COMPARING PERFORMANCE OF UNIVERSAL HEALTH CARE COUNTRIES, 2017

by Bacchus Barua, Sazid Hasan, and Ingrid Timmermans

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Executive Summary

Comparing the performance of different countries' health-care systems provides an opportunity for policy makers and the general public to determine how well Canada's health-care system is performing relative to its international peers. Overall, the data examined suggest that, although Canada's is among the most expensive universal-access health-care systems in the OECD, its performance is modest to poor.

This study uses a "value for money approach" to compare the cost and performance of 29 universal health-care systems in high-income countries. The level of health-care expenditure is measured using two indicators, while the performance of each country's health-care system is measured using 42 indicators, representing the four broad categories:

[1] availability of resources

[2] use of resources

[3] access to resources

[4] quality and clinical performance.

Five measures of the overall health status of the population are also included. However, these indicators can be influenced to a large degree by non-medical determinants of health that lie outside the purview of a country's health-care system and policies.

Expenditure on health care

Canada spends more on health care than the majority of high-income OECD countries with universal health-care systems. After adjustment for "age", the percentage of the population over 65, it ranks third highest for expenditure on health care as a percentage of GDP and eleventh highest for health-care expenditure per capita.

Availability of resources

The availability of medical resources is perhaps one of the most basic requirements for a properly functioning health-care system. Data suggests that Canada has substantially fewer human and capital medical resources than many peer jurisdictions that spend comparable amounts of money on health care. After adjustment for age, it has significantly fewer physicians, acute-care beds,

and psychiatric beds per capita compared to the average of OECD countries included in the study (it ranks close to the average for nurses). While Canada has the most Gamma cameras (per million population), it has fewer other medical technologies than the average high-income OECD country with universal health care for which comparable inventory data is available.

Use of resources

Medical resources are of little use if their services are not being consumed by those with health-care demands. Data suggests that Canada's performance is mixed in terms of use of resources, performing at higher rates than the average OECD country on about half the indicators examined (for example, consultations with a doctor, CT scans, and cataract surgery), and average to lower rates on the rest. Canada reports the least degree of hospital activity (as measured by discharge rates) in the group of countries studied.

Access to resources

While both the level of medical resources available and their use can provide insight into accessibility, it is also beneficial to measure accessibility more directly by examining measures of timeliness of care and cost-related barriers to access. Canada ranked worst on four of the five indicators of timeliness of care, and performed worse than the 10-country average on the indicator measuring the percentage of patients who reported that cost was a barrier to access.

Quality and clinical performance

When assessing indicators of availability of, access to, and use of resources, it is of critical importance to include as well some measure of quality and clinical performance in the areas of primary care, acute care, mental health care, cancer care, and patient safety. While Canada does well on four indicators of clinical performance and quality (such as rates of survival for breast and colorectal cancer), its performance on the seven others examined in this study are either no different from the average or in some cases—particularly obstetric traumas and diabetes-related amputations—worse.

The data examined in this report suggests that there is an imbalance between the value Canadians receive and the relatively high amount of money they spend on their health-care system. Although Canada ranks among the most expensive universal-access health-care systems in the OECD, its performance for availability and access to resources is generally below that of the average OECD country, while its performance for use of resources and quality and clinical performance is mixed.

Introduction

Measuring and reporting the performance of health-care systems is vital for ensuring accountability and transparency, and is valuable for identifying areas for improvement. Comparing the performance of different countries' health-care systems provides an opportunity for policy makers and the general public to determine how well Canada's health-care system is performing relative to its international counterparts.

This study updates Barua, Timmermans, Nason, and Esmail (2016), who followed the examples of Esmail and Walker (2008), Rovere and Skinner (2012), and Barua (2013) to examine the performance of health-care systems using a "value for money" approach. That is, the performances of various health-care systems are assessed using indicators measuring:

1. the expenditure on health care (the cost); and
2. the provision of health care (the value).

The cost of health care is measured using two indicators, while the provision of health care is measured using 42 indicators, representing four broad categories:

1. availability of resources;
2. use of resources;
3. access to resources;
4. clinical performance and quality.

Five indicators measuring the overall health status of the population are also included. The intention is to provide Canadians with a better understanding of how much they spend on health care in comparison to other countries with universal health-care systems, and assess whether the availability, use, access, and quality of their system is of commensurate value.

The first section of this paper provides an overview of the methodology used, and explains what is being measured and how. The second section presents data reflecting how much Canada spends on health care in comparison with other countries. The third section presents data reflecting the performance of Canada's health-care system (compared to other countries) as measured by the availability of resources, use of resources, access to resources, and clinical performance and quality. The fourth section examines indicators reflecting the overall health status of the populations in the countries examined. A conclusion follows.

1. Method

What is measured, and why?

The objective of this report is to provide an overview of the amount different countries spend on their respective health-care systems, and to concurrently measure (using a number of indicators) the value they receive for that expenditure. When measuring the quality of health care in Canada, the Canadian Institute of Health Information (CIHI) identifies two distinct questions: "How healthy are Canadians?"; and "How healthy is the Canadian health system?" (CIHI, 2011b: ix).

The answer to the first question—How healthy are Canadians?—can be informed through the examination of indicators of health status. While such indicators are included in section four of this paper, the information they provide must be interpreted with caution when assessing the performance of the health-care system. This is because the health status of a population is determined by a number of factors, some of which (like timely access to quality medical care) may fall under the purview of a health-care system, while others (like smoking rates, environmental quality, genetic factors, and lifestyle choices) may not.

In this study, we are more concerned with the second question—"How healthy is the Canadian health system?"—as measured by indicators reflecting the availability of resources, use of resources, access to resources, and clinical performance and quality. [1] The interaction between these various components can be seen in figure 1. This study focuses primarily on area 2 of the figure, includes indicators reflecting area 3 for reference (as it is partly affected by area 2), but excludes area 1. While indicators measuring the cost and performance of the health-care system as a result of government policy are included in this paper, government health-care policy itself is neither examined nor assessed. [2]

What indicators are included?

The level of health-care expenditure is measured using two indicators, while the performance of each country's health-care system is measured using 42 indicators, representing the four broad categories of: [1] availability of resources; [2] use of resources; [3] access to resources; and [4] clinical performance and quality. In addition, five indicators measuring health status are also included;

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[1] For a broader explanation of the framework of analysis used in this report, see Barua, 2013.
[2] For example, unlike Esmail and Walker (2008) this report does not present data on how each country's universal health-insurance system is structured, whether they employ user-fees and co-payments, how hospitals and doctors are paid, and so on.

Figure 1: Framework for analysis of health care
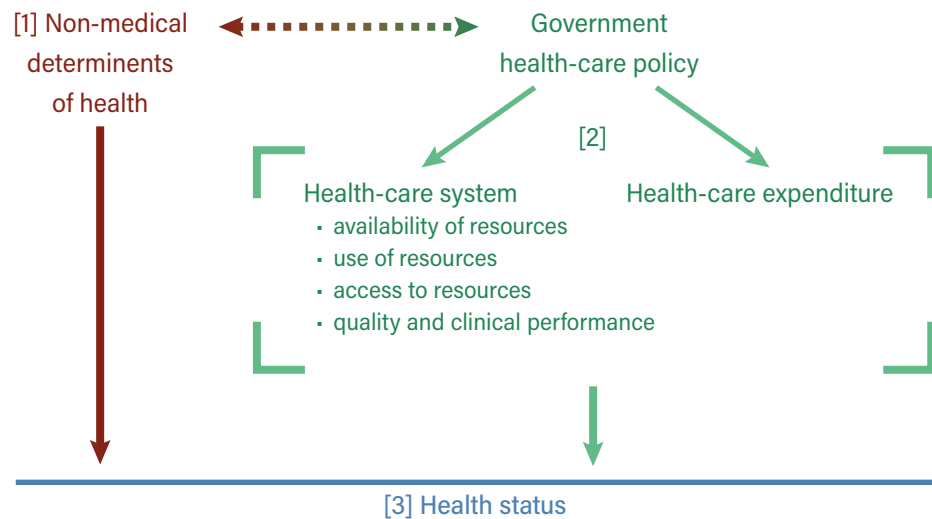
Adapted from OECD, 2015; Barua, 2013.

however, as mentioned above, the authors recognize that these may be affected by factors outside the purview of, and the amount of money spent on, the health-care system in question.

All the indicators used in this report are either publicly available, or derived from publicly available data, from the Organisation for Economic Co-operation and Development [OECD], the Commonwealth Fund, and the World Health Organization [WHO]. The choice of indicators included are primarily based on those presented in Esmail and Walker (2008) and Rovere and Skinner (2012), and are categorized using the framework presented in Barua (2013).

In addition, since the publication of the above reports, several new indicators have become available from the OECD, Commonwealth Fund, and WHO. Barua and colleagues examined these indicators and included those that either provide new information, or add more nuanced detail, within the previously identified area of concern (Barua, Timmermans, Nason, and Esmail, 2016).

A complete list of the indicators used in this report, organized according to the categories mentioned above, is presented in table 1. While the selection of indicators included in this report is not comprehensive, they are meant to provide readers with a broad overview of the performance of each country's health-care system.

What is the time-frame?

Data from the OECD and from the WHO are for 2015, or the most recent year available. Data from the Commonwealth Fund are for 2016. While newer data are available for certain countries, the authors have chosen to use the year that provides the most complete and comparable data for this edition of the report.

Table 1: Indicators used in *Comparing Performance*

Category	Indicator	Source
Spending	Total expenditure on health (% gross domestic product)	OECD, 2017
	Total expenditure on health (per capita US ppp)	OECD, 2017
Availability of resources	Physicians (per thousand population)	OECD, 2017
	Nurses (per thousand population)	OECD, 2017
	Curative (acute) care beds (per thousand population)	OECD, 2017
	Psychiatric care beds (per thousand population)	OECD, 2017
	Magnetic Resonance Imaging (MRI) units (per million population)	OECD, 2017
	Computed Tomography (CT) scanners (per million population)	OECD, 2017
	Positron Emission Tomography (PET) scanners (per million population)	OECD, 2017
	Gamma cameras (per million population)	OECD, 2017
	Digital Subtraction Angiography units (per million population)	OECD, 2017
	Mammographs (per million population)	OECD, 2017
	Lithotriptors (per million population)	OECD, 2017
Use of resources	Doctor consultations (per hundred population)	OECD, 2017
	Hospital discharges (per hundred thousand population)	OECD, 2017
	Magnetic Resonance Imaging (MRI) examinations (per thousand population)	OECD, 2017
	Computed Tomography (CT) examinations (per thousand population)	OECD, 2017
	Cataract surgery (per hundred thousand population)	OECD, 2017
	Transluminal coronary angiolasty (per hundred thousand population)	OECD, 2017
	Coronary artery bypass graft (CABG) (per hundred thousand population)	OECD, 2017
	Stem cell transplantation (per hundred thousand population)	OECD, 2017
	Appendectomy (per hundred thousand population)	OECD, 2017
	Cholecystectomy (per hundred thousand population)	OECD, 2017
	Repair of inguinal hernia (per hundred thousand population)	OECD, 2017
	Transplantation of kidney (per hundred thousand population)	OECD, 2017
	Hip replacement (per hundred thousand population)	OECD, 2017
	Knee replacement (per hundred thousand population)	OECD, 2017
Access to resources	Able to get same day appointment when sick (%)	Commonwealth Fund, 2017
	Very/somewhat easy getting care after hours (%)	Commonwealth Fund, 2017
	Waited 2 months or more for specialist appointment (%)	Commonwealth Fund, 2017
	Waited 4 months or more for elective surgery (%)	Commonwealth Fund, 2017
	Experienced barrier to access because of cost in past year (%)	Commonwealth Fund, 2017
	Waiting time of more than four weeks for getting an appointment with a specialist (%)	OECD, 2017
Quality and clinical performance	Breast cancer five year relative survival (%)	OECD, 2017
	Cervical cancer five year relative survival (%)	OECD, 2017
	Colorectal cancer five year relative survival (%)	OECD, 2017
	Admission-based AMI 30 day in-hospital mortality (per hundred patients)	OECD, 2017
	Admission based hemorrhagic stroke 30 day in hospital mortality (per hundred patients)	OECD, 2017
	Admission-based Ischemic stroke 30 day in-hospital mortality (per hundred patients)	OECD, 2017
	Hip-fracture surgery initiated within 48 hours of admission to the hospital (per 100 patients)	OECD, 2017
	Diabetes lower extremity amputation (per hundred thousand population)	OECD, 2017
	Obstetric trauma vaginal delivery with instrument (per hu-ndred vaginal deliveries)	OECD, 2017
	Obstetric trauma vaginal delivery without instrument (per hundred vaginal deliveries)	OECD, 2017
	In-patient suicide among patients diagnosed with a mental disorder (per hundred patients)	OECD, 2017
Health status	Life expectancy at birth (years)	OECD, 2017
	Infant mortality rate (per thousand live births)	OECD, 2017
	Perinatal mortality (per thousand total births)	OECD, 2015a
	Healthy-age life expectancy at birth (HALE) (years)	WHO, 2017a
	Mortality amenable to health care (MAH)	CIHI, 2016; Eurostat, 2013; WHO, 2017a, 2017b

Note: For precise definitions, see OECD, 2015a; Commonwealth Fund, 2015; and WHO, 2015a, 2015b.

Which countries are included?

The countries [3] included for comparison in this study were chosen based on the following three criteria:

1. must be a member of the OECD;

2. must have universal (or near-universal) coverage for core-medical services;

3. must be classified as a "high-income" country by the World Bank. [4]

Of 34 OECD members in 2015 considered for inclusion, the OECD (2015) concludes that three countries—Greece, the United States, and Poland—do not have universal (or near-universal) coverage for core medical services. Of the 31 countries remaining for consideration, two—Mexico, and Turkey—do not meet the criteria of being classified in the high-income group (in 2015) according to the World Bank (2017). The remaining 29 countries that meet the three criteria above can be seen in table 2 (p. 9).

Are the indicators adjusted for comparability?

The populations of the 29 countries included for comparison in this report vary significantly in their age-profiles. For example, while seniors represented only 10.2% of Chile's population in 2015, they represented 26.6% of the population in Japan in the same year (OECD, 2017). This is important because it is well established that older populations require higher levels of health-care spending as a result of consuming more health-care resources and services (Esmail and Walker, 2008). [5] For example, in 2014 seniors over 65 years of age represented 16% of the Canadian population but consumed 46% of all health-care expenditures (CIHI, 2016; calculations by authors).

For this reason, in addition to presenting unadjusted figures, this study also presents indicators measuring health-care expenditures, availability of resources, and use of resources adjusted according to the age-profile of the

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[3] It is of note that there may be significant variation within each country examined. This is particularly true in Canada where the provision of health-care services is a provincial responsibility and there may be meaningful differences with regards to policy, spending, and the delivery of care.

[4] "High-income" countries are those that have a gross national income (GNI) per capita of $12,475 or more in 2015.

[5] The Canadian Institute of Health Information (CIHI) suggests that "[o]lder seniors consume more health care dollars largely as a consequence of two factors: the cost of health care in the last few months of life, and the minority of the population with chronic illnesses that tend to require more intensive medical attention with age". They also note that "[t]here is some evidence that proximity to death rather than aging is the key factor in terms of health expenditure" (CIHI, 2011a: 16–17).

country. [6] While such adjustment may not affect the overall conclusion [7] about the performance of a country's health-care system compared to expenditure, it does provide a more nuanced view when examining indicators individually. For this reason, both unadjusted and age-adjusted rankings are presented in this paper. Taking the example of health care spending, the age-adjustment process used in this paper is based on the following two factors.

1. *An estimate of how health expenditures have historically changed as a result of changes in the proportion of the population over 65*
It is possible to calculate the change in average per-capita government health-care expenditures when the age structure changes, while keeping the age-specific expenditure constant (see, e.g., Barua, Palacios, and Emes, 2016; Morgan and Cunningham, 2011; Pinsonnault, 2011). While five-year age bands are most commonly used, we can adapt this method so that only two age bands are used (0–65, and 65+) to estimate the elasticity of real, total health-care expenditures per capita solely due to changes in the proportion of the population over 65. Using Canadian [8] population and per-capita health-care expenditure data from 1980 to 2000 (Grenon, 2001), and keeping the age-specific expenditure data constant, [9] we estimate that for every 1% (or percentage point, since the share of population over 65 is a percentage itself) increase in proportion of population over 65, health-care expenditure increased by 3.1%.

2. *The degree to which the proportion of a country's population over 65 deviates from the OECD average*
If β represents the proportion of the population over 65, and HCE_{pc} is health care expenditure per capita in a particular country, then:

$$HCE_{pc} \text{ age-adjusted} = HCE_{pc} (1 + 0.03098)^{(\beta_{oecd} - \beta)}$$

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[6] It is unclear whether indicators of timely access to care need to be adjusted for age, and the methodology for making such an adjustment has not been explored by the authors. Indicators of clinical performance and quality are already adjusted for age by the OECD. The indicators of health status (such as life expectancy) used in this report generally do not require (further) age-adjustment. The methodology for calculating Mortality Amenable to Healthcare [MAH] incorporates adjustments for age and is explained in detail in a later section.

[7] As Barua (2013) notes, in the process of calculating an overall value-for-money score, age-adjustment would apply to both the value and cost components in opposite directions and may cancel each other out in the process.

[8] Detailed age-specific historical data on health-care spending for every OECD country were not available. As a result, we assume that the effect of ageing on health-care spending in Canada is reflective of how ageing would affect health-care spending in high-income OECD countries more generally.

[9] 1990 is used as a base year. A sensitivity analysis using 1980 and 2000 as base years did not yield significantly different results.

One way to think of this estimation is, if β_{oecd} had exactly one-percentage point more seniors as a share of the population than Canada, the adjusted expenditure for Canada should be equal to Canada's projected health-care expenditure per capita when its population over 65 increases by one percentage point. Following Esmail and Walker (2008), we assume that it is logical to apply the same proportional increase (due to ageing) derived from our spending estimate to indicators measuring the number of resources and their use. [10]

[10] Esmail and Walker note that, "[l]ike health expenditures, where the elderly consume far more resources than other proportions of the population, medical professionals [and resources, more generally] are likely to be needed at a higher rate as the population ages" (2008: 53). In the absence of precise estimates, we assume that increased use of medical resources rise roughly proportionally to increased use of all health-care services (as reflected by increased health-care spending).

2. How much does Canada spend on health care compared to other countries?

When attempting to measure the performance of health-care systems, it is essential to consider the costs of maintaining such systems. It is not meaningful to either "define higher national levels of spending on health as negative without considering the benefits" (Rovere and Skinner, 2012: 15) or, conversely, to define a health system with higher levels of benefits as positive without considering the costs. There are two measures that can help inform us about the relative differences between the amount of money spent by different countries on health care. The first is health-care expenditure as a percentage of gross domestic product (GDP). As Esmail and Walker note, this indicator "controls for the level of income in a given country and shows what share of total production is committed to health care expenditures". Such a measure also helps avoid potentially "flawed comparisons with low spending in less developed OECD countries ... while also not overvaluing high expenditures in relatively rich countries" (2008: 17) .

A second measure is health-care expenditure per capita, adjusted for comparison using purchasing power parity data (PPP). While there are some important theoretical concerns about the reliability of international comparisons using data reliant on PPP, there are a number of benefits to using this indicator in general. Apart from being more straightforward from a conceptual standpoint, how countries rank on this indicator is less susceptible to short-term fluctuations in GDP.

Out of 29 countries, Canada ranked 8th highest for health-care expenditure as a percentage of GDP and 11th highest for health-care expenditure per capita (table A1, p. 44). After adjustment for age, Canada ranks third highest for health-care expenditure as a percentage of GDP and 11th highest for health-care expenditure per capita (table 2; figures 2a, 2b). Clearly, these indicators suggest that Canada spends more on health care than the majority of high-income OECD countries with universal health-care systems.
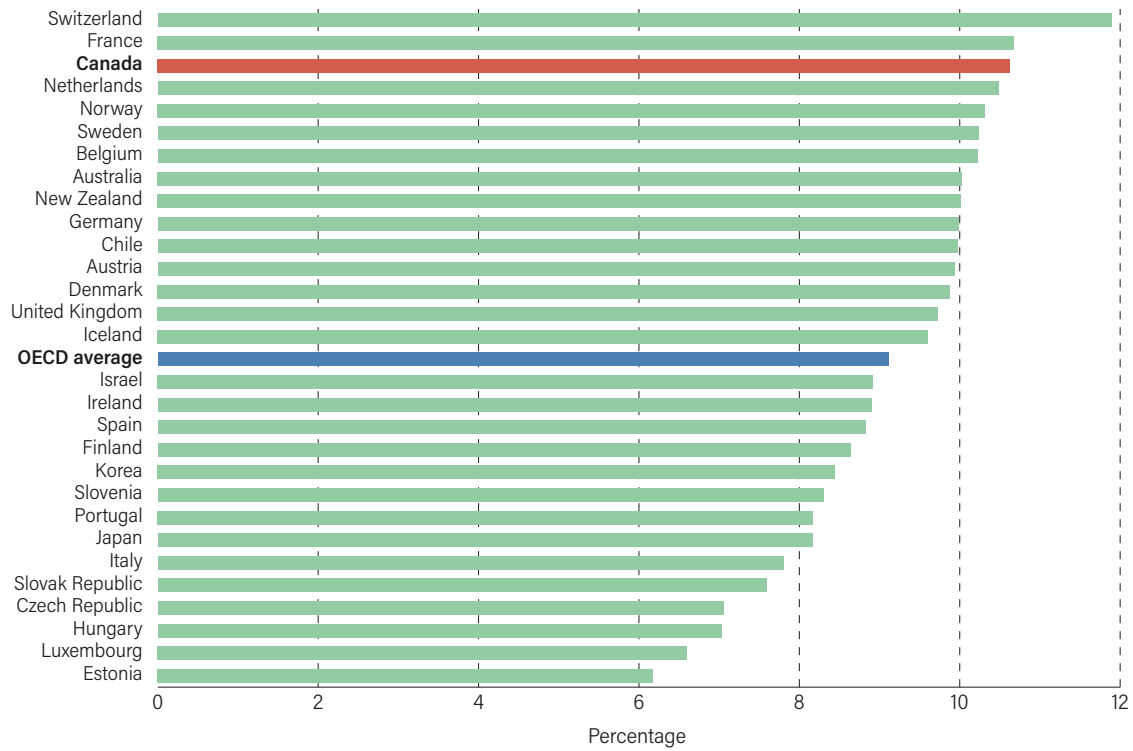
Table 2: Spending on health care, age-adjusted, 2015

	Spending as percentage of GDP		Spending per capita	
	Percentage	Rank	US$ PPP	Rank
Australia	10.0	8	4,793.4	9
Austria	9.9	12	4,920.3	6
Belgium	10.2	7	4,652.4	12
Canada	**10.6**	**3**	**4,676.7**	**11**
Chile	10.0	11	2,311.9	26
Czech Republic	7.1	26	2,384.4	25
Denmark	9.9	13	4,849.9	8
Estonia	6.2	29	1,791.2	29
Finland	8.6	19	3,668.9	17
France	10.7	2	4,356.6	14
Germany	10.0	10	4,770.1	10
Hungary	7.0	27	1,868.2	28
Iceland	9.6	15	4,585.8	13
Ireland	8.9	17	6,019.9	4
Israel	8.9	16	3,270.4	19
Italy	7.8	24	2,905.9	21
Japan	8.2	23	3,321.9	18
Korea	8.4	20	2,892.5	22
Luxembourg	6.6	28	7,499.8	1
Netherlands	10.5	4	5,188.6	5
New Zealand	10.0	9	3,816.7	16
Norway	10.3	5	6,386.6	3
Portugal	8.2	22	2,417.7	24
Slovak Republic	7.6	25	2,265.4	27
Slovenia	8.3	21	2,666.9	23
Spain	8.8	18	3,049.3	20
Sweden	10.2	6	4,898.1	7
Switzerland	11.9	1	7,404.3	2
United Kingdom	9.7	14	4,053.4	15
OECD average	**9.1**		**4,058.2**	

Note: Because the table shows rounded values, countries may have different ranks even if they appear to have same values.
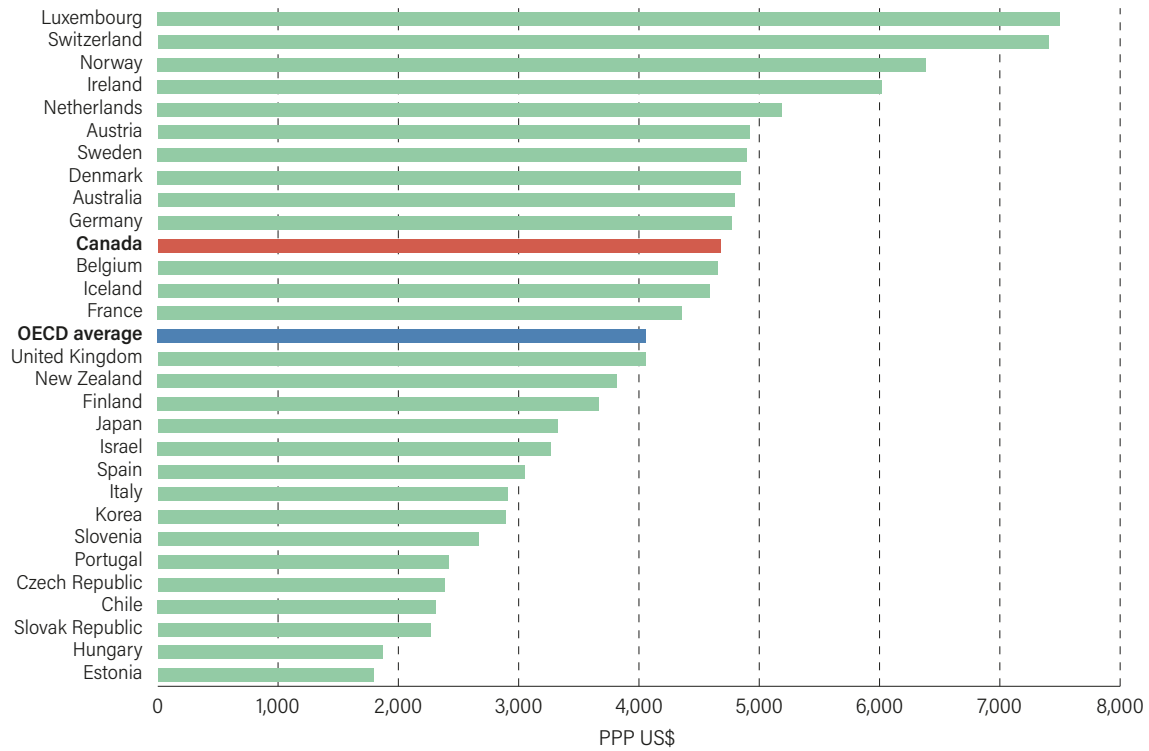Sources: OECD, 2017; calculations by authors.

Figure 2a: Health-care spending as a percentage of GDP, age-adjusted, 2015

Sources: OECD, 2017; calculations by authors.

Figure 2b: Health-care spending per capita (PPP US$), age-adjusted, 2015

Sources: OECD, 2017; calculations by authors.

3. How well does Canada's health-care system perform?

In light of Canada's relatively high spending on health care, the following section examines the performance of Canada's health-care system using 42 indicators, representing the four broad categories of: 1. availability of resources; 2. use of resources; 3. access to resources; 4. clinical performance and quality.

1. Availability of resources

The availability of adequate medical resources is perhaps one of the most basic requirements for a properly functioning health-care system. Due to its integral nature, along with the availability of comparable data, indicators of medical resources available are frequently examined by researchers, especially in the context of health-care expenditures (e.g., Esmail and Walker, 2008; Rovere and Skinner, 2012). The World Health Organisation (WHO) notes that "the provision of health care involves putting together a considerable number of resource inputs to deliver an extraordinary array of different service outputs" (WHO, 2000: 74, 75) and suggests that human resources, physical capital, and consumables such as medicine are the three primary inputs of a health system.

Of these, this study includes indictors of human and capital resources (table 3), and of technology resources. [11] Research has shown that drugs are also considered one of the most important forms of medical technology used to treat patients. [12] However, indicators of the availability, novelty, and consumption of pharmaceuticals are not included in this paper because comprehensive and comparable data are not available.

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[11] When analyzing medical resources in general, research also indicates that "more is not always better". For instance, Watson and McGrail (2009) found no association between avoidable mortality and the overall supply of physicians. The CIHI notes that what it calls the "structural dimensions" that characterize health-care systems are not "directional" and do not necessarily reflect the performance of health systems (CIHI, 2011c). Similarly, Kelly and Hurst (2006) contend that, while structural indicators (medical resources) are often necessary for delivering high-quality medical care, they are not always sufficient on their own: simply having an abundance of medical resources does not necessarily mean that they are being used efficiently or appropriately at all times. Therefore, this study makes no assertions about the optimal level at which such resources should be available.
[12] See, for example, Skinner and Rovere, 2011: 22–23; Cremieux et al., 2005; Frech and Miller, 1999; Kleinke, 2001; and Lichtenberg and Virabhak, 2002.

Table 3: Availability of human and capital resources, age-adjusted, per thousand population, 2015

	Physicians		Nurses		Acute beds		Psychiatric beds	
	per '000	Rank	per '000	Rank	per '000	Rank	per '000	Rank
Australia	3.8	9	12.3	8			0.4	21
Austria	4.9	1	7.8	19	5.5	4	0.6	14
Belgium	2.9	23	10.5	11	5.5	3	1.7	2
Canada	**2.7**	**25**	**10.2**	**14**	**2.1**	**27**	**0.4**	**25**
Chile	2.6	27	2.6	29	2.5	22	0.1	28
Czech Republic	3.6	12	7.8	18	4.2	9	1.0	7
Denmark	3.5	13	16.0	4	2.4	23	0.5	18
Estonia	3.2	18	5.7	26	3.5	14	0.5	17
Finland	2.9	22	13.5	6	2.8	19	0.6	16
France	3.2	19	9.5	15	3.9	11	0.8	12
Germany	3.7	11	11.9	9	5.4	5	1.1	5
Hungary	3.0	21	6.3	22	4.2	8	0.9	10
Iceland	4.2	3	17.3	3	2.9	17	0.5	20
Ireland	3.3	16	13.6	5	2.8	20	0.4	24
Israel	4.1	5	5.9	24	2.7	21	0.5	19
Italy	3.3	15	4.7	28	2.3	25	0.1	29
Japan	1.8	29	8.2	17	5.9	2	2.0	1
Korea	2.6	28	6.7	21	8.4	1	1.1	6
Luxembourg	3.2	20	13.1	7	4.5	7	0.9	11
Netherlands	3.4	14	10.3	13	3.5	13	1.2	3
New Zealand	3.3	17	11.1	10	2.9	18	0.3	27
Norway	4.5	2	17.8	1	3.5	15	1.2	4
Portugal	4.2	4	5.7	25	3.0	16	0.6	15
Slovak Republic	3.8	8	6.3	23	5.4	6	0.9	9
Slovenia	2.8	24	8.6	16	4.1	10	0.7	13
Spain	3.7	10	5.1	27	2.3	24	0.3	26
Sweden	3.9	7	10.3	12	2.1	26	0.4	23
Switzerland	4.1	6	17.7	2	3.7	12	0.9	8
United Kingdom	2.7	26	7.8	20			0.4	22
OECD Average	**3.4**		**9.8**		**3.8**		**0.7**	

Note: Because the table shows rounded values, countries may have different ranks even if they appear to have same values.
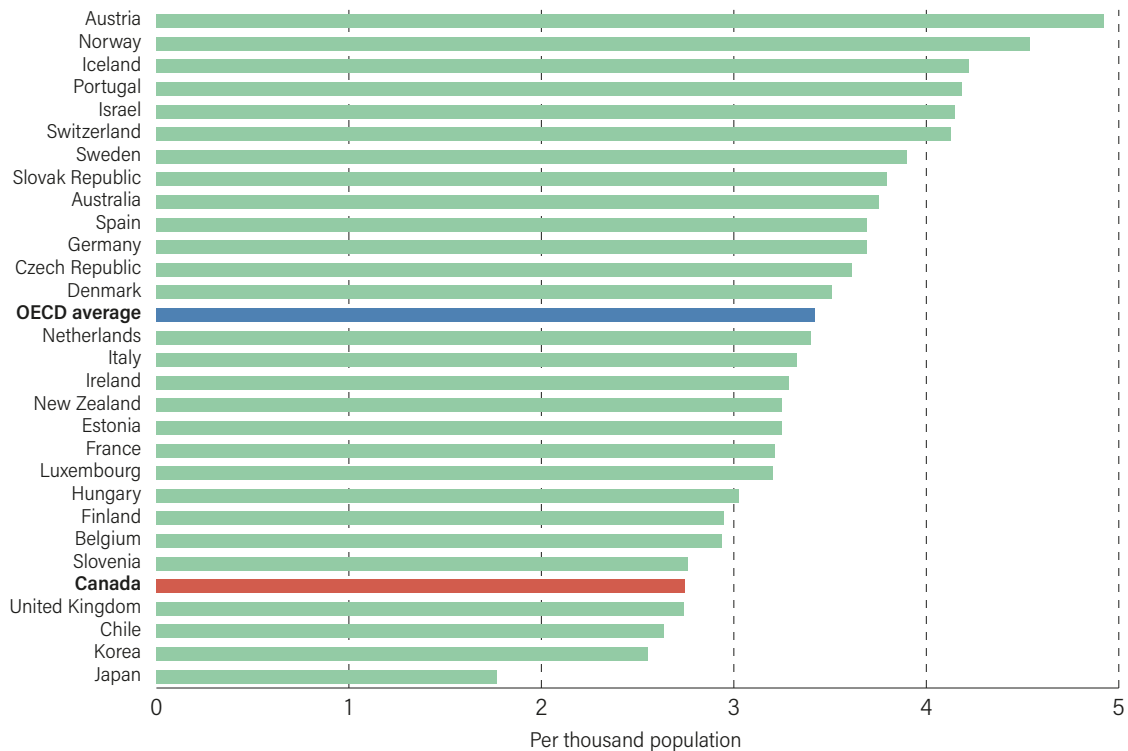Sources: OECD, 2017; calculations by authors.

Human and capital resources

Human resources are perhaps "the most important of the health system's inputs [and] usually the biggest single item in the recurrent budget for health" (WHO, 2000: 77). Importantly, apart from physicians, who, according to the WHO, play the primary role in the health-care system, it is also useful to measure the number of other health personnel such as nurses who are involved in the direct provision of care. At the same time, services cannot be effectively delivered without physical capital such as hospitals, [13] beds, and equipment. For this reason, it is useful to examine the number of physicians, nurses, curative (acute) care beds and psychiatric beds per thousand population.

Out of 29 countries, on a per-thousand-population basis, Canada ranks 26th for physicians, 15th for nurses, 26th for curative (acute) care beds (out of 27), and 25th for psychiatric care beds per thousand population (table A2, p. 45). As can be seen in table 3, after adjustment for age, Canada ranks 25th for physicians (**figure 3a**), 14th for nurses (**figure 3b**), 27th for curative (acute) care beds (out of 27) (**figure 3c**), and 25th for psychiatric care beds per thousand population.

Figure 3a: Physicians per thousand population, age-adjusted, 2015 or most recent

Sources: OECD, 2017; calculations by authors.

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[13] While data on the number of hospitals in the countries examined in this report are available, they are not included due to large variability in size and specialty. The number of beds in some ways serves as a proxy for the amount of physical capital that would be represented by a measure of the number of hospitals in a country.

Figure 3b: Nurses per thousand population, age-adjusted, 2015 or most recent

Sources: OECD, 2017; calculations by authors.

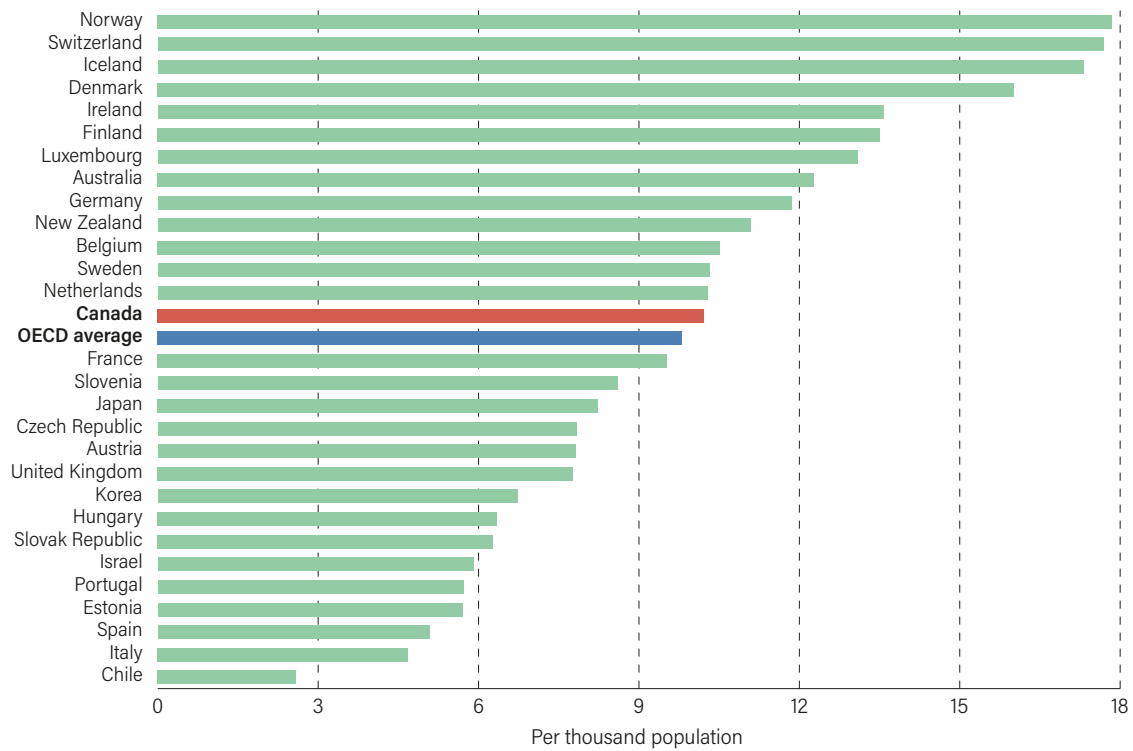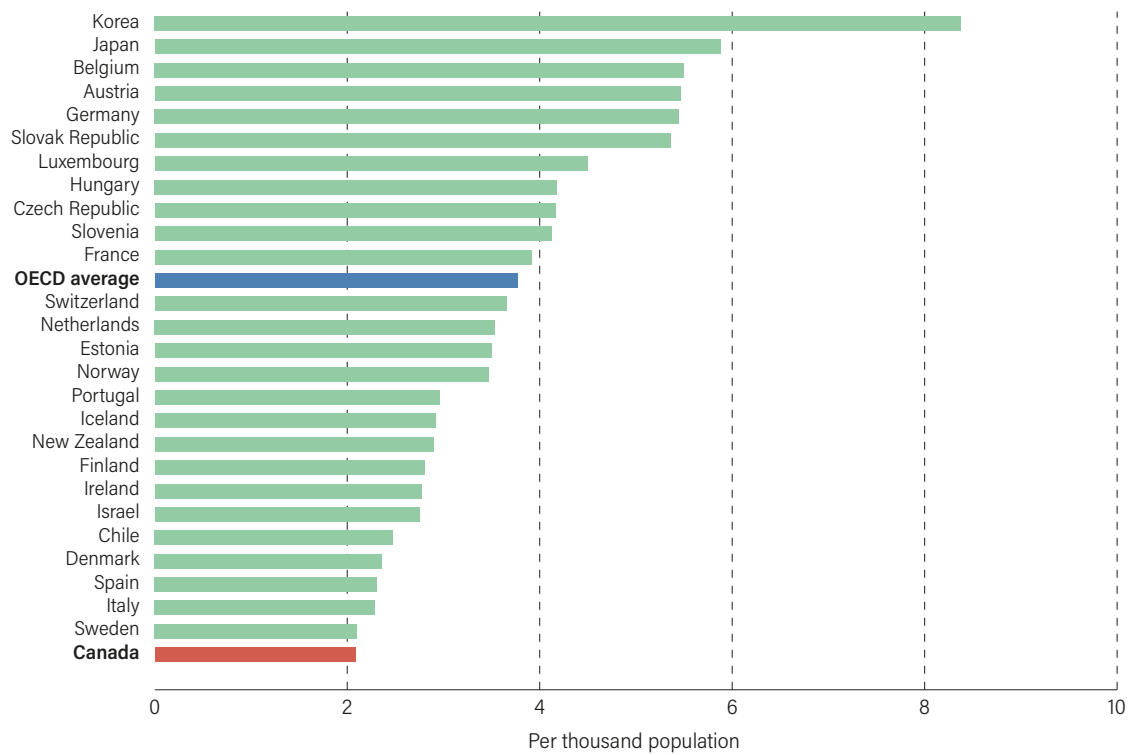## Figure 3c: Acute-care beds per thousand population, age-adjusted, 2015 or most recent

Sources: OECD, 2017; calculations by authors.

Except for the middling performance for nurses per capita, Canada clearly has many fewer human and capital medical resources per capita compared to other high-income OECD countries with universal health care.

Technology and diagnostic imaging resources

Research suggests that medical technology plays a significant role for improving the efficiency of medical services, ultimately benefiting patients while reducing health-care expenditures over time (Or, Wang, and Jamison, 2005). For example, medical technologies such as new diagnostic equipment and innovative surgical and laboratory procedures improve the efficiency of hospitals and increase the comfort and safety of patients (Esmail and Wrona, 2009). For this reason, it is useful to examine the number of Magnetic Resonance Imaging (MRI) units, Computed Tomography (CT) scanners, Positron Emission Tomography (PET) scanners, Gamma cameras, Digital Subtraction Angiography units, Mammographs, and Lithotriptors per million population.

Per million population, Canada ranks 19th (out of 27) for MRI units, 22nd (out of 28) for CT scanners, 16th (out of 24) for PET scanners, 1st (out of 24) for Gamma cameras, 16th (out of 20) for Digital Subtraction Angiography units, 11th (out of 22) for Mammographs, and 18th (out of 18) for Lithotriptors (table A3, pp. 46–47). After adjustment for age, Canada ranks 20th (out of 27) for MRI units (figure 4a), 22nd (out of 28) for CT scanners (figure 4b), 18th (out of 24) for PET scanners, 1st (out of 24) for Gamma cameras, 14th (out of 20) for Digital Subtraction Angiography units, 11th (out of 22) for Mammographs, and 18th (out of 18) for Lithotriptors (table 4). While Canada has the most Gamma cameras (per million population), it has fewer other medical technologies than the average high-income OECD country with universal health care for which comparable inventory data is available.

Table 4: Availability of technological and diagnostic imaging resources, age-adjusted, per million population, 2015

	MRI Units		CT Scanners		PET Scanners	
	Per million	Rank	Per million	Rank	Per million	Rank
Australia	16.0	10	63.6	2	2.8	6
Austria	19.0	8	28.4	9	2.2	9
Belgium	10.5	19	21.6	10		
Canada	**9.8**	**20**	**15.5**	**22**	**1.4**	**18**
Chile	11.6	17	18.2	19	0.7	21
Czech Republic	7.3	23	14.8	23	1.0	19
Denmark			36.3	5	5.8	1
Estonia	10.8	18	18.8	18	2.2	10
Finland	23.8	4	19.6	13	2.3	8
France	12.1	16	16.0	21	1.9	13
Germany	27.2	3	31.5	7		
Hungary	3.0	27	7.7	28	0.5	23
Iceland	23.8	5	44.1	3	0.0	24
Ireland	16.3	9	20.5	11	2.0	11
Israel	5.1	26	11.9	26	1.6	15
Italy	21.8	6	28.7	8	2.6	7
Japan	38.7	1	80.2	1	3.2	5
Korea	30.2	2	42.6	4	4.5	2
Luxembourg	13.7	13	19.5	14	1.9	12
Netherlands	12.6	15	13.1	24	3.7	3
New Zealand	14.3	12	19.2	15	1.4	17
Norway						
Portugal	6.5	24	19.9	12	0.5	22
Slovak Republic	9.1	21	19.1	16	1.6	14
Slovenia	8.5	22	12.8	25	0.9	20
Spain	14.7	11	16.8	20	1.6	16
Sweden	13.6	14	19.0	17		
Switzerland	20.5	7	35.5	6	3.4	4
United Kingdom	6.0	25	7.9	27		
OECD Average	**15.1**		**25.1**		**2.1**	

Sources: OECD, 2017; calculations by authors.

Gamma Cameras		Digital Subtraction Angiography units		Mammographs		Lithotriptors	
Per million	Rank	Per million	Rank	Per million	Rank	Per million	Rank
20.7	2	19.9	3	24.5	7		
10.9	8	8.4	12	22.6	9	1.9	11
21.4	**1**	**5.6**	**14**	**18.5**	**11**	**0.4**	**18**
2.0	24	5.0	18	15.0	17	2.4	9
11.3	6	8.5	11	10.4	20	3.4	4
16.1	3			15.9	15		
2.2	23	5.1	17	10.1	21	2.9	6
8.0	12	14.1	5	27.7	5	0.5	17
6.6	17						
11.2	7	5.6	15	14.2	18	5.8	3
10.1	9	23.6	2	16.9	12	3.4	5
6.8	16			16.1	13	1.5	13
12.1	5	10.1	8			0.6	16
7.2	15	11.9	6	29.4	3		
8.8	10			24.7	6		
6.6	18	10.6	7	62.4	1	16.2	1
15.4	4	17.4	4	13.5	19	1.9	10
8.0	14	9.3	10			2.4	8
3.5	22			23.7	8	0.7	15
4.4	21	4.6	19	32.4	2	2.8	7
5.5	20	9.5	9	20.7	10	7.5	2
8.0	13	8.0	13	16.1	14	0.9	14
6.2	19	5.5	16	15.5	16	1.8	12
8.3	11	29.6	1	27.8	4		
		1.0	20	9.9	22		
9.2		**10.7**		**21.3**		**3.2**	

Figure 4a: MRI units per million population, age-adjusted, 2015 or most recent
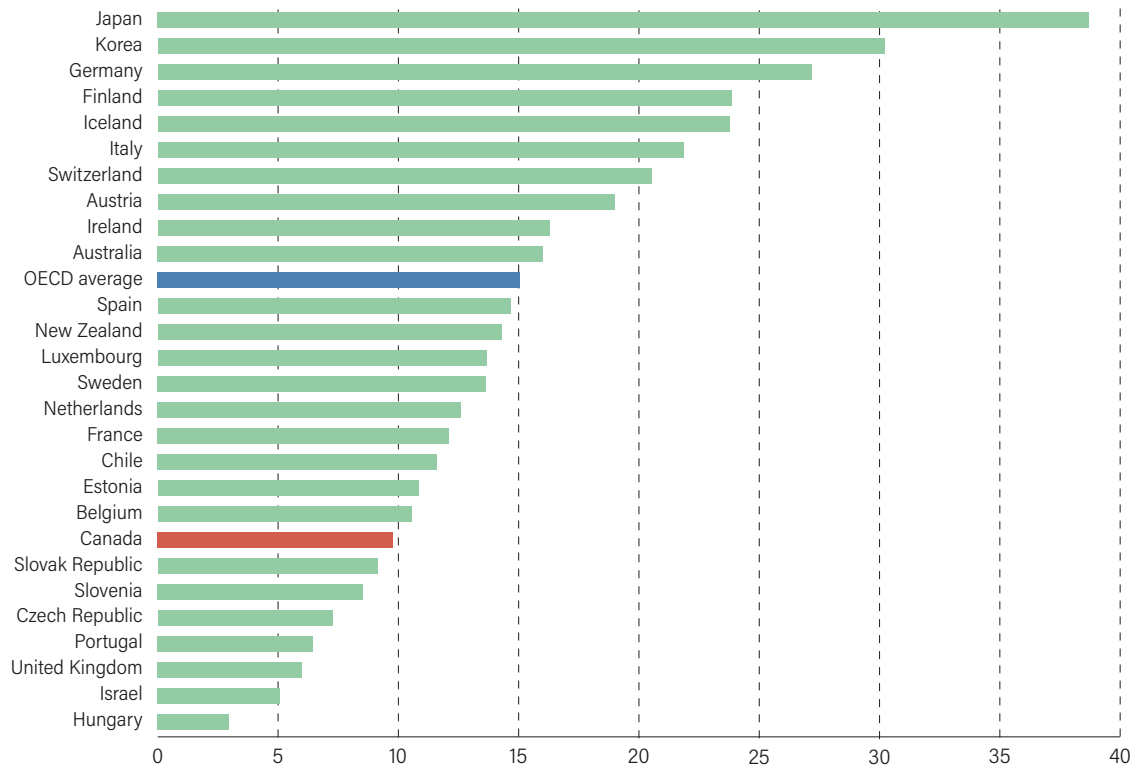
Figure 4b: CT scanners per million population, age-adjusted, 2015 or most recent

Per million population
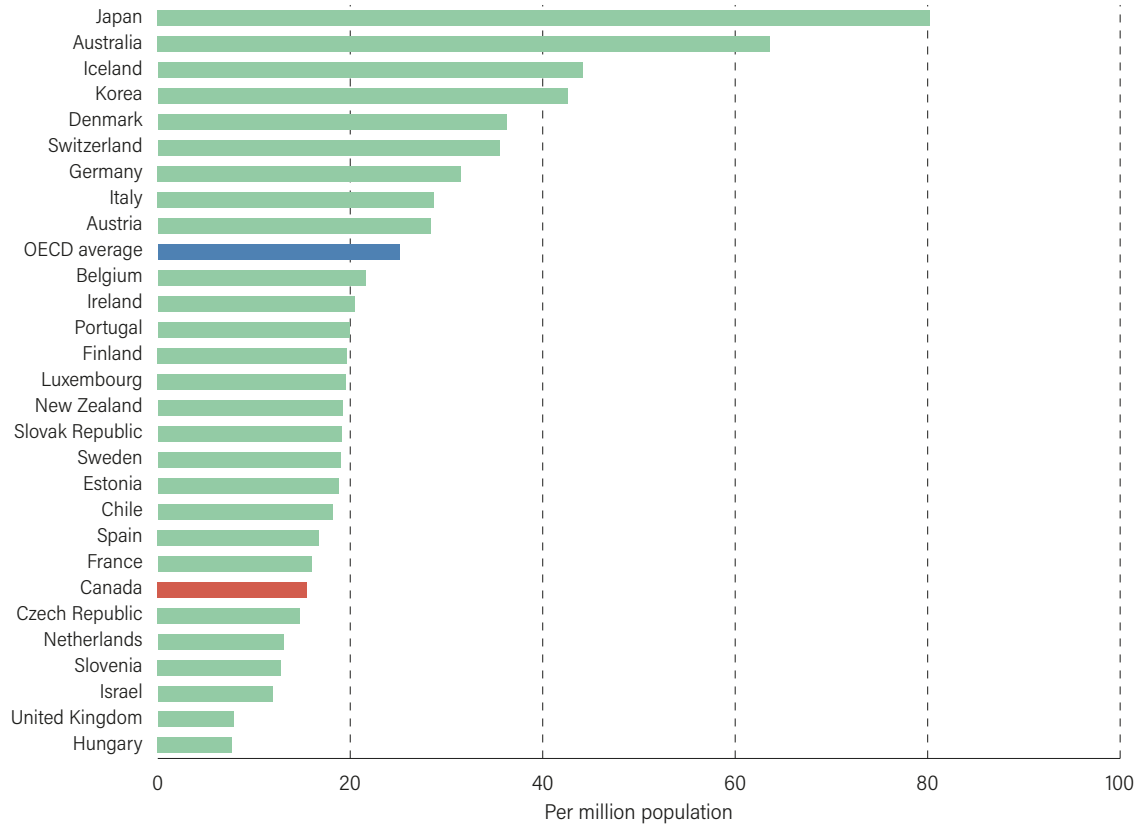
Sources: OECD, 2017; calculations by authors.

2. Use of resources

While measurement of the availability of medical resources is valuable, it does not provide us with information about their use. Importantly, medical resources are of little use if their services are not being consumed by those with health-care demands. A similar observation is made by Figueras, Saltman, Busse, and Dubois who note that "the number of units provides no information about the efficiency with which they are operated (utilization rates)" (2004: 136). The WHO as well points out that "major equipment purchases are an easy way for the health system to waste resources, when they are underused, yield little health gain, and use up staff time and recurrent budget" (2000: xvii). Thus, simply having an abundance of medical resources does not necessarily mean that they are being used; for this reason, it is important to also include the volume of services or use of resources. In other words, "the volume of care and services produced measures the quantity of health-related goods and services produced by the health-care system" (Champagne et al., 2005, quoted, in translation, by Tchouaket, Lamarche1, Goulet, and Contandriopoulos, 2012: 6).

In order to get a better idea of the quantity of health-related goods [14] and services provided by different countries, we examine indictors measuring the number of doctors' consultations per capita, hospital discharge rates per hundred thousand population, [15] MRI examinations per thousand population, and CT scans per thousand population. In addition, Canada's ranking based on the number of 10 specific procedures performed relative to other countries is also discussed (for data see table A6, p. 52). [16]

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[14] Data measuring the consumption of antibiotics were available but were not included in this study due to variability among countries in policies concerning use of antibiotics.

[15] The OECD (2015: 106) defines hospital discharge rates as "… the number of patients who leave a hospital after staying at least one night" including "… deaths in hospital following inpatient care". The OECD (2015) notes a number of methodological differences between countries for this indicator (for example, same-day surgeries are included in Chile and the Slovak Republic, while healthy babies born in hospitals are excluded in several countries like Australia, Austria, Canada, Chile, Estonia, Finland, Greece, Ireland, Luxembourg, Mexico, Spain).

[16] Of course, as the CIHI points out that "the utilization of health-care services should be related to the need for services" and that "other things being equal, a healthier population would have less need for services than an unhealthier one" (2011a: 17). However, this would also imply that a healthier population should therefore spend less on health-care services too (assuming other things, especially income, are equal). On the other hand, the provision of services (as measured by rates of use) can also be viewed as a purchased benefit, or simply an indication of the amount in services that a health-care system provides. Given that there have also been several recent academic examinations of the overuse of medical services (e.g., Korenstein, Falk, Howell, Bishop, and Keyhani, 2012; Chamot, Charvet, and Perneger, 2009), this study makes no assertions about the optimal level for the use of medical services.

Canada ranks 8th (out of 27) for doctor consultations per 100 population, 29th (out of 29) for hospital discharge rates per 100,000 population, 11th (out of 25) for MRI exams per thousand population, and 10th (out of 25) for CT scans per thousand population (table A6, p. 52). After adjustment for age, Canada ranks 8th (out of 27) for doctor consultations per 100 population (figure 5a), 29th (out of 29) for hospital discharge rates per 100,000 population (figure 5b), 11th (out of 25) for MRI examinations per thousand population, and 9th (out of 25) for CT scans per thousand population (table 5).

Canada ranks higher than the average high-income OECD country with universal health care for the rate of doctor consultations, and slightly higher than the average for MRI exams and CT scans. Canada ranks as the country with the lowest hospital discharge rate (per hundred thousand population). The OECD notes that "[h]ospital activities are affected by a number of factors, including the capacity of hospitals to treat patients, the ability of the primary care sector to prevent avoidable hospital admissions, and the availability of post-acute care settings to provide rehabilitative and long-term care services" (2015: 106). It is useful to reiterate that they are examined in this publication simply as an indicator of the use or provision of health-care services in the context of health-care spending.

After adjustment for the age of patients, Canada ranks 7th (out of 28) for cataract surgeries, 19th (out of 25) for transluminal coronary angioplasties, 4th (out of 25) for coronary artery bypass grafts, 13th (out of 26) for stem cell transplantation, 18th (out of 25) for appendectomies, 8th (out of 25) for cholecystectomies, 13th (out of 25) for repair of inguinal hernias, 7th (out of 28) for transplantation of kidneys, 17th (out of 26) for hip replacements, and 5th (out of 25) for knee replacements (table 6). Data for adjusted and unadjusted rates for specific procedures for each country can be seen in table A4 (pp. 48-49) and table A5 (pp. 50–51). Canada's performance is mixed, performing well, or at higher rates than the average OECD country, on about half the indicators examined, and at average to lower rates on the rest.

Figure 5a: Consultations with doctor per hundred population, age-adjusted, 2015 or most recent
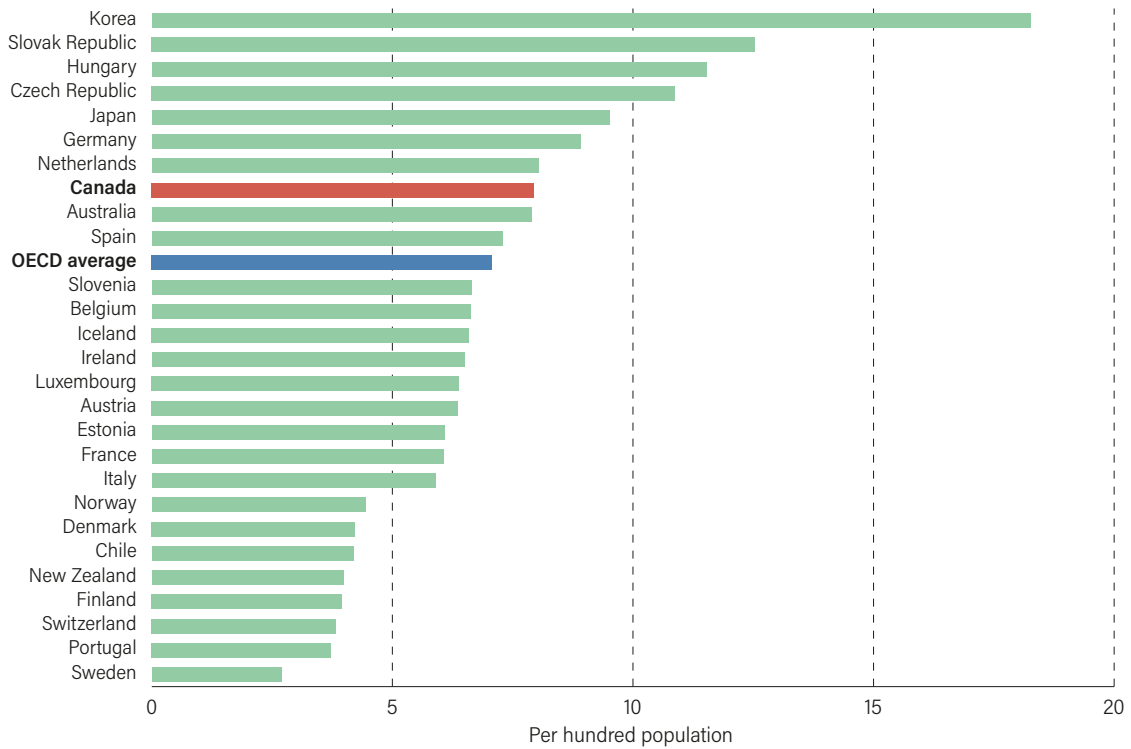
Sources: OECD, 2017; calculations by authors.

Figure 5b: Discharge rates per hundred thousand population, age-adjusted, 2015 or most recent
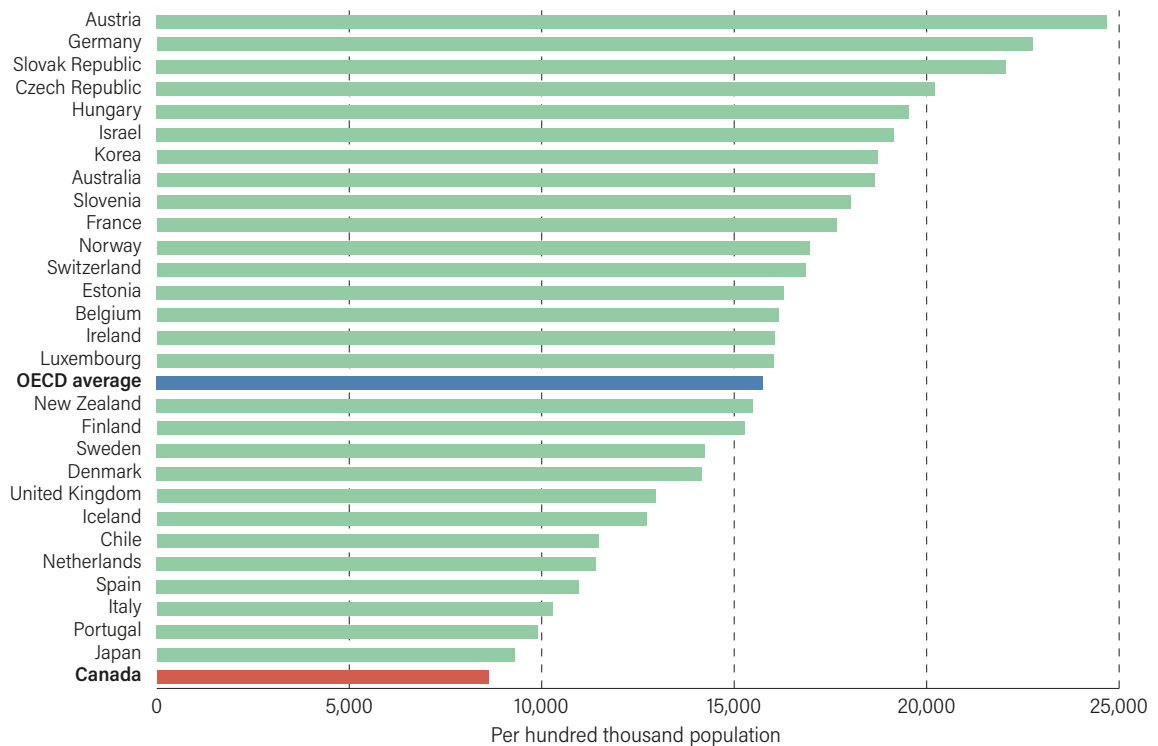
Sources: OECD, 2017; calculations by authors.

Table 5: Use of resources, age-adjusted, 2015

	Doctor consultations		Discharge rates		MRI exams		CT exams	
	Per 100	Rank	Per 100,000	Rank	Per 1,000	Rank	Per 1,000	Rank
Australia	7.9	9	18,649.2	8	43.7	17	127.6	15
Austria	6.4	16	24,679.5	1	53.1	12	137.2	13
Belgium	6.6	12	16,144.4	14	83.3	6	193.6	4
Canada	**7.9**	**8**	**8,619.3**	**29**	**57.3**	**11**	**157.7**	**9**
Chile	4.2	22	11,473.5	23	22.9	24	106.5	16
Czech Republic	10.9	4	20,216.9	4	47.0	15	99.8	19
Denmark	4.2	21	14,167.7	20	78.7	7	155.1	10
Estonia	6.1	17	16,291.6	13	46.4	16	144.3	12
Finland	4.0	24	15,274.1	18	36.0	21	31.4	24
France	6.1	18	17,658.7	10	100.8	2	189.9	5
Germany	8.9	6	22,755.5	2	117.0	1	128.2	14
Hungary	11.5	3	19,539.9	5	37.2	20	104.6	17
Iceland	6.6	13	12,716.6	22	91.5	3	213.2	2
Ireland	6.5	14	16,047.2	15				
Israel			19,155.3	6	42.0	18	158.3	8
Italy	5.9	19	10,279.7	26				
Japan	9.5	5	9,295.7	28	84.1	5	172.8	6
Korea	18.3	1	18,728.7	7	35.6	22	199.6	3
Luxembourg	6.4	15	16,023.8	16	90.8	4	228.5	1
Netherlands	8.0	7	11,408.1	24	50.7	14	79.2	21
New Zealand	4.0	23	15,487.7	17	4.7	25	30.9	25
Norway	4.4	20	16,959.1	11				
Portugal	3.7	26	9,909.1	27	32.9	23	150.0	11
Slovak Republic	12.5	2	22,058.6	3	62.5	10	171.8	7
Slovenia	6.6	11	18,025.0	9	41.4	19	60.4	23
Spain	7.3	10	10,965.3	25	75.1	8	100.6	18
Sweden	2.7	27	14,241.2	19				
Switzerland	3.8	25	16,848.2	12	68.7	9	98.6	20
United Kingdom			12,960.2	21	51.7	13	77.9	22
OECD Average	**7.1**		**15,744.1**		**58.2**		**132.7**	

Source: OECD 2017; calculations by authors

Table 6: Use of resources in Canada, by specialty, per 100,000 population, age-adjusted ranks, 2015

Procedure	Rate (per 100,000 population)	Rank	Average of selected countries
Cataract surgery	1,093.2	7 (out of 28)	833.6
Transluminal coronary angioplasty	162.3	19 (out of 25)	195.3
Coronary artery bypass graft	59.3	4 (out of 25)	39.8
Stem cell transplantation	6.0	13(out of 26)	5.6
Appendectomy	110.4	18 (out of 25)	127.3
Cholecystectomy	213.2	8 (out of 25)	180.2
Repair of inguinal hernia	188.5	13 (out of 25)	181.0
Transplantation of kidney	4.3	7 (out of 28)	3.8
Hip replacement	152.5	17 (out of 26)	183.0
Knee replacement	183.4	5 (out of 25)	137.1

Source: OECD, 2017; calculations by authors.

3. Access to resources

While both the level of medical resources available and their use can provide insight into accessibility, it is also useful to measure accessibility directly. Various dimensions of accessibility—physical, financial, and psychological—can be measured (Kelly and Hurst, 2006). However, another important interpretation of accessibility (for which objective data is more readily available) is the timeliness of care, as measured by waiting lists.

Murray and Frenk propose that individuals value prompt attention for two reasons: "it may lead to better health outcomes" and "it can allay fears and concerns that come with waiting for diagnosis or treatment" (2000: 720). Existing empirical support [17] for the first notion has been studied extensively by Nadeem Esmail who found that "adverse consequences from prolonged waiting are increasingly being identified and quantified in medical and economics literature" (Esmail, 2009: 11). In addition, waiting for treatment can, itself, also adversely affect the lives of those on waiting lists. For example, in Canada "18% of individuals who visited a specialist indicated that waiting for the visit affected their life compared with 11% and 12% for non-emergency surgery and diagnostic tests, respectively"; many of these people experienced worry, stress, anxiety, pain, and difficulties with activities of daily living (Statistics Canada 2006: 10, 11).

The CIHI (2011b) and the OECD (2011) include various measures of access in their reports, while the Commonwealth Fund (2015), the Fraser Institute (Barua, 2015; Rovere and Skinner, 2012), [18] and the Health Consumer Powerhouse (Björnberg, 2012) have measured access to health care by focusing primarily on wait times. [19] This report includes six indicators of access to care (five measuring timeliness, and one measuring financial barriers to access): 1. the percentage of patients who were able to get an appointment on the same day when sick; 2. who reported that it was very or somewhat easy to get care after hours; 3. who waited more than four weeks for an appointment with a specialist; 4. who waited two months or more for an appointment with a specialist; 5. who waited four months or more for elective surgery; and 6. who found cost a barrier to access in the past year. Unlike indicators in previous sections, lower rates are preferable for many indicators in this section. However, the performances of countries on each indicator are ordered such that a rank of 1 indicates superior performance on all indicators.

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[17] For a comprehensive review of studies looking at the adverse consequences associated with increased wait times, see Day, 2013.

[18] Barua (2013) also includes wait times for access to new pharmaceuticals.

[19] There is an abundance of literature that focuses on the medical and technical relationship between resources, use, wait times, and outcomes (which are not examined in this report). Nevertheless, as with the other indicators discussed, this analysis does not make any assertions about the optimal level of accessibility.

Table 7: Access to resources, 2016

|	Able to make same-day appointment when sick		Very or somewhat easy to find care after hours		Waited 4 weeks or more for appointment with a specialist (2013)		Waited 2 months or more for specialist appointment		Waited 4 months or more for elective surgery		Found cost a barrier to access in past year	
	%	Rank	%	Rank	%	Rank	%	Rank	%	Rank	%	Rank
Australia	67	3	44	7	46.2[w]	9	13	5	8	5	14	6
Belgium					20.1[b]	3						
Canada	**43**	**9**	**63**	**4**	**62.1[w]**	**14**	**30**	**10**	**18**	**10**	**16**	**7**
Estonia					39.5[a]	7						
France	56	6	64	1	49.3[w]	11	4	2	2	2	17	8
Germany	53	7	64	1	27.2[b]	6	3	1	0	1	7	1
Israel					20.5[b]	4						
Italy					54.3[w]	12						
Netherlands	77	1	25	10	22.6[b]	5	7	3	4	3	8	3
New Zealand	76	2	44	7	44.1[w]	8	20	8	15	8	18	9
Norway	43	9	40	9	55.3[w]	13	28	9	15	8	10	5
Sweden	49	8	64	1	48.7[w]	10	19	6	12	6	8	3
Switzerland	57	4	58	5	17.7[b]	1	9	4	7	4	22	10
United Kingdom	57	4	49	6	18.3[b]	2	19	6	12	6	7	1
OECD Average	**58**		**52**		**37.6**		**15**		**9**		**13**	

Note: w = statistically worse than average; b = statistically better than average; a = not statistically different from average. Calculations by authors based on the upper and lower confidence intervals of each country in relation to the average upper and lower confidence intervals of all countries in each group.

Sources: OECD, 2017; Commonwealth Fund, 2017; calculations by authors.

As can be seen in table 7, Canada is tied for last place (out of 10) for the percentage of patients able to make a same-day appointment when sick (43%; figure 6a), and ranks 4th (out of 10) for the percentage of patients who report that it is very or somewhat easy to find care after hours (63%). Canada placed last among the 14 countries for which data was available on the percentage of patients (62.1%) who reported waiting more than four weeks for an appointment with a specialist. Canada also ranked worst (10th out of 10) for the percentage of patients who reported waiting two months or more for a specialist appointment (30%; figure 6b), and worst (10th out of 10) for the percentage of patients who reported waiting four months or more for elective surgery (18%; figure 6c).

Canada placed at or near the bottom among other countries with universal-access health-care systems on four out of five indicators of timeliness of care. It performed better than average for the indicator measuring patients who reported it was very or somewhat easy to find care after hours, ranking 4th (out of 10). However, Canada performed worse than the 10-country average on the indicator measuring the percentage of patients (16%; figure 6d) who found cost was a barrier to access, ranking 7th (out of 10). [20]

Figure 6a: Percentage of patients able to make a same-day appointment when sick, 2016
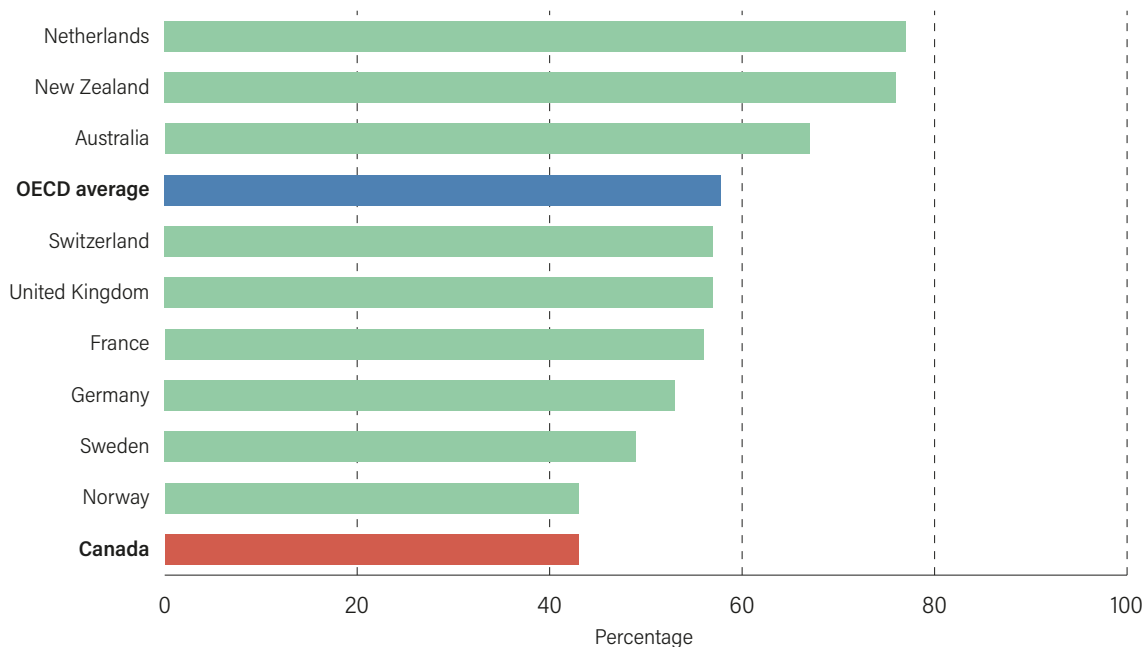
Sources: Commonwealth Fund, 2017; OECD, 2017; calculations by authors.

[20] Cost as a barrier to access defined as at least one of the following: Did not fill/skipped prescription, did not visit doctor with medical problem, and/or did not get recommended care.

Figure 6b: Percentage of patients who waited 2 months or more for appointment with specialist, 2016
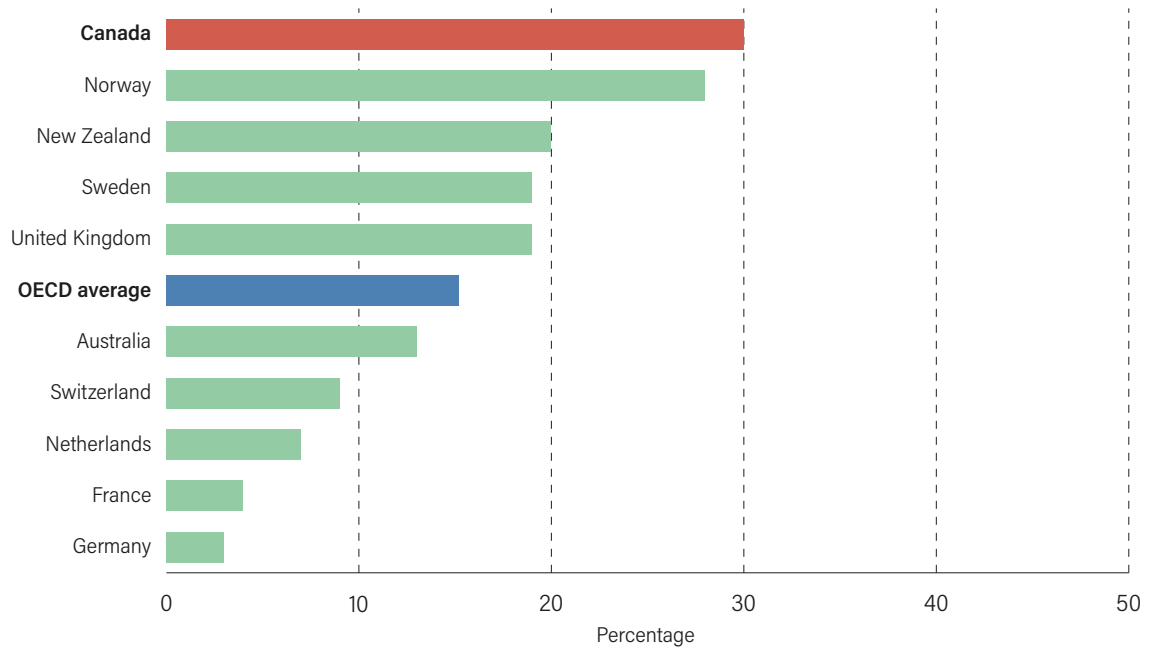
Sources: Commonwealth Fund, 2017; OECD, 2017; calculations by authors.

Figure 6c: Percentage of patients who waited 4 months or more for elective surgery, 2016

Sources: Commonwealth Fund, 2017; OECD, 2017; calculations by authors.

Figure 6d: Percentage of patients who found cost a barrier to access in the past year, 2016
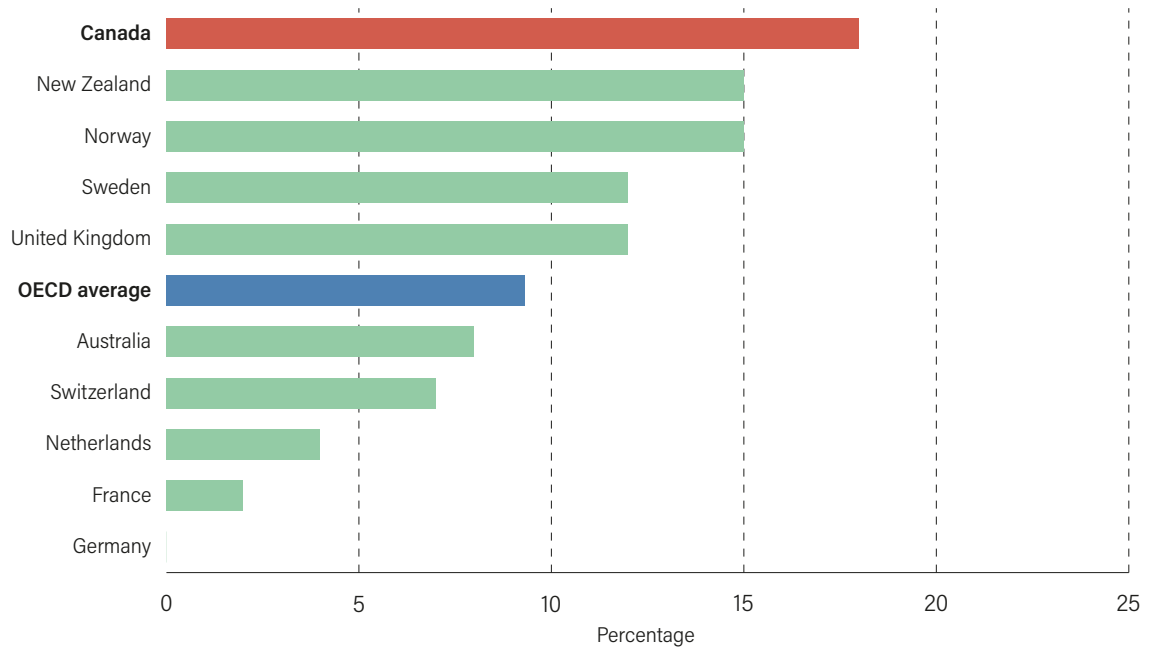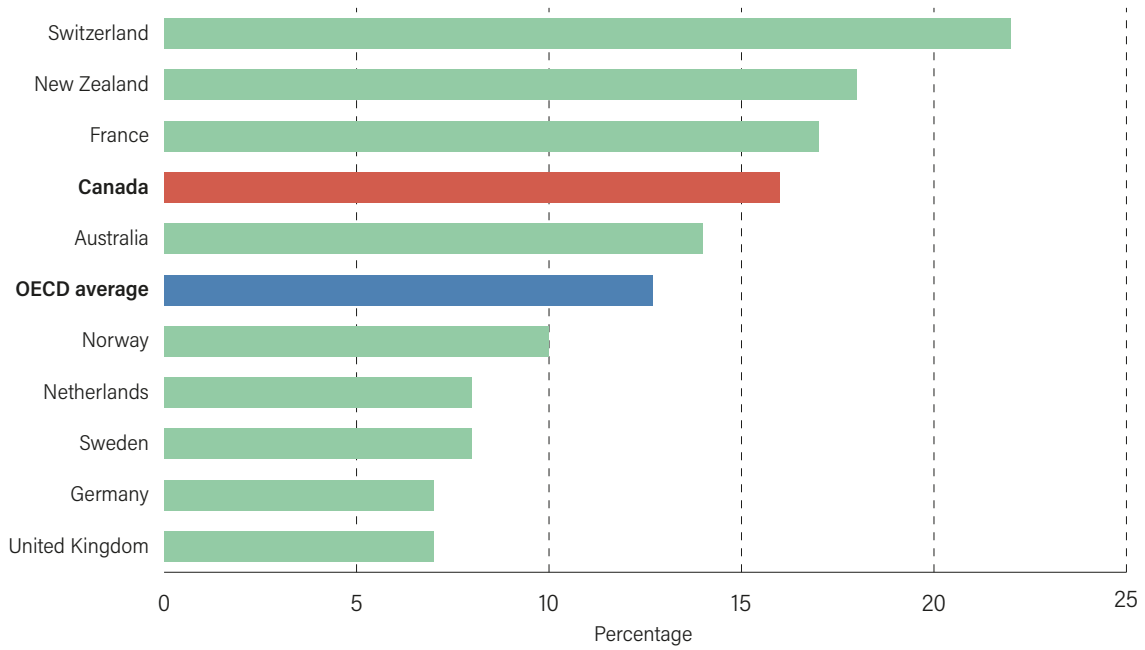

Sources: Commonwealth Fund, 2017; OECD, 2017; calculations by authors.

4. Clinical performance and quality

When assessing indicators of availability of, access to, and use of, resources, it is of critical importance to include as well some measure of clinical performance and quality. The OECD presents a number of indicators measuring different aspects of health-care quality in the areas of primary care, acute care, mental health care, patient safety, patient experiences, and cancer care. This report contains 11 indicators of clinical performance and quality:

- one indicator of primary care—diabetes-related amputation of a lower extremity; [21]
- four indicators of acute care—hip-fracture surgery initiated within 2 days of admission to the hospital, 30-day mortality after admission to hospital for AMI, hemorrhagic stroke, and ischemic stroke;
- one indicator of mental health care—in-patient suicide among patients diagnosed with a mental disorder;
- three indicators of cancer care—five-year survival rates for breast, cervical, and colorectal cancer; and
- two indicators of patient safety—obstetric trauma during a vaginal delivery with an instrument, and without.

The choice of the indicators included in this report is based on the assessment by Barua, Timmermans, Nason, and Esmail (2016) of how closely each indicator reflects direct intervention by the health-care system, whether or not data is available for Canada, and the novelty of information conveyed by the indicator. For example, hospital admission rates for asthma are not included since these may be largely reflective of genetic and environmental factors. [22] On the other hand, the age-sex standardized mortality rate (per 100 patients) within 30 days after admission to a hospital for an acute myocardial infarction is included. Not only does this account for the prevalence of the disease but it more closely "reflects the processes of care, such as timely transport of patients and effective medical interventions" and is "influenced by not only the quality of care provided in hospitals but also differences in hospital transfers, average length of stay and AMI severity" (OECD 2015: 138).

While the absolute rate for each indicator is presented in table 8a and table 8b, each country's relative performance is based on the upper and lower

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[21] Amputation of a lower extremity "is a significant complication of diabetes that is costly to individuals economically, socially and psychologically" (Buckley, Kearns, Kearney, Perry, and Bradley, 2014: 1). It is considered to be a preventable complication and, hence, reflective of the quality of care provided by a health-care system.

[22] The OECD (2015b) notes that disease prevalence may explain some (though not all) of the cross-country variation in these rates.

Table 8a: Clinical performance and quality, 2013 or latest: primary care, acute care, mental health care

	Diabetes lower extremity amputation		Hip-fracture surgery initiated within 48 hours after admission to the hospital	
	Age-sex standardized rate per 100,000; 15 years and older	Rank	Crude rate per 100 patients; 65 years and older	Rank
Australia	4.5[b]	9		
Austria			84.4	13
Belgium	4.8[b]	11	84.3	14
Canada	**7.4[w]**	**15**	**92.0**	**5**
Chile				
Czech Republic			85.4	11
Denmark	8.5[w]	17	95.8	1
Estonia			80.9	17
Finland			85.8	10
France	7.5[w]	16		
Germany	9.2[w]	18	87.6	8
Hungary			88.3	7
Iceland	3.5[a]	6	95.8	1
Ireland	3.2[b]	5	82.3	15
Israel	15.8[w]	21	84.8	12
Italy	2.7[b]	2	44.8	20
Japan				
Korea	2.4[b]	1		
Luxembourg	3.5[b]	6		
Netherlands	4.7[b]	10	95.2	3
New Zealand	5.9[a]	13	82.3	15
Norway	5.7[a]	12	89.3	6
Portugal	11.9[w]	19	45.0	19
Slovak Republic				
Slovenia	15.3[w]	20	61.9	18
Spain	6.7[a]	14	43.3	21
Sweden	4.1[b]	8	93.0	4
Switzerland	3.1[b]	3	85.9	9
United Kingdom	3.1[b]	3		
OECD Average	**6.4**		**80.4**	

Note: w = statistically worse than average; b = statistically better than average; a = not statistically different from average. Calculations by authors based on the upper and lower confidence intervals of each country in relation to the average upper and lower confidence intervals of all countries in each group.

Admission-based AMI 30 day in-hospital mortality		Admission-based Hemorrhagic stroke 30 day in-hospital mortality		Admission-based Ischemic stroke 30 day in-hospital mortality		In-patient suicide among patients diagnosed with a mental disorder	
Age-sex standardized rate per 100 patients; 45 years and older	Rank	Age-sex standardized rate per 100 patients; 45 years and older	Rank	Age-sex standardized rate per 100 patients; 45 years and older	Rank	Age-sex standardized rate per 100 patients	Rank
4.1[b]	1	21.1[b]	10	9.3[a]	19		
10.0[w]	25	19.0[b]	6	6.4[b]	7		
7.3[a]	17	27.1[a]	19	9.3[a]	19	0.07[a]	11
6.7[b]	**9**	**27.3[a]**	**20**	**10[w]**	**25**	**0.06[a]**	**10**
14[w]	29	30.2[w]	25	8.9[a]	15		
6.7[b]	9	25.8[a]	16	9.6[w]	21	0.00[b]	1
5.7[b]	5	28.8[w]	22	9.1[a]	16	0.13[a]	14
11.5[w]	26	34.8[w]	27	13[w]	27	0.30[w]	15
6.5[b]	7	13.5[b]	2	5.1[b]	3	0.08[a]	12
7.2[a]	15	26.9[a]	18	7.9[b]	12		
8.7[w]	23	16.7[b]	5	6.4[b]	7		
13.9[w]	28	40.5[w]	28	9.6[w]	21		
6.9[a]	13	24.6[a]	13	8.0[a]	13		
6.4[b]	6	24.6[a]	13	9.7[a]	23		
6.7[b]	9	22.0[a]	11	6.0[b]	5	0.09[a]	13
5.5[b]	4	19.6[b]	8	6.2[b]	6		
12.2[w]	27	11.8[b]	1	3.0[b]	1		
8.3[a]	22	14.0[b]	3	3.2[b]	2		
7.0[a]	14	19.0[b]	6	9.1[a]	16		
7.6[a]	18	31.1[w]	26	7.1[b]	11		
6.6[b]	8	29.1[w]	24	8.0[a]	13	0.04[a]	7
6.7[b]	9	24.1[a]	12	5.4[b]	4	0.05[a]	8
9.4[w]	24					0.05[a]	8
7.2[a]	15	27.9[a]	21	10.8[w]	26	0.01[b]	3
5.2[b]	3	28.9[a]	23	13.2[w]	28	0.00[b]	1
7.8[a]	21	25.5[a]	15	9.7[w]	23	0.02[b]	6
4.5[b]	2	15.0[b]	4	6.4[b]	7		
7.7[a]	20	20.0[b]	9	6.9[b]	10	0.01[b]	3
7.6[a]	18	26.5[a]	17	9.2[a]	18	0.01[b]	3
7.8		**24.1**		**8.1**		**0.10**	

Source: OECD, 2017; calculations by authors.

Table 8b: Clinical performance and quality: cancer care and patient safety

	Breast cancer		Cervical cancer	
	Five year relative survival, 2003–2008; 15 years and older; females	Rank	Five year relative survival, 2003–2008; 15 years and older; females	Rank
Australia	87.5[b]	4	67.2[a]	8
Austria	82.2[a]	16	65.1[a]	18
Belgium				
Canada	**87.7[b]**	**3**	**66.0[a]**	**13**
Chile				
Czech Republic	78.6[w]	21	62.5[a]	19
Denmark	82.7[a]	15	65.5[a]	16
Estonia	72.6[w]	22	66.5[a]	9
Finland	86.1[a]	6	66.3[a]	12
France	84.0[a]	13	66[a]	13
Germany	84.4[a]	11	65.3[a]	17
Hungary				
Iceland	88.7[a]	1	68.7[a]	6
Ireland	80.0[w]	19	55.8[w]	20
Israel	86.1[a]	6	66.5[a]	9
Italy	85.8[a]	9	70.6[a]	4
Japan	87.3[b]	5	70.2[a]	5
Korea	82.2[a]	16	77.4[b]	1
Luxembourg				
Netherlands	83.8[a]	14	67.8[a]	7
New Zealand	84.4[a]	11	66.4[a]	11
Norway	88.4[b]	2	77.4[b]	1
Portugal	81.1[a]	18	51.0[w]	22
Slovak Republic				
Slovenia	85.3[a]	10	71.3[a]	3
Spain				
Sweden	86.1[a]	6	65.6[a]	15
Switzerland				
United Kingdom	78.9[w]	20	55.7[w]	21
OECD Average	**80.2**		**66.1**	

Note: w = statistically worse than average; b = statistically better than average; a = not statistically different from average. Calculations by authors based on the upper and lower confidence intervals of each country in relation to the average upper and lower confidence intervals of all countries in each group.

Colorectal cancer		Obstetric trauma vaginal delivery with instrument, 2013		Obstetric trauma vaginal delivery without instrument, 2013	
Five year relative survival, 2003–2008; 15 years and older	Rank	Crude rate per 100 vaginal deliveries; 15 years and older; female	Rank	Crude rate per 100 vaginal deliveries; 15 years and older; female	Rank
65.7[b]	4	7.3	14	2.4	12
60.4[w]	13				
		2.9	6	0.6	5
63.5[b]	**6**	**17.1**	**19**	**3.1**	**19**
49.6[w]	22				
56.9[w]	17	13.4	18	2.6	14
51.2[w]	21				
62.7[b]	10	3.2	7	0.8	7
58.0[w]	16	2.6	5	0.6	5
63.5[b]	6	8.1	15	2.1	11
63.3[a]	8				
56.4[w]	18	4.8	10	1.9	10
67.5[a]	2	1.9	3	0.5	2
63.7[b]	5	1.4	2	0.5	2
68.0[b]	1				
66.1[b]	3				
59.7[a]	15	3.7	8	2.5	13
62.3[a]	11	8.4	16	2.6	14
61.9[w]	12	4.8	10	1.4	9
56.1[w]	19	2.3	4	0.5	2
62.8[a]	9	0.8	1	0.3	1
		4.2	9	0.9	8
60.3[w]	14	13.2	17	2.8	17
		7.2	12	2.6	14
51.3[w]	20	7.2	12	2.8	17
60.5		**6.0**		**1.7**	

Sources: OECD, 2017; calculations by authors.

confidence intervals of that rate (calculated by the OECD) in relation to the calculated average range for the included OECD countries for eight of the 11 indicators used in this section. Further, while lower rates are preferable for certain indicators, the performances of countries on each indicator are ordered such that a rank of 1 indicates superior performance on all indicators.

Primary care

Canada ranks 15th (out of 21) for performance on the indicator measuring the rate of diabetes-related lower extremity amputation, which is statistically worse than the average range for the OECD countries included for comparison (table 8a).

Acute care

Canada ranks 5th (out of 21) for the rate of hip-fracture surgery initiated within 48 hours after admission to the hospital. Canada ranks 9th (out of 29) for performance on the indicator measuring 30-day mortality after admission to hospital for AMI (statistically better than average), 20th (out of 28) for performance on the indicator measuring 30-day mortality after admission to hospital for a hemorrhagic stroke (not statistically different from the average), and 25th (out of 28) for performance on the indicator measuring 30-day mortality after admission to hospital for an ischemic stroke (statistically worse than average) (table 8a).

Mental health care

The OECD reports a rate of 0.06% for in-patient suicides among patients diagnosed with a mental disorder in Canada. This performance ranks Canada 10th (out of 15). However, the Canada's rate does not differ to a statistically significant degree from the average for the 15 countries for which data is available (table 8a).

Cancer care

Canada ranks 3rd (out of 22) on the indicator measuring the rate of 5-year survival after treatment for breast cancer (statistically better than average), 13th (out of 22) for the rate of 5-year survival after treatment for cervical cancer (not statistically different from the average), and 6th (out of 22) for the rate of 5-year survival after treatment for colorectal cancer (statistically better than average) (table 8b).

Patient safety

Canada ranks 19th (out of 19) for its performance on the indicator measuring obstetric trauma during a vaginal delivery with an instrument, and 19th (out of 19) for its performance on the indicator measuring obstetric trauma during a vaginal delivery without an instrument (table 8b).

While Canada does well on four indicators of clinical performance and quality, its performance on the seven others are either average or poor.

4 Health status and outcomes

As can be seen in figure 1 (p. 3), the literature suggests that achieving a certain health status—the health outcome for a population—, though of great interest and importance, is a product of both medical and non-medical determinants of health and is thus not necessarily a good measure of the performance of a health system (Arah, Westert, Hurst, and Klazinga, 2006; Rovere and Skinner, 2012; Skinner, 2009). In fact, much research seems to indicate that the health outcomes for a population are not correlated to spending on medical care or the type of health-insurance system (Centre for International Statistics, 1998). Indeed,

> factors such as clean water, proper sanitation, and good nutrition, along with additional environmental, economic, and lifestyle dimensions, are considerably more important in determining the outcomes a country experiences ... The actual contribution of medical and clinical services is usually considered to be in the range of 10 up to 25 per cent of observed outcome. (Figueras, Saltman, Busse, and Dubois, 2004: 83, citing Bunker, Frazier, and Mosteller, 1995; McKeown, 1976; Or, 1997)

However, such indicators (for example, life expectancy, mortality rates) are nevertheless widely used to provide a related view of how well a health-care system may be performing its objectives. Further, while it is clear that life expectancy is not completely determined by access to high-quality health care, it is also true that longer life spans would not be as likely without these services (Esmail and Walker, 2008). Therefore, in order to provide a more complete (if only related) picture of how well each country's health-care system performs, we include five indicators of health status and outcomes: 1. life expectancy [LE] at birth; 2. healthy-age life expectancy [HALE]; 3. infant mortality; 4. perinatal mortality; and 5. mortality amenable to health care [MAH]. All five of these indicators were previously used by Esmail and Walker (2008).

Measures of longevity

Perhaps the most commonly used measure of health status is life expectancy at birth, that is, the average number of years a person can be expected to live assuming age-specific mortality levels remain constant (OECD, 2015). Canada ranks 13th (out of 29) for its performance on the indicator measuring life expectancy at birth (calculated by the OECD) (table 9). The WHO calculates a related measure called healthy-age life expectancy [HALE] that reflects how long

Table 9: Health Status, 2013

	Life expectancy at birth (LE)		Healthy-age life expectancy (HALE)		Infant mortality rate		Perinatal mortality		Mortality Amenable to Health Care (MAH), 2011	
	Years	Rank	Years	Rank	Deaths per 1,000 live births	Rank	Deaths per 1,000 total births	Rank	SDRs per 100,000	Rank
Australia	82.5	5	71.9	14	3.2	16	8.2	28	58.5	4
Austria	81.3	18	72.0	11	3.1	14	5.4	17	69.6	11
Belgium	81.1	20	71.1	22	3.3	17	6.2	22		
Canada	**81.7**	**13**	**72.3**	**9**	**4.8**	**26**	**6.0**	**20**	**74.0**	**13**
Chile	79.1	25	70.5	25	7.2	29	7.6	25		
Czech Republic	78.7	26	69.4	26	2.5	6	3.4	7	129.1	23
Denmark	80.8	23	71.2	21	3.7	21	6.0	20	75.3	14
Estonia	77.7	27	69.0	27	2.5	6	2.9	4	180.9	25
Finland	81.6	15	71.0	24	1.7	2	2.7	3	79.6	20
France	82.4	7	72.6	7	3.7	21	10.6	29	56.4	3
Germany	80.7	24	71.3	20	3.3	17	5.4	17	79.2	16
Hungary	75.7	29	67.4	29	4.2	25	6.4	23	193.1	26
Iceland	82.5	5	72.7	6	2.2	4	1.6	1	53.9	2
Ireland	81.5	17	71.5	17	3.4	20	4.8	12	79.6	19
Israel	82.1	11	72.8	4	3.1	14	5.0	13	77.4	15
Italy	82.6	4	72.8	4	2.9	12	4.0	10	68.5	10
Japan	83.9	1	74.9	1	2.1	3	2.6	2	69.9	12
Korea	82.1	11	73.2	2	2.7	9	3.3	5		
Luxembourg	82.4	7	71.8	15	2.8	11	8.1	27	63.3	5
Netherlands	81.6	15	72.2	10	3.3	17	5.0	13	68.2	9
New Zealand	81.7	13	71.6	16	5.0	27	5.6	19	79.6	18
Norway	82.4	7	72.0	11	2.3	5	4.1	11	66.1	8
Portugal	81.2	19	71.4	18	2.9	12	3.4	7	87.3	21
Slovak Republic	76.7	28	68.1	28	5.1	28	5.0	13	180.4	24
Slovenia	80.9	22	71.1	22	1.6	1	3.3	5	88.4	22
Spain	83.0	2	72.4	8	2.7	9	3.6	9	64.9	6
Sweden	82.3	10	72.0	11	2.5	6	5.2	16	65.6	7
Switzerland	83.0	2	73.1	3	3.9	23	7.6	25	52.8	1
United Kingdom	81.0	21	71.4	18	3.9	23	7.0	24	79.4	17
OECD Average	**81.2**		**71.5**		**3.3**		**5.2**		**86.2**	

Note: SDR = Age-standardized death rates.

Source: CIHI, 2016; Eurosat, 2013; OECD, 2017; WHO, 2017a, 2017b; calculations by authors

individuals in a country will live in a good state of health (or not in a poor state of health). Canada ranks 9th (out of 29) for its performance on this indicator.

These two measures can be combined to determine the number of years lost to illness or the percentage of expected lifetime that individuals can expect to live in full health. This measure (HALE⁄LE) may allow some additional insight into the ability of the health-care system to provide care for individuals who may as a result of their illnesses soon endure a significantly negative effect on their standard of living. Canada ranks 9th (out of 29) on this measure.
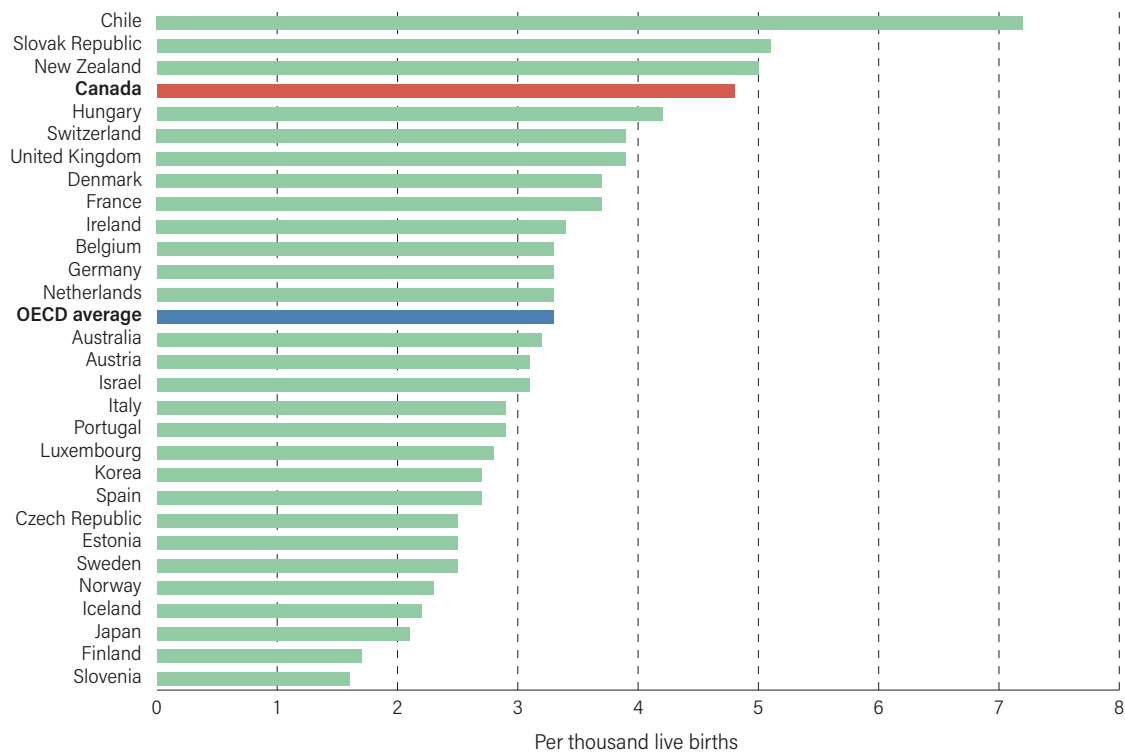
Measures of mortality

The diametric opposite of measures of the length of life and the proportion of that lifetime that can be enjoyed in full health are measures of mortality. The most basic measures of mortality commonly used to compare health status are infant and perinatal mortality rates. Though these mortality statistics can be affected by immigration from poor countries, unhealthy outlier populations, and other population demographics (Seeman, 2003), they can also serve as indicators of a well-functioning health-care system. Zeynep Or notes that these mortality statistics are a useful way to gauge the performance of a health-care system since "the performance of a health system is often judged by its capacity to prevent deaths at the youngest ages" and notes that perinatal mortality is an important indicator of "effectiveness of health care interventions during pregnancy and childbirth" (2001: 8). Canada ranks 26th (out of 29) for its performance on the indicator measuring infant mortality (figure 7a), and 20th (out of 29) for perinatal mortality (table 9).

Adjusted measures of mortality

Unfortunately, the use of HALE, LE, and infant and perinatal mortality as measures of the effectiveness of a health system includes a number of effects that are not related to the health system. Measures such as crime rates, pollution, water quality, and public sanitation systems affect life expectancy in addition to those directly related to the health-care systems that have been compared in this report. A finer way of breaking down mortality is to use a measure known as mortality amenable to health care [MAH]. This approach, originally developed out of a search for tools that would specifically allow measurement of the effects of improvements in medical care, attempts to capture more precisely the actual quality of health services by using mortality data related to specific conditions that should be preventable through appropriate medical intervention (Rutstein et al., 1976).

In 2008, Nolte and McKee published a comparison of a number of OECD countries on this measure using detailed statistics (from 2002/03) on causes of death published by the World Health Organisation. In their comparison,

Figure 7a: Infant mortality per thousand live births, 2015 or most recent

Sources: OECD, 2017; WHO, 2015b; calculations by authors.

Nolte and McKee also subdivided the mortality data by the age at which death occurred, in order to capture the actual quality of health services more accurately. The aim was to measure "the extent to which deaths that would not have occurred but for the presence of effective health care have been reduced among Organization for Economic Cooperation and Development (OECD) countries over time" (Nolte and McKee, 2008: 58).

In general, the causes of death considered amenable to health care fall in the categories of "bacterial infections, treatable cancers, diabetes, cardiovascular and cerebrovascular disease, and complications of common surgical procedures" (Nolte and McKee, 2008: 59) (table 10). Some causes of death were weighted based on available evidence regarding their ability to be affected by the health-care system. [23] In some cases, only childhood deaths were considered, since deaths at older ages were suspected of resulting from other medical processes. The measurement of mortality for other illnesses was capped at higher ages in order to accommodate evidence relating to the effectiveness or potential ineffectiveness of modern medicines in dealing with these conditions

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[23] For example, the "accumulating evidence [suggests] that only up to half of premature mortality from [ischemic heart diseases] may be potentially amenable to health care" (Nolte and McKee, 2008: 60).

Table 10: Causes of death considered amenable to health care

Cause of death	Age range
Intestinal infections	0–14
Tuberculosis	0–74
Other infections (diphtheria, tetanus, septicaemia, poliomyelitis)	0–74
Whooping cough	0–14
Measles	1–14
Malignant neoplasm of colon and rectum	0–74
Malignant neoplasm of skin	0–74
Malignant neoplasm of breast	0–74
Malignant neoplasm of cervix and uteri	0–74
Malignant neoplasm of cervix uteri and body of uterus	0–44
Malignant neoplasm of testes	0–74
Hodgkin's disease	0–74
Leukaemia	0–44
Diseases of the thyroid	0–74
Diabetes mellitus	0–49
Epilepsy	0–74
Chronic rheumatic heart disease	0–74
Hypertensive disease	0–74
Ischaemic heart disease (50% of deaths)	0–74
Cerebrovascular disease	0–74
All respiratory diseases (excl. pneumonia and influenza)	1–14
Influenza	0–74
Pneumonia	0–74
Peptic ulcer	0–74
Appendicitis	0–74
Abdominal Hernia	0–74
Cholelithiasis and cholecystitis	0–74
Nephritis and nephrosis	0–74
Benign prostatic hyperplasia	0–74
Misadventures to patients during surgical and medical care	0–74
Maternal death	0–74
Congenital cardiovascular anomalies	0–74
Perinatal deaths, all causes, excluding stillbirths	0–74

Source: Adapted from Nolte and McKee, 2004.

at more advanced ages. The resulting measures of mortality were also standardized for population age-profiles using direct standardization. [24]

Table 9 presents updated figures for mortality amenable to healthcare (MAH) using the methodology from Nolte and McKee's "Measuring the Health of Nations: Updating an Earlier Analysis" (2008). Mortality and population data [25] for the year 2012 were extracted from the WHO Mortality Database (WHO, 2017b). Following Nolte and McKee, age limits were applied to the data and the measures of MAH were standardized for population age-profiles using the EU standard population (Eurostat, 2013). Canada ranks 13th for its performance on the indicators measuring mortality amenable to healthcare among the 26 countries [26] ranked (figure 7b).

Figure 7b: Mortality amenable to health care (MAH), 2012
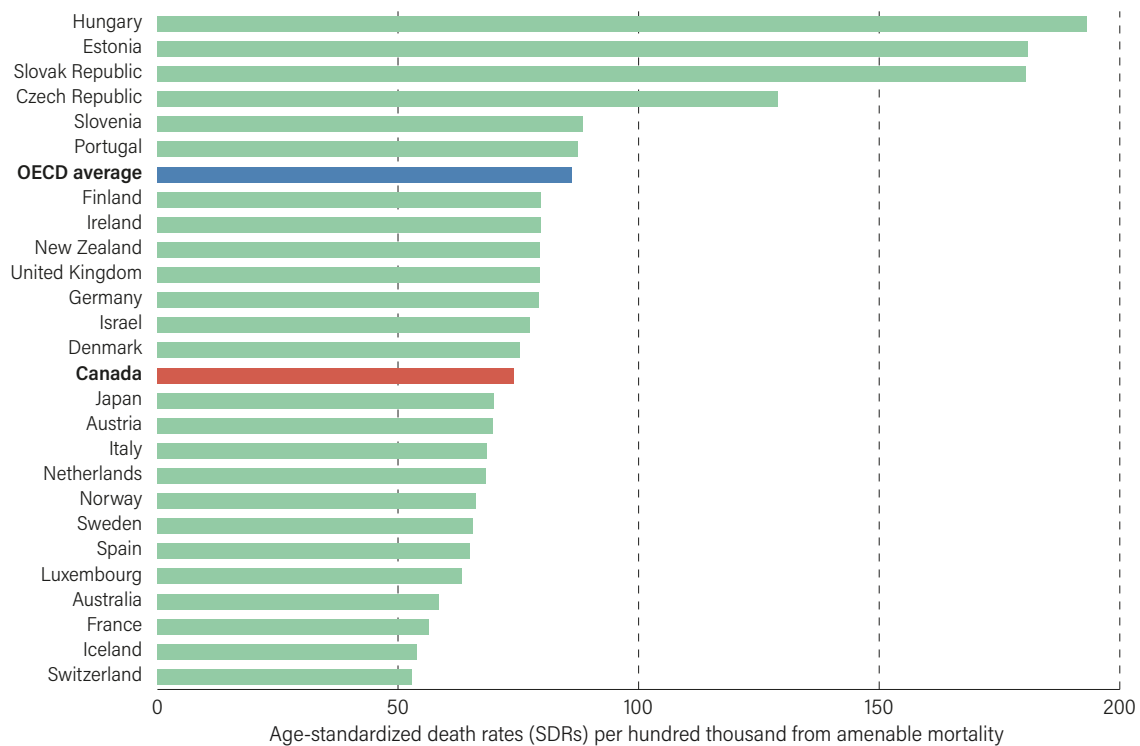
Sources: CIHI, 2016; Eurosat, 2013; WHO, 2017a, 2017b; calculations by authors.

[24] The Canadian Institute for Health Information explains direct standardization as a procedure to "remove the confounding effect of different population structures among OECD countries" (CIHI, 2013: 55).

[25] Population data for Canada is derived from the CIHI, 2016.

[26] Data for countries with smaller populations should be interpreted with caution.

Conclusion

Canada spends more on health care than the majority of high-income OECD countries with universal health-care systems. After adjustment for age, Canada's expenditure on health care as a percentage of GDP ranks 3rd highest and its health-care expenditure per capita (out of 29), 11th highest. Despite this level of spending, it has significantly fewer physicians, acute care beds and psychiatric beds per capita compared to the average OECD country (it ranks close to the average for nurses). Further, while Canada has the most Gamma cameras (per million population), it has fewer other medical technologies than the average high-income OECD country with universal health care for which comparable inventory data is available.

Canada's performance is mixed for use of resources, performing higher rates than the average OECD country on about half the indicators examined (for example, consultations with a doctor, CT scans, and cataract surgery), and average to lower rates on the rest. Canada reports the least hospital activity (as measured by discharge rates) in the group of countries studied.

For access to resources, Canada either ranked last on four of five indicators of timeliness of care. It also ranked worse than the 10-country average for the indicator measuring the percentage of patients who reported that cost was a barrier to access.

Finally, while Canada does well on four indicators of clinical performance and quality (such as rates of survival for breast and colorectal cancer), its performance on the seven others are either no different from the average or in some cases—particularly obstetric trauma and diabetes related amputations—worse.

Canada ranks among the most expensive universal health-care systems in the OECD. However, its performance for availability and access to resources is generally below that of the average OECD country, while its performance for use of resources and quality and clinical performance is mixed. Clearly, there is an imbalance between the value Canadians receive and the relatively high amount of money they spend on their health-care system.

Appendix—additional tables and data

Table A1: Health-care spending, 2015

	Spending as percentage of GDP		Spending per capita	
	Percentage	Rank	US$ PPP	Rank
Australia	9.4	13	4,492.6	13
Austria	10.3	8	5,100.0	8
Belgium	10.5	7	4,778.5	10
Canada	**10.3**	**8**	**4,532.8**	**11**
Chile	8.1	21	1,877.3	29
Czech Republic	7.2	25	2,434.1	25
Denmark	10.3	8	5,057.9	9
Estonia	6.5	28	1,885.2	28
Finland	9.4	13	3,993.2	17
France	11.1	3	4,529.6	12
Germany	11.2	2	5,352.6	4
Hungary	7.2	25	1,913.0	27
Iceland	8.6	19	4,105.7	16
Ireland	7.8	22	5,275.8	6
Israel	7.4	23	2,713.0	22
Italy	9.0	17	3,351.6	19
Japan	10.9	5	4,435.6	14
Korea	7.4	23	2,534.9	24
Luxembourg	6.0	29	6,817.9	2
Netherlands	10.7	6	5,296.7	5
New Zealand	9.3	15	3,544.6	18
Norway	10.0	11	6,190.1	3
Portugal	9.0	17	2,663.7	23
Slovak Republic	6.9	27	2,059.4	26
Slovenia	8.5	20	2,730.8	21
Spain	9.2	16	3,180.0	20
Sweden	11.0	4	5,266.3	7
Switzerland	12.1	1	7,535.6	1
United Kingdom	9.9	12	4,125.3	15
OECD average	**9.1**		**4,061.2**	

Source: OECD, 2017; calculations by authors.

Table A2: Availability of human and capital resources, per thousand population, 2015 or latest

	Physicians		Nurses		Acute beds		Psychiatric beds	
	per '000	Rank	per '000	Rank	per '000	Rank	per '000	Rank
Australia	3.52	12	11.50	9			0.40	23
Austria	5.10	1	8.10	18	5.66	4	0.61	16
Belgium	3.02	20	10.80	12	5.65	5	1.74	2
Canada	**2.66**	**26**	**9.90**	**15**	**2.02**	**26**	**0.35**	**25**
Chile	2.14	29	2.10	29	2.01	27	0.10	28
Czech Republic	3.69	10	8.00	19	4.25	8	0.97	6
Denmark	3.66	11	16.70	3	2.46	21	0.54	18
Estonia	3.42	16	6.00	23	3.68	13	0.55	17
Finland	3.21	18	14.70	5	3.05	17	0.62	15
France	3.34	17	9.90	15	4.07	11	0.86	10
Germany	4.14	6	13.30	6	6.11	3	1.27	3
Hungary	3.10	19	6.50	21	4.28	7	0.89	9
Iceland	3.78	9	15.50	4	2.61	20	0.44	19
Ireland	2.88	23	11.90	7	2.43	22	0.35	25
Israel	3.44	15	4.90	28	2.28	24	0.42	21
Italy	3.84	8	5.40	26	2.64	19	0.09	29
Japan	2.36	27	11.00	11	7.85	1	2.65	1
Korea	2.24	28	5.90	24	7.34	2	0.97	6
Luxembourg	2.91	22	11.90	7	4.09	10	0.79	12
Netherlands	3.47	13	10.50	13	3.61	14	1.27	3
New Zealand	3.02	20	10.30	14	2.69	18	0.24	27
Norway	4.40	3	17.30	2	3.36	15	1.14	5
Portugal	4.61	2	6.30	22	3.26	16	0.64	14
Slovak Republic	3.45	14	5.70	25	4.87	6	0.81	11
Slovenia	2.83	24	8.80	17	4.22	9	0.67	13
Spain	3.85	7	5.30	27	2.41	23	0.36	24
Sweden	4.19	5	11.10	10	2.26	25	0.44	19
Switzerland	4.20	4	18.00	1	3.72	12	0.92	8
United Kingdom	2.79	25	7.90	20			0.42	21
OECD average	**3.42**		**9.83**		**3.81**		**0.74**	

Source: OECD, 2017; calculations by authors

Table A3: Availability of technological and diagnostic imaging resources, per million population, 2015 or latest

	MRI Units		CT Scanners		PET Scanners	
	Per million	Rank	Per million	Rank	Per million	Rank
Australia	15.0	10	59.6	2	2.7	7
Austria	19.7	8	29.4	9	2.3	9
Belgium	10.8	18	22.2	10		
Canada	**9.5**	**19**	**15.0**	**22**	**1.3**	**16**
Chile	9.4	20	14.8	23	0.6	22
Czech Republic	7.4	23	15.1	21	1.0	19
Denmark			37.8	4	6.1	1
Estonia	11.4	17	19.8	14	2.3	10
Finland	26.0	4	21.4	12	2.6	8
France	12.6	15	16.6	20	2.0	11
Germany	30.5	2	35.3	7		
Hungary	3.0	27	7.9	28	0.5	23
Iceland	21.3	6	39.5	3	0.0	24
Ireland	14.3	12	17.9	15	1.7	13
Israel	4.2	26	9.9	26	1.3	16
Italy	25.2	5	33.1	8	3.1	6
Japan	51.7	1	107.1	1	4.3	2
Korea	26.5	3	37.3	5	4.0	3
Luxembourg	12.4	16	17.8	17	1.8	12
Netherlands	12.9	14	13.3	24	3.8	4
New Zealand	13.3	13	17.8	16	1.3	16
Norway						
Portugal	7.1	24	21.9	11	0.6	21
Slovak Republic	8.3	22	17.4	19	1.5	15
Slovenia	8.7	21	13.1	25	1.0	20
Spain	15.3	9	17.5	18	1.6	14
Sweden	14.7	11	20.4	13		
Switzerland	20.9	7	36.2	6	3.5	5
United Kingdom	6.1	25	8.0	27		
OECD average	**15.5**		**25.8**		**2.1**	

Source: OECD 2017; calculations by authors

Gamma Cameras		Digital Subtraction Angiography units		Mammographs		Lithotriptors	
Per million	Rank	Per million	Rank	Per million	Rank	Per million	Rank
19.4	2	18.6	3	23.0	8		
11.4	8	8.7	9	23.4	7	1.9	9
20.7	**1**	**5.4**	**16**	**18.0**	**11**	**0.4**	**18**
1.6	24	4.0	19	12.2	19	1.9	10
11.6	6	8.6	11	10.6	21	3.5	4
16.7	3			16.5	12		
2.3	23	5.3	17	10.6	20	3.0	5
8.8	11	15.3	5	30.1	5	0.6	16
6.9	16						
11.4	7	5.7	15	14.6	16	6.0	3
9.1	10	21.2	2	15.1	15	3.0	7
6.0	18			14.1	17	1.3	13
10.0	9	8.4	12			0.5	17
8.4	13	13.7	6	33.9	3		
11.7	5			33.0	4		
5.8	19	9.3	8	54.7	1	14.2	1
14.0	4	15.8	4	12.3	18	1.8	12
8.2	15	9.5	7			2.4	8
3.3	22			22.0	9	0.7	15
4.8	21	5.1	18	35.7	2	3.0	5
5.0	20	8.7	10	18.8	10	6.8	2
8.2	14	8.2	13	16.5	13	1.0	14
6.4	17	5.8	14	16.2	14	1.9	11
8.4	12	30.2	1	28.3	6		
		1.0	20	10.0	22		
9.2		**10.4**		**21.3**		**3.0**	

Table A4: Use of resources, by specialty, per 100,000 population, age-adjusted, 2015 or latest

	Cataract surgery		Transluminal coronary angioplasty		Coronary artery bypass graft		Stem cell transplantation	
	Per 100,000	Rank	Per 100,000	Rank	Per 100,000	Rank	Per 100,000	Rank
Australia	1,130.9	5	183.3	15	57.9	5	8.5	2
Austria	1,191.5	3	269.2	3	41.4	10	5.3	16
Belgium	1,089.9	8	221.0	7	63.9	3	8.2	4
Canada	**1,093.2**	**7**	**162.3**	**19**	**59.3**	**4**	**6.0**	**13**
Chile	44.7	28					0.2	25
Czech Republic	1,059.3	9	210.4	8	46.3	8	6.7	9
Denmark	953.4	14	181.8	16	70.2	1	4.4	21
Estonia	1,049.2	10	207.9	9	34.0	15		
Finland	955.8	13	200.8	11	31.2	17	4.9	18
France	1,161.1	4	228.2	5	27.8	20	7.8	5
Germany	915.9	16	350.4	1	57.3	6	8.5	3
Hungary	933.7	15	203.4	10	27.4	21	3.4	22
Iceland	642.1	22						
Ireland	258.3	26	151.5	20	24.9	23	5.2	17
Israel	862.4	18	300.4	2	41.3	11	8.7	1
Italy	752.3	19	181.7	17	30.0	18	7.5	7
Japan							3.3	23
Korea	1,100.3	6	138.6	21	8.6	25		
Luxembourg	1,193.2	2	164.9	18	38.6	13	2.5	24
Netherlands	984.2	11	243.0	4	67.4	2	6.6	10
New Zealand	362.5	25	128.4	22	41.9	9	6.2	12
Norway	452.4	23	225.0	6	34.2	14	7.4	8
Portugal	1,287.8	1	110.1	25	32.1	16	4.7	19
Slovak Republic	192.6	27					4.6	20
Slovenia	872.6	17	192.7	12	39.8	12	0.0	26
Spain	691.9	21	120.6	24	17.2	24	6.3	11
Sweden	957.3	12	190.3	14	29.2	19	7.5	6
Switzerland	430.1	24	192.1	13	48.5	7	5.9	14
United Kingdom	722.8	20	125.3	23	25.5	22	5.7	15
OECD average	**833.6**		**195.3**		**39.8**		**5.6**	

Source: OECD 2017; calculations by authors

Appendectomy		Cholecystectomy		Repair of inguinal hernia		Transplantation of kidney		Hip replacement		Knee replacement	
Per 100,000	Rank	Per 100,000	Rank	Per 100,000	Rank	Per 100,000	Rank	Per 100,000	Rank	Per 100,000	Rank
185.3	2	243.7	2	206.9	7	3.9	15	196.0	12	210.4	1
142.1	8	209.9	9	264.4	1	4.8	6	261.5	3	207.4	3
133.9	11	215.5	6	212.0	6	4.2	12	247.8	5	197.0	4
110.4	**18**	**213.2**	**8**	**188.5**	**13**	**4.3**	**7**	**152.5**	**17**	**183.4**	**5**
		306.3	1	206.6	8	3.6	20				
127.0	12					4.2	11	176.5	14	123.7	14
114.3	16	152.1	17	197.7	9	5.4	3	226.9	9	160.8	9
151.2	5	214.2	7	162.8	18	2.8	24	147.9	20		
117.0	15	139.1	21	183.5	17	4.0	14	227.2	8	171.8	8
110.8	17	188.3	11	221.9	4	4.9	5	231.4	6	153.8	10
142.2	7	217.9	5	187.8	15	2.4	26	266.7	2	183.4	6
96.7	21	235.3	3	189.4	12	3.4	21	134.7	22	84.5	22
173.1	4	122.4	24	92.5	24	3.8	17	149.4	18	59.4	24
134.4	10	155.9	16	227.1	3	4.2	10	75.2	25	66.8	23
63.0	25	167.1	13	195.1	11	2.7	25	149.0	19	96.7	21
						1.0	27				
202.4	1	141.5	19	78.3	25	4.2	9	60.9	26	138.1	12
101.5	20	174.7	12	218.9	5	0.0	28	227.5	7	208.1	2
95.6	22	161.7	15	187.0	16	6.0	2	223.4	10	135.5	13
147.6	6	139.7	20	125.9	22	3.2	22	173.4	15	120.2	15
138.8	9	115.8	25	120.6	23	5.1	4	252.0	4	103.7	20
83.5	24	142.0	18	141.5	20	4.3	8	82.2	24	56.5	25
						3.7	18	134.8	21	113.7	18
119.8	14	223.7	4	196.3	10	3.0	23	169.0	16	104.8	19
104.3	19	166.7	14	187.8	14	6.0	1	108.3	23	114.8	17
123.9	13	133.7	23	155.1	19	4.1	13	217.6	11	115.0	16
175.3	3	190.8	10	249.0	2	3.7	19	286.9	1	172.8	7
88.4	23	135.1	22	127.8	21	3.8	16	179.2	13	146.2	11
127.3		**180.2**		**181.0**		**3.8**		**183.0**		**137.1**	

Table A5: Use of resources, by specialty, per 100,000 population, 2015 or latest

	Cataract surgery		Transluminal coronary angioplasty		Coronary artery bypass graft		Stem cell transplantation	
	Per 100,000	Rank	Per 100,000	Rank	Per 100,000	Rank	Per 100,000	Rank
Australia	1,059.9	8	171.8	17	54.3	6	8.0	6
Austria	1,235.0	2	279.0	2	42.9	9	5.5	16
Belgium	1,119.4	4	227.0	6	65.6	3	8.4	3
Canada	**1,059.6**	**9**	**157.3**	**18**	**57.5**	**5**	**5.8**	**13**
Chile	36.3	28					0.2	25
Czech Republic	1,081.4	7	214.8	10	47.3	8	6.8	9
Denmark	994.3	14	189.6	16	73.2	1	4.6	19
Estonia	1,104.2	5	218.8	7	35.8	12		
Finland	1,040.3	10	218.5	8	34.0	17	5.3	17
France	1,207.2	3	237.3	5	28.9	20	8.1	4
Germany	1,027.7	12	393.2	1	64.3	4	9.5	1
Hungary	956.1	16	208.3	12	28.1	21	3.5	23
Iceland	574.9	22						
Ireland	226.4	26	132.8	20	21.8	23	4.6	19
Israel	715.4	21	249.2	3	34.3	16	7.2	7
Italy	867.7	18	209.6	11	34.6	15	8.6	2
Japan							4.4	21
Korea	964.3	15	121.5	23	7.5	25		
Luxembourg	1,084.7	6	149.9	19	35.1	14	2.3	24
Netherlands	1,004.7	13	248.1	4	68.8	2	6.7	10
New Zealand	336.7	25	119.2	25	38.9	11	5.8	13
Norway	438.5	23	218.1	9	33.1	18	7.2	7
Portugal	1,418.8	1	121.3	24	35.4	13	5.2	18
Slovak Republic	175.1	27					4.2	22
Slovenia	893.5	17	197.3	14	40.8	10	0.0	26
Spain	721.6	20	125.8	22	17.9	24	6.6	11
Sweden	1,029.3	11	204.6	13	31.4	19	8.1	4
Switzerland	437.7	24	195.5	15	49.4	7	6.0	12
United Kingdom	735.6	19	127.5	21	26.0	22	5.8	13
OECD average	**840.9**		**197.4**		**40.3**		**5.7**	

Source: OECD 2017; calculations by authors

Appendectomy		Cholecystectomy		Repair of inguinal hernia		Transplantation of kidney		Hip replacement		Knee replacement	
Per 100,000	Rank	Per 100,000	Rank	Per 100,000	Rank	Per 100,000	Rank	Per 100,000	Rank	Per 100,000	Rank
173.7	3	228.4	5	193.9	12	3.7	15	183.7	12	197.2	4
147.3	7	217.6	8	274.1	1	5.0	5	271.1	3	215.0	1
137.5	8	221.3	7	217.7	5	4.3	9	254.5	4	202.3	3
107.0	**19**	**206.6**	**9**	**182.7**	**16**	**4.2**	**12**	**147.8**	**19**	**177.8**	**7**
		248.7	1	167.8	18	2.9	24				
129.6	12					4.3	9	180.2	14	126.3	13
119.2	15	158.6	16	206.2	7	5.6	3	236.6	8	167.7	9
159.1	5	225.4	6	171.3	17	2.9	24	155.7	18		
127.3	13	151.4	18	199.7	9	4.3	9	247.3	5	187.0	6
115.2	16	195.8	10	230.7	3	5.1	4	240.6	7	159.9	10
159.6	4	244.5	2	210.7	6	2.7	26	299.3	1	205.8	2
99.0	20	240.9	3	193.9	12	3.5	17	137.9	20	86.5	22
151.7	6	107.3	25	81.1	24	3.3	20	130.9	21	52.1	25
111.5	17	129.3	22	188.4	15	3.5	17	62.4	25	55.4	24
72.7	25	192.7	12	225.0	4	3.1	21	171.9	16	111.5	18
						1.3	27				
177.4	2	124.0	23	68.6	25	3.7	15	53.4	26	121.0	15
92.3	22	158.8	15	199.0	10	0.0	28	206.8	11	189.2	5
97.6	21	165.1	14	190.9	14	6.1	2	228.1	10	138.3	12
137.1	9	129.7	21	116.9	22	3.0	23	161.0	17	111.6	17
134.5	10	112.2	24	116.9	22	4.9	6	244.2	6	100.5	21
92.0	23	156.5	17	155.9	20	4.7	7	90.6	24	62.2	23
						3.4	19	122.5	22	103.4	20
122.7	14	229.1	4	201.0	8	3.1	21	173.0	15	107.3	19
108.8	18	173.8	13	195.9	11	6.3	1	112.9	23	119.7	16
133.2	11	143.8	19	166.8	19	4.4	8	234.0	9	123.6	14
178.4	1	194.2	11	253.4	2	3.8	14	292.0	2	175.9	8
90.0	24	137.5	20	130.1	21	3.9	13	182.4	13	148.8	11
127.0		**179.7**		**181.5**		**3.8**		**185.4**		**137.8**	

Table A6: Use of resources, 2015 or latest

	Doctor consultations		Discharge rates		MRI exams		CT exams	
	Per 100	Rank	Per 100,000	Rank	Per 1,000	Rank	Per 1,000	Rank
Australia	7.4	10	17,478.8	8	41.0	18	119.6	15
Austria	6.6	14	25,581.1	1	55.0	12	142.2	13
Belgium	6.8	11	16,581.7	12	85.6	4	198.8	3
Canada	**7.7**	**8**	**8,354.1**	**29**	**55.5**	**11**	**152.8**	**10**
Chile	3.4	26	9,316.7	28	18.6	24	86.5	20
Czech Republic	11.1	5	20,638.2	3	48.0	16	101.9	18
Denmark	4.4	20	14,775.2	17	82.1	6	161.8	8
Estonia	6.4	15	17,146.4	10	48.8	15	151.9	11
Finland	4.3	21	16,624.2	11	39.2	19	34.2	24
France	6.3	16	18,359.7	7	104.8	3	197.4	4
Germany	10.0	6	25,534.3	2	131.3	1	143.8	12
Hungary	11.8	3	20,008.0	5	38.1	20	107.1	16
Iceland	5.9	17	11,385.3	26	81.9	7	190.9	5
Ireland	5.7	19	14,063.6	20				
Israel			15,890.3	15	34.8	22	131.3	14
Italy	6.8	11	11,856.2	23				
Japan	12.7	2	12,412.4	22	112.3	2	230.8	1
Korea	16.0	1	16,413.6	14	31.2	23	174.9	6
Luxembourg	5.8	18	14,566.8	18	82.5	5	207.7	2
Netherlands	8.2	7	11,645.8	24	51.8	14	80.8	21
New Zealand	3.7	25	14,383.4	19	4.4	25	28.7	25
Norway	4.3	21	16,437.3	13				
Portugal	4.1	23	10,917.4	27	36.3	21	165.3	7
Slovak Republic	11.4	4	20,052.9	4	56.8	10	156.2	9
Slovenia	6.8	11	18,456.8	6	42.4	17	61.8	23
Spain	7.6	9	11,435.4	25	78.3	8	104.9	17
Sweden	2.9	27	15,312.0	16				
Switzerland	3.9	24	17,146.9	9	69.9	9	100.3	19
United Kingdom			13,189.9	21	52.6	13	79.3	22
OECD average	**7.1**		**15,722.9**		**59.3**		**132.4**	

Source: OECD 2017; calculations by authors

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