Chapter 1

Geographic variations in health care use in 13 countries: A synthesis of findings

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This chapter summarises the main findings of this project on geographic variations in health care use across and within a number of OECD countries, and identifies a range of policy levers that can be used to reduce unwarranted variations, defined as variations that cannot be explained by patient needs and/or preferences. This summary draws mainly on the 13 national reports from Australia, Belgium, Canada, the Czech Republic, Finland, France, Germany, Israel, Italy, Portugal, Spain, Switzerland and the United Kingdom (England) which are published in the following chapters. The analysis focusses on a selected set of health care activities and procedures, including hospital medical admissions and some high-volume and high-cost diagnostic and surgical procedures. The results show that large variations in health care use persist, across and within countries, even after taking into account differences in demographic structures. While the analysis in this study does not allow to determine precisely how much of these variations are unwarranted, some of these variations are too large to be explained solely by patient needs and/or preferences. A number of policy interventions have been used in different countries to address unwarranted variations in health care use, including public reporting, the development and monitoring of clinical guidelines, the diffusion of decision aids for patients to complement the information they receive from physicians, and changes in financial incentives to try to reduce the inappropriate use of certain procedures.

1.1. Introduction

Geographic variations in health care use within countries have been widely documented, but only for a limited number of countries including the United States, Canada, the United Kingdom and Nordic countries. While some of these variations reflect differences in patient needs and/or preferences, others do not. Instead, they are due to other factors, such as variations in medical practice styles, the ability of providers to generate demand beyond what is clinically necessary, or unequal access to health care services. These *unwarranted* variations raise concern about the equity and the efficiency of health systems.

Geographic variations in health care use have been observed for a long time in some countries. As early as the 1930s, there has been evidence of large variations in the rates of tonsillectomy in England, which varied widely across English districts in a way that "defies any explanation, save that of variations of medical opinion on the indications for operation" (Glover, 1938). A well-known study carried out in the United States in the 1970s found similarly wide variations in tonsillectomy rates, with the probability of children having had their tonsils removed by the age of 20 ranging from 16% to over 66% in different areas of the State of Vermont (Wennberg and Gittelsohn, 1973).

Building on the pioneering work of the Dartmouth Institute for Health Policy and Clinical Practice in the United States, research on medical practice variations has been growing in recent years in many countries, covering a growing number of health care activities and procedures, with a view to identify possible inappropriate use (Corallo et al., 2014). Some of the geographic variations in health care are certainly related to different health needs: for example, part of the variations in revascularisation rates in France is related to differences in incidence and mortality rates from heart attack, which in turn is related to differences in socioeconomic status and risk factors (Gusmano et al., 2014). But the variations are often too large to plausibly be explained solely by differences in needs. A large proportion of the differences in health care use, either across geographic areas or providers, remains unexplained (Appleby et al., 2011; IOM, 2013; Corallo et al., 2014; Sundmacher and Busse, 2014).

This report focusses on geographic variations in the use of a selected number of health care activities and procedures, across and within OECD countries. It draws on 13 national reports from Australia, Belgium, Canada, the Czech Republic, Finland, France, Germany, Israel, Italy, Portugal, Spain, Switzerland and the United Kingdom (England). These countries differ with respect to the stage of development of research on variations in health care use, with some countries documenting geographic variations for the first time.

This chapter summarises the main findings of this report. The subsequent chapters present country-specific analyses and results. Section 1.2 presents some analytical frameworks which help to distinguish different types of medical practice variations and define "unwarranted" variations. Section 1.3 describes the scope and methods used in this OECD project, including the selected set of health care activities and procedures. Section 1.4 provides a summary of the main findings from the 13 country reports. Section 1.5 identifies a range of policy options that have been used or might be used to reduce unwarranted geographic variations in health care use.

1.2. Two main analytical frameworks to understand geographic variations in health care use

At least two analytical frameworks have been developed to analyse variations in health care use. The first framework was developed by the Dartmouth Institute for Health Policy and Clinical Practice in the United States (Wennberg et al., 2002). It distinguishes three categories of care:

- *Effective care*: Evidence-based interventions for which the benefit exceeds the harm so that all (or almost all) patients should receive the service (e.g. childhood immunisations or beta-blockers following heart attacks). Variations in the use of such treatments among eligible patients reflect a failure to deliver needed care, or underuse of effective care.
- *Preference-sensitive care*: Treatment options exist but carry different benefits and risks, and patients' attitudes towards these benefits and risks may vary. This is the case for instance of prostate-specific antigen (PSA) screening for prostate cancer, where uncertain survival benefits need to be weighed against the risk of needless biopsies and treatment for low-grade malignancies. If it was possible to identify the choices that well-informed patients would make, then this could become the reference to which actual usage could be compared.
- *Supply-sensitive care*: Services where the supply of a specific resource has a major influence on utilisation rates (e.g. diagnostic tests), in the absence of evidence for the need of these additional services. Variations in supply-sensitive care are largely due to differences in local supply of health care resources (e.g., number of doctors or hospital beds per capita) as well as reimbursement or budgeting systems that incentivise volume rather than quality/outcome of services. The reference rate should be the rate beyond which additional services do not result in better outcomes, but this requires good information on health outcomes.

In this framework, *unwarranted* variations are defined as medical practice variations that *cannot* be explained on the basis of patient needs or preferences.

The second framework was developed more recently in Europe by the European Collaboration for Health Optimisation (ECHO). It characterises health care activities according to the health benefit they bring to the patient (ECHO, 2014):

- *Effective care*: Procedures or activities with proven effectiveness for any patient.
- *Effective care with uncertain marginal benefit*: Procedures or activities whose risk-benefit balance depends on patient characteristics.
- *Lower-value care*: Procedures or activities with no evidence-based effectiveness.

This framework is used to interpret geographic variations in the use of services and make judgments on appropriateness of care, at least in the first and third categories.

These two frameworks emphasise that the available evidence on risks and benefits of different procedures is likely to have an important impact on utilisation rates by affecting medical opinions and patient preferences. Even if the indication for a certain surgical treatment can be generally agreed upon at a given point in time – for instance, the use of less invasive laparoscopic procedures – constant improvements in surgical techniques and other possible non-surgical treatments may require rapid changes in practice style to adopt the most appropriate and less risky treatment.

1.3. Scope and methods of the OECD project

The OECD project focusses on geographic variations in health care utilisation within countries, based on the patient's place of residence, not on the location of health care facilities (except in Spain, where all procedures but cardiac care are recorded based on the location of providers). It draws on 13 national reports, drafted in most cases by national experts, as well as on literature reviews and desk research. An expert group, which met twice, assisted in the design and implementation of the project.

The expert group selected a set of 11 health care activities and procedures, based mainly on the criteria of high-cost and high-volume, policy relevance and data availability. These included a general measure of hospital medical admissions, and ten specific diagnostic and surgical procedures, with some of these procedures identified as a lower priority (see Box 1.1 and Annex 1.A1).

Box 1.1. List of procedures selected in this project

Hospital medical admissions (i.e. not surgical)

Cardiac procedures

- Coronary artery bypass graft (CABG)
- Percutaneous transluminal coronary angioplasty (PTCA)
- *Cardiac catheterisation*

Joint procedures

- Admission/surgery after hip fracture (selected as an expected low-variation procedure, given that there is little discretion to admit and operate a patient after hip fracture)
- Knee replacement
- *Knee arthroscopy*

Gynaecologic procedures

- Caesarean section
- *Hysterectomy*

Diagnostic imaging procedures

- *Magnetic resonance imaging scan (MRI)*
- *Computed tomography scan (CT)*

Note: Procedures in italics were presented as optional.

Source: OECD project on Medical Practice Variations.

The data for most countries was drawn largely from hospital discharge databases, and included at least one recent year (generally 2011). Some countries (Czech Republic, Finland, Israel, Italy, Portugal and Switzerland) were also able to provide some time series covering up to ten years. Most participating countries reported data on hospital medical admissions and many of the surgical procedures. Table 1.1 summarises data availability for different procedures.

Table 1.1. Coverage of health care activities and procedures in national reports

Country	Hospital medical admission	CABG	PTCA	Catheterisation	Surgery after hip fracture	Knee replacement	Knee arthroscopy	Caesarean section	Hysterectomy	MRI & CT
Australia	•	•	•	•	•	•	•	•	•	
Belgium	•	•	•	•	•	•	•	•	•	•
Canada	•	•	•		•	•		•	•	•
Czech Rep.	•				•	•		•	•	
Finland	•	•	•	•	•	•	•	•	•	
France	•	•	•		•	•	•	•	•	
Germany	•	•	•		•	•		•	•	
Israel	•	•	•	•	•	•	•	•	•	
Italy	•	•	•	•	•	•	•	•		
Portugal	•	•	•	•	•	•	•	•	•	
Spain	•	•	•	•	•	•	•	•	•	
Switzerland	•	•	•	•	•	•	•	•		
United Kingdom (England)	•	•	•		•	•		•		•

Source: National reports included in this volume.

Countries selected their preferred geographic unit for analysis, based on data availability and/or policy relevance (see Table 1.2). Canada, the Czech Republic, Germany, Italy and Spain reported information for two different geographic levels. The number of geographic units ranges from a low of seven in Israel to 151 in England. In some cases, geographic units represent authorities with broad administrative competences in health policy, for instance *Länder* in Germany or *cantons* in Switzerland. In other cases, they are health care decision-making authorities, as was the case for Primary Care Trusts at the time of reporting[1] in England. In Italy, regions also have autonomy in health policy. In Belgium, provinces are grouped within three regions which have authority in health care decision making.

The population size of these geographic units varies widely. The smallest area considered is a Swiss canton with a population of 16 000 people and the largest is a German Land (North Rhine-Westphalia) with a population of almost 18 million people. When only the lowest geographic level is considered in each country, the largest geographic unit is the Community of Madrid in Spain (almost 6.5 million people). The average size of territorial units (based on the lowest level in each country) varies from 270 000 in Finland to 1 000 000 in Israel (see Figure 1.1).

The size of the geographic unit *matters* for the analysis and interpretation of variations within and across countries. Health care utilisation rates observed in large territorial units will tend to be closer to the country's average while those in some less populated areas are more likely to deviate from this average for different reasons. This means that countries with smaller geographic areas are more likely, statistically speaking, to display higher variations across areas than countries with larger units. For example, the Czech Republic is divided into 14 administrative regions and 77 districts. The coefficient of variation for caesarean section at the administrative region level (0.11) is lower than at the district level (0.20). For countries who reported procedure rates for two levels of territorial units, this chapter only refers to the smallest territorial unit (except for Germany).

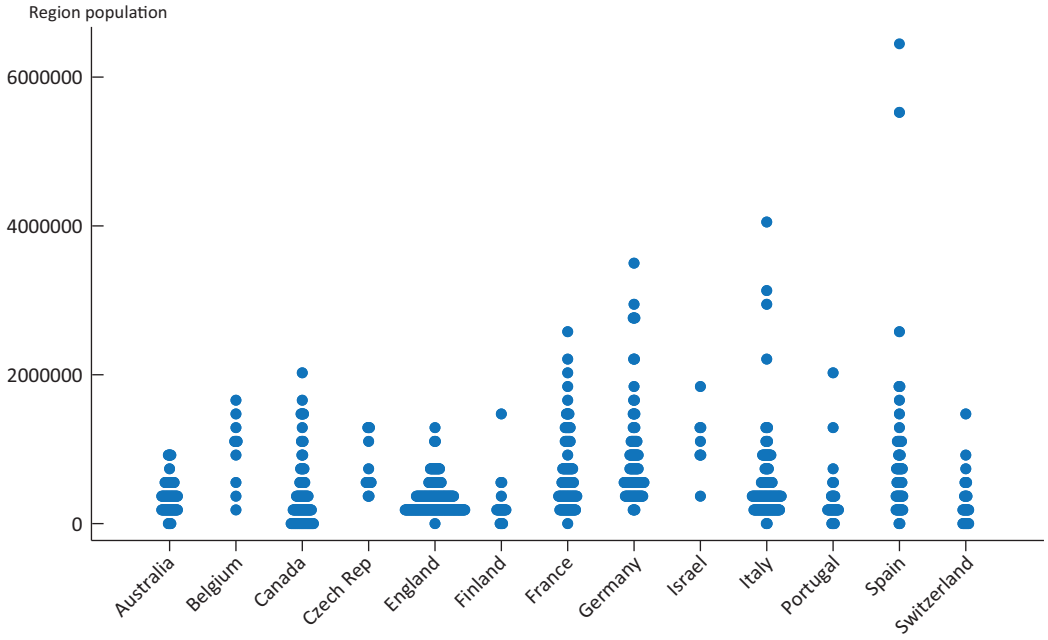
Table 1.2. Geographic units used for analysis in national reports and period covered

Country	Geographic units	Health decision making	Years
Australia	Medicare Locals (61)	No	2010/11
Belgium	Provinces (11)	No	2009
Canada	1. Provinces/territories (13) 2. Health regions (83)	Yes	2003/04 or 2006/07 and 2010/11
Czech Republic	1. Regions (14) 2. Districts (77)	Yes (Regions)	2007-10
Finland	Hospital districts (20)	Yes	2001-11
France	Administrative departments (95)	No	2005-11
Germany	1. Länder (16) 2. Spatial planning regions (96)	Yes (Länder)	2011
Israel	Districts (6)	No	2000-11
Italy	1. Regions (20) 2. Provinces (110)	Yes (Regions)	2007-11
Portugal	Grupos de municipios (28)	No	2002-09
Spain	1. Autonomous communities (17) 2. Provinces (50)	Yes (AC)	2000, 2005, 2010
Switzerland	Cantons (26)	Yes	2005-11
United Kingdom/England	Primary Care Trusts (PCTs) (151)	Yes	2010

Note: Some countries (Canada, Finland, France, Portugal and Switzerland) have merged or excluded some small units to obtain statistically significant results. Australia and Germany also analysed several years but only reported on the most recent year as the size of the within-country variation in the previous years was similar.

Source: National reports included in this volume.

Figure 1.1. Population size of geographic units in participating OECD countries, 2011 or latest year



Note: Each dot represents a territorial unit. This figure does not include the population for the largest units in Canada (provinces and territories), Germany (Länder), Italy (Regions) and Spain (Autonomous communities).

Source: National data submitted for the OECD project on Medical Practice Variations.

Countries were invited to report on a core set of statistics frequently used in medical practice variation measurement (see Annex 1.A2). These included: the unweighted average of geographic areas' standardised rates, the minimum and maximum rates across geographic areas, the 10th and 90th percentiles of their distribution (which limits the impact of "outlier" regions), the coefficient of variation (i.e. the ratio of the standard deviation to the mean), as well as the systematic component of variation (SCV). The SCV allows removing the random component of variation, that is the share of variation which is due to chance rather than to structural differences between regions.

In this chapter, the data were standardised using the OECD population structure as set out in Annex 1.A2, to remove the effect of differences in population structure in geographic areas across countries.[2] The standardisation by age and gender is expected to remove part of the variation explained by morbidity, especially for conditions which are age-dependant. However, this does not remove *all* the variation due to differences in morbidity across geographical areas. This implies that procedure rates presented in figures below are not totally adjusted for population needs.

Geographic variations in health care are explained by both demand and supply-side factors. The strategy used in this study to explain some of the variations had two steps: first potential determinants of procedure rates have been identified in the literature and second, measures of ecological relationships by countries have been used wherever possible. The OECD Secretariat carried out a non-exhaustive literature search on the determinants of variations for the set of activities and procedures analysed. This research included both studies performed at the regional level and studies performed at the provider or patient level. Factors which were significant in econometric models or had significant correlations are presented.

1.4. Substantial variations across and within countries for all activities and procedures

A summary of key findings

Across countries, the national average rates of procedures vary from nearly two-fold for caesarean section (from 181 per 1 000 live births in Finland to about 350 in Australia, Italy and Portugal) to nearly five-fold for knee replacement with the lowest standardised rates in Israel and the highest rates in Australia and Switzerland (Table 1.3).

As to ***within-country variations***, there is broad consistency across countries in the ranking of procedures. Cardiac procedures, knee replacement, MRI and CT scan were consistently ranked as "high" variation across geographic areas. Conversely, hospital medical admissions and hysterectomy were generally in the middle range. Surgery/admissions after hip fracture and caesarean section were generally ranked as having low variation (Table 1.3). These results are consistent with existing research.

Cardiac procedures rates show the highest level of geographic variations. They vary by more than three-fold *across* countries and have the highest level of *within-country* variation for more than half of the countries. The latter are particularly high for coronary bypass in Spain and Portugal. In both countries, however, outlying (low) values may partly result from partial coverage of data since Spain and Portugal only reported activities of public hospitals.

Knee replacement rates display high levels of variations. They vary by more than four-fold *across* countries. They are highest in Australia, Switzerland, Finland, Canada and Germany (above 200 per 100 000 population over 15-years old) while they are below 150 in other countries, with Israel having the lowest rate (56 per 100 000). Knee replacements also vary by two- to three-fold across geographic areas in most countries; and by more than five-fold in Canada, Portugal and Spain.

Table 1.3. National average rates and within-country variations in health care use, by procedure, 2011 or latest year

Summary statistics	Country	Hospital medical admission (per 100 000 pop.)	CABG (per 100 000 pop.)	PTCA (per 100 000 pop.)	Admission/surgery after hip fracture (per 100 000 pop.)	Knee replacement (per 100 000 pop.)	C-section (per 1 000 live births)	Hysterectomy (per 100 000 females)
Unweighted national average	Australia	12033	72	208	121	257	343	330
	Belgium	9723	84	261	78	186	206	308
	Canada	5717	75	212	-	213	292	394
	Czech Rep.	-	-	-	-	105	243	197
	England	10585	-	-	-	-	-	-
	Finland	8962	59	189	81	213	181	254
	France	8805	28	247	118	135	194	209
	Germany	12267	69	370	176	209	324	376
	Israel	12755	59	340	140	56	207	128
	Italy	6370	41	187	114	96	346	207
	Portugal	5245	26	111	108	74	349	175
	Spain	5121	27	135	108	98	189	172
	Switzerland	7662	52	242	151	230	332	-
Ratio 90th/10th percentile	Australia	1.5	1.8	1.8	1.5	1.7	1.3	1.6
	Belgium	1.3	1.7	1.7	1.6	1.5	1.3	1.5
	Canada	2.4	2.0	1.7	-	2.5	1.5	2.0
	Czech Rep.	-	-	-	-	1.6	1.4	3.0
	England	1.6	-	-	-	-	-	-
	Finland	2.1	2.4	2.9	1.4	1.6	1.6	1.8
	France	1.3	2.2	1.8	1.3	1.7	1.3	1.6
	Germany	1.4	2.0	1.8	1.3	1.5	1.4	1.5
	Israel	1.4	2.0	1.4	1.4	2.3	1.6	-
	Italy	1.4	2.1	1.8	1.4	1.7	2.0	1.5
	Portugal	1.5	3.2	1.9	1.4	3.2	1.5	2.1
	Spain	1.5	6.0	2.2	1.7	2.2	1.9	1.7
	Switzerland	1.5	2.3	1.7	1.8	1.6	1.5	-
Ratio Max/Min value	Australia	2.5	3.4	3.4	5.0	2.3	1.6	2.6
	Belgium	1.3	1.8	1.8	1.7	1.6	1.3	1.6
	Canada	3.6	4.0	4.0		5.7	2.8	4.1
	Czech Rep.	-	-	-	-	1.8	1.4	3.6
	England	3.2	-	-	-	-	-	-
	Finland	2.4	4.0	3.5	1.6	2.0	2.1	2.0
	France	1.7	5.4	2.8	1.5	2.8	1.9	2.4
	Germany	1.9	2.9	2.9	1.9	2.4	2.2	2.1
	Israel	1.4	2.0	1.4	1.4	2.3	1.6	2.1
	Italy	2.2	7.0	3.6	2.8	3.1	6.0	2.6
	Portugal	2.6	17.6	3.9	1.9	8.6	1.6	2.7
	Spain	2.0	**	5.2	2.6	5.6	3.6	3.5
	Switzerland	1.7	3.3	1.8	2.1	2.0	2.2	-
Coefficient of variation	Australia	0.20	0.21	0.24	0.23	0.19	0.10	0.20
	Belgium	0.08	0.17	0.18	0.16	0.14	0.09	0.13
	Canada	0.34	0.25	0.22	-	0.32	0.16	0.27
	Czech Rep.	-	-	-	-	0.16	0.11	0.39
	England	0.19	-	-	-	-	-	-
	Finland	0.20	0.34	0.30	0.13	0.18	0.18	0.20
	France	0.11	0.29	0.23	0.09	0.19	0.12	0.18
	Germany	0.14	0.24	0.22	0.11	0.17	0.13	0.14
	Israel	0.12	0.27	0.12	0.14	0.28	0.16	0.23
	Italy	0.15	0.30	0.23	0.14	0.20	0.29	0.17
	Portugal	0.21	0.41	0.27	0.15	0.39	0.13	0.27
	Spain	0.14	0.50	0.30	0.20	0.31	0.25	0.21
	Switzerland	0.13	0.26	0.17	0.20	0.17	0.15	-

Note: Rates are standardised using the 2010 OECD population. The coefficient of variation is the ratio of the standard deviation to the mean. Darker shaded cells refer to within-country variation that is more than two-fold and to the coefficient of variations equal or higher than 0.2 and "-" signals data that were not reported or not comparable. Data for Canada, Germany, Italy and Spain refer to the smaller territorial unit (see Table 1.2 for details). (**) Spain has a minimum value of 0 and so the ratio cannot be calculated.

Source: Authors' estimates based on data submitted by countries for the OECD project

Variations in ***hysterectomy rates*** are relatively high, in a context of declining use of this intervention. The prevalence of hysterectomy is 75% higher in Canada and Germany (above 350 per 100 000 females) than in Israel, Spain, Portugal or the Czech Republic. Most countries have two- to three-fold variation across geographic areas. Canada and the Czech Republic have higher levels of variation (close to four-fold), due to some high extreme values in certain areas.

Hospital medical admissions rates are twice as high in Israel, Germany or Australia (around 12 000 per 10 000 population) than in Canada. While within-country variations are lower than for other procedures, Canada, Australia, Finland and England display the highest levels of variation (ranging from 2.4 to 3.6-fold), partly due to outlying regions.

Caesarean section rates are as much as 50% higher in Italy, Portugal, Australia, Switzerland and Germany (above 300 per 1 000 live births) than in Finland. Within-country variations are relatively low, except in Italy where caesarean section rates vary by six-fold across regions.

Rates of ***admissions/surgery after hip fracture*** are about twice as high in Germany and Switzerland (more than 150 per 100 000 population) than in Belgium and Finland. Most countries have low variation across geographic areas (less than two-fold variation), with Australia having the highest levels of within-country variation (five-fold). In Australia, the wide variation is due to an extremely high value in one Medicare Local.

Some of the variations observed might be due to differences in health needs, not totally captured by demographic adjustments, or by differences in patient preferences. Others are explained by differences in the supply of services or variations in medical practices. These supply-related variations are deemed to be unwarranted and should be addressed to improve health system performance.

Hospital medical admissions vary by two-fold or more across and within countries

Hospital medical admissions refer to patients admitted for at least one night in hospital but who do not undergo any surgical procedure.[3] While indications to hospitalise patients are very clear for a few conditions, the rules are less clear for others, leaving much room to clinicians' discretionary decisions.

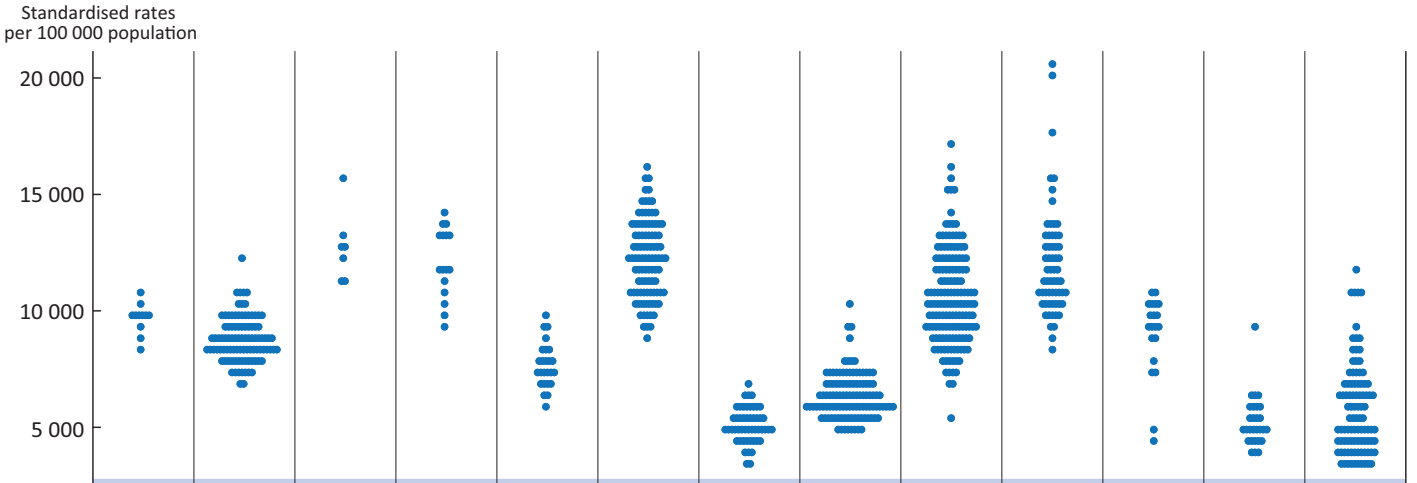
Hospital medical admission standardised rates are twice as high in Israel, Germany or Australia (around or above 12 000 per 100 000 population over 15 years) than in Spain,[4] Portugal,[5] and Canada,[6] where they stand at around or below 6 000 (see Figure 1.2). The low rates observed in Spain and Portugal, however, are partly explained by the fact that both countries only reported activities in public hospitals.

Hospital medical admission rates also vary within countries. Canada shows the highest level of variations, with admissions being more than three times higher in certain regions compared to others. Australia, Portugal, Finland and England also display high levels of variations, ranging from 2.4 to 3.2-fold, around very different average rates. Some of these variations are explained by extreme values: two territories in Canada (Nunavut and the Northwest Territories) and three Medicare Locals in Australia have very high rates of hospital medical admissions, while two districts in Finland have very low rates by comparison with other Finnish districts (Figure 1.2).

Hospital medical admission rates tend to decline in most OECD countries but not uniformly across geographic areas. In Finland, for instance, where the average standardised rate declined by 22% in the last decade, variations between districts

increased due to diverging trends. Medical admission rates decreased sharply in two districts with university hospitals (by 50 to 60%) (Chapter 6 in this volume). In Canada, where the average standardised rate declined by 9% between 2006 and 2010, the range of variations across regions remained stable over the period (Chapter 4). This suggests that hospital medical admissions have declined everywhere at the same rate. In Italy, both the average rate and the coefficient of variation decreased between 2007 and 2011 (Chapter 10). This means that the reduction has generally been greater in regions that had high rates. Similarly, Portugal experienced a slow decline in the average rate (-3%) and variation (-12%) between 2002 and 2009 (Chapter 11). By contrast, the average rate of hospital medical admissions increased in France between 2005 and 2011, but the range of variations across departments decreased (Chapter 7). The average rate also went up in Switzerland, driven by a surge in hospital medical admissions in two cantons with initial high rates, which remains unexplained so far (Chapter 13).

Figure 1.2. Hospital medical admission rate across and within selected OECD countries, 2011 or latest year



	Belgium	France	Israel	Germany1	Switzerland	Germany2	Spain	Italy	England	Australia	Finland	Portugal	Canada
Crude rate	10 337	8 802	11 878	13 342	7 047	13 342	5 244	7 403	10 276	10 986	8 168	5 277	4 376
Std rate	9 723	8 805	12 755	12 102	7 662	12 267	5 121	6 370	10 585	12 033	8 962	5 245	5 717
Coeff. of variation	0.08	0.11	0.12	0.12	0.13	0.14	0.14	0.15	0.19	0.20	0.20	0.21	0.34

Note: Each dot represents a territorial unit. Rates are standardised using OECD population >15 years. Countries are ordered from the lowest to highest coefficient of variation within countries. Germany 1 and 2 correspond respectively to Länder and Spatial Planning Regions. Canadian data do not include mental hospital admissions in general hospitals leading to a relatively small under-estimation. Data for Portugal and Spain only include public hospitals. For Spain, the rates are reported based on the province where the hospital is located.

Source: Authors' estimates based on data submitted by countries for the OECD project.

Hospital bed supply and inadequate primary care services explain part of the variations in hospital medical admissions

The influence of hospital supply on overall admission rates has been widely documented, generally confirming Rohmer's law that a "built bed is a filled bed". For instance, Fisher et al. (2000) analysed the relationships between resources and use in 313 hospital referral regions (HRR) in the United States. They showed that the number of beds per capita varied by more than two-fold across regions and that Medicare patients in areas with more beds were up to 30% more likely to be hospitalised, controlling for socio-economic characteristics and disease burden.

Other studies suggest that the availability and quality of primary care services can make a difference. For some chronic conditions, such as diabetes, good-quality care in the community is expected to prevent hospitalisations (Gibson et al., 2013). In Canada, the rate of ambulatory care sensitive conditions (defined as conditions that might be otherwise managed in primary care) in 2006 was more than 60% higher in rural areas compared with urban areas (CIHI, 2008). Similarly, the remoteness of hospitals and the lack of primary care providers in Nunavut and the Northwest Territories explain part of the variations in admission rates (CIHI, 2009, quoted in Chapter 4 in this volume).

On the demand side, several studies have showed the influence of socio-economic factors. For instance, Majeed et al. (2000), analysing admission rates across 66 primary care groups in England, showed that hospital admission rates were strongly correlated not only with the prevalence of chronic illness but also with social deprivation. In Canada, poor neighbourhoods have a higher rate of hospitalisations for ambulatory care sensitive conditions (more than two-times higher) than the wealthiest neighbourhoods (Chapter 4).

Strategies aiming to reduce unnecessary hospital admissions focus on closing hospital beds and strengthening primary care

Countries generally seek to reduce unnecessary hospital admissions through two strategies: closing hospital beds and strengthening primary care.

In the United States, since the 1980s, efforts have been made to close hospital beds or implement tighter regulation of hospital expansions. The Certificate of Need programme is one example. These efforts likely contributed to the reduction in bed supply and resulted in the United States having a low bed supply and low medical admission rates compared to other OECD countries.

The other strategy to reduce hospital admission rates is to reduce the number of avoidable admissions through quality improvement in primary care. England, for instance, introduced initiatives to reduce unnecessary hospital admissions such as self-management of certain chronic conditions (e.g. asthma and chronic obstructive pulmonary disease). However, the evidence on the impact of changes to GP practice service characteristics and quality improvement initiatives such as the Quality and Outcomes framework on unnecessary hospital admissions is mixed (Purdy, 2010). More recently, a pilot in London was set up in January 2011 to integrate care for people with diabetes and those aged 75 and over. This initiative has brought together GP practices, mental health care trusts, community health care trusts, local authorities and voluntary associations to set-up a more integrated health care system outside of hospital, thereby reducing unnecessary admissions (Harris et al., 2012).

Cardiac procedures show high levels of geographic variations irrespective of the national average

Revascularisation procedures (angioplasty and coronary bypass) are used to treat patients suffering from ischemic heart disease. They are among the most frequent surgical procedures performed in OECD countries, and they are costly (Koechlin et al., 2010). Coronary bypass (CABG) is an open-chest surgery that is used to divert blood around narrow or clogged arteries (blood vessels), and involves taking a blood vessel from another part of the body (usually chest or leg) to use as a graft to replace any hardened or narrowed arteries to the heart. Coronary angioplasty (PTCA) is used to widen the blood vessel to increase blood flow to the heart, and is usually accompanied by the insertion of a stent to keep the blood vessel open.

The use of angioplasty has increased rapidly over the past two decades in most OECD countries. On average across OECD countries, angioplasty now accounts for 75% of all revascularisation procedures (OECD, 2013). Although angioplasty has in many cases replaced bypass surgery, it is not always a substitute since bypass surgery is still the preferred method for treating patients with multiple-vessel obstructions, diabetes and other conditions. The choice between these procedures depends on physician preferences and differs across hospitals (Tu et al., 2012). It may also be sensitive to patient preferences because each procedure carries different benefits and risks: heart attacks, stroke or even death for PTCA, with higher risks and longer hospital stays for CABG (Brownlee et al., 2011; NHS Choices, 2014).

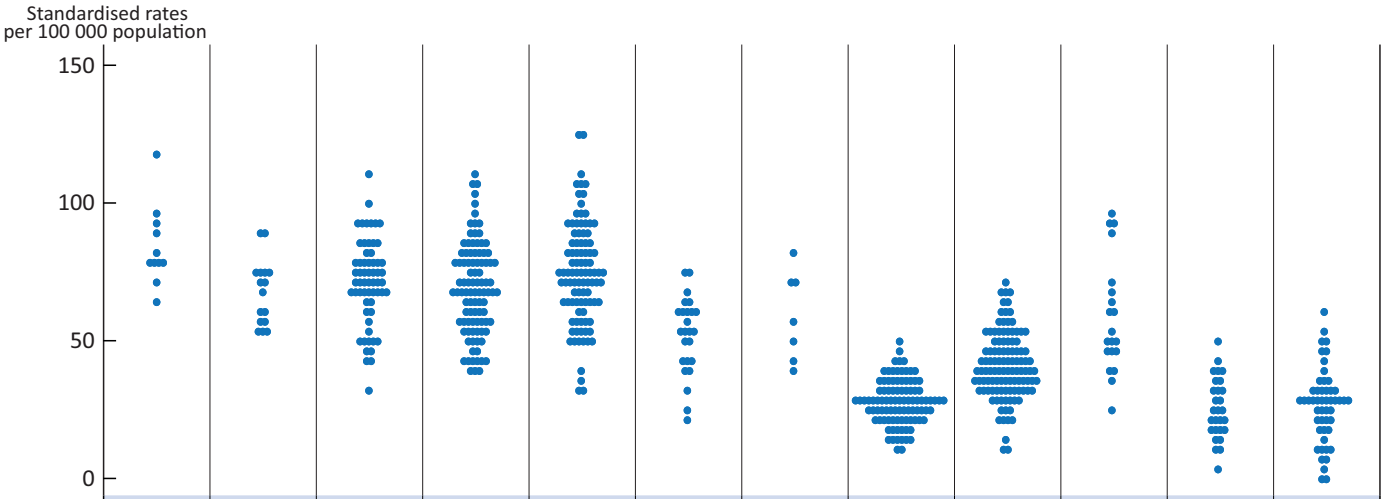
CABG and PTCA rates vary widely between countries and across smaller geographic areas (Figures 1.3 and 1.4). The average rate of revascularisation (CABG + PTCA) is high in Germany, Israel and Belgium (with rates above 300 per 100 000) and the lowest in Portugal and Spain (less than 200 per 100 000), but the latter might be under-estimated since both countries reported data only for public hospitals (Figures 1.3 and 1.4).

Cardiac procedures display some of the highest levels of within-country geographic variations across the set of reported procedures in many participating countries: Finland, France, Germany, Italy, England, Portugal and Spain. These results confirm findings reported in the literature that cardiac procedures generally show wide within-country variations (Corallo et al., 2014).

Belgium, Canada and Australia have high CABG rates (more than 70 per 100 000) Belgium shows small within-country variation around the average rate (1.8-fold). Spain and Portugal have low average rates but high levels of variation across geographic areas with ratios of 90th to 10th percentiles of respectively 6.0 and 3.2. Germany and Israel have high PTCA rates (340 or more per 100 000) while Portugal and Spain had the lowest rates (below 140 per 100 000). Variations in PTCA rates across geographic areas were somewhat smaller than for CABG, but still rates were more than five times higher in regions with the highest rates compared to those with the lowest rates in Spain. Portugal and Finland have the highest variations across geographic areas, in part due to very low procedure rates in some areas.

Geographic variation in each cardiac procedure could be related to some substitution between bypass and angioplasty. In such a case, regions with low rates of CABG would have high PTCA rates and the correlation between rates of the two procedures would be negative. Alternatively, regions with high CABG rates could also have high PTCA rates (positive correlation), which would suggest that rates are related to other supply factors (Hannan et al., 2006). The correlation between the two procedures was tested for all countries. There was no correlation in most countries and a small positive correlation in Belgium and Switzerland.

Figure 1.3. CABG rate across and within selected OECD countries, 2011 or latest year

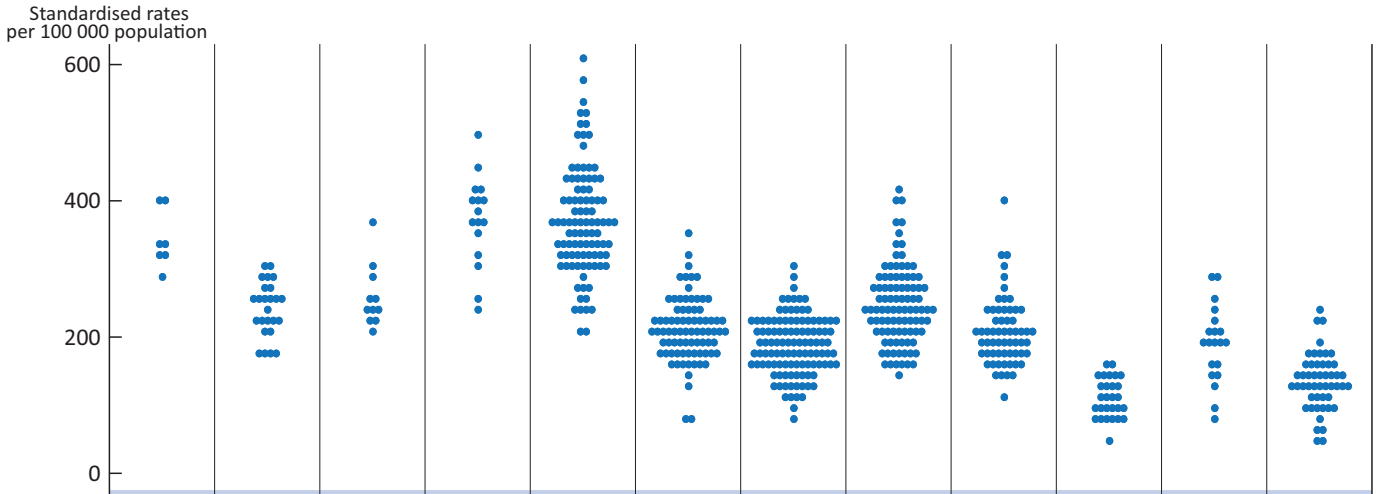


	Belgium	Germany1	Australia	Germany2	Canada	Switzerland	Israel	France	Italy	Finland	Portugal	Spain
Crude rate	90	66	73	66	75	49	49	29	47	66	30	19
Std rate	84	68	72	69	75	52	59	28	41	59	26	27
Coeff. of variation	0.17	0.17	0.21	0.24	0.25	0.26	0.27	0.29	0.30	0.34	0.41	0.50

Note: Each dot represents a territorial unit. Rates are standardised using OECD population over 20 years. Countries are ordered from the lowest to highest coefficient of variation within countries. Germany 1 and 2 refers respectively to Länder and Spatial Planning Regions. Data for Portugal and Spain only include public hospitals.

Source: Authors' estimates based on data submitted by countries for the OECD project.

Figure 1.4. PTCA rate across and within selected OECD countries, 2011 or latest year



	Israel	Switzerland	Belgium	Germany1	Germany2	Canada	Italy	France	Australia	Portugal	Finland	Spain
Crude rate	301	235	275	358	358	207	225	272	226	120	179	145
Std rate	340	242	261	371	370	212	187	247	208	111	189	135
Coeff. of variation	0.12	0.17	0.18	0.18	0.22	0.22	0.23	0.23	0.24	0.27	0.30	0.30

Note: Each dot represents a territorial unit. Rates are standardised using OECD population over 20 years. Countries are ordered from the lowest to highest coefficient of variation within countries. Germany 1 and 2 refers respectively to Länder and Spatial Planning Regions. Data for Portugal and Spain only include public hospitals.

Source: Authors' estimates based on data submitted by countries for the OECD project.

The average rate of CABG decreased or remained more or less stable over time, but this trend was not uniform in all geographic areas: variations increased in some countries (Israel, Italy, Portugal), decreased in others (Canada, France, Spain, Switzerland), and were relatively stable in England. For PTCA, country trajectories were more uniform. Country average rates increased and geographic variations decreased in most countries (Canada, England, France, Portugal, Spain and Switzerland), suggesting a convergence in practice. Israel and Italy observed a reduction in PTCA average rates with little or small changes in the coefficient of variation. Finland experienced an overall increase in revascularisation procedures rates over time while variations between hospital districts increased.

Lower economic status leads to lower revascularisation rates

Several studies on the determinants of variations in revascularisation procedures suggest that they are not fully explained by clinical factors, raising questions about appropriateness of care and equity in access. For instance, Pilote et al. (2004) found large variations across provinces and regions of Canada in the probability to undergo revascularisation after an acute myocardial infraction at the end of the 1990s. Germany carries out a lot of revascularisation though the national rate of ischemic heart disease mortality is similar to the OECD average (OECD, 2013). Research conducted in 2003 in more than 100 German hospitals concluded to a 10% overuse of revascularisation procedures, as well an additional quarter of cases in which appropriateness was uncertain (Gandjour et al., 2003).

Several studies suggest that other demand-side factors influence revascularisation rates. In France, Gusmano et al. (2014) compared local revascularisation rates, adjusted for the burden of ischemic health disease (measured by hospital admissions for this cause), between and within three regions. They found lower odds of receiving revascularisation rates in regions with low population density, a lower level of education, and lower income. Testing simultaneously the influence of demand-side and supply-side factors on revascularisation rates in 11 US states, Hannan et al. (2006) showed a positive influence of the proportion of the white population on procedure rates.

The role of supply factors seems to depend on overall context. Analysing revascularisation rates in 42 English districts, Black et al. (1995) showed a positive correlation with the proximity to a regional revascularisation centre and the presence of a local cardiologist. By contrast, Belgium and Portugal tested the association between procedures rates and the density of specialists in this study without finding any significant association. In France, Gusmano et al. (2014) did not find any association between regional rates of revascularisation and the density of cardiologists but found lower rates in regions with more public hospitals. The study by Hannan et al. (2006) on 11 US states did not find any effect of variables linked to the density of a specialised workforce.

A study on the adoption of revascularisation procedures across 17 countries found a positive influence of wealth (diminishing over time) as well as an effect of health systems characteristics. It showed that public-integrated systems had lower procedures rates by comparison to public-contract and reimbursement-based models and that higher procedure rates were observed in countries where investments are funded through general hospital revenue rather than through applications for public funding (Bech et al., 2009).

To sum up, morbidity patterns do not fully explain variations in revascularisation rates and socio-economic factors play a significant role. The role of supply factors seems more ambiguous and context dependant. The extent to which procedure rates reflect patient preferences is generally unknown.

Clinical guidelines have been developed to promote more appropriate use of revascularisation procedures

The production of guidelines along with the involvement of physician societies has been used to address variations observed at the local level. In Canada, a network of researchers was established to study variations in cardiac care in provinces. They produced a series of studies and atlases to better identify clinical guidance. They also adopted an urgency rating score (URS) that triaged patients into three categories (elective, emergent, urgent) and uniform eligibility criteria. These measures led to a reduction in variation observed in Canada (CCORT, 2014).

Similarly, in Australia, Clinical Cardiac Networks are well developed, and promote nationally agreed cardiac care guidelines produced by the National Heart Foundation and the Cardiac Society of Australia and New Zealand (Chapter 2 in this volume). These societies also have collaborated with clinical networks to produce intermittent audits of care in Australia's and New Zealand's hospitals. In Western Australia, additional payments are being trialled into the activity-based funding programme including one for the treatment of acute myocardial infarction in 2013-14. The state of Victoria has established a cardiac outcomes registry among public and private providers.

In Switzerland a working group was established to monitor, report, and promote better use of cardiac interventions. These guidelines are updated periodically but they are not binding for providers (Maeder et al., 2012). Improving cardiac care in Spain is a policy priority as the mortality rate in Spain from cardiovascular disease varies substantially across provinces. The promotion of best practice by the Spanish Society of Cardiology could in part explain the reduction in variation in revascularisation procedures over time (Chapter 12 in this volume). In Belgium, the Ministry of Health introduced policies in 2012 to improve cardiac treatment and the use of diagnostic technologies. The College of Cardiac Physicians is responsible for providing feedback to hospitals for benchmarking and to encourage health service improvements in cardiac care (Chapter 3).

Variations in joint procedures are high for knee replacements but lower for admission/surgery after hip fracture

Admissions/surgery after hip fracture show little variations across geographic areas

Surgery after hip fracture was chosen for this international study with the intent to act as a reference procedure with expected low variation. Since there is little uncertainty about the diagnosis and little choice but to admit and operate a patient after hip fracture, differences in rates likely reflect the incidence of hip fractures. Several studies have used this indicator as a low-variation procedure to benchmark geographic variations in other procedures (Bevan et al., 2004; Ibáñez et al., 2009).

A number of procedures exist for the treatment of hip fracture (e.g. the use of nails/screws, total hip replacement, partial replacement), and in many countries the clinical guidelines indicate that one of these interventions should usually be performed within 48 hours. The data reported by countries under this project relate either to admissions after hip fracture or to surgery after hip fracture (excluding external causes of hip fracture such as railway, motor vehicle, road accidents in some countries at least).[7]

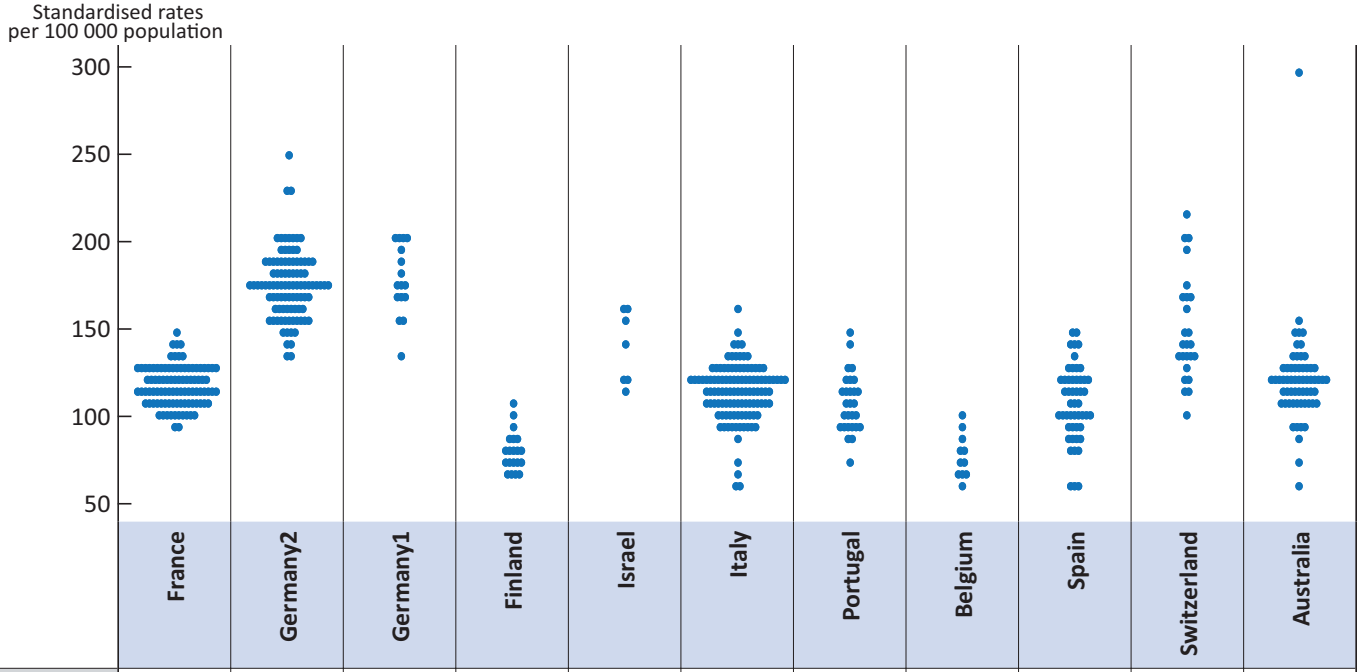
Rates of admission/surgery after hip fracture are twice as high in Germany and Switzerland (more than 150 per 100 000 population) than in Belgium or Finland (around 80 per 100 000) (Figure 1.5). As expected, most countries have low variation across geographic areas in admissions/surgery after hip fracture (less than two-fold variation). Australia has the highest levels of variation across geographic areas (five-fold), in part due to a high outlier with around 250 admissions per 100 000 (Kimberley-Pilbara). Italy, Spain and Switzerland have the next highest levels of variation (more than two-fold).

Trends in surgery/admissions for hip fracture are not homogeneous across countries and geographic areas. The occurrence of surgery/admissions after hip fractures increased in several countries, while variations slightly decreased (France, Spain and Portugal). In other countries, the average standardised rate remained more or less constant and variations were stable (Finland) or slightly decreased (Italy). Switzerland also observed stable rates and variations for most of the period except for the last two years (2010 and 2011) where a 18% rate increase was observed due to substantial increases recorded in some cantons (+30%). Israel saw a reduction in the average procedure rate but variations increased across districts.

Rates of admissions and surgery after hip fracture reflect need

Variations in surgery or admissions after hip fractures cannot be attributed to variations in medical practice *at the time the fracture occurs*. They more likely reflect variations in health needs, i.e. the prevalence of hip fracture in old age. These variations, in turn, are very much linked to the age of the population, the prevalence of osteoporosis and the prevalence of falls and accidents in the frail elderly. The prevalence of osteoporotic hip fractures is naturally increasing with the age of a population, with the prevalence of osteoporosis and with other population characteristics. For instance, in Australia, in 2006-07, Aboriginal men were twice as likely to have hip fractures as other Australian males, whereas Aboriginal women were 26% more likely to have hip fractures than other Australian females (AIHW, 2010).

Figure 1.5. Admissions/surgery after hip fracture across and within selected OECD countries, 2011 or latest year



	France	Germany2	Germany1	Finland	Israel	Italy	Portugal	Belgium	Spain	Switzerland	Australia
Crude rate	127	196	196	95	111	156	120	91	124	193	107
Std rate	118	176	178	81	140	114	108	78	108	151	121
Coeff. of variation	0.09	0.11	0.11	0.13	0.14	0.14	0.15	0.16	0.20	0.20	0.23

Note: Each dot represents a territorial unit. Rates are standardised using OECD's population over 15 years. Countries are ordered from the lowest to highest coefficient of variation within countries. Australia and Switzerland reported on admissions for hip fracture while other countries reported on surgery after hip fracture. Data for Portugal and Spain only include public hospitals. For Spain, the rates are reported based on the province where the hospital is located. Germany 1 and 2 refers respectively to Länder and Spatial Planning Regions.

Source: Authors' estimates based on data submitted by countries for the OECD project.

Countries have sought to reduce the prevalence of hip fracture

Quite recently, countries and professionals have sought to reduce the prevalence of hip fractures through guidelines supporting interventions that reduce the prevalence of osteoporosis and/or its consequences; reduce the risk of falls in older people; and reduce the risk of recurrent fracture by secondary prevention after a first fall. Australia published guidelines to promote "healthy bones throughout life" (Ebeling et al., 2013); Belgium published guidelines to promote secondary prevention of osteoporosis (KCE, 2011); and England and France published guidelines to prevent falls in older people (NICE, 2004 updated in 2013; HAS, 2005 and 2009). Internationally, the World Health Organization developed a risk-assessment tool,[8] whose use is recommended by several associations to identify older people in need for close case management.

A number of guidelines encourage prompt surgical treatment once the facture has occurred, as well as rehabilitative care including prevention of future fractures, for instance in Finland (Chapter 6 in this volume). In England (Chapter 14), financial incentives are used to encourage better quality care via Best Practice Tariffs (BPT): BPT offers additional payment for cases where the care meets agreed standards including surgery within 36 hours (Royal College of Physicians, 2013). Similarly, Israel rewards hospitals through an additional payment if the surgery is performed within 48 hours after admission and imposes a penalty when they do not (Chapter 9).

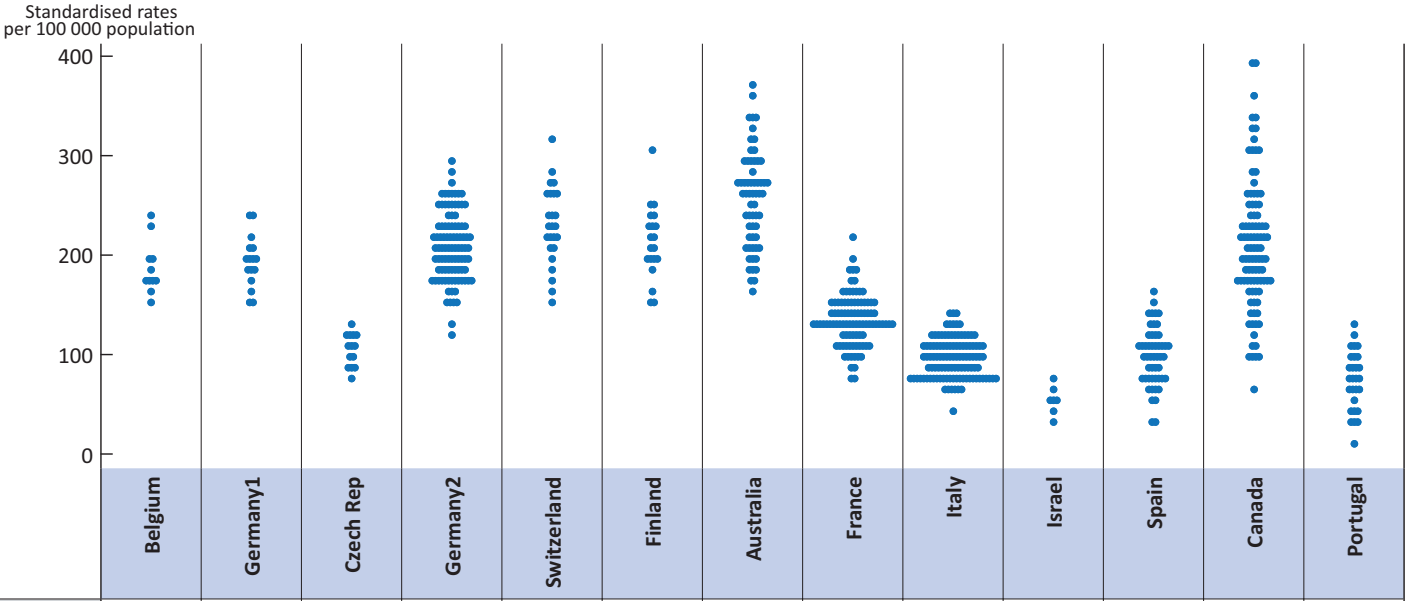
Knee replacement rates vary widely across and within countries

In knee replacement surgery, the knee is replaced with an artificial joint because it is damaged (e.g. by severe osteoarthritis). The knee can be completely or partially replaced. Knee replacement is indicated in severe osteoarthritis when more conservative treatments (including 6-month prescription drugs) have not succeeded in relieving pain and disability. However, there is no clear clinical consensus on indications for knee replacement (Dieppe, 2009). Mild symptoms are preferably treated with exercise and medications, but knee replacement usually relieves pain and improves mobility in patients with severe osteoarthritis. However, the intervention is not without risks (linked to the intervention itself or to the prosthetic joint) and imposes long periods of rehabilitation. It does not work in 10% of patients (Brownlee et al., 2011). This means that patient preferences should influence the decision to operate or use alternative treatments.

Knee replacement is a very frequent procedure and the number of knee replacements has increased rapidly over the past decade in most OECD countries. This is partly due to population ageing but also to the growing use of this intervention for people at earlier ages, due to concomitant morbidities such as rising levels of obesity which have increased need for knee replacement (Fehring et al., 2007).

Knee replacement rates display high levels of variations. They vary by more than four-fold across countries. They are highest in Australia, Switzerland, Finland, Canada and Germany (above 200 per 100 000 population over 15-years old) while they are below 150 in other countries, with Israel having the lowest rate (56 per 100 000). Knee replacements also vary by two- to three-fold across geographic areas in most countries; and vary by more than five-fold in Canada, Portugal and Spain. In these three countries, however, large variations are partly explained by outliers with very low rates (Spain and Portugal) or with both high and low rates (Canada). Low rates in Spain and Portugal may be partly explained by partial coverage of data, which only include public hospitals.

Figure 1.6. Knee replacement rate across and within selected OECD countries, 2011 or latest year



	Belgium	Germany1	Czech Rep	Germany2	Switzerland	Finland	Australia	France	Italy	Israel	Spain	Canada	Portugal
Crude rate	210	215	113	215	257	240	238	133	122	45	106	193	77
Std rate	186	194	105	209	230	213	257	135	96	56	98	213	74
Coeff. of variation	0.14	0.15	0.16	0.17	0.17	0.18	0.19	0.19	0.20	0.28	0.31	0.32	0.39

Note: Each dot represents a territorial unit. Rates are standardised using OECD's population over 15 years. Countries are ordered from the lowest to highest coefficient of variation within countries. Data for Portugal and Spain only include public hospitals. For Spain, the rates are reported based on the province where the hospital is located. Germany 1 and 2 refers respectively to Länder and Spatial Planning Regions.

Source: Authors' estimates based on data submitted by countries for the OECD project.

Over the study period, rates typically increased in the participating countries. In many participating countries, the increase was dramatic: +80% in Finland between 2001 and 2011; + 83% in Spain between 2000 and 2010, + 50% in Israel between 2001 and 2011 (but starting from a very low level), +46% in France between 2007 and 2011, and more than 100% in Portugal between 2002 and 2009. Over the same period, variations across small areas increased in Israel and the Czech Republic, increased in Spain until 2005 and then decreased; remained more or less stable in France, Italy and Portugal, and fluctuated in Finland.

Medical practices and socio-economic status of patients influence knee replacement rates

Differences in morbidity patterns explain part of the geographic variations in knee replacement rates. In France, for instance, regions with high rates of knee replacement, located in the North-East, tend to have a higher prevalence of osteoarthritis. However, in Germany, Schäfer et al. (2011) showed for broad regional clusters that the variation in the prevalence of osteoarthritis was small compared to the variation in knee replacement rates, suggesting that clinical need does not explain the whole range of variations.

Variations in medical practice play an important role. Weinstein et al. (2004) analysed variations in knee replacement rates across 306 hospital referral regions in the United States for Medicare patients. The authors showed that age-sex-race-adjusted rates of knee replacement vary by 2.4-fold between contiguous HHR and found it unlikely that such a difference could be explained by differences in patient needs or preferences. They attributed them to regional "surgical signatures" which they showed to persist over time. In Canada, Wright et al. (1999), focussing on health regions in the largest province (Ontario), found that orthopaedic surgeons' opinions or enthusiasm for the procedure was the main modifiable determinant of variations and underlined the need to focus on modifying the opinions of some surgeons to reduce geographic variations in knee replacement.

The influence of the density of supply is less obvious. The Weinstein study (2004) did not find any significant effect of the density of orthopaedic surgeons on procedure rates. Similarly, Finland explored the link between standardised rates of knee replacements and the density of orthopaedic surgeons in hospital districts and did not find any systematic relation (Chapter 6 in this volume).

People living in areas with lower socio-economic status or in less populated areas are more likely to undergo knee replacement. In the United States, Weinstein et al. (2004) found that hospital referral regions with higher income and greater population density tend to have lower rates of knee replacements. In Australia, Dixon et al. (2011), analysing differences in knee replacement rates across population categories in 2005-07, found that those living in disadvantaged areas and in less urban areas were more likely to have a knee replacement. However, Steel et al. (2008), using individual data from the United States Health and Retirement Survey, found that the probability to receive joint replacement (hip or knee) for those in need was 50% lower for black people than for white people and one-third lower for people without a college education than for those with a college education.

Patient-centered policies are gaining prominence for joint procedures

Several participating countries have implemented policies to influence medical practice in knee replacements. These policies seek to ensure appropriateness of surgery and to better account for preferences of patients. They might have spill-over effects on unwarranted variations in health care use.

Some countries have set up registries (Belgium and Canada) to monitor indications for surgery, surgical techniques used and health outcomes. In Canada, the Canadian Institute for Health Information (CIHI) developed the Canadian Joint Replacement Registry in 2001 which collects data on utilisation rates, patient characteristics, clinical issues and waiting times (Chapter 4 in this volume). In Belgium, a national registry ("Orthopride") has been set up to better understand the use of knee replacements, following a publication showing geographic disparities in elective surgery (Willems et al., 2013). The registry collects information on patient characteristics, causes for joint replacement as well as types of prostheses used and revision rates. However, recording of activity is voluntary and data published so far do not provide a full picture.

In Australia, the State of Victoria developed in 2005 a programme to improve waiting list management in hip and knee replacement surgery. A multi-attribute quality-of-life questionnaire was developed to help prioritise people with hip or knee joint disease for surgery. Patients referred for assessment to a hospital clinic by their general practitioner are managed by a multidisciplinary team who provides therapeutic, non-surgical treatment options, and assesses the priority for surgery. The health status of patients on the waiting list is regularly monitored using a standard quality of life measure and patients are fast tracked for surgery if required (Chapter 2 in this volume).

In England, decision aids are published to provide patients with a better understanding of the risks and benefits associated with the intervention. From 2009, all providers of NHS-funded care are also required to collect Patient Reported Outcomes (PROMs) for a number of procedures, including hip and knee replacements. For the latter, they use the Oxford Knee Score (OKS), which is a short, practical self-completed questionnaire, which measures need before and outcome after knee replacement surgery. Patient Reported Outcome Measures (PROMs) are publicly reported in the NHS Atlases (NHS, 2013). This information is useful to determine whether rising utilisation rates of certain procedures are reaching some "diminishing returns" in terms of benefit/cost ratios. Patient-reported outcomes after knee replacements were found to be good in Primary Care Trusts in England with increasing rates of knee replacement, suggesting that the point of overuse was not reached (Chapter 14 in this volume).

In Finland, the Ministry of Social Affairs and Health updated a set of criteria in 2010 to assess the need for knee replacement and the Medical Society Duodecim updated national clinical guidelines on osteoarthritis and knee and hip joints in 2012 (Chapter 6). These two sets of policies may have contributed to the stabilisation of the rapid increase in knee replacement and levelling out of geographic variations in rates of knee replacements but there is no strong evidence of that impact. Another contributing factor may have been that by the late 2000s after the rapid increase, the country had reached a very high activity level of knee operations (among the highest in the OECD countries) which may have brought about a ceiling effect.

Provider discretion and socio-economic status can influence geographic variations in gynaecological procedures

Caesarean section rates vary little within countries but are on the rise

Caesarean sections are indicated when risk factors compromise normal delivery. They can be performed on an emergency or an elective basis.[9] The World Health Organization, using data from all countries, estimated that beyond 15% caesarean section rates, risks to reproductive health outcomes may outweigh the benefits (McPherson et al., 2013). Caesarean section is a high-volume and high-cost procedure, more expensive than normal delivery (Koechlin et al., 2010).

Standardised caesarean section rates are as much as 50% higher in Italy, Portugal, Australia, Switzerland and Germany (above 300 per 1 000 live births) than in Finland (below 190) (Figure 1.7). Despite high rates in many countries, this procedure generally displays low variations within countries, except in Italy, where a six-fold variation is partly explained by very high rates in the south of the country. In England, while the caesarean section rate has increased, the variation is small, which may be due to adherence to NICE guidance (NICE, 2011).

In most countries that reported trend data, caesarean section rates increased over time. Variations across geographic units, however, either did not change considerably (e.g. Canada, Czech Republic, Italy and Spain), or decreased (e.g. France, Portugal and Switzerland). Israel and Finland (to a lesser degree) observed an increase in variation across geographic areas. Only Italy and Portugal observed a reduction in the caesarean section rate over time.

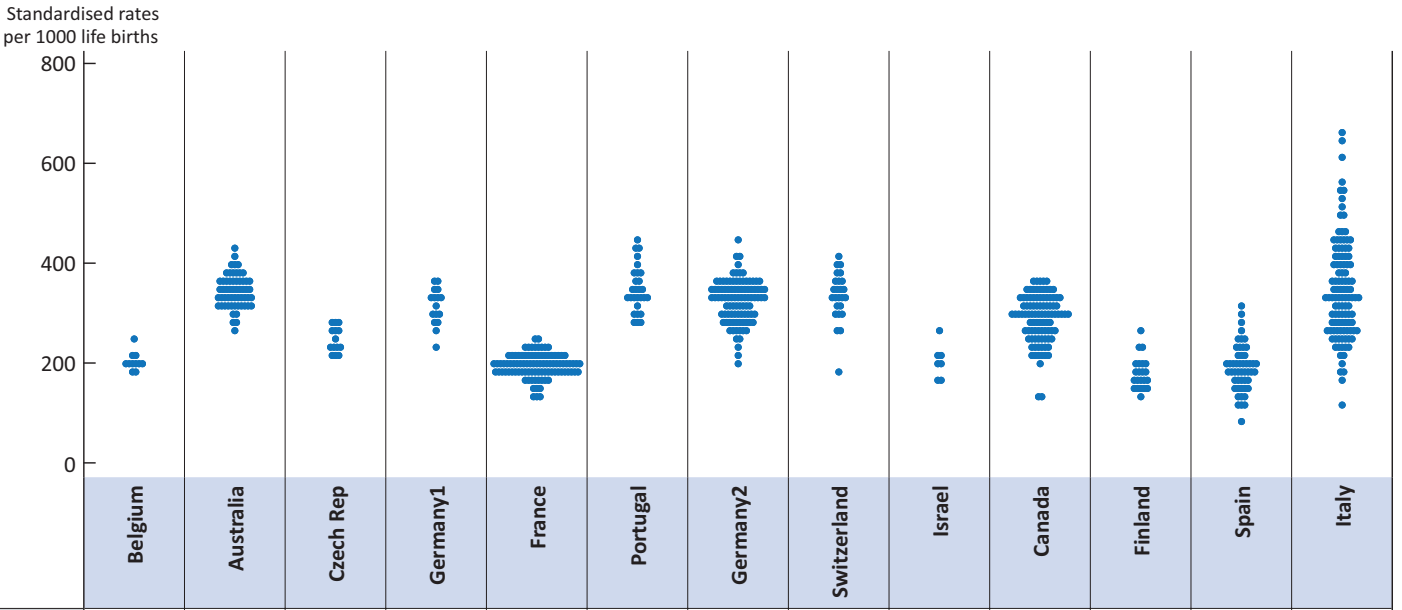
This study does not distinguish emergency and elective caesarean sections, whose respective contributions to overall variations seem to vary across countries. In Germany, variations in caesarean section rates are mainly due to variations in planned caesareans sections (Kolip et al., 2012) while in England, rates of emergency caesarean section varied between trusts more than rates of elective caesarean section (Bragg, 2010).

Physicians practice styles and delivery in private settings explain a large share of variations in caesarean section rates

Several studies showed that private hospitals tend to perform more caesarean sections than public hospitals. In France, private-for-profit hospitals authorised to provide maternity care for pregnancies without complications have caesarean section rates as high as public hospitals authorised to provide care for the most complex cases (FHF, 2008). Milcent and Rochut (2009) working on individual data in 2003 confirmed that private-for-profit hospitals are more likely to perform caesarean sections than other hospitals, even after adjustment of risk factors. In Switzerland, the Office Fédéral de la Santé Publique (OFSP, 2013), working on individual data allowing for adjustment for clinical need reached the same conclusion. The rate of caesarean sections is also higher in private hospitals in Italy and in Spain (Barbadoro et al., 2012; Márquez-Calderón et al., 2011).

Other supply factors seem to play a role. For instance, in France, in 2003, the number of obstetricians per bed in one hospital increased the probability of caesarean section (Milcent and Rochut, 2009). In the United States, the percentage of births assisted by midwives has a small negative impact on the probability of caesarean section at the state level (Yang et al., 2011). Epstein and Nicholson (2005), working on deliveries in Florida found that 30% of variations between physician-specific caesarean section rates were explained by physicians' practice styles and that practice styles of other physicians in the same hospital and of physicians in the same region were also influential.

Figure 1.7. Caesarean section rate across and within selected OECD countries, 2011 or latest year



	Belgium	Australia	Czech Rep	Germany1	France	Portugal	Germany2	Switzerland	Israel	Canada	Finland	Spain	Italy
Crude rate	194	323	237	314	196	328	314	332	185	270	161	170	369
Std rate	206	343	243	311	194	349	324	332	207	292	181	189	346
Coeff. of variation	0.09	0.10	0.11	0.11	0.12	0.13	0.13	0.15	0.16	0.16	0.18	0.25	0.29

Note: Each dot represents a territorial unit. Rates are standardised using Italy's population structure of live births according to the mother's age. Countries are ordered from the lowest to highest coefficient of variation within countries. Rates include emergency and non-emergency caesarean sections. Data for Portugal only include public hospitals. Spanish data only include public hospital leading to a 30% underestimation of caesarean sections. For Spain, the rates are reported based on the province where the hospital is located. Germany 1 and 2 refers respectively to Länder and Spatial Planning Regions.

Source: Authors' estimates based on data submitted by countries for the OECD project.

Two countries participating in this study reported the influence of the supply of resources on variations in caesarean sections rates. In Finland, caesarean section rates were generally higher in rural areas. This may in part be due to some small hospitals with insufficient resources for emergency services which tend to manage low-risk deliveries by planned caesarean sections. In the Czech Republic, the rate of caesarean sections was high in rural areas with low income levels and low hospital density but also in high concentrated urban areas (e.g. Prague) with a large number of hospital facilities, equipment and physicians.

On the demand side, women with higher socio-economic status tend to be more likely to give birth by caesarean section (Cáceres et al., 2013; Grant, 2009). In the Spanish Autonomous Community of Andalucía, women with a tertiary degree of education are 34% more likely to have a caesarean section than women who did not study and part of the variation might be explained by a more frequent use of private hospitals (Márquez-Calderón et al., 2011). In Florida, non-insured women or with Medicaid coverage are less likely to give birth by caesarean section (Epstein and Nicholson, 2005). By contrast, in Germany, a recent study of regional variations in caesarean section rates found that socio-demographic factors played a small or negligible role (Kolip et al., 2012).

Policies seeking to reduce caesarean section rates often target providers

The rapid increase in caesarean sections observed in many countries has raised questions on appropriateness. Public reporting, provider feedback, monitoring and clinical guidelines are used to reduce unwarranted variations in caesarean section rates. In the mid-2000s in Spain, caesarean section became an important part of the health strategy. An observatory on women's health to monitor caesarean section rates was established and more recently, the appropriateness of caesarean section was assessed against a set of indications. Hospitals who volunteered to use the inclusion protocol based on these criteria experienced a lower increase of caesarean section rates than those that did not. A second phase is planned in 2013-14.

In Belgium, the publication of a report documenting variations in caesarean section rates led to providing feedback to hospitals (Jacques et al., 2006). An analysis of hospital rates of caesarean section between 2008 and 2011 showed a convergence to the mean, where high-rate hospitals show a decrease towards a slightly lower rate, and low-rate hospitals increased their rate.

France introduced a financial disincentive in hospital payment rates to discourage inappropriate caesarean section: while the difference between payment rates of caesarean section and normal deliveries was expected to increase (to reflect changes in costs), the difference was kept constant in 2010 (Ministère de la Santé et des Sports, 2010). At the regional level, the ARS (*Agences Régionales de Santé*) directly monitor hospital activity in order to identify hospitals that have significantly high/low levels of activity/growth within the region. They can sign contracts with hospitals to encourage good practice. For example, in Alsace, hospitals are asked to limit the number of caesarean sections to 20% of total deliveries. Monitoring of changes in the caesarean section rates is encouraged.

In Australia, where caesarean section rates are high relative to many OECD countries, rates have continued to increase over the past 20 years, and a number of jurisdictions have taken an active role, developing guidelines covering perinatal practice, requiring reporting of hospital caesarean section rates, and investigation of performance against guidelines (Chapter 2 in this volume). The measures taken to monitor and review caesarean section rates may have discouraged variation in practice, and contributed to slowing down the rise in caesarean sections.

Within-country variations in hysterectomy are very large in a few countries

A hysterectomy is the surgical removal of the entire uterus (complete hysterectomy) or a part of it (removal of the uterine body while leaving the cervix intact). Hysterectomies are performed for a large number of benign and malignant conditions whose incidence varies by age as well as for symptoms caused by genital tract prolapse. The most common are menstrual irregularities, mostly fibroids and dysfunctional uterine bleeding, and symptoms associated with endometriosis. Alternatives exist as several new treatments have been introduced over the past decade to treat benign conditions that are less invasive than hysterectomy (NICE, 2007; McPherson et al., 2013).

The prevalence of hysterectomy is decreasing in most geographic areas thanks to the introduction of less invasive treatment alternatives. McPherson and colleagues (2013) found that cross-country variations in hysterectomy rates have been decreasing in the last decades. While countries with high rates 20 years ago, such as Australia, experienced a decline, countries with lower rates (e.g. United Kingdom/England) saw some increase.

However, standardised rates of hysterectomy are still 75% higher in Canada and Germany (above 350 per 100 000 females) than in Israel, Spain, Portugal and the Czech Republic (less than 200 per 100 000 females) (Figure 1.8).

Most countries have two- to three-fold variation across geographic units. Canada and the Czech Republic stand out with higher levels of variation (close to four-fold), due to some extreme values in certain areas: nearly 400 in Karlovarsky kraj, in the Czech Republic and above 600 per 100 000 females in certain regions in the provinces of Saskatchewan, British Columbia and Nova Scotia in Canada (Figure 1.8).

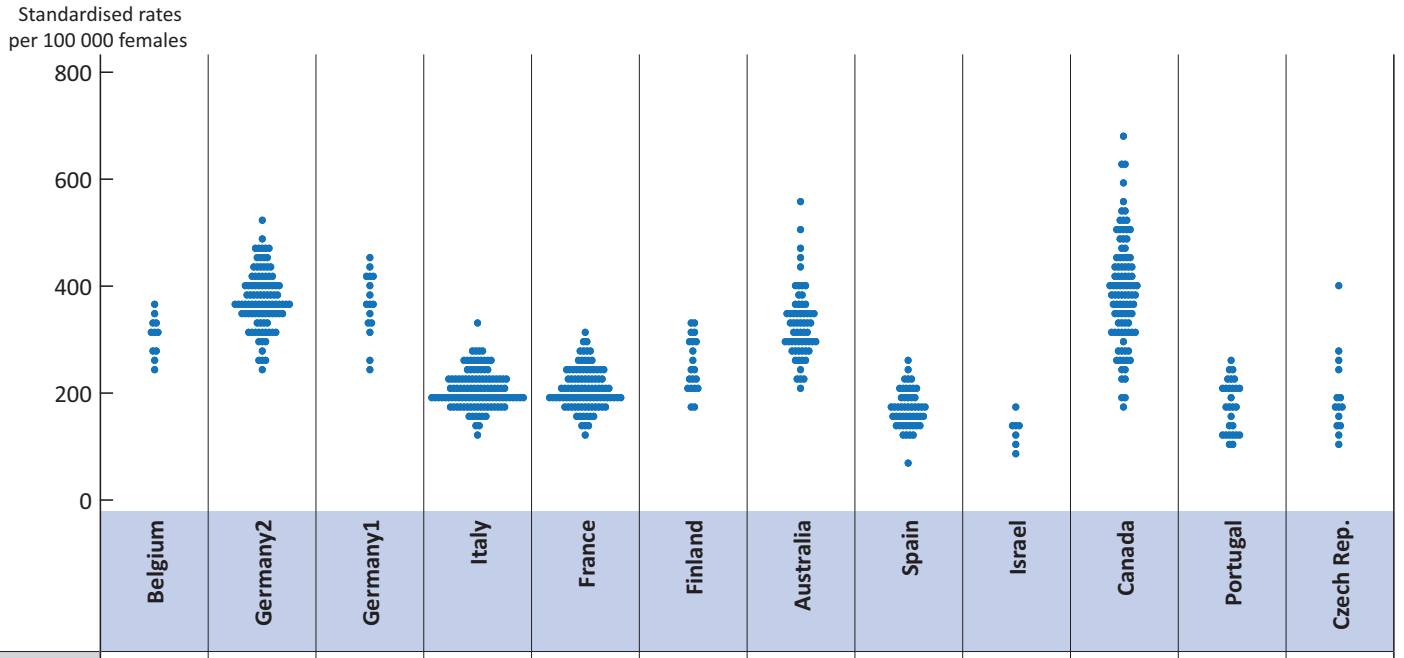
Over time, the average hysterectomy rate decreased in all countries participating in this project (e.g. by 11% in France between 2005 and 2011, a 40% drop in Finland between 2001 and 2011) but this was not uniform across geographic units. Within-country variations did not typically decrease (e.g. Spain) but rather were stable or increased (e.g. Canada, Italy, France, Finland and Portugal).

Hysterectomies are more frequent in women with low economic status, especially when physicians have greater discretion

Women with low education and low income tend to have higher rates of hysterectomies in some but not all countries. This is the case in Australia and England (Spilsbury et al., 2006; Marshall et al., 2000; and Cooper et al., 2008). In Australia, Reid et al. (1999) found that non-cancer-related hysterectomies were more frequent in local areas with lower socio-economic status. By contrast, in Belgium, Jacques et al. (2006) did not find any significant association between income level and municipal rates of hysterectomy. In Canada, hysterectomy rates were lower in the least affluent and most affluent neighbourhoods compared with women belonging to middle-income groups (CIHI, 2010). In Italy, higher industrialisation and socioeconomic status seem to be associated with higher hysterectomy rates; but the result deserves further analysis, as it contrasts with the conclusion of relevant literature.

Hysterectomies seem to be more frequent in rural areas. In Australia, rural areas had higher rates of hysterectomies performed for other causes than cancer (Reid et al., 1999). The national report produced for this project confirms higher rates in non-metropolitan areas (Chapter 2 in this volume). In Canada, the hysterectomy rate was significantly higher for women living in rural areas compared with women living in urban areas and this may be due to greater access to other treatment options for women living in urban areas (CIHI, 2010).

Figure 1.8. Hysterectomy rate across and within selected OECD countries, 2011 or latest year



	Belgium	Germany2	Germany1	Italy	France	Finland	Australia	Spain	Israel	Canada	Portugal	Czech Rep.
Crude rate	324	330	330	228	170	227	310	162	106	341	162	177
Std rate	308	376	365	207	209	254	330	172	128	394	175	197
Coeff. of variation	0.13	0.14	0.16	0.17	0.18	0.20	0.20	0.21	0.23	0.27	0.27	0.39

Note: Each dot represents a territorial unit. Rates are standardised using OECD female population over 15 years. Countries are ordered from the lowest to highest coefficient of variation within countries. Data for Portugal and Spain only include public hospitals. For Spain, the rates are reported based for the province where the hospital is located. Germany 1 and 2 refers respectively to Länder and Spatial Planning Regions.

Source: Authors' estimates based on data submitted by countries for the OECD project.

However, there is no clear relationship between hysterectomy rates and the density of health care supply. The prevalence of hysterectomy is not linked to the density of gynaecologists in Finland (Chapter 6) neither with the density of gynaecological beds in Germany (Geraedts and Malik, 2012).

Medical practice styles seem to play an important role. Hall and Cohen (1994) revealed that variations across regions in Ontarian were higher for indications that are more discretionary than others (i.e., menstrual haemorrhage, uterine prolapse and endometriosis).

Public reporting and clinical guidelines for hysterectomy

The publication of clinical guidelines has played some role in the observed reduction in hysterectomy rates. In Finland, for instance, the decline in overall hysterectomy rates coincided with the publication of results from a Finnish RCT study comparing hysterectomy and levonorgestrel-releasing intrauterine device for treating menorrhagia in the early 2000s (Hurskainen et al., 2001, 2004a, 2004b). The study influenced the national clinical guideline on the treatment of excess menstrual bleeding which underlined pharmaceutical treatments in menorrhagia. However, lower surgery rates have not led to any smaller relative regional variation in hysterectomy rates between hospital districts (Chapter 6).

In Canada, such guidelines might have contributed to the continuous reduction in hysterectomy rates overall, but they do not seem to have been sufficient to reduce the variations across provinces and health regions (Chapter 4).

In Germany, the rate of hysterectomies is monitored through the mandatory external quality assurance in German hospitals (Nolting et al., 2012). This hospital quality reporting scheme collects quality indicators on hysterectomy (AQUA Institute, 2012). While discussions are held at the Länder level, no particular action has occurred in response to the quality indicators on hysterectomy procedures (Chapter 8).

Geographic variations in imaging tests are high

The use of diagnostic imaging tests such as MRI and CT exams has increased greatly over the past decade in most OECD countries. MRI and CT exams are prescribed in a wide range of indications. Unlike conventional radiography and CT scanning, MRI exams do not expose patients to ionising radiation.

Only a few countries reported data on geographic variations in MRI and CT exams (Belgium, Canada and the United Kingdom/England). Among this small group of countries, the overall use of MRI and CT exams was greatest in Belgium, followed by Canada and the United Kingdom (based on crude rates or age-standardised rates). In Belgium and Canada, there was almost a two-fold variation in the use of MRI and CT exams between provinces with the highest and lowest rates in 2010, while in England the variation was even greater – around a four-fold difference between Primary Care Trusts (PCTs) with the highest rates and lowest rates in 2010/11.

In Belgium, there is strong evidence of a "substitution" in the use of MRI and CT exams across provinces: provinces that have high rates of utilisation of CT exams tend to have low rates of MRI exams, and vice versa. These differences in utilisation rates are due partly to a lower number of MRI units in some provinces. A s about high level of exposure to ionising radiation in Belgium compared to neighbouring countries led Belgian health authorities to develop, in co-operation with medical professional associations, a strategy to reduce radiation exposure. This strategy, which was launched

in 2010, aims to reduce radiation exposure by 25%, with provincial targets set to reduce a certain number of CT exams and X-rays. However, the strategy has not been fully implemented yet, and progress in achieving the target reduction so far has generally been modest but in the right direction (Chapter 3).

In Canada, there has been a strong rise in the use of both MRI and CT exams in all parts of the country over the past decade, which has been accompanied by some reduction in the variation in MRI exams across provinces (not for CT exams), although substantial variation remains. In order to promote a more appropriate use of these diagnostic procedures, the Canadian Association of Radiologists developed a few years ago some guidelines to assist doctors in their referral practices, but leaving a lot of autonomy and freedom to doctors in the application of these guidelines. More recently, in 2013, the Canadian Medical Association, in co-operation with some universities and patient groups, began to adapt the Choosing Wisely campaign initially developed in the United States to promote more informed discussions between doctors and patients and reduce unnecessary diagnostic tests (Chapter 4).

In the United Kingdom (England), the 2011 NHS Atlas of Variation in Health Care suggested that variations in MRI and CT exams may be due not only to the availability of the equipment and trained personnel, but also to local clinical practices, possibly reflecting an under-use of these diagnostic tests in some regions and an over-use in others (NHS, 2011). The development and application of clearer clinical guidelines might help reduce the degree of geographic variations.

1.5. Policy options to reduce unwarranted variations in health care use target demand and supply factors

A certain degree of geographic variations in health care use can be explained by differences in population needs and differences in patient preferences. The main challenge for health systems is to reduce as much as possible *unwarranted variations,* i.e. those variations that are due to other factors.

Based on a review of experience of countries thus far, a number of possible policy levers might be used to reduce unwarranted variations in health care use across geographic areas. While only few policy options aim to reduce geographic variations in health care use, several policy levers try to encourage appropriate care, with expected spill-over effects on local variations.

Eight types of policies might be envisaged:

- Public reporting on geographical variations, in order to raise questions among stakeholders and prompt actions, particularly in "outlier" regions.
- Setting targets at the regional level can support public reporting and help promoting appropriate use.
- The re-allocation of resources to increase (or reduce) supply of resources (e.g., beds, doctors) in regions with low (or high) utilisation rates.
- Establishment and implementation of clinical guidelines in order to promote greater consistency in clinical practice.
- Provider-level reporting and feedback to improve clinical practice and discourage unnecessary provision of health services.

- Changes in payment systems to promote higher (or lower) use when there is high suspicion of underuse (or overuse).
- The measurement of health outcomes, to promote greater consistency in clinical practice that ensures improved patient outcomes.
- The utilisation of decision aids for patients, to promote more informed decisions about benefits and risks of various interventions, and to better respond to patient preferences.

Many countries report public information relating to the procedures and activities in this study as shown in Table 1.4. Particular procedures may be the subject of more policy interventions than others in the same country (e.g. cardiac procedures have more types of policies than hysterectomy). For example, in England, public reporting, decision aids and health outcome measures are in place for knee interventions.

Table 1.4. Mapping national policies to health care activities and procedures

Country	Hospital medical admission	Cardiac procedures	Surgery after hip fracture	Knee replacement	Caesarean section	Hysterectomy	MRI & CT exams
Australia		Clinical guidelines, health outcomes, payment systems	Health outcomes, resource allocation	Health outcomes, resource allocation	Public reporting, clinical guidelines		
Belgium					Public reporting, clinical guidelines, provider feedback		Clinical guidelines, resource allocation, Setting targets
Canada		Public reporting, clinical guidelines	Public reporting, Health outcomes	Public reporting, clinical guidelines, health outcomes	Public reporting, clinical guidelines	Public reporting	Public reporting, clinical guidelines
Czech Republic			Health outcomes	Health outcomes			
Finland		Clinical guidelines	Clinical guidelines	Clinical guidelines, health outcomes		Public reporting, clinical guidelines	
France					Clinical guidelines		
Germany		Public reporting, clinical guidelines, decision aids	Public reporting, clinical guidelines	Public reporting, clinical guidelines	Public reporting, decision aids	Public reporting, clinical guidelines, decision aids	
Israel	Public reporting	Resource allocation	Clinical guidelines				Resource allocation
Italy	Public reporting, decision aids, health outcomes, payment systems, resource allocation	Decision-aids, Health outcomes	Public reporting, decision aids, health outcomes, payment systems, resource allocation		Public reporting, decision aids, health outcomes, payment systems, resource allocation		
Portugal					Public reporting, clinical guidelines, payment systems, resource allocation		
Spain		Clinical guidelines	Public reporting, clinical guidelines	Public reporting, clinical guidelines	Clinical guidelines		
Switzerland	Public reporting	Public reporting	Public reporting	Public reporting	Public reporting	Public reporting	
United Kingdom (England)	Clinical guidelines, payment systems, resource allocation	Public reporting, clinical guidelines		Public reporting, decision aids, health outcomes	Public reporting, clinical guidelines, payment systems	Public reporting	Public reporting

Source: National reports included in this volume.

Soft touch policies such as public reporting and target setting can be important catalysts for change

Public reporting of geographic variations in health care activities aims to raise questions among stakeholders and to prompt actions, particularly in "outlier" regions. Atlases of variations in health care now exist in a number of countries, produced by authorities in charge of health care or other independent stakeholders (Table 1.5).

Table 1.5. A generation of atlases of health care variations

Country / producers	Description
United States (from 1996) Dartmouth Institute for Health Policy and Clinical Practice	Atlases cover common procedures and treatments and report activities by hospital referral regions (HRRs) for the Medicare population (people aged 65 and over). Utilisation rates can be matched with data on population characteristics or health care resources (www.dartmouthatlas.org/publications/reports.aspx).
Canada (from mid-1990s) Institute for Clinical Evaluative Sciences (ICES), Centre for Health Services & Policy Research Atlas (CHSPR), Canadian Institute for Health Information (CIHI)	ICES Atlases cover procedures and conditions for the population of Ontario (most populous Canadian province) (www.ices.on.ca) CHSPR Atlases cover on pharmaceutical prescriptions across Canada and British Columbia (third largest province) (www.chspr.ubc.ca/research-area/pharmaceutical-policy). CIHI reports on variations in selected surgical procedures, hospitalisations and diagnostic procedures, wait times, health status and health outcomes (www.cihi.ca).
Netherlands (from 1999) National Institute of Public Health and the Environment (RIVM), Scientific Institute for Quality of Healthcare and other partners	RIVM Atlas covers public health indicators (www.zorgatlas.nl/). The Dutch Atlas of Healthcare Variation report data on variations in medical practice at the provincial and municipal level for a range of procedures (http://emc3dev.com/depraktijkindex).
Spain (from early 2000) Atlas of Variations in Medical Practice in the Spanish National Health System	Atlases cover many procedures (e.g. acute myocardial infarction admissions, surgery in breast cancer, knee replacement), categorised based on the value they bring to the patient: effective care, lower-value care, uncertain benefit. This initiative was concurrent with changes in the devolution of health care organisation and delivery to the regional governments and allowed for comparative analysis of variations across the country (www.atlasvpm.org/).
Belgium (from 2006) Belgian Healthcare Knowledge Centre, Ministry of Health	The Belgian Healthcare Knowledge Centre published a one-off atlas on a selected set of procedures in 2006, with analyses of determinants of variations (www.kce.fgov.be). The Ministry of Health annual Atlas of pathologies is published by district in hospital admissions for a large number of conditions (www.health.belgium.be)
United Kingdom (from 2010) NHS Right Care	The first NHS Atlas covered more than 30 procedures covering 17 service areas (e.g. cancer, organ donation, diagnostic services) and a number of thematic atlases have been published (e.g. children and young people, kidney disease, diabetes) www.rightcare.nhs.uk/index.php/nhs-atlas/
Australia (from 2010) New South Wales Health Care Atlas	The first New South Wales Health Care Atlas published information on medical practice variation across Area Health Service (AHS), based on public and private hospital data, for the period 1 July 2005 to 30 June 2008, www.atlas.nsw.gov.au/. Although other jurisdictions have not undertaken similar analysis, some have examined variation in hospitalisation rates for various conditions according to geographical area, often with a focus on ambulatory care sensitive conditions.
Germany (from 2011) Bertelsmann Foundation, Institute of Statutory Health Insurance Physicians	The Bertelsmann Foundation produces atlases which include age- and sex-standardised rates for a number of inpatient procedures and activities at the county level (412 counties /districts) such as caesarean sections, prostatectomies, CABG, inpatient treatment for depression and diabetes. It also includes information on health outcomes and explores possible reasons for over- or underuse of some procedures. The Bertelsmann Foundation's publication of Atlas of medical practice variations is part of its Initiative for High-Quality Healthcare (https://faktencheck-gesundheit.de/english-summary/). The Institute of Statutory Health Insurance physicians has undertaken analyses on different regional levels mainly on outpatient care-related activities (e.g. antibiotic drug prescriptions, prevalence of depression, utilisation of screening and office visits). The data are drawn from office-based physician billing codes and diagnosis as well as on outpatient prescriptions. Other data (regional) and different methods are used in some cases to explain potential determinants of variation. "Versorgungsatlas" (healthcare atlas) (www.versorgungsatlas.de).

The NHS Atlas in England has spurred further diagnostic tools. In conjunction with the NHS Atlas of Variation in Healthcare series, Rightcare produced a "Health Investment Pack" (HIP) for each PCT. HIPs used outputs from analytic tools already available to PCTs to analyse variation in spending, outcome and activity for a given budget category along the entire patient pathway for that PCT.

The NHS Commissioning Board (now named NHS England) produced "Outcomes benchmarking support packs" (NHS Commissioning Board, 2012) for Clinical Commissioning Groups (CCGs) and Local Authorities (LAs). These short documents provide CCGs and LAs with a quick and easy-to-use summary of their current position and enable comparison with the rest of England on various health outcomes and other indicators. The packs provide health information in a user-friendly format for use by local commissioners, local governments, health care services and the general public.

Following the transition in 2013, NHS England working with Public Health England and NHS Right Care provided all 211 CCGs with a comprehensive Commissioning for Value (CfV) data pack and two online tools in October 2013. The CfV packs included spending, drivers of spending and outcome measures for major diseases and identified where CCGs were outliers compared to similar CCGs. These showed CCGs their potential priority diseases for action and where to look to identify opportunities to improve outcomes and increase value for local populations. This work is supported by the two online CfV tools and help from the three organisations to enable CCGs to examine the data in greater detail including interactive maps (NHS England, 2014a, 2014b; Health Investment, 2014).

A study on the impact of the English NHS Atlas on local decision-making processes found half of the PCTs who responded to the survey reported using the Atlas (Schang et al., 2013).

Setting targets at the regional level can support public reporting and help meet public health objectives. In Italy, since 2005, the National Outcome Programme (*Programma Nazionale Esiti*), developed by the Italian National Agency for Regional Health Services (AGENAS) and the Ministry of Health, collects a wide range of indicators by hospital, local health unit (ASL), province and region, directly available to policy makers and health professionals on a dedicated website accessible through user credentials (Fusco et al., 2012; Amato et al., 2013). This programme is an audit instrument aimed at promoting quality, effectiveness and equity of the health system. In 2013, the programme collected 114 indicators on outcomes, processes and volumes in different clinical areas (e.g. cardiology, obstetrics and neurology).

In addition, the Italian Ministry of Health conducted additional studies to monitor the actual provision of the services included in the Essential Levels of Care (LEA) across the country and to assess health care systems across regions. An essential set of 21 indicators divided in three areas (collective health care; district health care and hospital care) and with different weights for each level of care is used to measure the effectiveness of LEA provision in Italian regions (Ministero della Salute, 2013). "Target" diagrams are used to show the performance of each region in the fulfilment of each indicator.

In Belgium, a study on substantial variations in diagnostic imaging by the National Institute for Health and Disability Insurance in Belgium prompted a strategy to reduce exposure to ionising radiation from X-ray and CT scans across the country (see Chapter 3 on Belgium on this volume). The policy aimed to reduce rates by 25%, with provincial targets set for a selected number of CT and X-ray procedures. An education campaign also targeted providers and patients about excessive exposure to ionising radiation. Some progress has been made but the full strategy has not been implemented yet.

Targeting providers could reduce unwarranted variations

The development and monitoring of clinical guidelines is one of the main policy levers to harmonise clinical practices and reduce unwarranted variations. Health technology assessment (HTA) agencies in England and Finland were set up in response to unwarranted variations in health care. Even though guidance exists, take-up in these two countries is voluntary, making it difficult to determine the impact of HTA bodies on local area variations (HSCIC, 2014). In almost all countries, physician societies and/or health authorities have produced clinical guidelines for many of the procedures examined in this report, with the aim to improve and harmonise clinical practices across regions.

However, compliance with guidelines is not always guaranteed (OECD, 2010) and their impact on variations is not straightforward (De Jong, 2008). To increase compliance with guidelines, which is always a challenge, Spain proposed an "inclusion protocol" for caesarean section in a sample of voluntary hospitals (Chapter 12). The check-list allowed practitioners to assess the appropriateness of caesarean section for each patient against a set of well-defined criteria. Hospitals which used this protocol experienced a lower increase in caesarean section rates than those that did not.

Provider level reporting and feedback, while not necessarily public, shows promising results. In Canada, for instance, a recent report by the Cardiac Care Network on variations in the ratio of PTCA to CABG across different hospitals in the province of Ontario (the largest province) identified opportunities to improve transparency and consistency in decision making for coronary revascularisation. A network of researchers was established across the country to study variations in cardiac care in provinces and produced a series of studies and atlases to better identify clinical guidance; adopted an urgency rating score (URS) to triage patients into three categories (elective, emergent, urgent); and adopted uniform eligibility criteria. These measures led to a reduction in variation of coronary revascularisation in Canada (CCORT, 2014).

In Belgium, monitoring and provider level feedback was found to have an impact on caesarean section rates. The Medical College of Mothers and Newborns monitored and gave feedback to hospitals on variations in caesarean section rates. An analysis of hospital rates of caesarean section between 2008 and 2011 showed a convergence to the mean, where high-rate hospitals showed a decrease towards a slightly lower rate, and low-rate hospitals increased their rate (Chapter 3 in this volume).

Financial incentives can be used to encourage appropriate care. Two countries (England, France) have recently reduced the gap between payments for caesarean section and for normal delivery, to remove incentives to perform unnecessary caesarean sections (Ministère de la Santé et des Sports, 2010; Department of Health, 2012). Korea introduced a pay-for-performance (P4P) scheme for hospitals, linked to a reduction in caesarean section rates. In Korea, this change coincided with a modest drop in the national caesarean section rate, but it is difficult to judge whether this scheme improved performance or simply captured a trajectory of improving performance that may have occurred irrespective of the scheme (OECD, 2012).

The re-allocation of resources (e.g. spending, equipment) could be envisaged as a means to reduce unwarranted variations. In Canada, some variation studies have highlighted/supported evidence of under-provision of health care services in remote areas, fostering policies to increase access to primary care.

Patient-centered policies are taking centre stage

The collection of information on patient clinical need before an intervention and health outcomes after this intervention can also help to assess the appropriateness and benefits of different health care interventions. Countries such as Sweden and the United Kingdom have led the way in systematic collection of patient-related outcomes following surgical procedures such as knee and hip replacement. Since 2006, the Swedish annual health care report documents the quality and outcomes of many conditions on a regional basis such as patient reported complications after hysterectomy (Socialstyrelsen, 2010). Regions are able to compare their health care outcomes to each other. Since 2010, an online cardiac registry reports the outcome for every patient hospitalised (Taylor, 2009).

In England, there are now numerous efforts to collect and examine data on patient outcomes to better monitor the health benefits of some interventions. Since April 2009, providers of NHS-funded care are obliged to collect information on patient quality of life before and after some surgical interventions and some PROMs are reported in the NHS Atlases of Variation in Healthcare as well as in the Commissioning for Value data packs for Clinical Commissioning Groups (NHS, 2010; HSCIC, 2013; NHS England, 2014b). NHS England has compared these health outcomes with spending and activity data to identify not just variation, but unwarranted variation, to help inform the CCGs (the decision-making units) on actions to take. This information is interesting to determine whether rising utilisation rates of certain procedures are reaching "diminishing returns" in terms of benefit/cost ratios.

Decision aids for patients may allow health systems to better respond to patient preferences that may have spill-over effects in addressing unwarranted variation at the local level. Decision aids are tools for patients that can be used as a complement to physician opinions, in order to facilitate informed, shared decision making between physicians and patients (McCulloch et al., 2013). Decision aids increase patient knowledge and involvement, improve perception of risk and benefits, positively affect patient-practitioner communication, and lower levels of decisional conflict and indecision (Stacey et al., 2012). They are particularly useful when alternative treatments exist with different risks and benefits that patients can value differently (e.g. cardiac procedures, hysterectomy, hip replacements). In a few countries, such as the United Kingdom and the United States, decision aids are available for a wide range of health care interventions.

Decision aids may be presented as a booklet or information leaflet, an audio programme, CD, DVD or via an interactive online platform. Currently, there are 455 decision aids listed in the Cochrane Inventory of Decision Aids (OHRI, 2013). A recent Cochrane Review of the literature showed that well-informed patients are less likely to choose to undergo surgery, in favour of less invasive procedures, though this is not always the case (Mulley at al., 2012; McCulloch et al., 2013; Katz, 2014).

Related policies have been developed which engage providers and patient groups. The Canadian Medical Association has also recently begun to adapt the Choosing Wisely initiative from the United States in a Canadian context. In conjunction with the University of Toronto, the Government of Ontario, Canadian medical speciality groups and patient groups, Choosing Wisely Canada aims to reduce unnecessary tests (and other procedures) that may be overused (Levinson and Huynh, 2014). The Choosing Wisely campaign is designed to engage physicians and patients in making the best choices in diagnostic and treatment options for people with different conditions. It will be important to monitor the impact of this new initiative.

1.6. Conclusions

The analysis carried out in this report has enabled to highlight that wide variations persist across and within countries for high-cost and high-volume procedures, for which there is still limited understanding of underlying reasons. There is broad consistency, however, across countries in the ranking of procedures according to the degree of within-country variation. Some procedures were consistently ranked as "high" variation across geographic units (cardiac procedures, knee arthroscopy, MRI and CT exams). Others were generally in the middle range (hospital medical admissions, knee replacement and hysterectomy). Surgery/admissions after hip fracture and caesarean section were generally ranked as having low variation. These results are consistent with existing research and generally confirm findings in the literature.

The evidence on the determinants of geographic variations is sparse, except for the United States, and information on clinical needs most often unavailable or incomplete. This study cannot determine the extent to which these variations are unwarranted, i.e. not explained by variations in clinical need and patient preferences. However, can variations in morbidity patterns be as large as variations observed for some procedures and some countries? Most likely, not.

Health systems must make sure that clinical needs are appropriately met and patient preferences taken into account. The analysis presented suggests that policy makers have several options to "steer" health care use at the local level in desired directions:

- For a handful of interventions whose effectiveness is based on strong evidence for targeting large populations (e.g. vaccinations or screening rates), public reporting of local variations can help identifying gaps in the coverage of the relevant population.
- For other interventions, where the appropriate level is difficult to define, analysis at the geographic level could be used as a starting point to detect outliers for further investigation.
- While only few policy options aim to reduce geographic variations in health care use, several policy levers try to encourage appropriate care, with expected spill-over effects on local variations. Public/provider reporting at the local level is likely to better support existing governance structures and could be a catalyst for greater dialogue and discussion with stakeholders. It is too early to assess the other policies reviewed but there is considerable scope for better supporting patient preferences (e.g. decision-aids) and improving clinical practice (e.g. inclusion protocols).
- Governments are encouraged to consider systematic monitoring and public/provider reporting for at least a core set of high-cost diagnostic and surgical procedures. Such variations analysis could be an extremely important factor to spark debate, dialogue and inform policy development to improve health system performance.

Finally, this study has shown that taking forward analysis of health care use at the local level needs to take into account the following:

- Establishing causal relationships and assessing the appropriateness of care requires quantitative analysis of patient-level data moving beyond local area analysis. Studies have shown that inappropriate use of health care services can equally exist in areas with high and low utilisation.

- Variation analysis at the geographic level is superior to patient level data analysis to identify possible unmet needs. Patient level data help to contextualise patients who underwent treatment but do not help to identify patients who required a treatment but did not receive it.
- Observing variation across geographic areas seems to be more useful when these areas coincide with decision-making units, which have the power to act on health care supply and organisation.
- Decision makers are encouraged to consider how to make such data more readily accessible to encourage local level analysis.

Notes

1. PCTs were abolished in March 2014 and part of their competencies transferred to the newly created Clinical Care Commissioning Groups.
2. OECD population structure was estimated using population estimates published by the United Nations (2011).
3. All types of hospitals, general or specialised, are considered, except mental health hospitals. Hospital stays for normal deliveries are excluded.
4. Data for Spain only include admissions in public hospitals, which account for the 75% of all hospital activities (Chapter 12). However, the share of private beds differs across regions and provinces. This influences both the average rate and the range of variations across Autonomous Communities and provinces. For Spain, hospital admissions are reported at the location of provider.
5. Data for Portugal only include admissions in public hospitals, which account for three-quarter of hospital beds.
6. Data for Canada exclude all discharges for mental health, while other countries kept admissions/discharges for mental health in general hospitals. However, this only explains a small share of Canada's low admission rates since the crude admission rate for mental health problems in general hospitals is below 500 per 100 000 population (OECD, 2013).
7. Australia, France and Switzerland reported on admissions for hip fracture while other countries reported on surgery after hip fracture. The Czech Republic reported on all hip replacements (not only following hip fractures) and is not included in these international comparisons.
8. FRAX or Fracture Risk Assessment Tool (see www.shef.ac.uk/FRAX/).
9. Data collected for this project include all types of caesarean sections (elective and emergency, primary and others).

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ANNEX 1.A1

OECD project guidelines on procedure codes

This annex includes guidance on the list of procedures/activities that was provided to country experts. When possible, procedure codes and the sources used in their identification are provided using the Classification of Procedures of the ICD-9-CM.[1] For each procedure, rules for exclusion and inclusion are provided to standardise as much as possible the procedures/activities. The unit of analysis used to calculate the rates is included along with the suggested age group.

Hospital medical admissions

Countries should consider for inclusion any hospital inpatient stay (i.e., with at least one night) with a medical (non-surgical) purpose in a "hospital", as defined by the category HP.1.1 (general hospitals) and HP.1.3 (specialised hospitals) in the revised System of Health Accounts[2]. This category does not include mental hospitals or long-term care facilities. Where DRG-like classifications are used, medical admissions can be identified by medical (i.e. non-surgical) DRGs, with an overnight stay.

Description	Hospital admission for a minimum one night inpatient stay. Hospitals are defined to be general or specialised hospitals (HP.1.1. and HP.1.3 in the System of Health Accounts)
Rules	All medical discharges
Exclusion	Day care is not included. Exclude surgical discharges.
Unit to be used for rates	Per 100 000 population
Age group (suggested) for women and men	15-34, 35-44, 45-54,55-64,65-74,75+ OR five-year age groups
Resource use (optional)	Density of hospital beds by territorial unit

Revascularisation

The three revascularisation procedures selected are CABG, PTCA and catheterisation. The ICD-9-CM codes are provided below.

To avoid double counting procedures for which more than one code may be used depending on each national classification system, only one code should be reported per procedure category for each patient. For example, if a percutaneous coronary intervention including a coronary stenting is recorded as two separate codes, only one code/procedure should be reported. Crude and standardised rates are suggested to be reported per 100 000 of the population in the territorial unit across age groups/gender. Data should be reported separately for each procedure.

ICD-9-CM code Coronary bypass	36.1, 36.11-36.19 Aortocoronary bypass for heart revascularisation
ICD-9-CM code Percutaneous coronary interventions (PTCA and stenting)	36.0 Removal of coronary artery obstruction and insertion of stent(s)
ICD-9-CM code Cardiac catheterisation (optional)	37.21 Right heart cardiac catheterisation 37.22 Left heart cardiac catheterisation 37.23 Combined right and left heart cardiac catheterisation
Rules	Any principal diagnosis code. To avoid double counting procedures only one code should be reported per procedure category for each patient.
Unit to be used for rates	Per 100 000 population in the territorial unit
Age group (suggested) for women and men	20-49,50-64,65-74, 75+, OR five-year groups

Joint procedures

Admission/Surgery after hip fracture

A number of procedures exist for the treatment (e.g. total hip replacement, partial replacement, the use of nails/screws). All hip fracture emergency admissions are included regardless of the way in which the hip was repaired. This measure is a proxy for the burden of disease for hip fracture because treatment is typically provided for this condition. External causes are excluded (e.g. accidents).

Crude and standardised rates are suggested to be reported per 100 000 of the population in the territorial unit across age groups/gender.

ICD-9-CM code	820.0-820.3, 820.8,820.9 Only emergency admissions of fracture of neck of femur Plus 733.14 Pathologic fractures
Rules	Principal diagnosis code (Emergency admission) can be reported with or without the pathologic fractures.
Exclusion	E800-E849.9 (Accidents: railway, motor vehicle, road, water, air and space)
Unit to be used for rates	Per 100 000 population in the territorial unit
Age group (suggested)	15-34,35-44,45-54,55-64,65-74,75+ OR five-year age groups

Source: ECHO project.

Knee interventions

Two knee interventions were agreed upon: knee replacement and knee arthroscopy (diagnostic procedure). It is optional for countries to include knee arthroscopy in this analysis.

Crude and standardised rates are suggested to be reported per 100 000 of the population in the territorial unit across age groups/gender. Data should be reported separately for each procedure.

ICD-9-CM code Knee replacement	81.54 Total knee replacement 81.55 Revision of knee replacement, not otherwise specified OR 00.80-00.84 Revision of knee replacement if specified
Rules knee replacement	Any principal code
Inclusion knee revision	Revision of knee replacement
Knee arthroscopy (optional)	80.26 Arthroscopy knee and 80.6 Excision of semilunar cartilage of knee
Rules knee arthroscopy	Only one code should be reported per event/patient.
Unit to be used for rates	Per 100 000 population
Age group (suggested)	15-34,35-44,45-54,55-64,65-74,75+ OR five-year age groups

Gynaecological procedures

Caesarean sections

Countries should consider all procedures where a baby is delivered by caesarean. These procedures can either be planned where the procedure becomes apparent during pregnancy, unplanned or an elective procedure on the basis of personal choice. The ICD-9-CM codes are provided below. Crude and standardised rates are commonly reported per 1 000 live births and will be the relevant unit for this procedure across a range of suggested age groups.

ICD-9-CM code	74.0-74.2 Classical, low cervical or extraperitoneal caesarean 74.4 Caesarean section of other specified type 74.99 Other caesarean section of unspecified type
Rules	Any procedure code
Unit to be used for rates	Per 1 000 live births
Age group (suggested) for women	<19, 20-24,25-29,30-34,35-39,40+ OR five-year age groupings

Hysterectomy

The OECD Secretariat proposes to consider all types of hysterectomies, be they partial or complete, abdominal or vaginal. The table below shows procedures codes in ICD-9-CM. All diagnoses should be included. The unit of analysis for rates is the number of procedures for 100 000 of the female population.

ICD-9-CM code	68.3-68.9 Abdominal or vaginal hysterectomy
Rules	Any principal diagnosis code
Unit	Per 100 000 female population in the territorial unit
Age group (suggested)	15-34,35-44,45-54,55-64,75+ OR five-year age groups

Imaging tests

MRI exams

The variable of interest is the number of patients receiving the exam. Crude and standardised rates are suggested to be reported per 100 000 of the population in the territorial unit across age groups/gender.

Unit to be used for rates	Number of patients receiving MRI exams per 100 000 population in the territorial unit
Age group (suggested)	15-34,35-44,45-54,55-64,65-74,75+ OR five-year age groups

CT exam

The variable of interest is the number of patients receiving the CT exam. Crude and standardised rates are suggested to be reported per 100 000 of the population in the territorial unit across age groups/gender.

Unit to be used for rates	Number of a patients receiving the CT scan per 100 000 population in the territorial unit
Age group (suggested)	15-34,35-44,45-54,55-64,65-74,75+ OR five-year age groups

ANNEX 1.A2

Measurement of variations

Table 1.A2.1. How is variation in health care use measured

Measures	Description
Average rate (mean) μ	Definition: The arithmetic unweighted average of the standardised rates of a procedure across a number of given territorial units. Rates in this synthesis chapter are age- and sex-standardised using the OECD population, while rates in national reports are standardised based on national population structures. Advantages: The unweighted average of standardised rates for a given country reflects what would be the average procedure rate if all territorial units had the same population structure. Disadvantages: It does not convey any information relating to distribution of the data, nor variation. It gives equal weight to all regions, regardless of population and size.
Ratio Max/Min	Definition: The ratio of the highest territorial unit rate to lowest territorial unit rates of a procedure. Advantages: Intuitive, easy to understand. Disadvantages: Can be highly influenced by extreme values of outliers.
Ratio 90/10	Definition: The ratio of the 90th percentile to the 10th percentile of the distribution of standardised rates. Advantage: Removes the effect of any extreme values of outliers.
Coefficient of variation (CV)	Definition: The ratio of the standard deviation to the mean of a procedure across a number of given territorial units. The higher the coefficient of variation, the greater the dispersion around the mean. $$CV = \frac{\sigma}{\mu}$$ Advantages: Can be used to compare variation between data of different units, since the coefficient is itself without units. Relatively insensitive to population sizes. Disadvantages: Does not adjust for random variation or systematic variation, may be sensitive to over dispersion in the data, and is less intuitive than simpler measures. May not be an appropriate method to compare surgeries that are performed at different rates.
Systematic component of variation (SCV)	Definition: Considers the number of observed episodes relative to the number which are expected for that population structure, given the age and sex distribution of the population $$\mathrm{SCV} = \frac{\left[\left(\sum_{t=1}^{n} \frac{(O_t - E_t)^2}{E_t^2}\right) - \left(\sum_{t=1}^{n} \frac{1}{E_t}\right)\right]}{n-1}$$ Where: SCV = systematic component of variation O_t= observed cases in region t E_t= expected cases in region t n = number of observations Advantages: Incorporates demographic structure of the population, and provides an indication whether variation is greater than would be expected by chance. It is not sensitive to extreme value and therefore can be used to compare different procedures that have different mean rates. Not influenced by small sample sizes. Disadvantages: Not an intuitive measure.

Source: Diehr, P. (1984). "Small Area Statistics : Large Statistical Problems", A*merican Journal of Public Health*, Vol. 74, No. 4, pp. 313-314; Appleby, J. et al. (2011), *Variations in Health Care: The Good, the Bad and the Inexplicable*, The King's Fund, London; OECD project on Medical Practice Variations.

Box 1.A2.1.Technical note on OECD standardisation for cross-country comparisons

The age/sex standardised rate was calculated to eliminate the effect of differences in population age/sex structures when comparing procedure rates for different geographic areas across countries. The standard population used in this chapter for the international comparisons is the 2010 OECD population which includes all 34 countries (United Nations, 2011). Caesarean section is the only procedure for which a different population structure has been used, that is, the 2011 Italian population structure according to the mother's age (Chapter 10).

Calculation of age/sex standardised rates

The age/sex standardised rate for each territorial unit (SR_t) is a weighted average of age and sex specific rates:

$$SR_t = \sum ij(ASRijt) * [POPij/POP_{tot}]$$

Where the ASR_{ijt} is the age-and-sex-specific rate (per 1 000 or 100 000 population depending on the procedure) for age group i; sex j and the territorial unit t. POP_{ij} is the OECD standard population size in age group i, sex j, and POP_{tot} is the OECD total standard population defined as $\sum_{ij} POP_{ij}$.

Warning! The standardised rates reported in this chapter are different from the ones presented in national reports, where standardisation was operated with *national* population structures. While the standardisation using a unique population structure is needed to make international comparisons, the use of national population structures is more meaningful in a national context.

Notes

1. The International Classification of Diseases, 9th Revision, Clinical Modification (ICD-9-CM), Sixth Edition, issued for use beginning October 1, 2008 for federal fiscal year 2009 (FY09). The ICD-9-CM is maintained jointly by the National Center for Health Statistics (NCHS) and the Centers for Medicare & Medicaid Services (CMS).
2. See www.oecd-ilibrary.org/social-issues-migration-health/a-system-of-health-accounts_9789264116016-en, pp. 130-133.