

Minerva Access is the Institutional Repository of The University of Melbourne

Author/s:

Pang, HYM;Chalmers, K;Landon, B;Elshaug, AG;Matelski, J;Ling, V;Krzyzanowska, MK;Kulkarni, G;Erickson, BA;Cram, P

Title:

Utilization Rates of Pancreatectomy, Radical Prostatectomy, and Nephrectomy in New York, Ontario, and New South Wales, 2011 to 2018

Date:

2021-04-19

Citation:

Pang, H. Y. M., Chalmers, K., Landon, B., Elshaug, A. G., Matelski, J., Ling, V., Krzyzanowska, M. K., Kulkarni, G., Erickson, B. A. & Cram, P. (2021). Utilization Rates of Pancreatectomy, Radical Prostatectomy, and Nephrectomy in New York, Ontario, and New South Wales, 2011 to 2018. JAMA Network Open, 4 (4), pp.E215477-. <https://doi.org/10.1001/jamanetworkopen.2021.5477>.

Persistent Link:

<https://hdl.handle.net/11343/280484>

License:

CC BY



Original Investigation | Health Policy

Utilization Rates of Pancreatectomy, Radical Prostatectomy, and Nephrectomy in New York, Ontario, and New South Wales, 2011 to 2018

Hilary Y. M. Pang, MSc; Kelsey Chalmers, PhD; Bruce Landon, MD, MBA; Adam G. Elshaug, PhD, MPH; John Matelski, MSc; Vicki Ling, MSc; Monika K. Krzyzanowska, MD, MPH; Girish Kulkarni, MD, PhD; Bradley A. Erickson, MD, MS; Peter Cram, MD, MBA

Abstract

IMPORTANCE Few studies have compared surgical utilization between countries or how rates may differ according to patients' socioeconomic status.

OBJECTIVE To compare population-level utilization of 3 common nonemergent surgical procedures in New York State (US), Ontario (Canada), and New South Wales (Australia) and how utilization differs for residents of lower- and higher-income neighborhoods.

DESIGN, SETTING, AND PARTICIPANTS This cohort study included all adults aged 18 years and older who were hospitalized for pancreatectomy, radical prostatectomy, or nephrectomy between 2011 and 2016 in New York, between 2011 and 2018 in Ontario, and between 2013 and 2018 in New South Wales. Each patient's address of residence was linked to 2016 census data to ascertain neighborhood income. Data were analyzed from August 2019 to November 2020.

MAIN OUTCOMES AND MEASURES Primary outcomes were (1) each jurisdiction's per capita age- and sex-standardized utilization rates (procedures per 100 000 residents per year) for each surgery and (2) utilization rates among residents of lower- and higher-income neighborhoods.

RESULTS This study included 115 428 surgical patients (25 780 [22.3%] women); 5717, 21 752, and 24 617 patients in New York were hospitalized for pancreatectomy, radical prostatectomy, and nephrectomy, respectively; 4929, 19 125, and 16 916 patients in Ontario, respectively; and 2069, 13 499, and 6804 patients in New South Wales, respectively. Patients in New South Wales were older for all procedures (eg, radical prostatectomy, mean [SD] age in New South Wales, 64.8 [7.3] years; in New York, 62.7 [8.4] years; in Ontario, 62.8 [6.7] years; $P < .001$); patients in New York were more likely than those in other locations to be women for pancreatectomy (New York: 2926 [51.2%]; Ontario: 2372 [48.1%]; New South Wales, 1003 [48.5%]; $P = .004$) and nephrectomy (New York: 10 645 [43.2%]; Ontario: 6529 [38.6%]; 2605 [38.3%]; $P < .001$). With the exception of nephrectomy in Ontario, there was a higher annual utilization rate for all procedures in all jurisdictions among patients residing in affluent neighborhoods (quintile 5) compared with poorer neighborhoods (quintile 1). This difference was largest in New South Wales for pancreatectomy (4.65 additional procedures per 100 000 residents [SE, 0.28]; $P < .001$) and radical prostatectomy (73.46 additional procedures per 100 000 residents [SE, 1.20]; $P < .001$); largest in New York for nephrectomy (8.43 additional procedures per 100 000 residents [SE, 0.85]; $P < .001$) and smallest in New York for radical prostatectomy (19.70 additional procedures per 100 000 residents [SE, 2.63]; $P < .001$); and smallest in Ontario for pancreatectomy (1.15 additional procedures per 100 000 residents [SE, 0.28]; $P < .001$) and nephrectomy (−1.10 additional procedures per 100 000 residents [SE, 0.52]; $P < .001$). New York had the highest utilization of nephrectomy (28.93 procedures per 100 000 residents per year [SE, 0.18]) and New South Wales for had the highest utilization of pancreatectomy and radical prostatectomy (6.94 procedures per 100 000 residents per year [SE,

(continued)

Key Points

Question Do utilization rates for pancreatectomy, radical prostatectomy, and nephrectomy differ between New York State (US), Ontario (Canada), and New South Wales (Australia), and do income-based differences in utilization vary between countries?

Findings This cohort study of 115 428 surgical patients found significantly lower surgical utilization in Ontario than in New York and New South Wales. Residents of lower-income neighborhoods had lower rates of surgery than residents of higher-income neighborhoods in all countries; income-based differences were significantly smaller in Ontario than in New York and New South Wales.

Meaning In this study, Ontario had lower surgical utilization rates and smaller differences in utilization between patients in high-income vs low-income neighborhoods, but income-based disparities were present in all jurisdictions.

+ Supplemental content

Author affiliations and article information are listed at the end of this article.

Open Access. This is an open access article distributed under the terms of the CC-BY License.

Abstract (continued)

0.15] and 94.37 procedures per 100 000 residents per year [SE, 0.81], respectively; all $P < .001$. Utilization was lowest in Ontario for all procedures (pancreatectomy, 6.18 procedures per 100 000 residents per year [SE, 0.09]; radical prostatectomy, 49.24 procedures per 100 000 residents per year [SE, 0.36]; nephrectomy, 21.40 procedures per 100 000 residents per year [SE, 0.16]; all $P < .001$).

CONCLUSIONS AND RELEVANCE In this study, New York and New South Wales had higher per capita surgical utilization and larger neighborhood income-utilization gradients than Ontario. These findings suggest that income-based disparities are larger in the United States and Australia and smaller in Canada and highlight trade-offs inherent in the health care systems of different countries.

JAMA Network Open. 2021;4(4):e215477. doi:10.1001/jamanetworkopen.2021.5477

Introduction

The US health care system is recognized for world-class tertiary and quaternary care for those who are able to pay but poorer outcomes and limited access for those who cannot.^{1,2} In the US, there is also growing concern about overuse of certain surgical procedures, motivated by easy access to imaging and diagnostic testing.³⁻⁶ Interestingly, there are very few population-based studies comparing surgical utilization rates between countries.^{7,8} Moreover, few studies have examined whether the strong positive association between surgical utilization rates and socioeconomic status (SES) that have been documented in the US also exist in other countries where health insurance coverage differs.

In contrast to the US, both Canada and Australia have government-sponsored insurance programs that cover all legal residents. Canada generally prohibits private insurance and is thought to have more equitable access to services than the US, but many have raised concerns over inadequate access to many medical services.^{9,10} The Australian public system similarly has long queues, but approximately 50% of the population purchases supplemental private insurance that allows for improved access, particularly for surgical services.¹¹⁻¹³ Few studies have directly compared utilization of health services in the US, Canada, and Australia, and whether differences in utilization across strata of SES might vary between countries.

We used population-based administrative data from New York State (US), Ontario (Canada), and New South Wales (Australia) to compare utilization rates of the following 3 surgical procedures: pancreatectomy, radical prostatectomy, and nephrectomy. We selected these procedures because they are common, usually performed in the inpatient setting, and would have major public health impacts if underused (ie, patients not receiving needed surgery) or overused (ie, unnecessary morbidity and mortality). Moreover, the juxtaposition of these procedures provides an interesting contrast between jurisdictions; pancreatectomy and nephrectomy have few nonsurgical alternatives, while radical prostatectomy has several. Thus, these 3 procedures offer a rich perspective on care delivery across the 3 countries with dissimilar health care financing programs. Our primary hypotheses were that utilization of all procedures would be significantly higher in New York relative to Ontario and New South Wales and that differences in utilization between patients of lower and higher SES would be significantly greater in New York and smaller in Ontario.

Methods

This retrospective cohort study used administrative data from New York (2016 population, 19.7 million), Ontario (2016 population, 13.4 million) and New South Wales (2016 population, 7.7 million) to identify all hospitalized adults in each jurisdiction who underwent pancreatectomy, radical

prostatectomy, and nephrectomy. We chose these 3 Organization for Economic Co-operation and Development (OECD) countries for comparison because of their racial, ethnic, and geographic diversity, large populations, and close geopolitical ties but vastly different health care systems.

This study received ethical approval by the research ethics boards at ICES, University Health Network, and the New South Wales Population and Health Services Research Ethics Committee. A waiver of informed consent was granted because the population-based databases used in this study were large, and obtaining informed consent was considered not feasible for this study. This study followed the reporting requirements of the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) reporting guideline.

Data Sources

For New York, we used data from the 2011 to 2016 State Inpatient Database (SID), which has been used extensively in prior research.¹⁴ The SID contains administrative data for all patients admitted to all nongovernmental acute care hospitals in the state, including individuals covered by Medicare, Medicaid, or private insurance as well as those who are uninsured. Data elements for each admission include patient demographic characteristics (including zip code of residence), primary and secondary diagnosis and procedures using *International Classification of Diseases, Ninth Revision (ICD-9)* and *ICD-10* codes, and discharge disposition (eg, home, died). The SID also assigns each patient a unique identifier that allows patients to be tracked for purposes of interhospital transfer or hospital readmission. The SID does not capture out-of-hospital care or deaths.

For Ontario, we used the 2011 to 2018 Discharge Abstract Database (DAD), which provides information on all hospitalizations paid for by the Ontario Health Insurance Plan (OHIP); OHIP provides health insurance to all legal residents of Ontario (approximately 99% of the population) and 100% of inpatient hospitalizations.¹⁵ Ontario's DAD contains analogous data elements to the SID, including demographic characteristics, primary and secondary diagnoses using *ICD-10 Canadian modification (ICD-10-CA)* codes, and procedures captured using Canadian Classification of Health Interventions (CCI) codes.

For New South Wales, we used the 2013 to 2018 Admitted Patient Data Collection (APDC), which records all inpatient hospitalizations within the state and is often used for health services research.¹⁶ Key data elements for each hospitalization include demographic characteristics, a unique facility identifier, unique patient identifier, and discharge disposition. Procedures are recorded using the Australian Classification of Health Interventions and diagnosis codes are recorded using *ICD-10 Australian Modification codes (ICD-10-AM)*. The SID, DAD, and APDC each contain nearly 100% of hospital inpatient claims for New York State, Ontario, and New South Wales, respectively.

Cohort Generation

We identified all patients aged 18 to 105 years who underwent initial pancreatectomy, radical prostatectomy, or nephrectomy between January 1, 2011, (Ontario and New York) or January 1, 2013, (New South Wales) and March 31, 2018, (Ontario and New South Wales) or September 30, 2016, (New York) excluding those who had received the same procedure during a 90-day look-back period to avoid counting readmissions as de novo procedures (eFigure 1 in the [Supplement](#)). Differing timelines reflected differences in data availability and access across jurisdictions. Patients were identified using relevant *ICD-9-CM*, *ICD-10*, CCI, or *ICD-10-AM* codes listed in the primary procedure field using published algorithms in conjunction with local content experts (eAppendix in the [Supplement](#)). Our full study protocol and hypotheses were developed a priori and are available on Open Science Framework.¹⁷

We excluded patients discharged after September 30, 2016, (New York) and March 31, 2018, (Ontario and New South Wales) to allow for 90 days of postdischarge follow-up (eFigure 1 in the [Supplement](#)). We excluded patients who had missing age, sex, or hospital identification number, resided outside the jurisdiction where they received their surgery, had hospital length of stay (LOS)

of less than 1 day, or received their procedures in hospitals that performed less than 1 surgery per year. We created a single linked episode of care for patients who underwent interhospital transfers.

We linked the address of residence for each patient to publicly available 2016 census data available for each jurisdiction (US Census Bureau, Statistics Canada, and the Australian Bureau of Statistics) to ascertain neighborhood income.¹⁸⁻²⁰ We then stratified the neighborhoods in each jurisdiction into income quintiles (with quintile 1 indicating lowest income and quintile 5 indicating highest income).

Statistical Analysis

First, we compared the demographic characteristics of patients hospitalized for pancreatectomy, radical prostatectomy, and nephrectomy across New York State, Ontario, and New South Wales using bivariate methods. We used similar methods to compare the proportion of patients residing in higher- and lower-income neighborhoods and the proportion of patients who underwent interhospital transfers.

Second, we compared the proportion of acute care hospitals in each jurisdiction that performed each surgery as well as annual surgical volumes. Importantly, our comparisons of patient characteristics and hospital characteristics were secondary analyses and should be considered as such.

Third, to evaluate our primary hypotheses, we used direct standardization (Ontario population reference) to compare per capita rates of pancreatectomy, radical prostatectomy, and nephrectomy (procedures per 100 000 residents per year) between jurisdictions.²¹ The numerator was the total number of procedures performed in each jurisdiction; the denominator was the number of eligible adults in that jurisdiction (only men for radical prostatectomy) with rates annualized to account for study period differences. We then compared utilization rates across jurisdictions after stratifying by neighborhood income quintile. These comparisons constituted our primary outcomes.

Fourth, we conducted stratified analyses comparing utilization across jurisdictions in subgroups defined by decade of age and sex. Finally, we compared short-term outcomes for each surgery between our 3 jurisdictions using generalized estimating equations. Outcomes included: hospital LOS (excluding LOS >100 days); discharge disposition (death, home, nonhome care facility [ie, long-term care, nursing home, or rehabilitation center], or other); and hospital readmission within 30 days and 90 days of discharge among those who survived to discharge. We examined both overall in-hospital mortality and in-hospital mortality within 7 days of surgery. We compared unadjusted outcomes, outcomes standardized for age- and sex-differences between jurisdictions (model 1), and outcomes standardized by all model 1 factors plus hospital volume and neighborhood income (model 2). We did not standardize for differences in comorbid illness because of implausibly large differences in coding demonstrated previously.^{8,22}

Statistical significance was set at $P < .05$ a priori, and all tests were 2-sided. Analyses were performed using SAS version 9.4 (SAS Institute) or R statistical software version 3.6.3 (R Project for Statistical Computing) packages. We did not make any adjustment for multiple comparisons.

Results

This study included 115 428 surgical patients (25 780 [22.3%] women); 5717, 21 752, and 24 617 patients in New York hospitalized for pancreatectomy, radical prostatectomy, and nephrectomy, respectively; 4929, 19 125, and 16 916 patients in Ontario, respectively; and 2069, 13 499, and 6804 patients in New South Wales, respectively (**Table 1**). For pancreatectomy and nephrectomy, patients in New York were more likely to be women compared with Ontario and New South Wales (pancreatectomy: New York: 2926 [51.2%]; Ontario: 2372 [48.1%]; New South Wales, 1003 [48.5%]; $P = .004$; nephrectomy: New York: 10 645 [43.2%]; Ontario: 6529 [38.6%]; 2605 [38.3%]; $P < .001$). Patients in New South Wales were slightly older for all 3 procedures (eg, radical prostatectomy, mean [SD] age in New South Wales, 64.8 [7.3] years; in New York, 62.7 [8.4] years; in

Table 1. Patient and Hospital Characteristics and Per-Capita Standardized Utilization Rates for Pancreatectomy, Radical Prostatectomy, and Nephrectomy for Recipients From New York (US), Ontario (Canada), and New South Wales (Australia)									
Characteristic	Pancreatectomy			Radical Prostatectomy			Nephrectomy		
	No. (%)	New South Wales	Ontario	P value	No. (%)	New York State	Ontario	New South Wales	P value
Patient characteristics									
No.	5717	4929	2069	NA	21 752	19 125	13 499	24 617	NA
Age, mean (SD), y	63.1 (13.4)	62.5 (13.4)	64.3 (13.0)	<.001	62.7 (8.4)	62.8 (6.7)	64.8 (7.3)	59.1 (14.9)	61.7 (13.4)
Women	2926 (51.2)	2372 (48.1)	1003 (48.5)		NA	NA	NA	10 645 (43.2)	6529 (38.6)
Men	2791 (48.8)	2557 (51.9)	1066 (51.5)	.004	21 752 (100)	19 125 (100)	13 499 (100)	13 972 (56.8)	4199 (61.7)
Neighborhood income quintile, No. (%)									
1, lowest 20%	1062 (18.6)	868 (17.6)	2670 (13.1)	<.001	4098 (18.8)	2573 (10.9)	1760 (13.1)	4833 (19.6)	3261 (19.3)
2	766 (13.4)	996 (20.2)	347 (16.8)	<.001	2893 (13.3)	3493 (18.3)	2353 (17.4)	3538 (14.4)	3414 (20.2)
3	852 (14.9)	969 (19.7)	408 (19.7)	<.001	3530 (16.2)	3783 (19.8)	2412 (17.9)	4135 (16.8)	3333 (19.7)
4	1245 (21.8)	965 (19.6)	479 (23.1)	<.001	4631 (21.3)	4210 (22.0)	3273 (24.3)	5055 (20.5)	3512 (20.8)
5, highest 20%	1651 (28.9)	1118 (22.7)	566 (27.3)	<.001	6143 (28.2)	5028 (26.3)	3697 (27.4)	6513 (26.5)	3359 (19.9)
Missing	141 (2.5)	13 (0.3)	0		457 (2.1)	38 (0.2)	0	543 (2.2)	37 (0.2)
Difference, quintile 5-quintile 1	589 (10.3)	250 (5.1)	295.7 (14.3)	<.001	2045 (9.4)	2455 (12.8)	1937 (14.3)	1680 (6.8)	98 (0.6)
Underwent interhospital transfer	20 (0.3)	140 (2.8)	202 (9.7)	<.001	18 (0.1)	27 (0.1)	159 (1.2)	46 (0.2)	175 (1.0)
Hospital characteristics									
No.	224	166	314	NA	224	166	314	224	166
Hospitals performing surgery	55 (24.6)	23 (13.9)	42 (13.4)	.001	123 (54.9)	56 (33.7)	62 (19.8)	126 (56.2)	60 (36.1)
Annual surgical volume, mean (SD), No.	18.2 (29.0)	29.7 (41.6)	11.2 (12.1)	.04	30.8 (52.1)	47.2 (55.3)	41.0 (61.4)	34.5 (55.2)	39.4 (43.6)
Annual surgical volume, median (IQR)	8 (2-21)	7 (2-39)	7 (2-20)	NA	9 (3-33)	33 (17-55)	19 (9-37)	12 (4-32)	27 (13-47)
Utilization rate, Procedures per 100 000 residents (SE)									
Overall per capita rate	6.68 (0.09)	6.18 (0.09)	6.94 (0.15)	<.001	54.01 (0.37)	49.24 (0.36)	94.37 (0.81)	28.93 (0.18)	21.40 (0.16)
Sex									
Men	6.96 (0.13)	6.61 (0.13)	7.33 (0.23)	.01	54.01 (0.37)	49.24 (0.36)	94.37 (0.81)	34.88 (0.29)	27.17 (0.26)
Women	6.41 (0.12)	5.77 (0.12)	6.58 (0.21)	<.001	NA	NA	NA	23.35 (0.23)	15.98 (0.20)
Difference, male-female, (SE)	0.56 (0.18)	0.83 (0.18)	0.74 (0.31)	.57	NA	NA	NA	11.53 (0.37)	11.19 (0.33)
P value by region	.002	<.001	.02	NA	NA	NA	NA	<.001	<.001

Abbreviations: IQR, interquartile range; NA, not applicable; SC, suppressed cell.
a Cell sizes of less than 5 (Ontario and New South Wales) or less than 10 (New York) were suppressed in accordance with jurisdictional research ethics board policy.

Ontario, 62.8 [6.7] years; $P < .001$). Patients in New York had a significantly higher prevalence of most comorbid conditions (eTable 1 in the [Supplement](#)).

Hospitals in New York were significantly more likely to perform each of the 3 procedures than those in Ontario and New South Wales. However, there were more low volume hospitals in New York and New South Wales relative to Ontario, as assessed by interquartile range (Table 1).

Focusing on our primary outcomes, New York had the highest utilization for nephrectomy (28.93 procedures per 100 000 residents per year [SE, 0.18]; $P < .001$), while New South Wales had the highest utilization of pancreatectomy (6.94 procedures per 100 000 residents per year [SE, 0.15]; $P < .001$) and radical prostatectomy (94.37 procedures per 100 000 residents per year [SE, 0.81]; $P < .001$) (Table 1). Ontario had the lowest utilization for all 3 procedures (pancreatectomy, 6.18 procedures per 100 000 residents per year [SE, 0.09]; radical prostatectomy, 49.24 procedures per 100 000 residents per year [SE, 0.36]; nephrectomy, 21.40 procedures per 100 000 residents per year [SE, 0.16]; all $P < .001$) (Table 1).

Utilization rates were significantly higher for residents of the highest income neighborhoods (quintile 5) compared with the lowest income neighborhoods (quintile 1) for all procedures in all jurisdictions, with the exception of nephrectomy in Ontario (**Table 2** and **Figure 1**). Viewed through a different lens, New South Wales had the largest difference in utilization between quintile 5 and quintile 1 for both pancreatectomy (4.65 additional procedures per 100 000 residents; SE, 0.28) and radical prostatectomy (difference, 73.46 procedures per 100 000 residents; SE, 1.20), while New York had the largest difference for nephrectomy (difference, 8.43 procedures per 100 000 residents; SE, 0.85) but the smallest difference for radical prostatectomy (difference, 19.70 procedures per 100 000 residents; SE, 2.63). Ontario had the smallest gradient for both pancreatectomy (difference, 1.15 procedures per 100 000 residents; SE, 0.28) and nephrectomy (difference, −1.10 procedures per 100 000 residents; SE, 0.52).

Looking instead at the relative utilization for residents of neighborhood income quintile 5 vs quintile 1 (Table 2 and **Figure 2**), residents of wealthy neighborhoods in New York had relatively similar increases in utilization for all 3 procedures compared with residents of poorer neighborhoods (ratio of quintile 5 to 1: pancreatectomy, 1.52; radical prostatectomy, 1.39; nephrectomy, 1.32). In contrast, the neighborhood income-based differences were highly variable in both New South Wales (ratio of quintile 5 to 1: pancreatectomy, 1.97; radical prostatectomy, 2.23; nephrectomy, 1.36) and Ontario (ratio of quintile 5 to 1: pancreatectomy, 1.20; radical prostatectomy, 1.79; nephrectomy, 0.95) (Figure 2).

In subgroup analyses, we found that utilization of pancreatectomy and nephrectomy was significantly higher for men than women in all jurisdictions (Table 1). Utilization of all 3 procedures

Table 2. Standardized Utilization Rate by Neighborhood Income Quintile for Pancreatectomy, Radical Prostatectomy, and Nephrectomy for Recipients From New York, Ontario, and New South Wales

Neighborhood income quintile	Pancreatectomy				Radical Prostatectomy				Nephrectomy			
	Procedures/100 000 residents, No.				Procedures/100 000 residents, No.				Procedures/100 000 residents, No.			
	NY	ON	NSW	P value	NY	ON	NSW	P value	NY	ON	NSW	P value
1, lowest 20%	5.83	5.78	4.77	.001	50.56	35.57	59.55	<.001	26.35	21.97	17.29	<.001
2	5.92	6.38	5.85	.20	47.53	46.00	81.23	<.001	27.06	22.10	23.49	<.001
3	6.18	6.04	7.04	.04	55.09	48.5	87.16	<.001	30.06	21.03	24.68	<.001
4	7.46	5.67	7.70	<.001	59.23	50.75	111.85	<.001	30.41	20.88	26.30	<.001
5, highest 20%	8.88	6.93	9.42	<.001	70.26	63.51	133.00	<.001	34.78	20.87	23.52	<.001
P value	<.001	<.001	<.001	NA	<.001	<.001	<.001	NA	<.001	<.001	0.036	NA
5 vs 1, difference (SE)	3.05 (0.49)	1.15 (0.28)	4.65 (0.28)	<.001	19.70 (2.63)	27.94 (1.14)	73.46 (1.20)	<.001	8.43 (0.85)	−1.10 (0.52)	6.23 (0.57)	<.001
5 to 1 ratio	1.52	1.20	1.97		1.39	1.79	2.23		1.32	0.95	1.36	
Regional comparison	NY vs ON	NS vs ON	NSW vs NY	NA	NY vs ON	NSW vs ON	NSW vs NY	NA	NY vs ON	NSW vs ON	NSW vs NY	NA
Quintile 5 vs 1 P value	.001	<.001	.005	NA	.004	<.001	<.001	NA	<.001	<.001	.031	NA

Abbreviations: NA, not applicable; NSW, New South Wales; NY, New York; ON, Ontario.

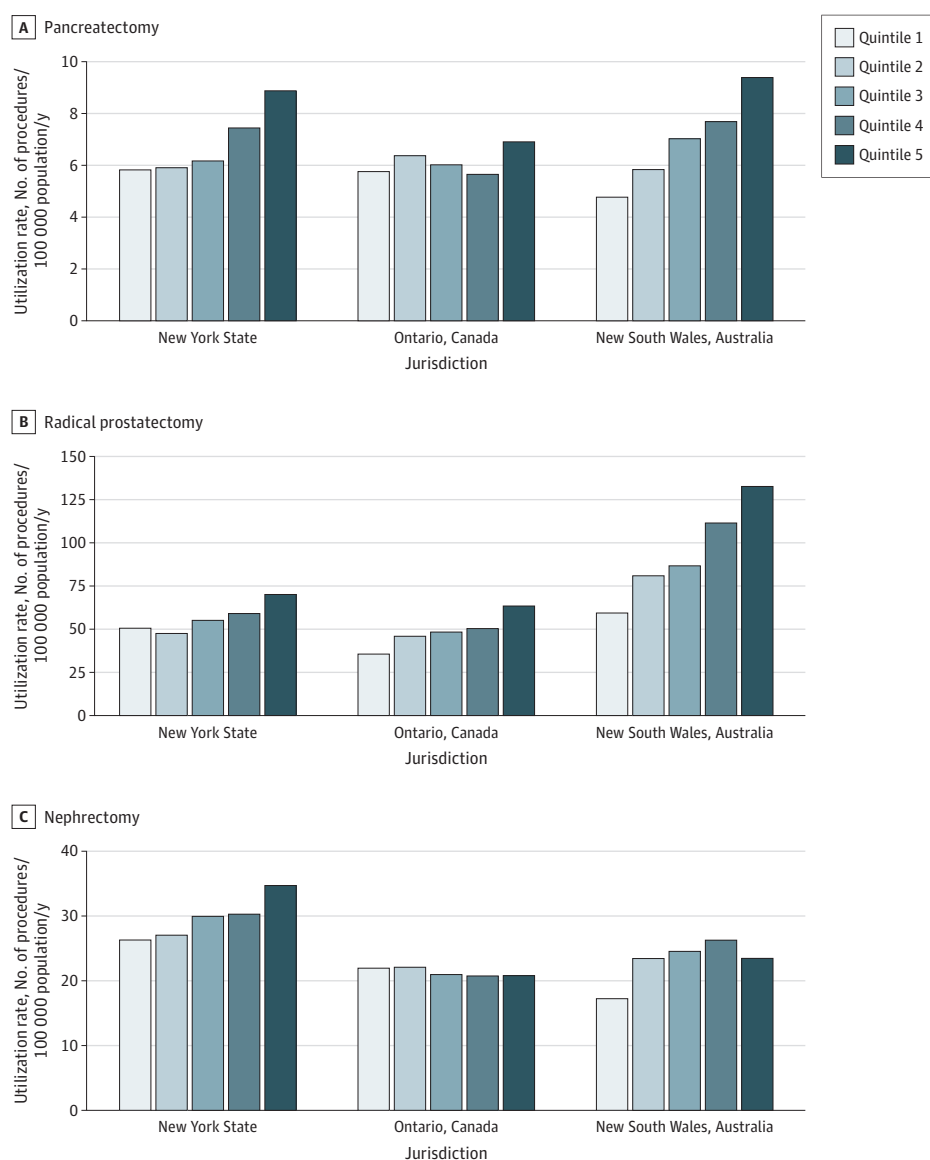
increased until age 70 to 79 years, before declining at age 80 years and older (eFigure 2 in the [Supplement](#)).

Secondary outcomes demonstrated that in-hospital mortality was significantly higher in Ontario for pancreatectomy and nephrectomy in unadjusted analyses, although differences were attenuated in risk-standardized analysis (eTable 2 and eTable 3 in the [Supplement](#)). Rates of readmission within 30 days and 90 days of surgery were generally similar between jurisdictions (eTable 2 and eTable 3 in the [Supplement](#)).

Discussion

In an analysis of population-based administrative data from New York State (US), Ontario (Canada), and New South Wales (Australia), we found higher overall utilization rates of pancreatectomy, radical prostatectomy, and nephrectomy in the US and Australia compared with Canada for all procedures.

Figure 1. Standardized Per Capita Utilization of Pancreatectomy, Radical Prostatectomy, and Nephrectomy by Neighborhood Income Quintile in New York State, Ontario, and New South Wales



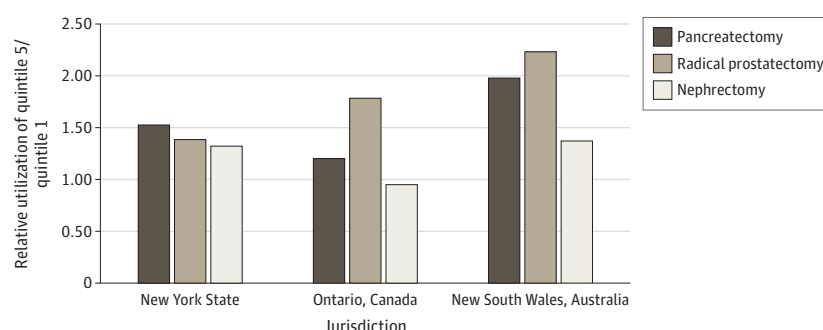
Residents of higher-income neighborhoods in all 3 jurisdictions were significantly more likely to undergo all 3 surgical procedures compared with residents of lower-income neighborhoods. However, the neighborhood income–utilization gradient was larger in New York State and New South Wales than in Ontario. In aggregate, our results suggest that while all jurisdictions have some degree of income-based disparities, the magnitude of these differences is smaller in Canada and larger in the US and Australia. Our findings highlight how countries' health care systems can exacerbate or alleviate wealth-based differences in access to surgical procedures.

Several aspects of our study warrant elaboration. First, it is important to consider the overall differences in utilization rates between jurisdictions. Ontario had the lowest per capita utilization rate for all 3 procedures (8%, 9%, and 26% lower than New York for pancreatectomy, radical prostatectomy, and nephrectomy, respectively). There have been longstanding concerns in Canada regarding wait times for surgery but few direct comparisons with other countries.^{23,24} While the debate over access is often highly politicized, our results expand on evidence of markedly lower surgical utilization rates in Canada relative to not only the US but also to other high-income countries.^{8,14,22,25}

When considering the overall utilization rates of these 3 procedures, it is important to recognize that each surgery is predominantly performed for the treatment of cancer. While it may be tempting to conclude that the differences in surgical utilization between countries reflect underlying differences in cancer incidence, this seems biologically implausible.^{26–28} A more likely explanation is that the differences in surgical utilization reflect a complex diagnostic cascade that begins with between-country differences in cancer screening practices (such as prostate specific antigen [PSA] testing) and extending to differences in the supply of surgeons and hospital operating room capacity.^{3,29–35} Our finding that New South Wales had markedly higher rates of radical prostatectomy compared with New York and Ontario is consistent with similar single-jurisdiction studies.^{36–38} The US and Canada had more conservative PSA screening guidelines than Australia during the study period; US and Canadian guidelines did not recommend PSA testing for prostate cancer screening in healthy asymptomatic men, while Australia supported testing if requested and if an informed discussion was had on the benefits and harms of testing.^{39–41} Further studies are needed to better understand the drivers of the differences in utilization across jurisdictions we have identified.

It is also important to recognize that jurisdictions may have differences in terms of preferences for surgical and nonsurgical treatment for prostate cancer. Pancreatectomy and nephrectomy constitute the principal treatments for resectable pancreatic and kidney cancer, respectively, whereas localized prostate cancer can be managed with watchful waiting, radiation, or surgery.^{42–45} Further research is needed to elucidate whether the higher rate of radical prostatectomy in New South Wales could be counterbalanced by higher utilization of nonsurgical management (ie, radiation, watchful waiting) in New York and Ontario.

Figure 2. Relative Utilization of Pancreatectomy, Radical Prostatectomy, and Nephrectomy in Neighborhood Income Quintile 5 vs Quintile 1 in New York State, Ontario, and New South Wales



A relative utilization of greater than 1.00 indicates higher utilization for residents in the highest income neighborhoods (quintile 5) relative to the lowest income neighborhoods (quintile 1). A relative utilization of less than 1.00 indicates lower utilization for residents in the highest income neighborhoods (quintile 5) relative to the lowest income neighborhoods (quintile 1).

Second, our finding of higher utilization of all 3 procedures for residents of higher-income neighborhoods in all 3 countries extends prior research linking higher-income and increased health care access.^{2,46-48} Single-country studies have demonstrated that wealthier patients are likelier to obtain cancer screening, undergo cardiovascular procedures, and receive cardiac transplants; there are few studies on this topic outside the US.⁴⁹⁻⁵³ There are many reasons to interpret existing data as evidence of surgical underuse for patients with lower income, particularly in the US, where employer-based insurance is common.⁵⁴⁻⁵⁷ At the same time, there is growing concern that at least part of wealth-based differences in utilization may represent overuse of certain treatments that are at best unnecessary and at worst harmful.^{4,30,58-61} If this is the case, residents of higher-income neighborhoods may be at increased risk of unnecessary or harmful care.

Third, our finding that the magnitude of the income-utilization gradient was generally larger in New York State and New South Wales than in Ontario is noteworthy. It begets important questions about potential overuse in the US and Australia, particularly among patients with higher incomes, as well as potential underuse in Canada.^{62,63} It is crucial to contemplate the role of health system organization and financing. Residents of Canada are served exclusively by a publicly funded single-payer health care system, while US residents and residents of Australia are served by a public-private hybrid.^{23,64} A recent study by Landon et al⁶⁵ described Australia's public-private hybrid delivery system. There is good reason to believe that single-payer systems, such as Canada, reduce income-based disparities and enhance equity, while public-private systems improve access problems inherent to single-payer models but potentiate increased utilization and inequities.⁶⁶ Our work is consistent with a rich body of research by Gorey et al,^{67,68} who have published several international comparisons demonstrating improved cancer outcomes for low-income residents of Canada relative to their low-income US counterparts.

Fourth, our study highlights the importance of international comparative health services research and the powerful analyses that can be performed when population-based patient-level data from multiple countries are analyzed in parallel. Many studies, including those from The Commonwealth Fund and OECD, rely on aggregate data.⁶⁹ Such studies are vital, but they lack the granularity required for fulsome comparison of disparities, utilization, and outcomes for individual diseases.^{14,22,70-72}

Lastly, it is important to briefly mention some of our secondary outcomes and subgroup analyses. Our finding that a higher proportion of New York hospitals performed each surgery with more low-volume hospitals, relative to Ontario and New South Wales, highlights a continued lack of surgical regionalization in the US despite decades of research highlighting the importance of adequate procedural volumes.^{33,34} However, the nonsignificant differences in postoperative mortality outcomes and readmission rates in our study brings forward another aspect of surgical care quality across jurisdictions for each surgery despite greater regionalization in Ontario and New South Wales.

Limitations

Our analyses are subject to several limitations. First, our analyses were limited to 1 geographic region in each of our 3 countries and should be generalized more broadly with care. Future work might examine these intercountry findings against intracountry (ie, state/provincial) comparisons. Second, our reliance on hospital administrative data prevented us from being able to ascertain indications for surgery or appropriateness, although we chose 3 conditions for which the indication for surgery is predominantly cancer.^{35,73,74} Further analyses using clinical registries is warranted. Likewise, the lack of clinical details in the administrative data sets precludes us from determining whether the higher rates of surgery in residents of higher-income neighborhoods compared with those of lower-income neighborhoods represent underuse in residents of lower-income neighborhoods or overuse in residents of higher-income neighborhoods; given the implications of potentially unnecessary procedures in those with higher-income or inadequate access in those with lower-income, further

study is needed. Third, our data sources precluded us from evaluating longer-term or patient-reported outcomes. Fourth, we lacked information about radical prostatectomy performed in the outpatient setting; utilization of nonsurgical alternatives, such as radiation or watchful waiting, can be explored in the future.^{37,42,75} Fifth, given our large sample size and multiple comparisons, readers should interpret our subgroup and secondary analyses with caution, recognizing the potential for type 1 error.

Conclusions

This study found higher overall utilization and a wider high income–low income gradient in New York and New South Wales than in Ontario for pancreatectomy, radical prostatectomy, and nephrectomy. These findings suggest that private health coverage in conjunction with public insurance systems may exacerbate income-based disparities in surgical utilization. Our study provides important evidence of the trade-offs in access and equity intrinsic to the health care systems of New York State (US), Ontario (Canada), and New South Wales (Australia).

ARTICLE INFORMATION

Accepted for Publication: February 20, 2021.

Published: April 19, 2021. doi:[10.1001/jamanetworkopen.2021.5477](https://doi.org/10.1001/jamanetworkopen.2021.5477)

Open Access: This is an open access article distributed under the terms of the [CC-BY License](https://creativecommons.org/licenses/by/4.0/). © 2021 Pang HYM et al. *JAMA Network Open*.

Corresponding Author: Peter Cram, MD, MBA, Division of General Internal Medicine, Toronto General Hospital, University Health Network and Sinai Health Systems, 200 Elizabeth St, Eaton 14th Floor, Toronto, ON M5G 2C4 Canada (pecram@utmb.edu).

Author Affiliations: Temerty Faculty of Medicine, University of Toronto, Toronto, Ontario, Canada (Pang, Cram); Institute of Health Policy, Management, and Evaluation, Dalla Lana School of Public Health, University of Toronto, Toronto, Ontario, Canada (Pang, Krzyzanowska, Kulkarni, Cram); Menzies Centre for Health Policy, School of Public Health, University of Sydney, Sydney, New South Wales, Australia (Chalmers); Lown Institute, Brookline, Massachusetts (Chalmers); Department of Health Care Policy, Harvard Medical School, Boston, Massachusetts (Landon); Division of General Medicine, Beth Israel Deaconess Medical Center, Boston, Massachusetts (Landon); Centre for Health Policy, Melbourne School of Population and Global Health and the Melbourne Medical School, University of Melbourne, Melbourne, Victoria, Australia (Elshaug); USC–Brookings Schaeffer Initiative for Health Policy, The Brookings Institution, Washington, DC (Elshaug); Biostatistics Research Unit, Toronto General Hospital, Toronto, Ontario, Canada (Matelski); ICES Sciences, Toronto, Ontario, Canada (Ling, Kulkarni, Cram); Department of Medical Oncology and Haematology, Princess Margaret Cancer Centre, University Health Network, Toronto, Ontario, Canada (Krzyzanowska); Department of Surgical Oncology, Princess Margaret Cancer Centre, University Health Network, Toronto, Ontario, Canada (Kulkarni); Department of Urology, University of Iowa and Clinics, Iowa City (Erickson); Department of General Internal Medicine, University Health Network and Sinai Health Systems, Toronto, Ontario, Canada (Cram).

Author Contributions: Dr Cram and Ms Pang had full access to all of the data in the study and take responsibility for the integrity of the data and the accuracy of the data analysis.

Concept and design: Pang, Landon, Krzyzanowska, Cram.

Acquisition, analysis, or interpretation of data: Pang, Chalmers, Elshaug, Matelski, Ling, Krzyzanowska, Kulkarni, Erickson, Cram.

Drafting of the manuscript: Pang, Elshaug, Matelski, Cram.

Critical revision of the manuscript for important intellectual content: All authors.

Statistical analysis: Chalmers, Matelski, Ling, Cram.

Obtained funding: Elshaug.

Administrative, technical, or material support: Pang, Elshaug, Matelski, Kulkarni, Cram.

Supervision: Elshaug, Cram.

Conflict of Interest Disclosures: Dr Elshaug reported receiving personal fees from Cancer Australia as a health economics and policy adviser outside the submitted work. Dr Krzyzanowska reported receiving grants from Eisai and Eli Lilly and Co and receiving personal fees from Bayer and Eisai outside the submitted work. Dr Kulkarni reported receiving personal fees from Janssen Pharmaceuticals, Merck, Sanofi, Biosynt, TerSera, Theralase, and Ferring outside the submitted work. No other disclosures were reported.

Funding/Support: This study was supported by the ICES, which is funded by an annual grant from the Ontario Ministry of Health and Long-term Care (MOHLTC). This work is also supported by grant R01AG058878 from the US National Institute of Aging to Drs Cram and Landon and by grant 1109626 from the National Health and Medical Research and grants from the Laura and John Arnold Foundation to Dr Elshaug.

Role of the Funder/Sponsor: The funders had no role in the design and conduct of the study; collection, management, analysis, and interpretation of the data; preparation, review, or approval of the manuscript; and decision to submit the manuscript for publication.

Disclaimer: The opinions, results and conclusions reported in this article are those of the authors and are independent from the funding sources. No endorsement by ICES or the Ontario MOHLTC is intended or should be inferred. Parts of this material are based on data and/or information compiled and provided by the Canadian Institute for Health Information (CIHI). However, the analyses, conclusions, opinions and statements expressed in the material are those of the authors and not necessarily those of CIHI.

Additional Information: Statistical code is available from the corresponding author on reasonable request.

REFERENCES

1. Bradley EH, Sipsma H, Taylor LA. American health care paradox—high spending on health care and poor health. *QJM*. 2017;110(2):61-65.
2. National Research Council (US); Institute of Medicine (US). *U.S. Health in International Perspective: Shorter Lives, Poorer Health*. Woolf SH, Aron L, eds. National Academies Press; 2013.
3. Welch HG, Skinner JS, Schroek FR, Zhou W, Black WC. Regional variation of computed tomographic imaging in the United States and the risk of nephrectomy. *JAMA Intern Med*. 2018;178(2):221-227. doi:10.1001/jamainternmed.2017.7508
4. Welch HG, Fisher ES. Income and cancer overdiagnosis—when too much care is harmful. *N Engl J Med*. 2017;376(23):2208-2209. doi:10.1056/NEJMp1615069
5. Kepka D, Breen N, King JB, et al. Demographic factors associated with overuse of Pap testing. *Am J Prev Med*. 2014;47(5):629-633. doi:10.1016/j.amepre.2014.07.034
6. Davies L, Welch HG. Current thyroid cancer trends in the United States. *JAMA Otolaryngol Head Neck Surg*. 2014;140(4):317-322. doi:10.1001/jamaoto.2014.1
7. Pabinger C, Lothaller H, Geissler A. Utilization rates of knee-arthroplasty in OECD countries. *Osteoarthritis Cartilage*. 2015;23(10):1664-1673. doi:10.1016/j.joca.2015.05.008
8. Cram P, Landon BE, Matelski J, et al. Utilization and short-term outcomes of primary total hip and knee arthroplasty in the United States and Canada: an analysis of New York and Ontario administrative data utilization. *Arthritis Rheumatol*. 2018;70(4):547-554. doi:10.1002/art.40407
9. Martin D, Miller AP, Quesnel-Vallée A, Caron NR, Vissandjée B, Marchildon GP. Canada's universal health-care system: achieving its potential. *Lancet*. 2018;391(10131):1718-1735. doi:10.1016/S0140-6736(18)30181-8
10. Ivers N, Brown AD, Detsky AS. Lessons from the Canadian experience with single-payer health insurance: just comfortable enough with the status quo. *JAMA Intern Med*. 2018;178(9):1250-1255. doi:10.1001/jamainternmed.2018.3568
11. Dixit SK, Sambasivan M. A review of the Australian healthcare system: a policy perspective. *SAGE Open Med*. 2018;6:2050312118769211. doi:10.1177/2050312118769211
12. Squires D, Anderson C. U.S. health care from a global perspective: spending, use of services, prices, and health in 13 countries. *Issue Brief (Commonw Fund)*. 2015;15:1-15. doi:10.15868/socialsector.25051
13. Department of Parliamentary Services. Health in Australia: a quick guide. Updated August 31, 2018. Accessed March 16, 2021. https://www.aph.gov.au/About_Parliament/Parliamentary_Departments/Parliamentary_Library/pubs/rp/rp1819/Quick_Guides/HealthAust
14. Cram P, Girotra S, Matelski J, et al. Utilization of advanced cardiovascular therapies in the United States and Canada: an observational study of New York and Ontario administrative data. *Circ Cardiovasc Qual Outcomes*. 2020;13(1):e006037. doi:10.1161/CIRCOUTCOMES.119.006037
15. Stukel TA, Fisher ES, Alter DA, et al. Association of hospital spending intensity with mortality and readmission rates in Ontario hospitals. *JAMA*. 2012;307(10):1037-1045. doi:10.1001/jama.2012.265

16. Badgery-Parker T, Pearson SA, Elshaug AG. Estimating misclassification error in a binary performance indicator: case study of low value care in Australian hospitals. *BMJ Qual Saf*. 2020;29(12):992-999. doi:10.1136/bmjqs-2019-010564
17. Cram P, Pang H. Socioeconomic status and surgery utilization in Ontario Canada, New York USA, and New South Wales, Australia. OSF. Accessed March 17, 2021. <https://osf.io/cw85z/>
18. Statistics Canada. 2016 Census topic: age and sex. Updated November 15, 2017. Accessed March 16, 2021. <https://www12.statcan.gc.ca/census-recensement/2016/rt-td/as-eng.cfm>
19. Australian Bureau of Statistics. Personal income in Australia. Published December 17, 2019. Accessed March 16, 2021. <https://www.abs.gov.au/statistics/labour/earnings-and-work-hours/personal-income-australia/2011-12-2016-17>
20. US Census Bureau. Annual social and economic supplements. Accessed March 16, 2021. <https://www.census.gov/data/datasets/time-series/demo/cps/cps-asec.2019.html>
21. Curtin LR, Klein RJ. Direct standardization (age-adjusted death rates). Published March 1995. Accessed March 16, 2021. <https://www.cdc.gov/nchs/data/statnt/statnt06rv.pdf>
22. Cram P, Landon BE, Matelski J, et al. Utilization and outcomes for spine surgery in the United States and Canada. *Spine (Phila Pa 1976)*. 2019;44(19):1371-1380. doi:10.1097/BRS.0000000000003083
23. Simpson J. *Chronic Condition: Why Canada's Health Care System Needs to Be Dragged Into the 21st Century*. Allan Lane; 2012.
24. Pilote L, Saynina O, Lavoie F, McClellan M. Cardiac procedure use and outcomes in elderly patients with acute myocardial infarction in the United States and Quebec, Canada, 1988 to 1994. *Med Care*. 2003;41(7):813-822. doi:10.1097/00005650-200307000-00005
25. Zlomislac D. Top doctors, health critics blast Health Minister Eric Hoskins for stem cell transplant crisis. *Toronto Star*. Published April 26, 2016. Accessed March 16, 2021. <https://www.thestar.com/news/canada/2016/04/20/top-docs-health-critic-blast-hoskins-for-stem-cell-crisis.html>
26. Sanmartin C, Ng E, Blackwell D, Gentleman J, Martinez M, Simile C. *Joint Canada/United States Survey of Health, 2002-03*. Accessed March 23, 2021. https://www.cdc.gov/nchs/data/nhis/jcush_analyticalreport.pdf
27. Wister A, Kendig H, Mitchell B, Fyffe I, Loh V. Multimorbidity, health and aging in Canada and Australia: a tale of two countries. *BMC Geriatr*. 2016;16(1):163. doi:10.1186/s12877-016-0341-z
28. Philippon DJ, Marchildon GP, Ludlow K, Boyling C, Braithwaite J. The comparative performance of the Canadian and Australian health systems. *Healthc Manage Forum*. 2018;31(6):239-244. doi:10.1177/0840470418788378
29. Anderson GF, Hussey P, Petrosyan V. It's still the prices, stupid: why the US spends so much on health care, and a tribute to Uwe Reinhardt. *Health Aff (Millwood)*. 2019;38(1):87-95. doi:10.1377/hlthaff.2018.05144
30. Brownlee S, Chalkidou K, Doust J, et al. Evidence for overuse of medical services around the world. *Lancet*. 2017;390(10090):156-168. doi:10.1016/S0140-6736(16)32585-5
31. Feng LB, Pines JM, Yusuf HR, Grosse SDUS. U.S. trends in computed tomography use and diagnoses in emergency department visits by patients with symptoms suggestive of pulmonary embolism, 2001-2009. *Acad Emerg Med*. 2013;20(10):1033-1040. doi:10.1111/ace.12221
32. Coco AS, O'Gurek DT. Increased emergency department computed tomography use for common chest symptoms without clear patient benefits. *J Am Board Fam Med*. 2012;25(1):33-41. doi:10.3122/jabfm.2012.01.110039
33. Birkmeyer JD, Siewers AE, Finlayson EV, et al. Hospital volume and surgical mortality in the United States. *N Engl J Med*. 2002;346(15):1128-1137. doi:10.1056/NEJMsa012337
34. Luft HS, Bunker JP, Enthoven AC. Should operations be regionalized? the empirical relation between surgical volume and mortality. *N Engl J Med*. 1979;301(25):1364-1369. doi:10.1056/NEJM197912203012503
35. Witherspoon L, Lau JL, Breaux RH, et al. Reducing overtreatment of prostate cancer by radical prostatectomy in Eastern Ontario: a population-based cohort study. *CMAJ Open*. 2018;6(2):E197-E201. doi:10.9778/cmajo.20170149
36. Australian Commission On Safety And Quality In Health Care. 3.4 Radical prostatectomy hospital admissions 40 years and over. Accessed March 16, 2021. https://hub.arcgis.com/datasets/6bca9d4caf714eada591b48ea39d6223_3?geometry=72.460%2C-40.480%2C-176.534%2C-13.453
37. Tyson MD II, Andrews PE, Ferrigni RF, Humphreys MR, Parker AS, Castle EP. Radical prostatectomy trends in the United States: 1998 to 2011. *Mayo Clin Proc*. 2016;91(1):10-16. doi:10.1016/j.mayocp.2015.09.018

38. McClintock TR, Wang Y, Cole AP, et al. Contemporary trends in the utilisation of radical prostatectomy. *BJU Int*. 2018;122(5):726-728. doi:10.1111/bju.14411
39. Moyer VA; U.S. Preventive Services Task Force. Screening for prostate cancer: U.S. Preventive Services Task Force recommendation statement. *Ann Intern Med*. 2012;157(2):120-134. doi:10.7326/0003-4819-157-2-201207170-00459
40. Prostate Cancer Foundation of Australia and Cancer Council Australia. PSA testing and early management of test-detected prostate cancer: clinical practice guidelines. Accessed March 16, 2021. <https://www.prostate.org.au/media/611412/PSA-Testing-Guidelines-Overview.pdf>
41. Bell N, Gorber SC, Shane A, et al; Canadian Task Force on Preventive Health Care. Recommendations on screening for prostate cancer with the prostate-specific antigen test. *CMAJ*. 2014;186(16):1225-1234. doi:10.1503/cmaj.140703
42. NICE. NICE guidance—prostate cancer: diagnosis and management. *BJU Int*. 2019;124(1):9-26. doi:10.1111/bju.14809
43. Sanda MG, Cadeddu JA, Kirkby E, et al. Clinically localized prostate cancer: AUA/ASTRO/SUO guideline part I: risk stratification, shared decision making, and care options. *J Urol*. 2018;199(3):683-690. doi:10.1016/j.juro.2017.11.095
44. Campbell S, Uzzo RG, Allaf ME, et al. Renal mass and localized renal cancer: AUA guideline. *J Urol*. 2017;198(3):520-529. doi:10.1016/j.juro.2017.04.100
45. Ducreux M, Cuhna AS, Caramella C, et al; ESMO Guidelines Committee. Cancer of the pancreas: ESMO Clinical Practice Guidelines for diagnosis, treatment and follow-up. *Ann Oncol*. 2015;26(suppl 5):v56-v68. doi:10.1093/annonc/mdv295
46. Plümper T, Laroze D, Neumayer E. Regional inequalities in premature mortality in Great Britain. *PLoS One*. 2018;13(2):e0193488. doi:10.1371/journal.pone.0193488
47. Marmot M. The influence of income on health: views of an epidemiologist. *Health Aff (Millwood)*. 2002;21(2):31-46. doi:10.1377/hlthaff.21.2.31
48. Chetty R, Stepner M, Abraham S, et al. The association between income and life expectancy in the United States, 2001-2014. *JAMA*. 2016;315(16):1750-1766. doi:10.1001/jama.2016.4226
49. Agarwal S, Garg A, Parashar A, Jaber WA, Menon V. Outcomes and resource utilization in ST-elevation myocardial infarction in the United States: evidence for socioeconomic disparities. *J Am Heart Assoc*. 2014;3(6):e001057. doi:10.1161/JAHA.114.001057
50. Yong CM, Abnoui F, Asch SM, Heidenreich PA. Socioeconomic inequalities in quality of care and outcomes among patients with acute coronary syndrome in the modern era of drug eluting stents. *J Am Heart Assoc*. 2014;3(6):e001029. doi:10.1161/JAHA.114.001029
51. Givens RC, Dardas T, Clerkin KJ, Restaino S, Schulze PC, Mancini DM. Outcomes of multiple listing for adult heart transplantation in the United States: analysis of OPTN data from 2000 to 2013. *JACC Heart Fail*. 2015;3(12):933-941. doi:10.1016/j.jchf.2015.07.012
52. Welch HG, Schwartz L, Woloshin S. *Overdiagnosed: Making People Sick in the Pursuit of Health*. Beacon Press; 2011.
53. Schnittker J, Bhatt M. The role of income and race/ethnicity in experiences with medical care in the United States and United Kingdom. *Int J Health Serv*. 2008;38(4):671-695. doi:10.2190/HS.38.4.f
54. Dubay LC, Lebrun LA. Health, behavior, and health care disparities: disentangling the effects of income and race in the United States. *Int J Health Serv*. 2012;42(4):607-625. doi:10.2190/HS.42.4.c
55. Ponce NA, Ko M, Liang SY, et al. Early diffusion of gene expression profiling in breast cancer patients associated with areas of high income inequality. *Health Aff (Millwood)*. 2015;34(4):609-615. doi:10.1377/hlthaff.2014.1013
56. Rana RH, Alam K, Gow J, Ralph N. Predictors of health care use in Australian cancer patients. *Cancer Manag Res*. 2019;11:6941-6957. doi:10.2147/CMAR.S193615
57. Dunlop S, Coyte PC, McIsaac W. Socio-economic status and the utilisation of physicians' services: results from the Canadian National Population Health Survey. *Soc Sci Med*. 2000;51(1):123-133. doi:10.1016/S0277-9536(99)00424-4
58. Fisher ES, Wennberg DE, Stukel TA, Gottlieb DJ, Lucas FL, Pinder EL. The implications of regional variations in Medicare spending part 2: health outcomes and satisfaction with care. *Ann Intern Med*. 2003;138(4):288-298. doi:10.7326/0003-4819-138-4-200302180-00007

59. Welch HG, Black WC. Overdiagnosis in cancer. *J Natl Cancer Inst*. 2010;102(9):605-613. doi:10.1093/jnci/djq099
60. Gershengoren L. Our duty to the "VIP patient." *J Grad Med Educ*. 2016;8(5):784. doi:10.4300/JGME-D-16-00468.1
61. Weintraub W. The VIP syndrome: a clinical study in hospital psychiatry. *J Nerv Ment Dis*. 1964;138:181-193. doi:10.1097/00005053-196402000-00012
62. Cohen E, Rodean J, Diong C, et al. Low-value diagnostic imaging use in the pediatric emergency department in the United States and Canada. *JAMA Pediatr*. 2019;e191439. doi:10.1001/jamapediatrics.2019.1439
63. Segal JB, Nassery N, Chang HY, Chang E, Chan K, Bridges JF. An index for measuring overuse of health care resources with Medicare claims. *Med Care*. 2015;53(3):230-236. doi:10.1097/MLR.0000000000000304
64. Davis K, Ballreich J. Equitable access to care—how the United States ranks internationally. *N Engl J Med*. 2014;371(17):1567-1570. doi:10.1056/NEJMp1406707
65. Landon BE, Larkin S, Elshaug AG. Challenges of a supplemental private option under national health insurance—observations from Australia. *JAMA Intern Med*. 2021;1-2.
66. Sturchio JL, Kickbusch I, Galambos L. *The Road to Universal Health Coverage: Innovation, Equity, and the New Health Economy*. Johns Hopkins University Press; 2019.
67. Gorey KM, Luginah IN, Bartfay E, et al. Better colon cancer care for extremely poor Canadian women compared with American women. *Health Soc Work*. 2013;38(4):240-248. doi:10.1093/hsw/hlt022
68. Gorey KM, Richter NL, Luginah IN, et al. Breast cancer among women living in poverty: better care in Canada than in the United States. *Soc Work Res*. 2015;39(2):107-118. doi:10.1093/swr/svv006
69. Reinhardt UE, Hussey PS, Anderson GFUS. U.S. health care spending in an international context. *Health Aff (Millwood)*. 2004;23(3):10-25. doi:10.1377/hlthaff.23.3.10
70. Rapsomaniki E, Thuresson M, Yang E, et al. Using big data from health records from four countries to evaluate chronic disease outcomes: a study in 114 364 survivors of myocardial infarction. *Eur Heart J Qual Care Clin Outcomes*. 2016;2(3):172-183. doi:10.1093/ehjqcco/qcw004
71. McNamara RL, Chung SC, Jernberg T, et al. International comparisons of the management of patients with non-ST segment elevation acute myocardial infarction in the United Kingdom, Sweden, and the United States: the MINAP/NICOR, SWEDHEART/RIKS-HIA, and ACTION Registry-GWTG/NCDR registries. *Int J Cardiol*. 2014;175(2):240-247. doi:10.1016/j.ijcard.2014.04.270
72. Cram P, Lix LM, Bohm E, et al. Hip fracture care in Manitoba, Canada and New York State, United States: an analysis of administrative data. *CMAJ Open*. 2019;7(1):E55-E62. doi:10.9778/cmajo.20180126
73. Rios G, Conrad A, Cole D, et al. Trends in indications and outcomes in the Whipple procedure over a 40-year period. *Am Surg*. 1999;65(9):889-893.
74. Beisland C, Medby PC, Sander S, Beisland HO. Nephrectomy—indications, complications and postoperative mortality in 646 consecutive patients. *Eur Urol*. 2000;37(1):58-64. doi:10.1159/000020101
75. Khalil MI, Bhandari NR, Payakachat N, Davis R, Raheem OA, Kamel MH. Perioperative mortality and morbidity of outpatient versus inpatient robot-assisted radical prostatectomy: a propensity matched analysis. *Urol Oncol*. 2020;38(1):3.e1-3.e6. doi:10.1016/j.urolonc.2019.07.008

SUPPLEMENT.

eFigure 1. Flowchart for Cohort Generation of Patients Hospitalized for Pancreatectomy, Radical Prostatectomy, or Nephrectomy in New York State, Ontario, and New South Wales

eFigure 2. Standardized Per Capita Utilization of Pancreatectomy, Radical Prostatectomy, and Nephrectomy (per 100 000 Population per Year) by Decade of Age in New York State, Ontario, and New South Wales

eTable 1. Comorbid Conditions of Patients Who Underwent Pancreatectomy, Radical Prostatectomy, and Nephrectomy in New York State, Ontario, and New South Wales

eTable 2. Unadjusted Outcomes of Patients Who Underwent Pancreatectomy, Radical Prostatectomy, and Nephrectomy in New York State, Ontario, and New South Wales

eTable 3. Risk-Standardized Outcomes of Patients Who Underwent Pancreatectomy, Radical Prostatectomy, or Nephrectomy in New York State, Ontario, and New South Wales

eAppendix. Procedure Codes for Pancreatectomy, Radical Prostatectomy, and Nephrectomy in New York State, Ontario, and New South Wales

eReferences.