% of eligible patients in the CIHI database to an OHIP procedure bill; the range for the 4 cancer sites was 93%–97%. We linked 86% of eligible patients in the CIHI database to both an OHIP procedure and a consult bill; range for the 4 sites was 86%–88%. There was more than 1 consult bill from the operating surgeon in the relevant time window for 1% of patients undergoing breast, 2% colorectal, 1% lung and 3% prostate cancer surgery, respectively. Using the first rather than the most proximate consult as

the anchor point of the surgical waiting time for these patients did not change the magnitude or significance of our results. The consult of interest was dated the day before or during hospital admission for 22% of patients with colorectal cancer; this percentage declined through time. Consultations dated in this interval rarely occurred for other sites of cancer.

Numbers of patients and their median and 75th-percentile surgical waiting times for cancer surgery are shown in Table 1. In the year 2000 there were 14% more patients undergoing surgery for breast cancer than in 1993; 33% more for colorectal; 2% more for lung; and 96% more for prostate cancer surgery than in 1993. Median surgical waiting times increased for all sites of cancer: by 36% for breast, 46% for colorectal, 36% for lung and 4% for prostate cancer surgery. These increases were significant for all but prostate cancer.

Multilevel regression models revealed significant proportional increases in median surgical waiting times from 1993–1994 to 1999–2000. Patients undergoing breast cancer surgery had a proportional increase in waiting period of 25%; colorectal, 34%; lung, 36%; and prostate cancer surgery, 5%. Other factors associated with longer delays in waiting time included elderliness of patients (for all sites but prostate) and presence of 1 or more comorbidities

Table 1

Case volumes and median (and 75th-percentile) surgical waiting times for cancer surgery in Ontario, 1993–2000

Year	Breast cancer cases		Colorectal cancer cases		Lung cancer cases		Prostate cancer cases	
	Patients, n	Median wait (and 75th %ile), d	Patients, n	Median wait (and 75th %ile), d	Patients, n	Median wait (and 75th %ile), d	Patients, n	Median wait (and 75th %ile), d
1993	4479	14 (25)	2642	13 (23)	943	25 (40)	798	80 (124)
1994	4655	15 (24)	2929	14 (26)	869	26 (43)	894	83 (126)
1995	4799	14 (23)	2930	14 (27)	931	28 (45)	876	96 (140)
1996	4922	15 (24)	3007	14 (25)	892	27 (42)	1106	107 (158)
1997	5239	16 (27)	3087	15 (28)	1071	29 (46)	1411	99 (151)
1998	5138	16 (27)	3294	16 (29)	1068	32 (47)	1369	99 (157)
1999	5245	18 (31)	3391	19 (33)	977	33 (50)	1481	92 (134)
2000	5127	19 (31)	3510	19 (34)	965	34 (51)	1565	83 (120)

*Linear change in median wait over single years: $p < 0.001$.

(all sites; Table 2). Patients in the low- versus high-income group had longer waits for breast (estimate 1.04, 95% confidence interval [CI] 1.02–1.06, $p \leq 0.001$) and colorectal surgery (estimate 1.05, CI 1.02–1.08, $p = 0.001$). The median wait in teaching centres was shorter for patients with prostate cancer (estimate 0.85, CI 0.73–0.99, $p = 0.042$) than in non-teaching hospitals, but longer for those with breast cancer (estimate 1.16, CI 1.01–1.32, $p = 0.032$). Hospital procedure volume had no significant effect on surgical waiting times; neither were there significant hospital level interactions for any of the 4 sites.

Discussion

Queues and accompanying periods of delay for a medical service are often viewed as the reasonable price paid by Canadians for a health system that promises universal, comprehensive and accessible care.^{25–27} As well, some pre-surgical delay should be expected to allow patients and physicians to optimize treatment decisions. Recently, however, some have questioned if the implicit ra-

tioning of care in Canada through organized or informal queues has become excessive.^{26–28} There is a surprisingly paucity of data on how long patients do wait for most medical services, a prerequisite for further discussion and decision-making. Our study found that increases in surgical waiting times in Ontario for breast, colorectal, lung and prostate cancer operations over years 1993 to 2000 were significant. Such information is especially important in the Canadian health care debate since cancer in this country is a major source of morbidity and mortality.

Our results add to results from 2 studies^{29,30} that also used administrative databases to measure waiting times for surgery. Mayo and associates²⁹ showed that for patients from Quebec, the median interval from first diagnostic procedure to breast cancer surgery had increased 45% from 1991 to 1998. (The interval from surgeon consult to surgery was not reported in their results.) Decoster and colleagues³⁰ found that surgical waiting times in the province of Manitoba had not increased significantly from 1991 to 1995. Of the 10 procedures examined, only major

breast surgery was cancer-related. It is of interest that in our investigation the increases in surgical waiting times for breast cancer were most pronounced after 1995. These 2 reports and our own demonstrate that in Canada cancer surgery waits can be efficiently measured by use of administrative databases. Such measuring, and comparisons among jurisdictions, can encourage the focusing of attention on access to surgical care for patients diagnosed with cancer.

There were no concerning or consistent differences in surgical waiting times observed among the hospital and patient groups examined. The longer waiting times seen for elderly patients and those with comorbidities are understandable; such patients often require relatively more preoperative tests, consults or preparation for the operating room. The lengthier median waits for breast (4% longer) and colorectal surgery (5% longer) for patients in low- versus high-income groups were probably of little clinical importance. Hospital teaching status influenced waiting times inconsistently: patients treated in teaching hospitals experienced longer waits for breast surgery, short-

Table 2

Estimates* of adjusted proportional change in median surgical waiting time (and 95% confidence intervals) for patients undergoing cancer surgery in Ontario, 1993–2000

Explanatory variable*	Breast cancer	Colorectal cancer	Lung cancer	Prostate cancer
Age of 70 yr or more	1.14 (1.12–1.16) [†]	1.06 (1.04–1.08) [†]	1.13 (1.10–1.17) [†]	1.01 (0.97–1.06)
Male	NA	1.03 (1.00–1.05) [‡]	1.00 (0.96–1.03)	NA
Comorbidity ≥ 1	1.04 (1.01–1.07) [‡]	1.05 (1.02–1.08) [§]	1.07 (1.04–1.11) [†]	1.08 (1.03–1.12) [§]
Low + low-median income	1.04 (1.02–1.06) [†]	1.05 (1.02–1.08) [§]	1.04 (1.00–1.09)	1.03 (0.99–1.07)
Medium + medium-high income	1.02 (1.00–1.04)	1.03 (1.01–1.06) [‡]	1.03 (0.98–1.07)	1.03 (1.00–1.07)
Rural setting	0.99 (0.97–1.02)	1.00 (0.96–1.03)	0.99 (0.95–1.03)	0.87 (0.83–0.90) [†]
Teaching hospital	1.16 (1.01–1.32) [‡]	0.91 (0.81–1.02)	0.98 (0.81–1.18)	0.85 (0.73–0.99) [‡]
Low-volume hospital	0.94 (0.84–1.06)	1.02 (0.90–1.15)	1.26 (0.94–1.69)	1.15 (0.93–1.43)
Medium-volume hospital	1.00 (0.88–1.14)	1.03 (0.91–1.18)	1.26 (0.92–1.72)	1.13 (0.90–1.42)
1995–1996	1.00 (0.98–1.03)	1.05 (1.02–1.09) [§]	1.09 (1.04–1.14) [†]	1.18 (1.13–1.24) [†]
1997–1998	1.11 (1.09–1.14) [†]	1.16 (1.12–1.20) [†]	1.23 (1.18–1.29) [†]	1.16 (1.11–1.21) [†]
1999–2000	1.25 (1.22–1.27) [†]	1.34 (1.30–1.39) [†]	1.36 (1.30–1.43) [†]	1.05 (1.01–1.10) [‡]

* Estimates >1.00 indicate a proportional increase in median surgical waiting time compared to the baseline group; estimates <1.00 , a proportional decrease. Baseline group: age <70 yr, female, comorbidity = 0, high income, urban, non-teaching, high-volume hospital, years 1993–1994.

[†] $p < 0.001$

[‡] $p < 0.05$

[§] $p < 0.01$

er waits for prostate surgery, and similar waits for colorectal and lung surgery than those in non-teaching hospitals. Hospital procedure volumes appear to be unrelated to changes in waiting times.

A key question is whether the waiting times observed in this study were excessive or harmful to patients. There is little evidence that such delays (in 2000, a median of 19 d for breast cancer surgery, 19 d for colorectal, 34 d for lung and 83 d for prostate) have a negative impact on clinical outcomes such as operative mortality or long-term survival. That such evidence will be forthcoming is unlikely, given that cancer tumours typically grow over months and years prior to clinical presentation.⁸ Nevertheless, increased waits are known to increase psychological distress for patients and their families.¹⁻³ We suggest that it is ultimately society that must decide, through interested stakeholders, what constitutes an acceptable wait. For example, was it acceptable in the year 2000 that 25% of patients awaited lung cancer surgery for at least 51 days?

There are limitations in our study. Although some may question the use of retrospective administrative data to measure surgical waiting times, the accuracy and comprehensiveness of the databases used here have, as mentioned, been assessed previously.¹⁸⁻²¹ Waits in our study are also comparable to those from study data collected prospectively on 547 patients in the year 2000 by surgeons affiliated with an Ontario regional cancer centre,³¹ which furnished median waits from surgeon consult to admission of 24 days for breast cancer, 22 days for colorectal, 29 days for *thoracic*, and 43.5 days for prostate cancer operations [M. Simunovic, unpublished data, 2001]. Our current study also lacks cancer staging information. Yet our main interest was to measure waiting times for all of Ontario, across time, and by various patient and hospital characteristics. Since it is unlikely there

were major changes in disease stage over the years 1993 to 2000, we do not believe a lack of staging data biased our results.

In conclusion, over years 1993 to 2000 patients from Ontario undergoing breast, colorectal, lung or prostate cancer surgery experienced significant increases in surgical waiting times. There were no concerning or consistent differences in waiting times among the examined hospital and patient groups. Administrative databases can be used to efficiently measure waiting times for cancer surgery.

Competing interests: None declared.

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