# Healthcare Fact Check

## Regional Variations in German Healthcare

Faktencheck Gesundheit

Bertelsmann Stiftung

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## Regional Variations in German Healthcare

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# 1. The Healthcare Fact Check project

*Uwe Schwenk (Bertelsmann Stiftung)*

Overuse, underuse and misuse in the German health system have been debated by experts for years. The Advisory Council on the Assessment of Developments in the Health Care System called attention to the problem as early as 2001. Valuable resources are used inappropriately and unnecessarily, and often the regional provision of healthcare services and the range of healthcare options offered do not reflect people's needs.

Although these problems are known, they are difficult to solve. Complex interdependencies, a lack of clarity around the data, and diverse interests delay necessary improvements. With its Initiative for High-Quality Healthcare, the Bertelsmann Stiftung, in cooperation with partners, seeks to break new ground in order to create pressure for change. Through the Healthcare Fact Check, we will provide clear, concrete information on the overuse, underuse, and misuse of healthcare resources in Germany. Two aspects are central to this endeavor. Instead of focusing solely on the "inner circle" of health policy makers and healthcare-related specialists, our efforts are also geared toward the general public. Furthermore, our goal is to include in the project as many stakeholders as possible from the German healthcare system. Only by means of cooperation can we achieve the goal of better healthcare for all people.

## Objectives

The Initiative for High-Quality Healthcare wants to make a contribution so that ...

- Health services are better aligned with the actual needs of patients, and limited resources are used more appropriately
- People actively engage in discussions on which services match their needs and how healthcare can be shaped in a better way
- Citizens become more involved with health services in their region, better understand the health system and necessary reforms, and increase their trust in the system.

## Approach

In the Healthcare Fact Check, we will be regularly analyzing, interpreting, and publicizing regional variations based on hard data, while carrying out research into underlying causes and suggesting workable solutions for specific issues. We aim to find answers to the following questions:

- Are there unwarranted geographical discrepancies in healthcare?
- Where are services delivered regardless of need? Where does unmet need exist? Where does the use of resources deviate from guidelines and expectations?
- What are the causes of unwarranted regional variations?
- What solutions can contribute to needs-based provision of healthcare?
- How can citizens be better informed and engaged?

We will publish two or three issues of the Healthcare Fact Check each year. The selected themes illustrate structural deficits in the German healthcare system, such as inadequate planning and coordination, a lack of accountability, perverse incentives, and insufficient involvement of patients.

Themes are selected by the partners on the basis of defined criteria: The themes should be very relevant to the general public, highlight significant deficits in the system, and yield concrete options for action and improvement. Stakeholders in the healthcare system as well as citizens can propose topics.

Themes are analyzed and the findings interpreted by mentors from academia through a structured review process. The Healthcare Fact Check goes beyond describing the reality of healthcare delivery to provide interpretation and analysis, research the underlying causes, and recommend ways to

resolve the identified shortcomings. Maps show regional healthcare provision and spark people's interest in actively engaging with the problems identified in their region.

## Communication and participation

The Initiative for High-Quality Healthcare communicates the content and results of the Healthcare Fact Check through many different channels.

Communication and discussion are not confined to expert circles. Rather, the Initiative intends to raise awareness among the general public in order to create pressure for change. For this purpose it makes sense to involve multipliers – journalists and media experts, but also those who interact with people directly: consumer and patient advisers, sickness funds, physicians, self-help groups, civic groups and senior citizens' associations, and so forth.

However, communicating with the general public about healthcare policy presents challenges, because interdependencies are complex and difficult to convey to laypeople. Often, a patient's subjective impressions differ from healthcare realities and expert assessments – for example, when despite evident overprovision, patients consider their needs not fully met. The sometimes emotional and often interest-driven public debate requires a sensitive form of communication.

## Health policy from a citizen's perspective

The Initiative for High-Quality Healthcare is grounded in the citizen's perspective. At every stage of development of our Fact Checks, we take into account the expectations and wishes of citizens. This can happen in various ways. We might consider the results of representative surveys, provide helpful information that is easy to understand, involve consumer organizations and civic associations, or support regional initiatives that seek to align healthcare more closely with the needs of citizens.

## A platform for cooperation

In the Initiative for High-Quality Healthcare, the Bertelsmann Stiftung intends to work with partners and experts from the health policy arena who support the project's concept and objectives. Partners can enrich the Initiative in various ways; examples include

- Submitting proposals for themes
- Providing analyses of their own databases
- Contributing existing research
- Cooperating in communications measures

If you are interested, please contact us. We look forward to working with you.

# 2. Unwarranted regional variations – known for years but still present

*Marion Grote Westrick (Bertelsmann Stiftung) and Prof. Dr. med. David Klemperer (Hochschule Regensburg)*

*Regional variations in healthcare exist for most diagnostic and therapeutic activities – and many variations are justified. For example, if the incidence or severity of a disease is higher in one region, more diagnostic and therapeutic services are performed. However, many regional variations do not merely reflect medical reasons or patient preferences. Identifying and reducing such unwarranted variations would increase the quality, efficiency, and needs-based provision of care in our health system and, most importantly, would prevent unnecessary harm and risk to patients.*

## 2.1. Unwarranted variations – how and where do they occur?

The seminal study by Wennberg and Gittelsohn (1973) of local variations in healthcare raised fundamental questions for health services research, such as these: How to evaluate regional differences in the density of supply, the utilization of services, or the level of expenditure? What causes unwarranted variations? How can these causes, and only these, be reduced?

Wennberg defines unwarranted variation as "variation that cannot be explained on the basis of illness, medical evidence, or patient preference" (Wennberg J 2010, p. 4). Accordingly, variations are deemed unwarranted or unjustified if differences due to illness, medical evidence, or patient preference can be ruled out:

- **Illness:** Regional differences in disease incidence and severity may be a reason for justified variations in utilization. For example, an influenza epidemic that leads to more cases in one region than in another can lead to differences in the number of patients treated in outpatient and inpatient care.
- **Medical Evidence:** Variations in healthcare also occur when a lack of evidence regarding healthcare outcomes allows broad medical discretion. Resulting differences cannot be evaluated as either warranted or unwarranted. However, they should trigger further research in order to increase certainty and define optimal care. Variations are unwarranted if care deviates from evidence-based guidelines, including standards, norms, and tolerance limits, without due justification.[2]
- **Patient Preference:** Variations in healthcare are also justified if several options exist for a medical problem and well-informed patients consciously decide on one option more often in one region than in another. The precondition for such a decision is value-neutral nondirective communication about possible options and their advantages, disadvantages, benefits, and risks.

Unwarranted variations represent quality deficits in healthcare. Quality of care is understood according to Gray (2008, p.43) as "doing the right thing right," whereby "the right thing" refers to the indication and "doing right" refers to the process of delivery. The Institute of Medicine (IOM 1990A) has offered a more precise definition of "the right thing": *"Quality of care is the degree to which health services for individuals and populations increase the likelihood of desired health outcomes and are consistent with current professional knowledge."* Based on this definition, an IOM working group developed the three well-known types of quality deficits – underuse, overuse and misuse (Chassin et al. 1998). Underuse refers to the failure to provide a health service when it would have produced a favorable outcome for a patient. Providing a health service when its risk of harm exceeds its potential benefit constitutes overuse. Misuse occurs when appropriate healthcare is provided but a preventable complication occurs and the patient cannot obtain the optimal benefit.

[1] For instance, because of a surprising dearth of evidence, nobody knows the optimal duration of bed rest following uncomplicated acute myocardial infarction, for example whether 12 days is better than 2 or whether 24 hours is sufficient (Herkner et al. 2007).
[2] However, the cut-off point when deviations from the norm should be deemed inappropriate is difficult to identify in some cases.

In his analyses of unwarranted variations, Wennberg has concluded that some services are associated more often with overuse and/or misuse, others more often with underuse. He distinguishes among effective care, preference-sensitive care, and supply-sensitive care (Wennberg 2005).

## Effective care

Effective care refers to services whose benefit outweighs their harm to such a significant degree that almost all patients with the relevant health problem should receive them – provided no contra-indications exist. Interventions that constitute effective care are often characterized by underuse.

In their study "The Quality of Health Care Delivered to Adults in the United States," McGlynn et al. (2003) found a high degree of underuse for effective services to treat 30 acute and chronic diseases. Just over half the services defined as effective care were delivered (54.9%). The Dartmouth Atlas has also identified underuse for a range of effective interventions in the United States, subject to regional variations (Wennberg et al. 2008). In a recent study, investigators identified underuse of drug therapy for stable coronary heart disease, along with overuse of invasive measures (Borden et al. 2011).

For Germany, the SVR review has documented deficits in the provision of effective healthcare for ischemic heart disease, stroke, and chronic obstructive pulmonary diseases (SVR 2000). A recent German study also shows underuse in drug therapy for patients with myocardial infarction (Mangiapane et al. 2011).

However, these analyses do not take into account how patients evaluate therapeutic measures in light of their own health status, multimorbidity, and quality of life. In other words: 100% implementation of effective care is not to be expected, nor is it desirable, when some patients decide against the use of these services in a well-informed and conscious way

## Preference-sensitive care

With preference-sensitive care, a patient can choose between two or more treatment options, weighing the tradeoffs among their risks and benefits. It should be recognized, however, that medical outcomes cannot be predicted for certain; they can only be expected with a certain probability. Indeed, in many cases there is little certainty about which treatment option leads to better health outcomes. Preference-sensitive interventions usually involve improving the patient's quality of life, and patients weighing the prospect of alleviated symptoms against the risk of potentially serious side effects draw widely different conclusions. Variations that reflect the actual preferences of patients can be considered warranted. If patient preferences are not sufficiently taken into account, there is a risk of overuse, as patients are more likely than their physician to decide against an optional intervention.

Examples of preference-sensitive care are prostatectomy versus watchful waiting for benign enlargement of the prostate, breast-preserving surgery versus mastectomy for early stage breast cancer, and coronary bypass surgery versus stent insertion for stable symptomatic coronary heart disease.

Preference-sensitive decisions may represent the normal case in healthcare; especially for chronic diseases, only few therapeutic services are vital, and postponing or declining treatment may often be a reasonable option. Therefore, patients should always receive information explicit to their treatment goals, namely alleviated symptoms and improved quality of life, including the likelihood of achieving these goals. On this basis, patients can decide whether to receive, postpone, or decline the treatment.

### Supply-sensitive care

Supply-sensitive care occurs when physicians adjust indications for treatment to align demand with resource availability. The supply of physical and human resources – hospital beds, intensive care beds, specialists, medical technology ¬– determines utilization.

Based on interviews, Wennberg concludes that supply-driven treatment decisions often occur unconsciously. If few intensive care beds are available, the physician sets a strict standard for admission to the intensive care unit. If more ICU beds are available, the threshold for treatment is lower, although physicians tend not to be aware of this fact. Contact with physicians, demand for hospital care, referrals to specialists, and utilization of diagnostic imaging and other tests are also supply-sensitive.[3] The phenomenon is observed primarily in the treatment of patients with chronic diseases (e.g., diabetes, coronary heart disease, chronic obstructive pulmonary disease). According to Wennberg (2010, p. 10), supply-sensitive care accounts for about 60% of Medicare expenditure and explains the majority of geographic variations.

With supply-sensitive care, the question arises whether more care leads to better outcomes. Research for the Dartmouth Atlas suggests that the opposite is true: In regions with higher expenditure, the quality of treatment, access to care, and degree of patient satisfaction among Medicare patients were worse over the six-month period preceding the survey than in regions with lower expenditure (Fisher et al. 2003). The problem is not underuse in regions with lower expenditure, but overuse in regions with higher expenditure.

Wennberg's categorization according to effective, preference-sensitive and supply-sensitive care has proven to be an appropriate concept to explain overuse, underuse, and misuse of services. However, the three categories of care are not mutually exclusive – especially regarding the question whether a service should be deemed effective or preference-sensitive. Even for services in the effective care category, patients in principle also have the option of watchful waiting. Moreover, with analyses of secondary data sources, it may be difficult to ascertain whether a service that is preference-sensitive in theory did in practice have actual alternative options. These factors need to be taken into account in the evaluation of regional variations in healthcare.

## 2.2 Healthcare Fact Check "Regional Variations" – Background

International research on regional variations in healthcare has a long tradition in the Anglo-American countries. Over the past decade, it has also gained attention and momentum in Germany. More than 70 years ago, in 1938, J. Alison Glover published evidence of regional variations in healthcare in the county of Kent in England. Among his findings was that in 1931, the tonsillectomy rate for elementary school children living in Margate was eight times the rate in neighboring Ramsgate. The likelihood of a child's undergoing tonsillectomy correlated with the physician's personal views rather than with the child's medical condition (Glover AJ 1938).

In Germany, international research findings on geographic variations in healthcare and the associated overuse, underuse, and misuse of services was hardly acknowledged until the late 1990s. An exception was the study by Lichtner and Pflanz (1971) on appendectomy in Germany, in which the authors noted high rates of appendectomy in Germany compared to other countries, different rates for blue-collar and white-collar workers, and seasonal variations (e.g., fewer appendectomies during vacation periods). In its 1988 report, the Advisory Council for the Concerted Action in Health Care reported on a longitudinal study of supply and demand for hospital services that identified considerable variation among German states but stopped short of an in-depth comparison with international research findings (SVR Gesundheit 1988, section 167). A later study sponsored by the Federal Ministry of Health on the incidence of operations in Germany explicitly refers to international research results and presents clear evidence of regional variations in surgical procedure rates (Bundesministerium für Gesundheit 2000, Weitkunat et al. 2000).

A broad debate on issues relating to overuse, underuse, and misuse was sparked by the Advisory Council for Health with its report "Bedarfsgerechtigkeit und Wirtschaftlichkeit" [Appropriateness and Cost-effectiveness] (2000/2001). In Volume III of the report, the Advisory Council illustrated that overuse, underuse, and misuse also occur in Germany, in particular for the very common conditions ischemic heart diseases, cerebrovascular diseases, chronic obstructive pulmonary diseases, cancer, and depressive disorders.

[3] Wennberg refers, following Adam Smith's "invisible hand of the market," to the "invisible hand of capacity" (Wennberg 2010, p. 128).

Since then, numerous scientific studies have been published in Germany on regional variations as well as on overuse, underuse, and misuse. The focus of attention lies, for instance, on the density of physicians (Klose J, Rebein I 2011), pharmaceutical consumption (Häussler B et al. 2007), and special pharmaceutical regimens (Heier M et al. 2009, Müller-Nordhorn J et al. 2005), cancer (Katalinic A 2010), causes of mortality and life expectancy (Gaber E 2011, Latzitis N et al. 2011), avoidable mortality (Sundmacher L et al. 2011), and regional variations in healthcare in individual German states (Swart E et al. 2000, Swart E et al. 2008).

For this initial Healthcare Fact Check, the Bertelsmann Stiftung commissioned the IGES Institut to compile an overview of regional variations in different areas of healthcare in Germany based on publicly available data, to quantify the magnitude of regional variations and identify regional patterns, and to outline initial explanations and possible options for action (for details see Chapter 3, "Approach and Methods").

The 16 aspects of care for which regional variations are presented and explained in this Fact Check concern more than two million people per year. Although due to the lack of publicly accessible regionalized data on healthcare almost all 16 topics (indicators) considered here refer to inpatient care, these indicators cover very diverse aspects of care.

- **Rates of surgery:** The majority of indicators refer to surgery. The ten interventions analyzed here account for about 12 percent of all surgical interventions in Germany.[4] Some of the interventions – caesarean section, appendectomy, tonsillectomy, hysterectomy, prostatectomy, and coronary bypass surgery – have been subject to international research for years due to their considerable degree of regional variability. A common set of problems for at least some of these indicators is the marked increase in volume, the limited consideration of patient preferences, and the insufficient quality of diagnostic evaluation .
- **Access to and interaction between sectors of care:** Six indicators – density of child and adolescent psychotherapists and psychiatrists, inpatient hernia surgery that should predominantly be outpatient surgery, hospital admissions for diabetes, hospital admissions for depression, proportion of day cases among all hospital cases, proportion of people over 75 who die in a hospital – focus on access to healthcare and the interaction between different sectors of care. A common set of problems for these indicators is the sometimes inefficient allocation of ambulatory care options at the regional level and the associated substitution effects between the outpatient and inpatient sectors.
- **Perinatal mortality:** The indicator "perinatal mortality," a subset of avoidable mortality, differs from the other indicators because it is the only "outcome indicator" – not only in a clinical but also in a social medical sense. This indicator refers to potentially inappropriate care within the social and medical care systems as well as at their interfaces.

[4] Own calculations based on the Federal Statistical Office (DRG_OPSend).

## 2.3 Healthcare Fact Check "Regional Variations" – Results and possible explanations

### Rates of surgery: regional variations, their magnitude, and possible reasons

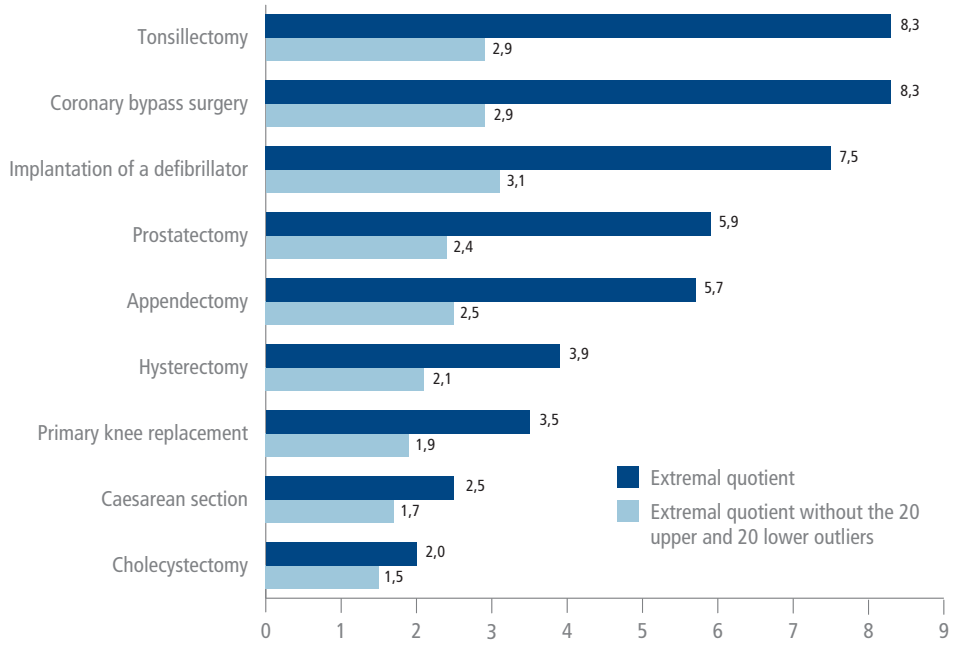
Almost all indicators considered here are subject to considerable regional variations in healthcare. The largest variations are seen for complete tonsillectomy among children and youth: The likelihood that a child will undergo tonsillectomy is eight times higher in the district with the highest surgical index than in the district with the lowest surgical index (extremal quotient). Even if the 20 districts with the highest and lowest surgical indices are excluded from the analysis (extremal quotient 95th/5th percentiles), the variation remains 2.9-fold.

The other surgery-related indicators also show a large degree of regional variation; the extremal quotient between the district with the highest and lowest surgical index is almost always greater than 2. An overview of the magnitude of regional variations for the individual types of surgery is given in Figure 1.[5]

As Figure 1 illustrates, there are considerable regional variations in rates of surgery. Wennberg's laconic claim "In health care, geography is destiny" (Wennberg J 2010, p. 3) thus seems also to apply to Germany.

**Figure 1: Magnitude of regional variations**

Extremal quotients of the indicators for rates of surgery




Source: Bertelsmann Stiftung, IGES, Statistisches Bundesamt | BertelsmannStiftung

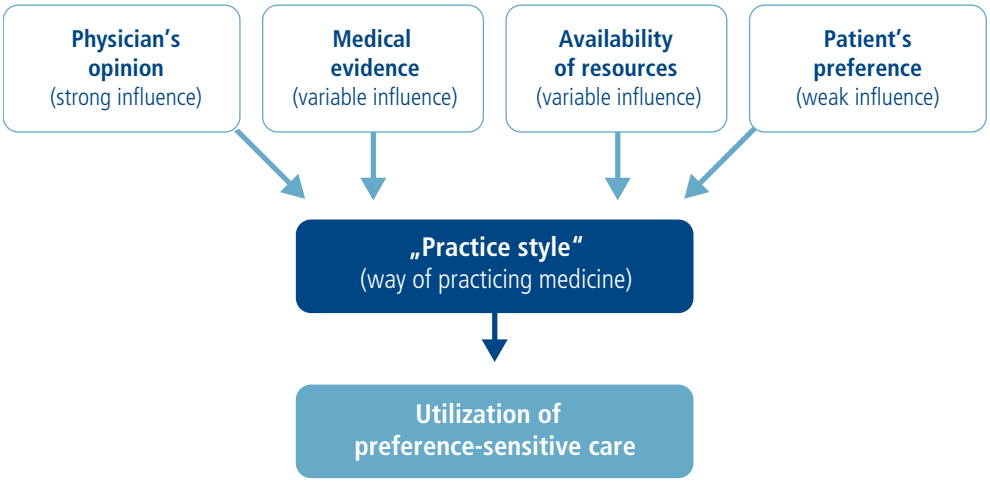
Many hypotheses regarding the causes of regional variations are relevant for the indicators considered here. In Chapter 4, specific possible explanations are proposed for each indicator. The following section aims to offer general explanatory approaches beyond indicator- and theme-specific explanations for regional variations.

[5] As an overview, this Healthcare Fact Check does not calculate or interpret other measures of regional distribution or compare them in greater detail.

The surgical interventions considered here can frequently, though not exclusively, be categorized as preference-sensitive care.[6] Thus, after consideration of the possible benefit and harm of each option and the implications for future quality of life, the patient has to decide which treatment option best aligns with his or her personal situation. Frequently, however, the patient delegates the decision to choose a treatment option to the doctor. In this case, the doctor decides and, according to Wennberg, follows his or her own "practice style" (see Figure 2). Differences in practice style of only a few physicians may cause large regional variations when smaller regions are compared.

## Figure 2: Which factors influence the use of preference-sensitive services?

Model of preference-sensitive care when the patient delegates the decision to the physician.




Source: Wennberg J (2010), S. 10. | BertelsmannStiftung

If the patient has delegated the decision to the physician, then four main factors influence the physician's choice (Wennberg 2010 p.38ff.):

1. **Personal opinion of the physician:** for or against an operation. Some physicians follow the guiding principle of "surgery as prevention." In order to prevent possible aggravation of the disease and associated complications – or only the fear of these – the physician advocates performing the surgery to avoid future harm. Other physicians follow the guiding principle of "primum non nocere" ("first, do no harm") and prefer conservative, pharmaceutical, or watchful waiting strategies over surgical interventions (Wennberg 2010, p.46). Which principle a physician tends to follow is likely to depend on socialization during medical school, the habits of colleagues, and personal experience.[7] This approach to explaining regional variations may apply to appendectomy, tonsillectomy, hysterectomy, prostatectomy, primary knee replacement, caesarean section, and cholecystectomy.

2. **Medical evidence:** In numerous analyses which refer to individual US states, the entire United States, or several countries, a statistical relationship was found between medical evidence and the degree of regional variations: The higher the degree of uncertainty about the benefits of surgery compared to other treatment options (including watchful waiting), the higher the degree of discretion for the decision (Wennberg 2010, p.48ff). For the indicators considered here, this hypothesis may apply to prostatectomy, appendectomy and hysterectomy, caesarean section and – in the sense of a relatively clear state of medical evidence – cholecystectomy.[8]

[6] For example, in most cases caesarean section may be as medically appropriate as hysterectomy. In some situations, such as prostate cancer, watchful waiting can be a reasonable alternative to surgery.
[7] On the influence of sociological factors on physician behavior see de Jong JD (2007) and Westert G, Groenewegen P (1999).
[8] An international comparison could also show that higher rates of surgery in a country can be explained with overall higher availability of human and technological resources.

3. **Availability of resources:** The availability of necessary physical and human resources for the respective surgical intervention also influences the regional variability of services: The more resources in the form of staff, hospital beds, and medical technology are available, the greater the likelihood of performing the respective surgery. This hypothesis might apply to coronary bypass surgery, the implantation of a defibrillator, and caesarean section.
4. **Patient preferences:** If the patient has delegated his or her personal decision to the physician, patient preferences have only a limited influence on the treatment option chosen by the physician. As a serious result, according to Wennberg, frequently the "wrong patients" are operated upon, namely those who would have decided against surgery had they been fully informed. Wennberg calls for fundamental reform in this area, championing the democratization of the patient-doctor relationship as a way to transform the culture of medicine (Wennberg 2010, p.9f.).

Another important cause of regional variations in rates of surgery may be financial incentives. German hospitals receive a prospective budget that anticipates the volume of services (number of coronary angiographies, prostatectomies, etc.) based on historical patterns. This creates an incentive to offer services at least up to the budgeted volume. The hospital is paid for surgical procedures but not for treatment options such as watchful waiting. It can be assumed that German hospitals face different degrees of economic pressure to perform services whose indication is ambiguous. Whether this economic pressure exhibits regional patterns would require further analysis.

### Structure-dependent services: regional variations, their magnitude, and possible reasons

This Healthcare Fact Check, "Regional Variations in Health Care," presents regional differences not only in surgery rates but also in services whose utilization depends on supply structures and their interaction.[9] As explained above, these indicators illustrate the common problem of a regionally diverse and in some cases inefficient allocation of ambulatory and inpatient care options, and hence a situation in which the inpatient sector compensates for the under-resourced outpatient sector.

According to Wennberg's categorization, these indicators tend to reflect supply-sensitive services whose utilization depends on the regional availability – or the regional shortage – of supply structures.

However, a direct comparison of the extremal quotients makes little sense, first because their determinants are specific rather than general (see individual explanations in Chapter 5), and second because the available data are too limited for comprehensive comparisons of regional service profiles.

Some common causes for regional variations may be conjectured, however. Demand-based planning for outpatient services on the one hand and inpatient services on the other seems to affect the relationship between utilization of outpatient and inpatient care for many indicators. Another reason for regional variations in these supply-sensitive services may lie in the regionally diverse contracting, billing, and monitoring systems between service providers and sickness funds.

## 2.4 Healthcare Fact Check on Regional Variations – Which variations are unwarranted?

How should the results of the Healthcare Fact Check on Regional Variations be evaluated? Does the calculated magnitude of regional variations point to unwarranted variations for some indicators? Does overuse, underuse, or misuse exist for some indicators considered here?

General and overarching answers for all indicators cannot be given. It should be kept in mind that this Fact Check is based on the national average (index value = 1) as the reference point to calculate regional variations and deviations. A medical reference point per indicator (e.g., 80 interventions per 100,000 inhabitants) is deliberately not provided, for three reasons. First, the "right rate" for the provision of services is not known to the authors and reviewers; accepted norms for the indicators considered here do not exist. Second, to define such a norm requires a resource-intensive process that would have gone

[9] The indicator "density of child and adolescent psychiatrists and psychotherapists," for example, is merely a structural indicator, representing the density of supply rather than the use of services.

beyond the scope of this overview. Third, the definition of the national average as reference point has the advantage of concentrating the interpretation of results mainly on the magnitude of regional variations and not on the debate on whether the chosen norm is indeed the "right" one.

The disadvantage of choosing the national average as the reference point lies in the difficulty of making claims regarding possible overuse or underuse. Based on a norm or normative range, deviations to the higher end could clearly point to overuse, while deviations to the lower end could clearly point to underuse. But whether the national average reflects the "right rate" or medical norm is questionable. It is quite possible that the level of service provided in Germany is high or low overall in an international comparison, and that even large deviations from the national average would need to be interpreted based on this high or low overall level.

Nevertheless, for some indicators the magnitude of regional variations is very high, medically incomprehensible, and in need of explanation, and one may certainly surmise that unwarranted regional variations exist. It seems safe to assume that Germany exhibits overuse of tonsillectomy, appendectomy, prostatectomy and hysterectomy, coronary bypass surgery, inpatient instead of outpatient hernia surgery, and the proportion of day cases among all hospitalizations in Germany.

Regarding the density of psychiatrists and psychotherapists for children and adolescents as well as for the treatment of patients with depression, it seems safe to assume regional situations of underuse. Regarding indicators that reflect interactions between outpatient and inpatient supply structures, one may suspect underuse in terms of a low availability of outpatient service structures and overuse in terms of more readily accessible inpatient structures that then compensate for outpatient care deficits. Problems of underuse and misuse may exist when it comes to expectant mothers with high-risk pregnancies and preterm births.

Determining whether these assumptions regarding overuse, underuse, or simultaneous over- and underuse in regional and urban districts are indeed valid would require further quantitative and qualitative research on the individual indicators. For many topics, it would be interesting to augment the indicators considered here with other indicators. For instance, it would be quite enlightening to consider the regional rate of appendectomy versus the regional rate of ruptured appendix cases, or the regional rate of coronary bypass surgery versus regional patterns of catheterization treatment, or inpatient versus outpatient diabetes care. Such comprehensive analyses, though undoubtedly illuminating, were beyond the scope of this Fact Check, which is intended to provide an initial overview across various topics along with preliminary explanations for these regional differences.

## 2.5 Unwarranted variations – How can they be reduced? And how can needs-based provision of care be improved?

The medical and health policy objective should be to reduce the unwarranted variations, and only the unwarranted ones. This would decrease the inefficient deployment of resources, whether through wasteful overuse or through denial of care. More importantly, it is an ethical imperative to care for patients based on preference and need while avoiding unnecessary burdens and risks. The great challenge is to tackle unwarranted variations while sustaining the warranted variations, which reflect patient-oriented care (Mulley A 2010). The identification of unwarranted variations is an important, albeit methodologically and medically demanding, first step. The second step is to seek out the causes and target them directly. This too is a challenging task, for often a number of factors are responsible for unwarranted regional variations.

In general, cross-sectorial needs-based healthcare planning, integrated supply structures, and financial incentives that more strongly reward narrative-based medicine and watchful waiting may contribute to a reduction of unwarranted variations at macro level and thus to appropriate care. At micro level, the availability of evidence-based guidelines and decision aids, supportive IT systems, and physicians' greater willingness to engage in shared decision-making may favorably influence the provision of appropriate and preference-oriented care.

Reducing or avoiding unwarranted variations in healthcare is an important objective. The analytic strategy described above, which calls for first identifying and then directly targeting unwarranted variations and their causes, is complex and resource-intensive. In contrast, an alternative strategy starts not with the unwarranted outcomes of supply-side and medical decisions, but with the decision-making process itself. Following the King's Fund, this approach represents procedural justice: As long as the medical decisions made are based on an agreed fair process, outcomes will and can differ (Appleby et al. 2011).

This process-oriented strategy is based on shared decision-making – a partnership in which the physician and the patient exchange all relevant information and agree on the most suitable treatment option (see text box). When followed as intended, it results in more preference-sensitive decisions.

## Shared Decision Making (SDM):

- **What is SDM?** IBased on mutual trust, physicians and patients exchange all important information – the physician as independent medical expert about the diagnosis and possible treatment options with their respective benefits and risks, the patient as expert about his or her personal preferences, fears and life situation. Both agree on the option that is in the patient's best interest; both assume responsibility for the joint decision and put it in writing.
- **What are the effects of SDM?** Following an SDM process, patients have better knowledge and understanding of their disease. They have more accurate risk perceptions, are more comfortable with decisions – indeed, fewer patients choose major surgery – and show greater adherence to treatment and self-efficacy in coping with their disease.
- **How can SDM be successful?** A successful shared decision-making process requires sufficient time and calmness, independent decision aids as supporting documents, and last but not least the willingness of physician and patient to decide jointly.
- **Do patients and physicians want SDM?** Surveys (including surveys from Germany) repeatedly show that the majority of patients want to be more involved and (co-)decide in situations that affect them personally. Even patients from vulnerable groups, who more often leave the responsibility and decision to the physician, can be encouraged to participate in shared decision-making. They also benefit the most. Many physicians are also generally open-minded towards the shared decision-making process. However, they often cite similar rationales and reservations in saying why shared decision-making is not yet practiced.
- **How can decision aids help?** Decision aids give patients all the relevant medical information in clear, comprehensible language. They describe the disease and its symptoms, present – without one-sided recommendations – the possible treatment options (including watchful waiting), and describe their expected effects and side effects as well as the likelihood that they will occur. Moreover, decision aids provide concrete examples illustrating what it would be like to experience some of the most frequent effects of different treatment options. Comprehensive and independent, evidence-based but understandable to ordinary people, they are literally aids to support the decision, before, during, or after the consultation with a physician.

Source: Coulter and Collins (2011), Klemperer and Rosenwirth (2005).

Although patients benefit from a process of participative decision-making in many ways, routine medical care in Germany rarely involves shared decision-making. The reasons are wide-ranging. On the side of physicians, knowledge of the concept of shared decision-making is probably still limited. This leads to the misconception that most patients do not want a partnership-based decision-making process or would find it burdensome, as well as to an underestimation of its positive effects.[10] Moreover, in Germany there are still not enough independent evidence-based decision aids that could support patients in the process and would make consultations with the physician shorter and more efficient.[11] Still the greatest barrier, however, is a remuneration structure that rewards action rather than inaction or watchful waiting.

The health policy objective should be that patients receive those services, and only those, that align with their need and personal preferences. Shared decision-making – along with numerous legal, financial, and other regulatory incentives and guidelines – can make an important contribution. The following measures may be regarded as conducive to the wider use of shared decision-making between physician and patient:

- Communication skills and the practice of shared decision-making should become an integral part of the medical curriculum and continuing education.
- Evidence-based and readily understood decision aids that present all treatment options and their advantages and disadvantages in a neutral way should be developed, made available in doctors' offices, and disseminated by sickness funds, consumer information centers, and patient advisory boards.
- In cases where international studies have found that patients revise their initial opinion or decision about a particular intervention after using an independent and evidence-based decision aid, the mandatory integration of that decision aid into the patient-physician consultation might be considered.

Even these measures are certainly not easily or quickly implemented. However, they are attractive, inasmuch as they promote the fundamental right of patients to decide and co-decide. In that regard, they represent a step – in the words of Muir Gray and Gerd Gigerenzer – toward making the 21st century the century of the patient (Gigerenzer and Gray 2011).

[10] According to Légaré F et al. (2008), frequently cited objections are "We already do it," "Patients don't want it," "Not appropriate for those with low health literacy," "Patients will want inappropriate/expensive treatments," "No time to do it," "It's irrelevant and ineffective," "There's no incentive to do it." Such objections are likely to exist also among physicians in Germany. Coulter and Collins (2011) show that each of these objections can be resolved.

[11] Evidence-based decision aids for patients are so far mainly offered on the independent websites www.patient-als-partner.de and www.gesundheitsinformation.de

# 3. Approach and Methods

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## 3.1 Rationale for the Fact Check "Regional Variations"

In health policy debates in Germany, some stakeholder groups repeatedly demand that the alleged need to ration services financed by statutory health insurance (Gesetzliche Krankenversicherung, GKV) should no longer be merely discussed but actively promoted through the development of relevant institutions and procedures. Similarly, from the academic perspective, scenarios of a reduced GKV benefits package and the emergence of new health markets and financing options are discussed in terms of concepts such as "innovation insurance" ("Innovationsversicherung," Häussler and Albrecht 2010) or "mezzanine health markets" ("Mezzanine Gesundheitsmärkte," Dierks et al. 2010).

Common to these developments is the implicit assumption that further reduction of existing inefficiencies (and potential changes in the financing system) will no longer yield sufficient additional resources to finance the growing demand for health services (keyword: demographic change) and future supply-side increases (keyword: medical advances). To put it bluntly: We have squeezed all the savings from the healthcare lemon; now we must pursue other options.

On the other hand, studies regularly find evidence of unnecessary or inappropriate use of resources in Germany's health system. As early as 2000/01, a special report from the Advisory Council on the Assessment of Developments in the Health Care System, and particularly Volume 3 (Overuse, Underuse, Misuse), described numerous cases of misallocation. From the perspective of 2011, it is clear that little has actually changed, especially regarding the identified overuse and misuse; furthermore, policymakers and experts seem to have largely lost interest in the matter.

By contrast, in other countries misallocations in the health system are quite systematically traced. The Dartmouth Atlas of Health Care is the best-known example. Based on a national data set regarding healthcare utilization by Medicare beneficiaries – largely Americans 65 and older – the Dartmouth Atlas analyzes regional differences in resource use and health outcomes. Core findings of most analyses are remarkable discrepancies between resource inputs and health outcomes as well as substantial variations in the quality and cost of care, none of which are explained by differences in the morbidity or age of the regional populations. Instead, the authors of the Dartmouth Atlas frequently attribute deficits in the quality and efficiency of care to perverse incentives and insufficiencies of the regulatory framework. Similarly, researchers in Great Britain, the Netherlands and Spain systematically address the question of regional variations and possible misallocations in healthcare.

Against the backdrop of often premature debates around priority-setting and rationing in Germany, and with an eye to international models identifying targets for improvement, in January 2011 the Bertelsmann Stiftung in cooperation with partners launched the Initiative for High-Quality Healthcare ("Initiative für gute Gesundheitsversorgung").

The Initiative for High-Quality Healthcare aims to publicize concrete examples that document regional variations in healthcare, to carry out research into the underlying causes, and to develop proposals for solutions. This publication, "Regional Variations in Healthcare," is the first in a series of Healthcare Fact Checks on various topics. Its purpose is to provide an initial overview without addressing the selected topics in depth. As a way to start the discussion, this Healthcare Fact Check will illustrate the differences in service utilization or healthcare capacity among Germany's 412 urban and rural districts or among German states, synthesize explanatory hypotheses, and identify initial options for action to reduce the possibly unwarranted variations.

## 3.2 Selection of Indicators for the "Regional Variations" Fact Check

The cornerstone for the Initiative for High-Quality Healthcare was laid in several expert workshops organized by the Bertelsmann Stiftung in April 2010. During a structured process, participants selected several topics that they agreed would usefully illustrate overuse, underuse, and misuse in healthcare as well as the key underlying forces.

Preparatory work for "Regional Variations in Healthcare" began in April 2011. The IGES Institute conducted a broad search for suitable topics in line with the above objectives. The list of topics resulting from the expert workshops was reviewed, though not all of these could be included (for the reasons given below).

Topics for the "Regional Variations" Fact Check were expected to meet a number of criteria determined jointly with the Bertelsmann Stiftung, namely being highly relevant to the population (prevalence, severity), important for healthcare economics, and representative of (healthcare) systemic deficits. Since the intended audience includes the general public, topics are suitable only if they can be described clearly and communicated effectively. Additional criteria included evidence that the utilization or distribution of resources was not needs-based and the presence of clear benchmarks or solid evidence. Another important selection criterion was access to population-based, small-area data for the IGES Institute within the limited project timeframe.

This preliminary selection process yielded more than 60 potential indicators/topics, which could be categorized as relating to inpatient hospital treatment, outpatient medical care, pharmaceutical care, rehabilitation, nursing care, inputs/capacities/structures, financing/expenditure, outcomes/outputs, prevention, demographics or "other." The suitability of these 60 themes for the "Regional Variations" Fact Check was discussed in depth with all reviewers involved in the project. Working hypotheses regarding possible explanations for regional differences in service utilization and structures (supply sensitivity, preference sensitivity, sensitivity in terms of availability of outpatient care, etc.) were likewise thoroughly discussed for each topic.

The main reason for reducing the initial 60 topics to the 16 topics considered in the "Regional Variations" Fact Check was the limited public access to healthcare data in Germany. There is, for instance, no public access to sufficiently differentiated data on outpatient medical care. The same holds true for nearly all the other healthcare domains (pharmaceuticals, medical devices, nursing care, etc.) that are just as significant for the expenditure of public and private health and nursing care insurance, as well as for the individuals affected. As a result, many of the topics preselected as potentially relevant could not be addressed in this Fact Check for reasons of data accessibility. Therefore, the remaining 16 topics focus primarily on inpatient hospital treatment, where up-to-date and high-quality data, differentiated according to small-area populations, has been publicly available for years. The "Regional Variations" Fact Check draws on sources other than official public data only in isolated instances (the Stiftung Gesundheit regarding the number of statutory health insurance physicians and psychotherapists).

"Regional Variations in Healthcare" was therefore clearly developed to give "only" an overview of each selected topic, based on publicly available official data and within the predefined timeframe of just under six months. For each topic, the overview is limited to two book pages, one page for graphical illustrations of the variations and one page for a lay-oriented description of the topic, the magnitude of regional variation, and the formulation of initial explanatory hypotheses and options for action. In-depth analyses, for example based on other data from the Federal Statistical Office or from partner institutions and organizations, will follow at a later date via topic-specific Fact Checks (see above).

The 16 topics illustrate healthcare domains in which regional variations have been discussed at an international level for decades (hysterectomy, tonsillectomy, caesarean section, appendectomy); domains characterized by substantial increases in volume for years (primary knee replacement); domains that have long been the focus of quality assurance efforts and/or are monitored in the context of health reporting (perinatal mortality); domains located at the complicated interface between outpatient and inpatient care (inpatient instead of outpatient hernia surgery, hospitalizations for type 2 diabetes, day cases in hospital),

and domains addressing further problems of coordination along the healthcare continuum (inpatient treatment because of depressive/recurrent depressive episodes, deaths in hospital among elderly patients).

Regarding the order of indicators, several options were discussed (by indication; by life stages; as input-output relationships; by meta-hypotheses regarding the drivers of overuse, underuse, and misuse; etc.). As finally selected by the reviewers and Bertelsmann Stiftung experts under consideration of data accessibility, the indicators cover important aspects of our healthcare from birth to death. To the extent possible, therefore, the order of topics in this Fact Check follows stages in life.

## 3.3 References and Role Models for the "Regional Variations" Fact Check

The "Regional Variations" Fact Check clearly draws on other products developed for similar purposes in other countries (Dartmouth Atlas of Health Care [www.dartmouth- atlas.org], NHS Atlas of Variation in Healthcare [www.rightcare.nhs.uk/atlas]). Similarities exist regarding the calculation and representation of regional variations. The breadth of topics differs. While the Dartmouth Atlas of Health Care and the NHS Atlas of Variation in Healthcare can refer to comprehensive data sets that extend to aspects of expenditures, for example, or primary healthcare, the "Regional Variations" Fact Check had access to a comparatively narrow set of data, as previously described.

**International Role Models for the "Regional Variations" Fact Check**

| | |
|---|---|
| **USA** | www.dartmouthatlas.org |
| **UK** | www.sepho.org.uk/extras/maps/NHSatlas/atlas.html |
| **E** | www.atlasvpm.org |
| **NL** | www.zorgatlas.nl |

## 3.4 Calculation of Indicators

### 3.4.1 Definition of indicators and depth of analysis

Each of the 16 topics in the "Regional Variations" Fact Check reports on regional differences in utilization or in supply capacity. Each is described or expressed in terms of a single topic-specific indicator. The indicators cannot always cover the topic completely. For the indicator on appendectomy, for example, it would be desirable to likewise consider rates of perforation. The indicator on coronary bypass surgery immediately raises questions about cardiac catheterization for coronary heart disease. The density of child/adolescent psychiatrists and psychotherapists should be considered in relation to regional differences in the young patients' migration backgrounds and the extent of other outpatient, inpatient, and alternative care options. And the list goes on. Such desiderata were recognized and compiled by the reviewers of the overview report. However, these "gaps" in the "Regional Variations" Fact Check remain part of its conceptual design and are openly discussed. This sustains interest in more in-depth, regionally oriented engagement with these topics, which may be addressed in future specific reports.

### 3.4.2 Sources of information

The data sources and the methods used to calculate the indicators are clearly set forth in Chapter 5, Data Sources and Use. The chapter also describes possible limitations of the crude statistics and transformations. The case-based hospital statistics (DRG statistics) used for many indicators are taken from special analyses by the Federal Statistical Office. This approach, chosen because of time constraints, may limit the significance of regional variations in utilization rates, as it is not possible to adopt a hospital-specific perspective (for example in order to consider the principal reason for treatment in addition to the sur-

gery itself). Overall, however, it is plausible to assume that the magnitude of regional variation does not primarily depend on such peculiarities and limitations (as described in the chapter on Data Sources and Use) but that such peculiarities are for the most part equally distributed across regions.

All indicators covered are based on place of residence. Thus, for example, the surgery rate is shown for the population of a given urban or rural district. This prevents distortions arising from patient flows across district boundaries.

### 3.4.3 Standardization and aggregation over time

Regional variations in the use of health services can also result from distinctive features of the resident population in the individual regions compared. Potential determinants include differences in demographic profiles (age and sex), in disease prevalence, in the totality of services already delivered (e.g., number of children and adolescents whose tonsils were removed prior to the selected timeframe), and in particulars arising from social status (income, employment, etc.) and lifestyle. Usually, an attempt is made to "clear" these differences between populations as much as possible.

For the "Regional Variations" Fact Check it was possible, apart from a few instances, to indirectly standardize the indicators according to age and sex. With indirect standardization, the observed utilization of a reference population (here, national average by age group and sex) is applied to the population of a particular region by age group and sex to calculate an expected rate of utilization. The data are then presented as a ratio of actual to expected rates. If the ratio is greater than 1, utilization in the region is above the national average. If the ratio is less than 1, utilization is below the national average. In the text, we call this ratio an "index." It denotes the relative position of a region in comparison to the national average (index value 1).

Indirect standardization or calculating index values ensures that a district is evaluated as fairly as possible. For example, if a district's population is relatively old, it is "allotted" a higher rate of surgical procedures that are generally more common in older people. But if the region exceeds the allotted level, the resulting index is greater than 1, indicating that – taking into account the population's actual age – the rate of use is above average. Of course, a similar process takes place for districts with particularly low use, which may or may not be attributable to a relatively young population in the district. If values were not standardized and only the actually observed rates were presented, there would be no way of knowing the extent to which a particularly low or high rate was in fact attributable to the age and sex distribution for the population in a particular district.

Direct standardization is also an option for regional analyses. In direct standardization, the districts are statistically weighted against a uniform age and sex distribution – for example, that of Germany as a whole. The directly standardized values are thereby "cleared" of the district's specific age and sex distribution. In this report, the indicator "hospitalizations for depressive/recurrent depressive episodes" was used in the directly standardized form provided by the Federal Statistical Office. In this instance, the standard population is that of Germany in 1987 (for more information, see www.gbe-bund.de).

In other exceptions, the number of "child and adolescent psychiatrists and/or psychotherapists" was given per 100,000 children and adolescents of the regional population. Data on perinatal mortality is provided by the Statistical Offices at the federal state level for the purpose of federal health reporting, and the indicator does not allow for subsequent standardization by third parties. Detailed descriptions of the methods for standardization for each indicator can be found in Chapter 5, Data Sources and Use. For further information, see the Federal Statistical Office's descriptions of statistical methods (in German) at http://www.gbe-bund. de/gbe10/owards.prc_show_pdf?p_id=9768&p_sprache=d (Appendix 1).

Indirect standardization was chosen for the majority of indicators because it supports the objective of uniform presentation of results across indicators. Furthermore, indirectly standardized results offer greater statistical stability. On the other hand, direct standardization allows for direct comparison of the results for individual districts. The indirectly standardized values give a reliable picture of a district's position relative to the national average. In theory, however, under certain circumstances the comparison of two districts based on indirectly standardized results can yield a distorted picture. (Tsai and Wen (1986) offer interested readers a fuller discussion of these methodological issues.)

Therefore, in preparing the Healthcare Fact Check, for all the indirectly standardized indicators and all 412 regions we investigated the extent to which individual comparisons based on indirectly standardized results differ from comparisons based on directly standardized results. We found deviations in comparisons of districts with very high or very low values, though only in the sense that the margin between the two districts ¬– a margin that varied in magnitude because of the extreme position of at least one of the districts compared – was estimated differently. (For example, comparison based on indirectly standardized values indicated a rate 2.45 times higher in District B than in District A, while comparison based on directly standardized values indicated a rate 2.7 times higher in District B.) However, the observed deviations do not lead to wrong conclusions in the sense that two districts demonstrate substantial differences (i.e., that their positions are switched) depending on the standardization method used. Therefore, we consider the problem of potentially distorted results for individual districts based on indirectly standardized values to be empirically of minor importance.

We recognize that differences in disease prevalence, social situations, and/or lifestyle may influence the observed variations. If known, these influences are mentioned in the reports for the individual indicators, though with no claim to completeness.

All the indicators are described in terms of the average value over several years (usually three), not a one-year value. This approach mitigates the random fluctuations that inevitably appear in the analysis of annual values for small regional units. It thus permits reliable statements about utilization rates even for districts with relatively small populations.

### 3.4.4 Representation and appraisal of regional variations

Regional variations in utilization rates or in available capacity are described under the subhead “Magnitude of regional variation” for each topic. For most indicators, the districts or federal states (simplified: regions) can be compared using the index value, which expresses the position of this region relative to the national average (value 1). For example, consider the topic of appendectomy among children and adolescents. The index values for appendectomy among children and adolescents (aged 5 to 19 years) are represented by district. These regional values can be compared to the national average, which has the index value 1. An index value less than 1 (e.g., 0.5) means that appendectomies are performed less often among children and adolescents in that region than the national average (in this example, only half as often). A higher index value (e.g., 2.0) means that appendectomies are performed at a higher rate than the national average (in this example, twice as often).

This approach, applied with few exceptions throughout the study, has the advantage of enabling even the lay reader to gain a rapid overview for each indicator. It also allows direct comparison of the magnitude of regional variation across the various topics.

For each topic, one page of text describes the magnitude of the difference between the result for the district/state with the highest index value and the result for the district/state with the lowest index value. This difference is expressed as the ratio of the highest to the lowest result (the extremal quotient), as if answering the lay reader’s question “How many times higher is it?” Even when data from a relatively long period are considered, extreme values can represent statistical artifacts. For this reason, another parameter of deviation is calculated for the indicators reported for the 412 districts. This calculation excludes the 20 districts (about 5% of the total) with the lowest or highest reported utilization rate after standardization for age and sex. For the remaining 372 districts, the magnitude of regional variation is again expressed as the extremal quotient (of approximately the 95th to the 5th percentile).

For each topic, the data on regional variation are depicted on a map and, in almost every case, as a distribution graph (according to the 412 districts). After much discussion, the decision was made to group the results (index values) for the individual regions according to fixed bands of variation for each topic. The eight classes developed for this purpose range from a “lower extreme value group” (index values ≥0 to <0.5) across five classes that approach the national average (index value = 1) by equal intervals (index values ≥0.5 to <0.7, ≥0.7 to <0.9), approximate the national average (index values ≥0.9 to <1.1), and exceed the national average (index values ≥1.1 to <1.3, ≥1.3 to <1.5). The population in regions classified in index value groups of ≥1.5 to <2 utilizes 50% to almost 100% more services than the national aver-

age. The “higher extreme value group” (index values ≥2) comprises all districts whose population utilizes services at least twice as often as the national average. In contrast to grouping in flexible bands of variation that are of equal size (e.g., quartiles or quantiles), the chosen static approach to classification has the key advantages of permitting comparison of the magnitude of variation across topics and facilitating communication to the lay reader.

The individual index value groups are colored using a neutral color spectrum, which ranges from dark blue (for lower extreme-value groups) over lighter blue tones to pale green for the middle group (index values ≥0.9 to <1.1). Above-average index value groups are colored in copper using an increasingly rich tone toward the higher extreme-value groups. The mapping of results on the website www.faktencheck-gesundheit.de conforms to this scale and coloring pattern.

| | |
|---|---|
| ≥ 0 to < 0,5 | lower extreme-value group of the variation: result less than 50% of the national average |
| ≥ 0,5 to < 0,7 | result 50% to almost 30% lower than the national average |
| ≥ 0,7 to < 0,9 | result 30% to almost 10% lower than the national average |
| ≥ 0,9 to < 1,1 | result equal to or within 10% of the national average |
| ≥ 1,1 to < 1,3 | result 10% to almost 30% greater than the national average |
| ≥ 1,3 to < 1,5 | result 30% to almost 50% greater than the national average |
| ≥ 1,5 to < 2,0 | result 50% to almost 100% greater than the national average |
| ≥ 2,0 | upper extreme-value group of the variation: result 100% or more greater than the national average |

## 3.5 Possibilities and Constraints of the “Regional Variations” Fact Check

The possibilities and constraints of the “Regional Variations” Fact Check have been addressed in previous paragraphs and are summarized below.

The indicators selected for this fact check cover a broad spectrum of topics, though these are largely focused on the inpatient hospital sector. The primary reason for this focus was the limited availability of publicly available official data differentiated according to small area populations for many other interesting healthcare fields (outpatient care, pharmaceutical care, nursing, etc.). Another reason was that additional existing sources of data could not be accessed within the limited time and resources of the project. This brings to mind the long-planned implementation of §303a ff. of Volume V of the German Social Insurance Code (SGB V; “Data Transparency”). The expansion of its limited database is intended to support longitudinal studies over longer time periods, analyses of treatment workflows, and analyses of healthcare processes to identify deficits and create starting points for reforms (regarding overuse, underuse, and misuse of services). The Improvement of Healthcare Structures in Statutory Health Insurance Act describes new regulations regarding data transparency. Also important for health services research is performance-related information (e.g., provision of outpatient services [EBM codes] and DRG-based reimbursement of hospitals).

Because of the chosen limit of two pages per indicator/topic, in combination with a focus on the lay reader, this Fact Check is only the first step toward investigating and interpreting the reasons for the reported regional variations in service utilization or supply capacities. Further research is necessary to understand the sometimes considerable interregional differences for each indicator/theme and to identify relevant regionally oriented options for action. All in all, it can be said that the reported variations cannot be explained, at least not in all cases, solely by demographic differences within the populations. Largely based on the scientific literature, the “Regional Variations” Fact Check formulates initial explanatory hypotheses and describes possible responses. During its development, meetings and discussions among the authors, reviewers, and experts from the Bertelsmann Stiftung impressively showed that this limited illustration of chosen topics can stimulate fruitful debate on causes, solutions and pathways to change.

The “Regional Variations” Fact Check gives examples of possible misallocations and unexplained variations in the utilization of healthcare. Until such indications of existing inefficiencies are adequately explained or reduced, we do not consider it justifiable to embark on the rationing of effective healthcare services.

# 4. Selected indicators

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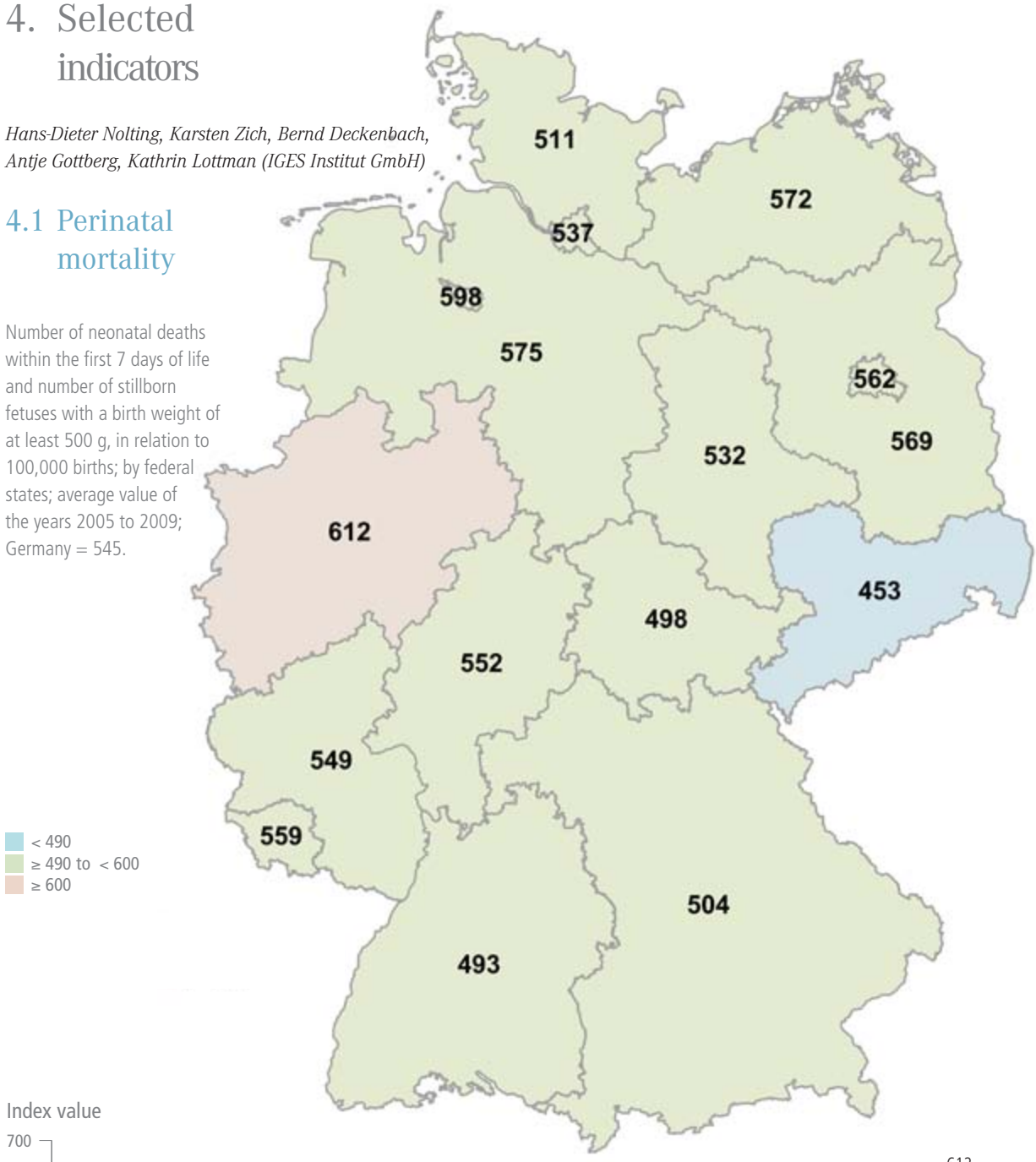
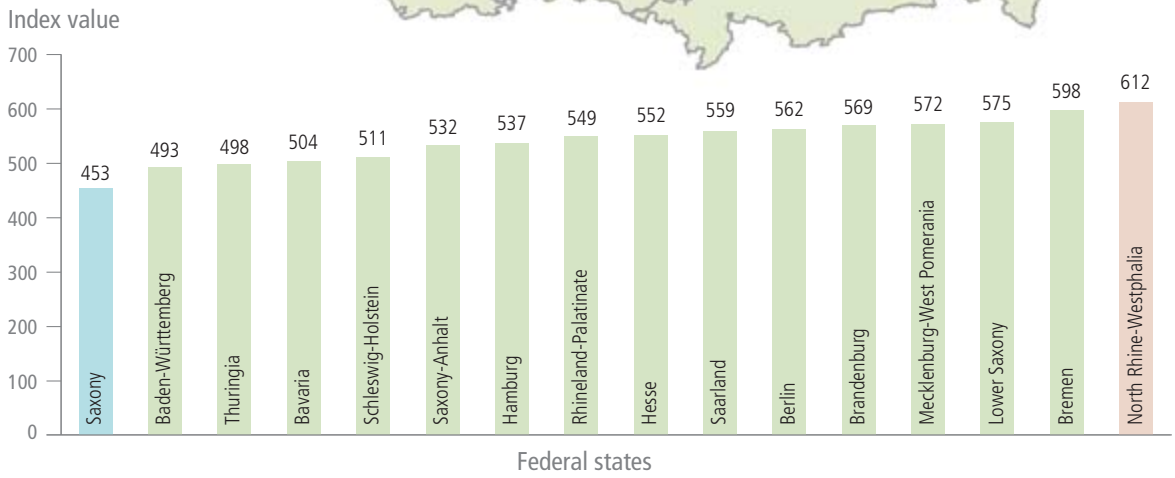
## 4.1 Perinatal mortality

Number of neonatal deaths within the first 7 days of life and number of stillborn fetuses with a birth weight of at least 500 g, in relation to 100,000 births; by federal states; average value of the years 2005 to 2009; Germany = 545.




Source: German Federal Statistical Office (Stat_PerinatSterb)

## Context

Perinatal deaths (stillbirths with a birth weight of at least 500 g and neonatal deaths up to the 7th day following birth) are considered avoidable deaths that can be prevented by means of adequate medical care before, during, and after birth.

The Joint Federal Committee (G-BA) has defined legislative quality standards to ensure the quality and safety of hospital care for neonates and pre-term infants. Accordingly, hospitals are assigned to one of four levels depending on their degree of specialization. In a "perinatal center level 1," highly advanced medical care can be provided, for example for pre-term babies with an expected birth weight below 1,250 g. "Perinatal centers level 2" and hospitals with a perinatal focus are less specialized. The fourth level includes maternity clinics without specialized services or affiliated pediatric clinics. Hospitals at this level may only manage births during and after the 36th week of pregnancy without expected complications – which applies to the majority of births.

If expectant mothers face risks such as pelvic presentation, multiples, gestational diabetes or expected pre-term birth, they should visit a specialized hospital in order to receive specialist care if complications arise. This can help prevent high-risk transfers (e.g., of small pre-term babies) to a specialized hospital.

Between 2005 and 2009, average perinatal mortality amounted to 545 deaths per 100,000 live and stillbirths at national level, which translates into a risk of about 0.5%.

## Magnitude of regional variation

Between 2005 and 2009, Saxony had the lowest perinatal mortality rate with, on average, 453 deaths per 100,000 births. NRW with on average 613 cases had the highest rate (12% above the national average of 545 cases).

An elevated perinatal mortality rate was also reported for Bremen, Lower Saxony, Mecklenburg-Western Pomerania, and Brandenburg. In contrast to the nationwide trend, for these federal states a slight increase can be observed between 2005 and 2009. In Baden-Württemberg, Thuringia, and Bavaria, perinatal mortality not only was below the national average but also further decreased between 2005 and 2009.

## Hypotheses and options for action

Quality assurance and transparency for perinatal hospital care have a strong heritage in Germany; the foundations were laid by the Munich Perinatal Study conducted between 1975 and 1977 (Selbmann HK et al. 1980). Since then, perinatal mortality has declined from about 626/100,000 births in 1990 to 533/100,000 births in 2009, thus by about 15% (www.gbe-bund.de). Several factors may influence the substantial regional differences that persisted until 2009.

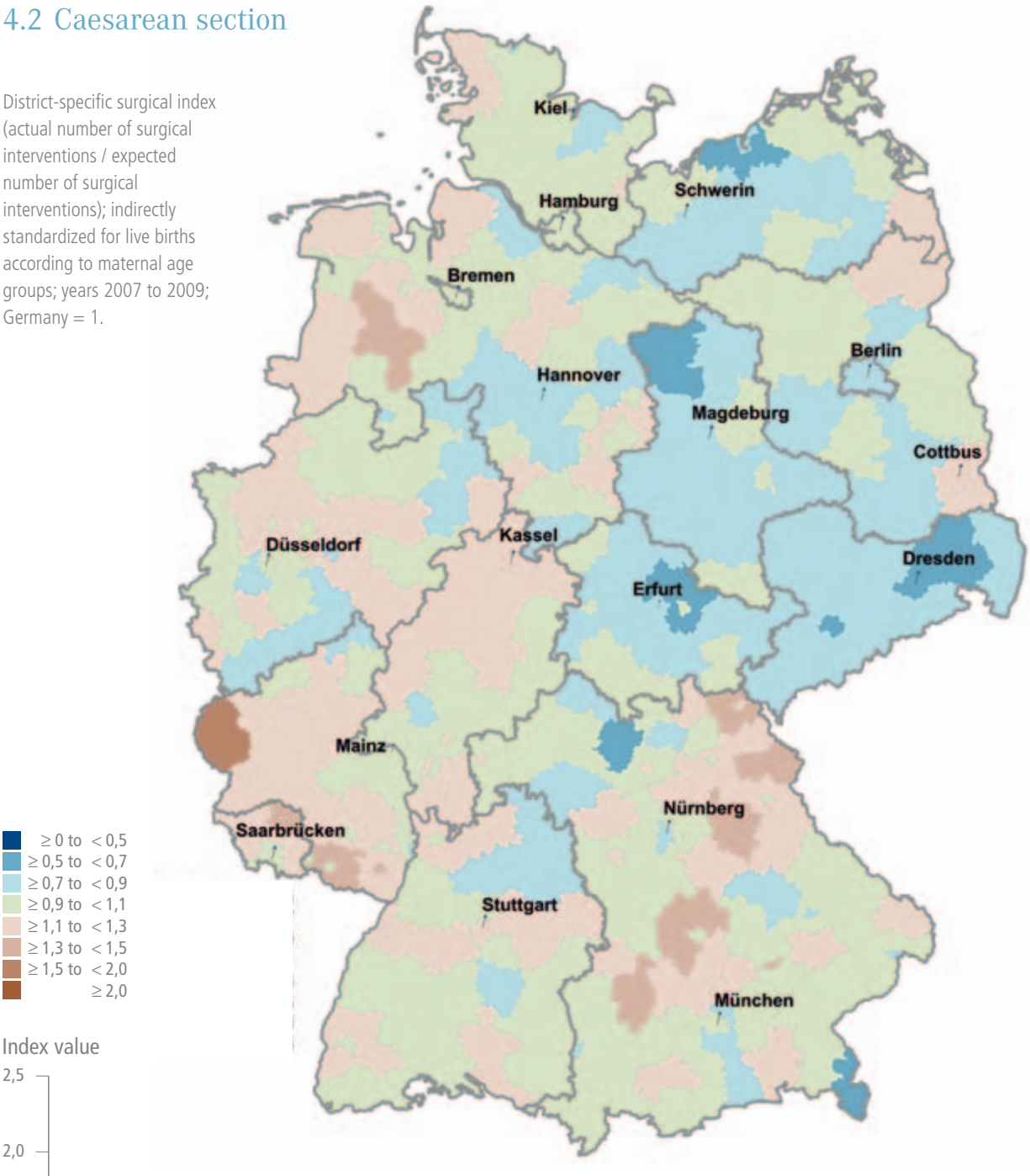
Numerous studies show that perinatal mortality also depends on the socioeconomic situation of the parents (e.g., Senatsverwaltung für Gesundheit, Umwelt und Verbraucherschutz Berlin 2007, Weilandt et al. 2000). Such factors already influence the utilization of pregnancy checkups, which tends to be lower among pregnant women of foreign origin (Weilandt et al. 2000), unmarried women, and those with a lower level of education (Simoes 2009). The social status of pregnant women should not lead to a lower utilization of preventive services, which is associated with higher perinatal mortality. Gynecologists and midwives should fully inform all pregnant women who are at risk of complications about these risks and about appropriate services, and they should ask whether their recommendations are followed. Moreover, counseling services for pregnant women should be improved to support an informed choice of maternity clinic (Nolting et al. 2003). Successful pilot projects that offer targeted information and support services for high-risk groups and align with their sociocultural needs should be rolled out on a nationwide scale.

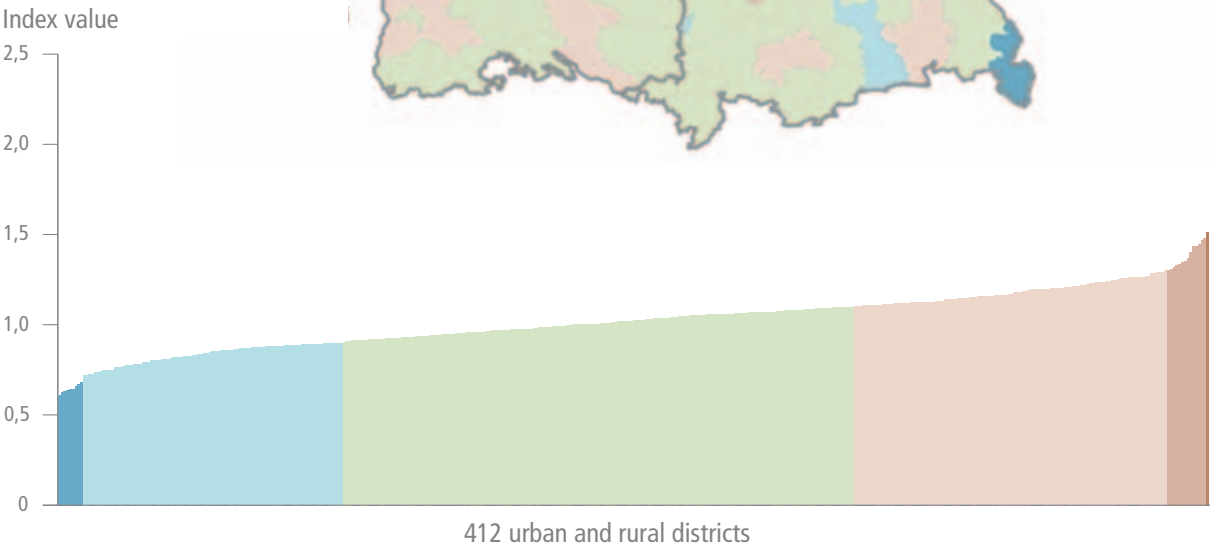
Another cause of regional variation in perinatal mortality might be the degree to which levels of care for neonates and pre-term babies are developed in different geographic areas. The policy described above, which concentrates high-risk births in specialized centers, has stood the test. Several studies confirm that this system of care has reduced rates of perinatal illness and death (e.g., Cifuentes et al. 2002).

In general, high levels of care cannot be offered in each region; however, normal maternity clinics and hospitals with a perinatal focus are available all over the country. Hospitals specializing in high-risk births do exist, though not always near where the pregnant woman lives, but not all high-risk babies are delivered in an appropriately specialized center (Dudenhausen et al. 2006, Heller 2003). The criteria set by the G-BA (e.g., minimum number of births) that hospitals must meet in order to be assigned to one of the four levels of care remain controversial and subject to legal challenge. Stricter criteria may mean that hospitals of the next-lower level of care lose their permission to manage certain births. Particularly when combined with regionally declining birth rates, this can jeopardize the economic viability of the entire hospital. An important step in this regard would be the implementation of a legislative framework that is sustainable over the long term.

## 4.2 Caesarean section

District-specific surgical index (actual number of surgical interventions / expected number of surgical interventions); indirectly standardized for live births according to maternal age groups; years 2007 to 2009; Germany = 1.




Source: IGES; Destatis; Bundesamt für Kartographie und Geodäsie

## Context

The proportion of caesarean sections among all hospital births in Germany has increased from about 17% in 1994 to more than 31% in 2009 (GBE 2011a). Similar trends are observed in other industrialized countries (GBE 2011b).

Obstetricians distinguish between absolute and relative indications for a caesarean section. An absolute indication means that diseases of the expectant mother or of the fetus, obstetric complications, or anomalies endanger the life or health of mother or child. This includes, for example, placental abruption or amniotic inflammation. Beyond these absolute indications, there are a larger number of relative indications, where deliberation is necessary to decide whether vaginal birth is possible or whether a caesarean section would substantially reduce the risk. This is the case for pelvic presentation, multiples, or previous caesarean sections, for example. The German Society of Obstetrics and Gynecology (DGGG) estimates that about 90% of all caesarean sections result from a relative indication (DGGG 2010).

In light of the growing rates of caesarean sections in industrialized countries, the status of this intervention and in particular the appropriateness of caesarean delivery on maternal request are under debate among the midwifery and obstetric professions (Schücking, 2004; DGGG 2010). For caesarean section on maternal request, not even a relative medical indication exists. Instead, justifications given for this type of elective caesarean section include the avoidance of possible disadvantages associated with vaginal birth – such as damage to the pelvic floor and the risk of incontinence – but also the advantage of being able to plan the birth (Al-Mufti et al. 1996).

Even with caesarean sections, the mother faces risks and possible complications, including for subsequent pregnancies (DGGG 2010). For the child, a caesarean section entails a higher risk of developing respiratory distress syndrome (Hansen et al. 2007). This rare complication usually requires inpatient treatment. In Switzerland, the apparent association between the increasing rate of caesarean sections and a parallel increase in the number of children with respiratory distress syndrome is under discussion (Roth-Kleiner 2007).

## Magnitude of regional variation

IIn Germany, depending on where the mother lives, the proportion of caesarean sections among 1,000 live births lies between 17.7% and 45%. This means that in some districts more than 2.5 times as many caesarean sections are performed as in other districts.

## Hypotheses and options for action

Several reasons for the general increase in the share of caesarean sections among all births are discussed, such as the increasing average age of mothers as well as higher average birth weights. These factors, however, are not subject to such marked regional variation and therefore cannot adequately explain regional differences in rates of caesarean section.

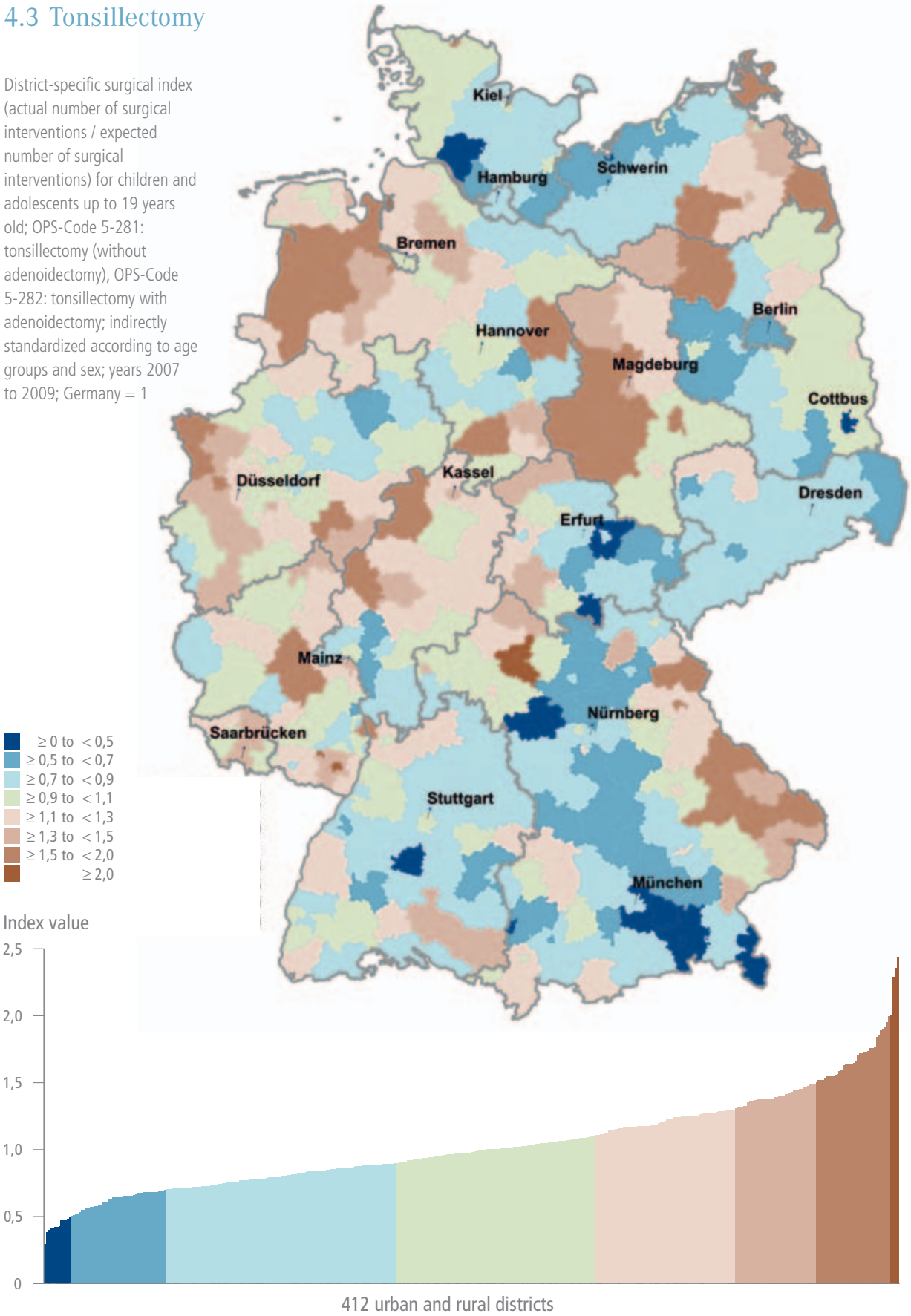
Another reason cited for the growth in caesarean sections includes liability risks, which are hypothesized to lead to a recommendation for caesarean section in cases of doubt, such as with breech presentation, to reduce the risk of birth defects (Lutz & Kolip 2006). This factor or, more generally, the factor of "obstetric experience" might also contribute to regional variation: In smaller departments with fewer births, a caesarean section is performed more often in risky situations – especially at times when department staffing is low (DGGG 2010). For the DDDG, factors of hospital organization (staffing levels) as well as a lack of obstetric experience thus also constitute relative indications for caesarean section (DGGG 2010).

Besides these structural factors (departmental size, experience of obstetricians, hospital organization), an unequal distribution of maternal preference for caesarean section might influence regional variation in caesarean section rates. Studies suggest, however, that caesarean delivery on maternal request in a strict sense – that is, without any medical indication – is rather the exception and that the majority represents some constellation of risk, which may include the expectant mother's pronounced fear of a vaginal delivery (Lutz & Kolip 2006; NICE 2004). Therefore it is plausible to assume that, apart from the above-mentioned structural causes, regional variations can mainly be attributed to differences in how obstetricians view the advantages and disadvantages of both forms of delivery and how they advise expectant mothers.

Pregnant women should be fully informed about the advantages and disadvantages, especially the risks, of different forms of delivery for mother and child. Counseling should include not only the physical and medical aspects, but also the experience of birth. The less caesarean section is medically indicated, the more comprehensive patient information should be.

## 4.3 Tonsillectomy

District-specific surgical index (actual number of surgical interventions / expected number of surgical interventions) for children and adolescents up to 19 years old; OPS-Code 5-281: tonsillectomy (without adenoidectomy), OPS-Code 5-282: tonsillectomy with adenoidectomy; indirectly standardized according to age groups and sex; years 2007 to 2009; Germany = 1




Source: IGES; German Federal Statistical Office (DRG_OPSvier, Stat_Bev_EA)

## Context

The complete surgical removal of the tonsils (tonsillectomy), if applicable in combination with removal of the adenoids (adenoidectomy), is one of the surgical procedures most frequently performed on children. Between 2007 and 2009, on average about 72,000 complete tonsillectomies were performed in hospital per year on children and adolescents up to 19 years old.

It is generally acknowledged that the decision to operate should be based on robust criteria (BQS 2004) and that the younger the patient, the greater the need for compliance with these criteria (HNO 2007). This recommendation is based on the risk of post-operative bleeding, the most severe and potentially life-threatening complication of this surgical intervention (Stuck et al. 2008).

One of the most important indications for tonsillectomy is obstruction of the respiratory system because of greatly enlarged tonsils. Frequent inflammation of the tonsils or of the surrounding area also tends to result in tonsillectomy (Stuck et al. 2008; HNO 2007). There are guidelines specifying the number of inflammations of the tonsils within defined time periods that merit consideration of a complete tonsillectomy (Stuck et al. 2008; HNO 2007). However, before this indication leads to a complete tonsillectomy, the available conservative and pharmaceutical treatment options should be exhausted. Ineffectiveness of these first-line therapeutic approaches can often be attributed to insufficient compliance of patients with medical recommendations. For example, studies show that only 8% of all patients are still complying with their ten-day pharmaceutical regimen with penicillin G on the ninth day of treatment (HNO 2007).

## Magnitude of regional variation

Whether children undergo tonsillectomy evidently also depends on where they live. German districts show marked differences in the incidence of tonsillectomy.

In the district with most surgical interventions, the frequency of surgery is more than eight times higher (surgical index 2.4, national average 1) than in the district with the fewest tonsillectomies (surgical index 0.3). When the 20 districts at each extreme are excluded, the range of the surgical index for the remaining districts is still almost threefold (0.6 to 1.7).

The analysis did not suggest consistent patterns regarding regions of particularly high or low utilization. For example, there are no obvious variations between urban and rural districts. Only in some federal states (Saxony, Schleswig-Holstein) does the frequency of surgery fall below the national average in almost all districts between 2007 and 2009.

## Hypotheses and options for action

The observation that tonsillectomy rates exhibit substantial regional variations is not new. Internationally, the discussion on the appropriate rate of tonsillectomies can be traced back to the 1920s (Klemperer 1990).

There is no evidence that the indications for tonsillectomy identified in the literature vary as strongly between regions as the frequency of surgical interventions in this analysis suggests. Thus, it is likely that there are major differences in diagnostic practices leading to a complete tonsillectomy.

A possible incentive for a more generous diagnosis lies in the fact that especially in smaller ENT departments of hospitals, a considerable share of surgical volume consists of tonsillectomies. A major reduction in the frequency of these surgical interventions might call into question the economic viability of these departments.

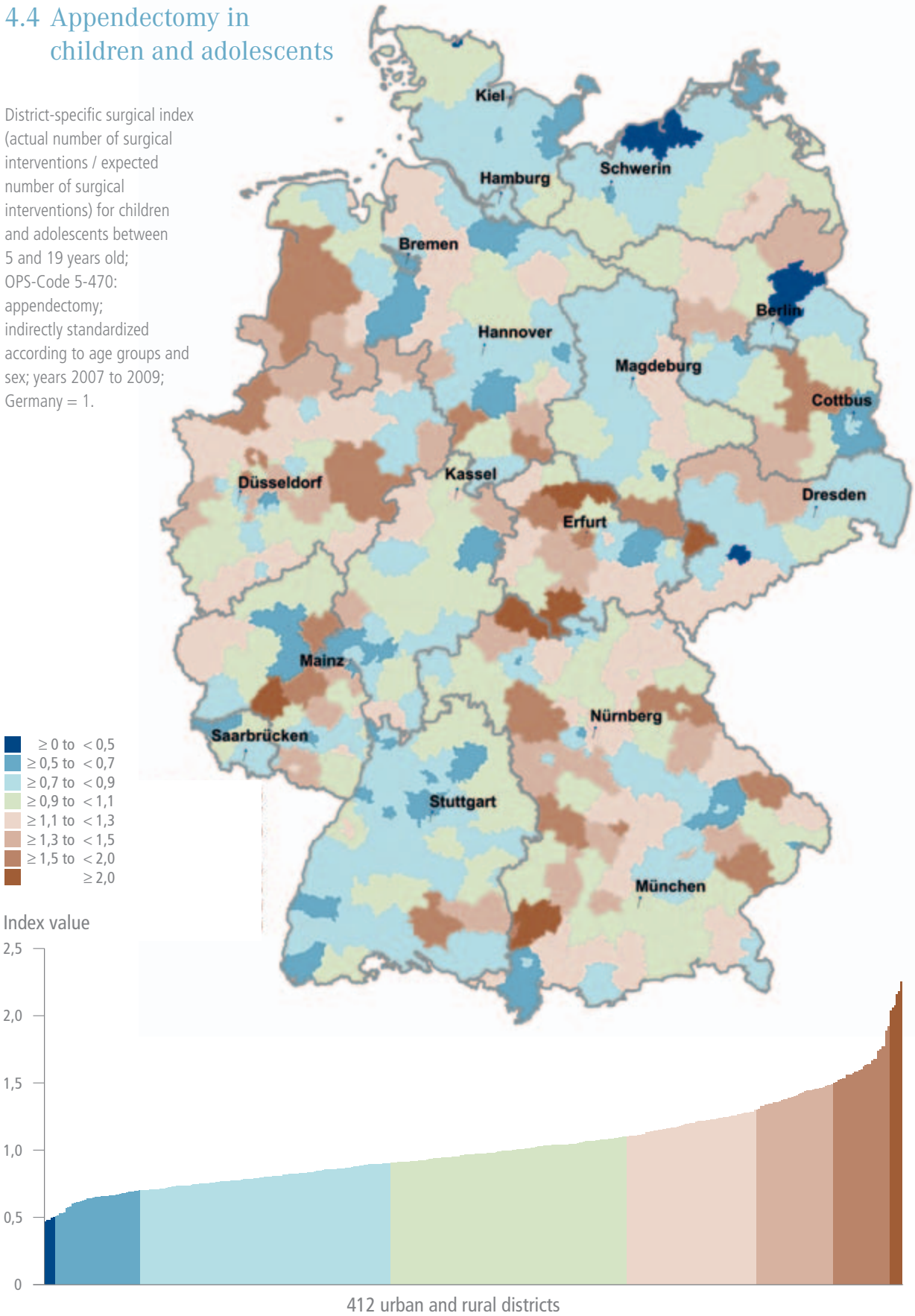
The German Society of Oto-Rhino-Laryngology, Head and Neck Surgery (http://www.hno.org) has also pursued greater standardization of indications for tonsillectomy. In 2008, the Society submitted guidelines for chronic and recurrent tonsillitis to the Association of Scientific Medical Societies (AWMF), with publication expected in December 2012. The guidelines seek to define patient symptoms for chronic or recurrent tonsillitis, offer direction for and management of diagnostic and therapeutic procedures, identify recognized surgical techniques, and specify how to handle the removed tissue for diagnostic workup (AWMF 2011). To what extent the availability of a guideline results in alignment of regional surgery rates requires further monitoring.

In principle, several indicators can be used to appraise diagnosis leading to tonsillectomy in the context of external quality assurance for hospitals. In the absence of a national requirement for documentation, however, such services may have to be included (again) in the mandatory external quality assurance program for hospitals.

If it turns out that regional variations mainly depend on other factors that cannot be sufficiently influenced by guidelines or quality assurance, it will be necessary to discuss whether possible perverse incentives at the level of healthcare structures or reimbursement systems should be addressed.

## 4.4 Appendectomy in children and adolescents

District-specific surgical index (actual number of surgical interventions / expected number of surgical interventions) for children and adolescents between 5 and 19 years old; OPS-Code 5-470: appendectomy; indirectly standardized according to age groups and sex; years 2007 to 2009; Germany = 1.




Source: IGES; German Federal Statistical Office (DRG_OPSvier, Stat_Bev_EA)

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## Context

Appendicitis (an inflammation of the appendix) is among the most frequent causes of hospitalization. Between 2007 and 2009, on average about 127,000 appendectomies (surgical removals of the appendix) per year were performed. Appendicitis occurs most often in children and adolescents as well as young adults, according to diagnostic data from the 2009 hospital diagnosis statistics. Around 38% of all appendectomies are performed on 5- to 19-year-olds, 58% on 5- to 29-year-olds.

Appendicitis is ordinarily marked by sudden onset. Suspected appendicitis is an indication for appendectomy. There is no diagnostic method to confirm or refute appendicitis with certainty. The judgment of the surgeon in charge plays a pivotal role in the decision for or against surgery (DIMDI 2006).

Diagnosing acute appendicitis is not easy; it mainly relies on fairly unspecific symptoms such as right lower abdominal pain, fever, and elevated inflammatory markers, along with the patient's medical history. Less critical decisions may increase the number of unnecessary operations, while watchful waiting may increase the rate of potentially life-threatening perforation. According to the literature, between 12% and 28.8% of removed appendices turn out to be normal (BQS 2004).

## Magnitude of regional variation

In Germany in 2009, about 46,500 children between 5 and 19 years old underwent appendectomy. However, the rate of surgery differs markedly between districts. It was six times higher in the district with the highest surgical index (2.3) – relative to the number of 5- to 19-year-olds living there – than in the district with the lowest index (0.4). When the 20 districts at each extreme are excluded, the range of the surgical index for the intermediate districts remains approximately 2.5-fold (0.6 to 1.6). The range of variation hardly diminishes if the population base is extended to 5- to 29-year-olds (surgical index 0.4 to 2.2).

## Hypotheses and options for action

Regional differences in the diagnosis leading to appendectomy may be a key reason for the marked variations in surgical intervention. Whether low rates of surgery in some regions represent a medically appropriate level or whether they correlate with a higher incidence of perforations or other complications would require further analyses. Until 2003, appendectomy was included in the legislatively mandated audit in the context of external quality assurance of hospitals. One of the data points audited was the proportion of cases with suspected acute appendicitis that is confirmed postoperatively. In 2003, this proportion was below 50% in 53 of 1,092 hospitals. That is, more than half of all patients who underwent surgery in these 53 hospitals did not have an inflamed appendix, and the operation was unnecessary. These hospitals were advised to conduct a structured analysis of the causes ("Structured Dialogue"), which was to include data for the quality indicator "perforation and preoperative length of stay" (BQS 2004). This indicator measures the percentage of patients with postoperatively confirmed perforation of the appendix who had been hospitalized for more than one day prior to surgery.

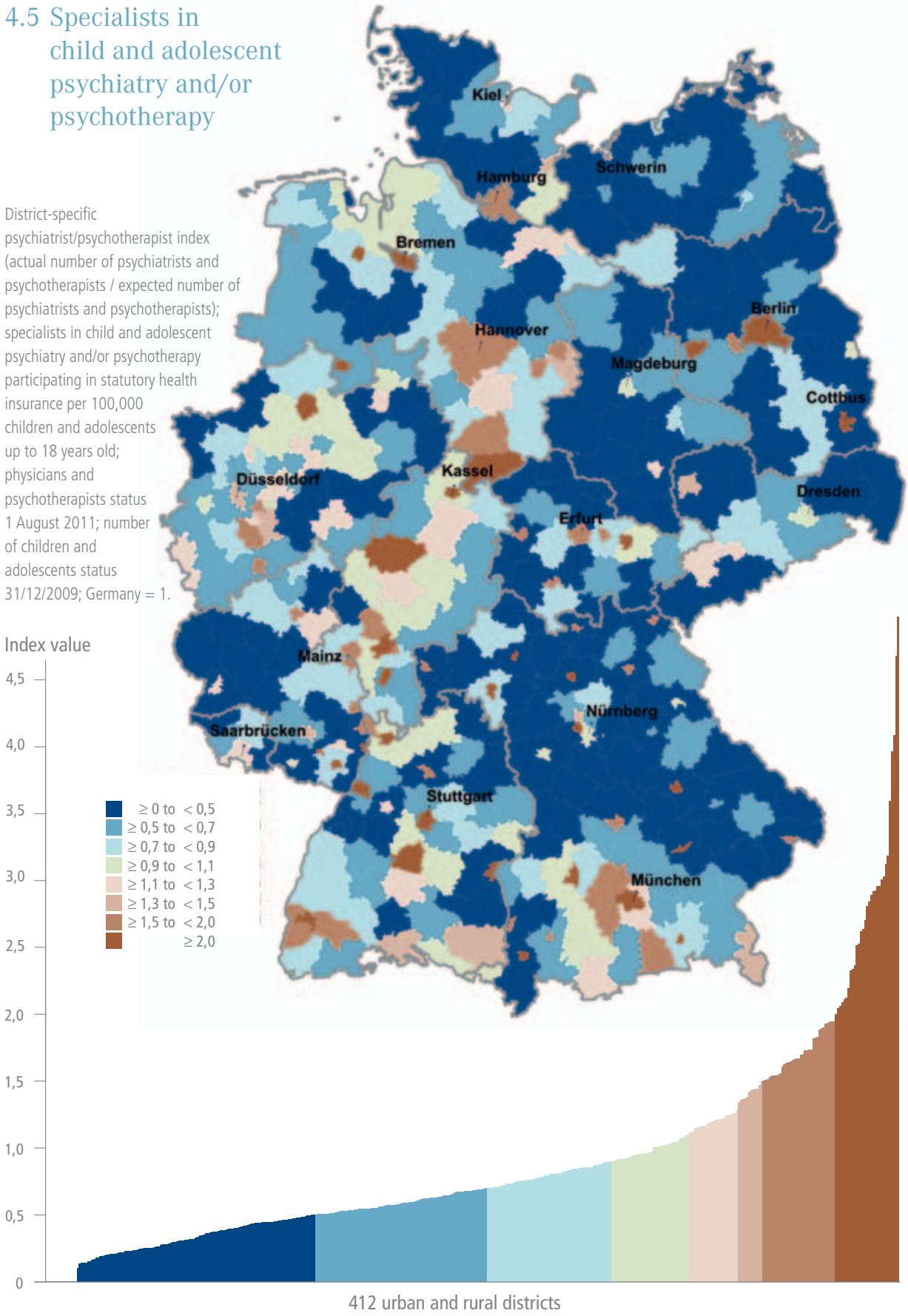
Feedback by external quality management could be helpful for surgeons having to decide on operations in the future. Nevertheless, surgeons in charge will still be held accountable for their decisions on indications for appendectomy based on properly conducted risk assessment. The surgeon must weigh the risk of possible perforation against the risk of an appendectomy, which is lower than that of other abdominal operations. Less experienced surgeons might tend toward risk avoidance and a higher surgery rate.

However, since 2004 German hospitals have not been required to document appendectomies for external quality management – a decision reflecting the prolonged stability of the country's healthcare situation (BQS 2004).

The large regional differences in rates of activity should lead to further analyses of the relevant clinical specialties. It will be necessary to examine which approaches can support medical decision-making in order to minimize the risk of perforation while keeping the surgery rate as low as possible.

## 4.5 Specialists in child and adolescent psychiatry and/or psychotherapy

District-specific psychiatrist/psychotherapist index (actual number of psychiatrists and psychotherapists / expected number of psychiatrists and psychotherapists); specialists in child and adolescent psychiatry and/or psychotherapy participating in statutory health insurance per 100,000 children and adolescents up to 18 years old; physicians and psychotherapists status 1 August 2011; number of children and adolescents status 31/12/2009; Germany = 1.




Source: IGES; Stiftung Gesundheit (Stat_KuJ), German Federal Statistical Office (Stat_Bev_EA)

## Context

Child and adolescent psychiatry focuses on the care – including prevention and rehabilitation – of mental, psycho-somatic, developmental and neurological disorders and diseases as well as behavioral conditions in childhood, adolescence, and young adulthood. In addition to just under 200 inpatient institutions or departments for child and adolescent psychiatry – which usually also provide outpatient care – Germany has about 900 office-based specialists in child and adolescent psychiatry (KBV 2010). An important element of care tends to be psychotherapy, which is also offered by child and adolescent psychotherapists, of whom about 3,000 provide outpatient care (KBV 2009). Furthermore, mental and developmental disorders as well as behavioral conditions are treated – in the sense of primary care – by approximately 7,000 pediatricians (KBV 2010).

This analysis combines two types of specialists, namely psychiatrists and psychotherapists who provide mental health care for children and adolescents in outpatient practice, under the heading "Specialists in child and adolescent psychiatry and/or psychotherapy." Psychiatric outpatient clinics of hospitals are not included, as they are intended only for severely ill patients who cannot be adequately cared for by office-based statutory health insurance (SHI) physicians (Vereinbarung PIA). According to the German Health Interview and Examination for Children and Adolescents (known as KiGGS), about 12% of girls and 18% of boys 3 to 17 years old have mental health problems (Hölling et al. 2007). Literature reviews arrive at similar prevalence estimates (Barkmann & Schulte-Markwort, 2004). Of course, this epidemiological evidence does not allow direct inferences about the number of children and adolescents who need treatment. Increasingly discussed, however, is a shift in the health and illness pattern of children and adolescents, with mental health problems becoming increasingly important – a phenomenon referred to as the "new morbidity" (Schlack 2004; BMFSFJ o.J.).

## Magnitude of regional variation

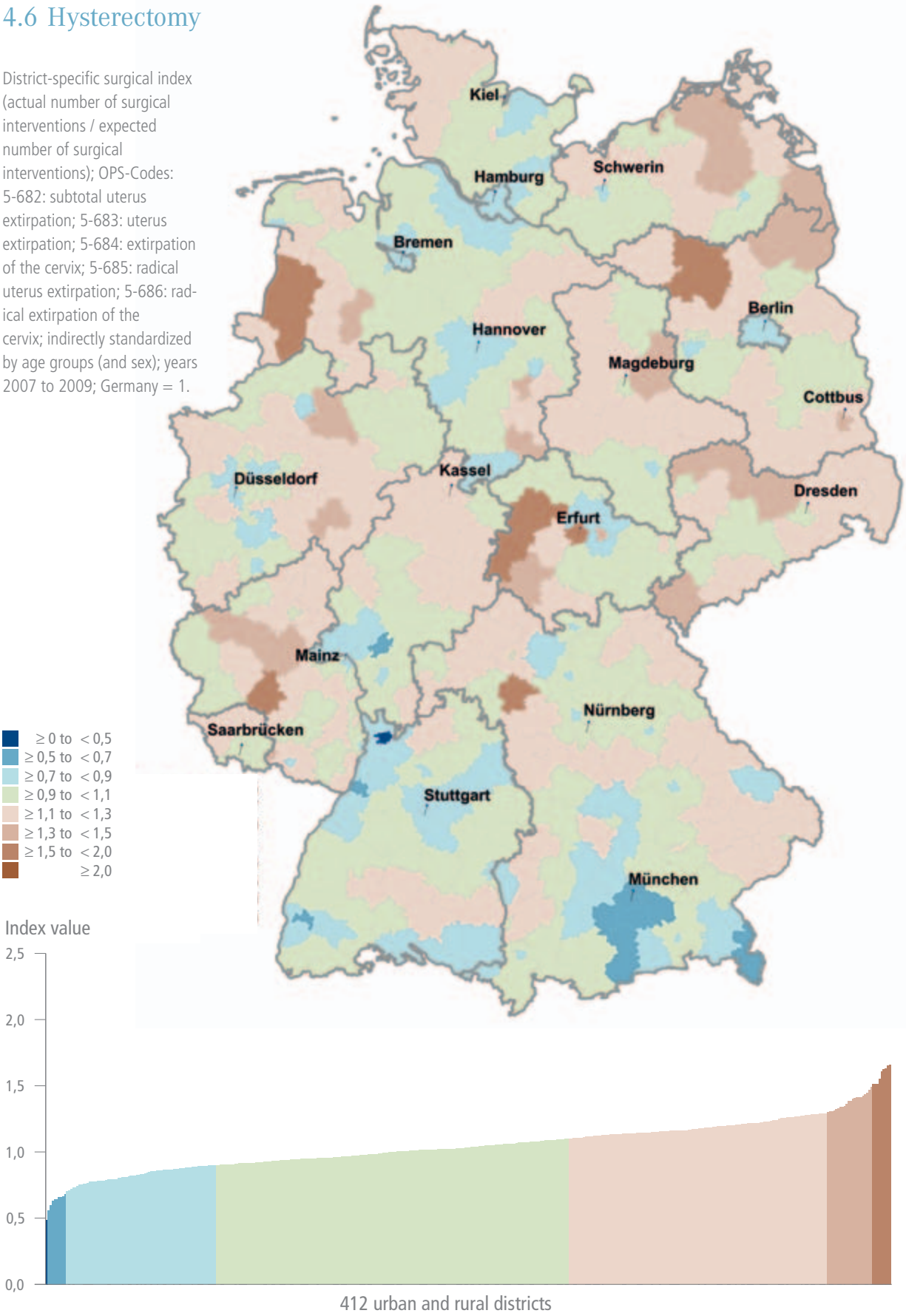
The map shows an unusual picture: In the large majority of districts, supply capacities are (considerably) below the national average. Above-average values are found almost exclusively in metropolitan areas or university cities. When the 20 districts at each extreme are excluded, the provision of care is still 16.6 times higher in the district with the highest index value than in the district with the lowest index value. An analysis of concrete figures highlights the extremely unequal distribution: Nationwide, on average there are about 29 child and adolescent mental health specialists for every 100,000 people up to 18 years old. However, more than 70% of all districts fall below this national average. In 15 districts, not a single child and adolescent psychotherapist or psychiatrist has an office. The national average is largely determined by a few cities with a markedly higher supply density; at the top there are up to 150 specialists per 100,000 children and adolescents.

## Hypotheses and options for action

The number of physicians and psychotherapists authorized to practice in a certain region as SHI physicians is regulated in the Joint Federal Committee's directive on need-related planning. Depending on the specialty and type of region, the directive stipulates an "inhabitants-per-physician" ratio that is considered the general appropriate level of care (§ 2 Directive on Need-related Planning). Moreover, threshold values define oversupply or undersupply. If oversupply is ascertained, the district is closed for additional offices. The needs planning directive explicitly considers only specialties that included more than 1,000 SHI-physicians on 31/12/2009 as the reference date. Therefore, it does not cover child and adolescent psychiatrists. In principle, many regions could have additional office practices. In addition, the needs planning directive assigns child and adolescent psychotherapists to the overall category of psychotherapists; thus, they are not reported separately. It is therefore possible that regions without child and adolescent psychotherapists are described as having an "appropriate level" of mental health care. In regions closed to psychotherapists because of oversupply, the licensing committee can nevertheless identify and justify special need (§ 24 Directive on Need-related Planning). The directive sets different inhabitant-per-physician ratios for different types of region: In "inner cities" (urban districts with more than 100,000 inhabitants), one psychotherapist per 2,577 inhabitants is considered appropriate, for example, while in some rural districts the ratio is one psychotherapist per 23,106 inhabitants. Incidentally, this unequal distribution across regions inherently applies to all specialties in the current system of need-related planning. Especially for highly specialized medical fields, an unequal distribution across regions can be justified. However, the observed variation in supply density among outpatient SHI mental health specialists for children and adolescents hardly represents appropriate provision of care. Sound reform of the need-related planning system is needed, along with measures ensuring that children and adolescents in all regions have access to outpatient mental health care by specialists near where they live. This also includes preventive care and auxiliary pedagogical and social care services.

## 4.6 Hysterectomy

District-specific surgical index (actual number of surgical interventions / expected number of surgical interventions); OPS-Codes: 5-682: subtotal uterus extirpation; 5-683: uterus extirpation; 5-684: extirpation of the cervix; 5-685: radical uterus extirpation; 5-686: radical extirpation of the cervix; indirectly standardized by age groups (and sex); years 2007 to 2009; Germany = 1.




Sources: IGES; Federal Statistical Office (DRG_OPSvier, Stat_Bev_EA)

## Context

Partial or total removal of the uterus is one of the most frequent surgical interventions in gynecology and obstetrics. It is performed under a specialty commonly available in hospitals, from general hospitals to university hospitals. To a rather large and regionally diverse extent, it is also provided by office-based physicians with special admitting rights (Federal Statistical Office 2011). Among all interventions considered here, about 157,000 were performed in 2007 and only about 148,000 in 2009. While the number of hysterectomies (OPS-Code 5-683) decreased from about 138,000 to 125,000 between 2007 and 2009, the number of subtotal hysterectomies (OPS-Code 5-682) climbed from about 9,000 to 14,000 in the same period.

Indications for surgical removal of the uterus are manifold, and even the proportion of different reported indications differs among sources. Most reasons for hysterectomy are benign conditions (uterine fibroids in about 40% of cases, endometriosis in about 17% of cases, uterine prolapse in about 14.5% of cases), with malignant conditions presenting in "only" about 9% of cases (Thill et al. 2008). Depending on the indication and the patient's nonmedical situation, different therapeutic options may exist. Hysterectomy is a surgical intervention that can entail a broad spectrum of complications and always leads to a loss of fertility. Hysterectomies for benign tumors in women under the age of 35 require critical surveillance; the development of rates of activity is therefore monitored in the context of legislatively mandated external quality assurance in German hospitals (AQUA 2010).

## Magnitude of regional variation

The rate of surgical intervention differs across German districts. The rate is three times higher in the district with the highest index (1.7) than in the district with the lowest index (0.5). When the 20 districts at each extreme are excluded, the range drops to only about twofold (0.8 to 1.4). The map highlights that the rate of surgical interventions among women living in (larger) cities tends to be below average or above average.

## Hypotheses and options for action

Regional differences in the rate of hysterectomies and the diagnosis leading to this surgical intervention have been discussed in many countries over several decades, because evidence had indicated that a substantial proportion of hysterectomies were performed without sufficient indication (Klemperer 1990). Furthermore, public information campaigns about regional frequencies of hysterectomy and the necessity for surgery can suffice to substantially reduce rates of surgery (Domengighetti et al. 1988).

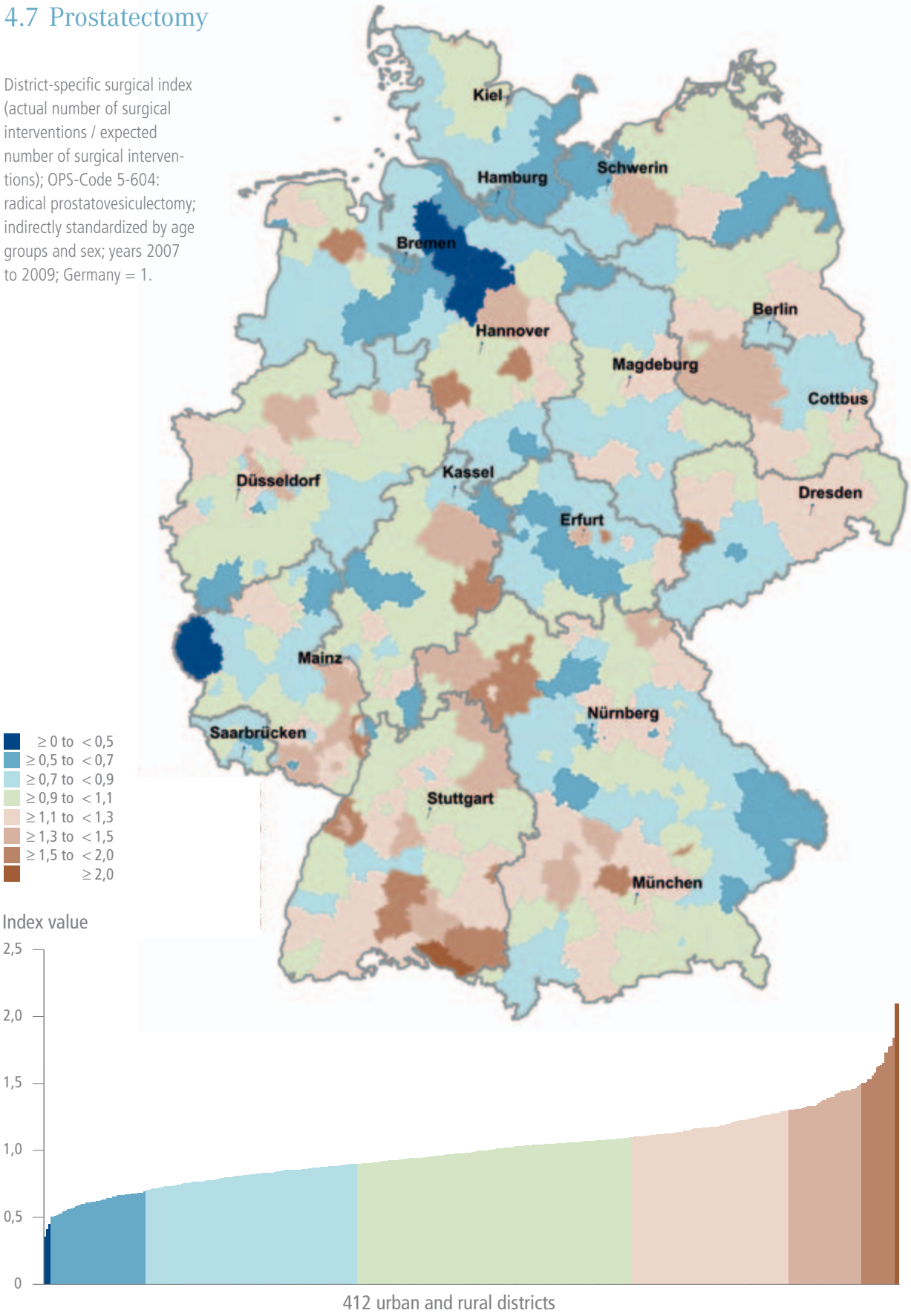
The persistent variations suggest that the diagnosis leading to hysterectomy is given more freely in some regions than in others. Statements regarding the "appropriate" rate of hysterectomy cannot be made. Professionals are increasingly discussing which indications for hysterectomy are unequivocal and which create discretion – aided by advances in treatment options – for patients and/or physicians to decide that hysterectomy could be avoided (e.g., Taran et al. 2008; Rein et al. 2009).

The declining total of hysterectomies described above might indicate that diagnoses in recent years have involved a more critical approach. And yet the treatment of uterine fibroids, for example, has not sufficiently included new and especially conservative procedures (Taran et al. 2008). Contributing factors might be the extent to which hospitals and physicians have access to all relevant diagnostic measures and the rate at which information about new treatment options spreads and is generally applied. This certainly also concerns the office-based gynecologists who have some influence on the patient's choice of a hospital for further treatment. Such differences might help to explain regional variations in the rate of hysterectomy. In 2010, the German Society for Gynecology and Obstetrics (Gesellschaft für Gynäkologie und Geburtshilfe / DGGG) announced a project to develop clinical guidelines for decisions about, performance of, and post-operative care of hysterectomy, including appraisal of alternative surgical interventions, by the end of 2011 (AWMF 2011).The guideline is also intended to address the indication for hysterectomy in light of a patient's current medical status and potential later complications, as well as alternatives to hysterectomy. The guidelines will apply to office- and hospital-based gynecologists. Its target group includes patients with an equivocal indication for surgical intervention (AWMF 2011). To what extent the availability of guidelines will lead to alignment of regional hysterectomy rates is a topic for further study.

Special attention should be given to translating the guidelines into material that can broaden patients' awareness of treatment options depending on their diagnosis. If a surgical intervention aims to improve quality of life by relieving symptoms, shared decision-making will be vital. There must be clarity about how the patient weighs her symptoms and the probability of positive and negative treatment outcomes.

## 4.7 Prostatectomy

District-specific surgical index (actual number of surgical interventions / expected number of surgical interventions); OPS-Code 5-604: radical prostatovesiculectomy; indirectly standardized by age groups and sex; years 2007 to 2009; Germany = 1.




Sources: IGES; Federal Statistical Office (DRG_OPSvier, Stat_Bev_EA)

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## Context

In Germany, about 58,500 new cases of prostate cancer are diagnosed and about 11,000 men die of the disease each year (Robert Koch Institut / RKI 2010). Radical prostatovesiculectomy (complete removal of the prostate, seminal vesicles, and in some cases nearby lymph nodes) is one of the therapeutic options for diagnosed prostate cancer. From 2007 to 2009, the national average for complete prostatectomies reported by hospitals was about 29,500 cases; thus, about half of diagnosed patients underwent surgery. Prostate cancer normally grows relatively slowly, causing hardly any pain or symptoms in its early stage. Most prostate cancers diagnosed today have a good prognosis. Four of five men with prostate cancer die from another disease (PATLL_ProstataCa I). Prostate cancer is often detected incidentally (e.g., during the examination of a benign enlargement of the prostate) or via digital rectal exams or PSA testing. In recent decades, screening has increased the number of tumors diagnosed in early stages, though potentially at the cost of overdiagnosis and overtreatment (DGU 2011, Draisma et al. 2009).

Treatment depends on medical findings and the patient's overall health status, age, and preferences. One therapeutic option for local or locally advanced prostate cancer is radical prostatectomy. If the tumor can be removed completely, surgery can help cure the patient. Serious negative side effects of surgery are incontinence among 35% of patients and erectile dysfunction among 58% of patients (Wilt et al. 2008).

Apart from surgical intervention, which can entail complications and adverse effects, other prostate-preserving therapeutic options exist. These include percutaneous radiotherapy and internal radiotherapy as well as hormone therapy to support treatment of locally advanced or metastasizing cancer. These methods also entail undesirable side effects whose severity and magnitude can be comparable to those of radical prostatectomy (Wilt et al. 2008). Under some circumstances, active surveillance may be an alternative to surgical intervention, radiotherapy or pharmacotherapy. This "watchful waiting" relies on careful monitoring of the tumor for signs of progression (DGU 2011). Hyperthermia, cryotherapy, and high intensity focused ultrasound (HIFU, for localized prostate cancer) are other treatment modes, but these are not advisable as (routine) therapy (DGU 2011, PATLL_ProstataCaII 2009, PATLL_ ProstataCa I 2009).

## Magnitude of regional variation

The frequency of surgical intervention differs markedly across German districts. Almost six times as many radical prostatectomies were performed in the district with the highest index (2.1) as in the district with the lowest index (0.4). When the 20 districts at each extreme are excluded, the range is still more than twofold (0.6 to 1.5).

## Hypotheses and options for action

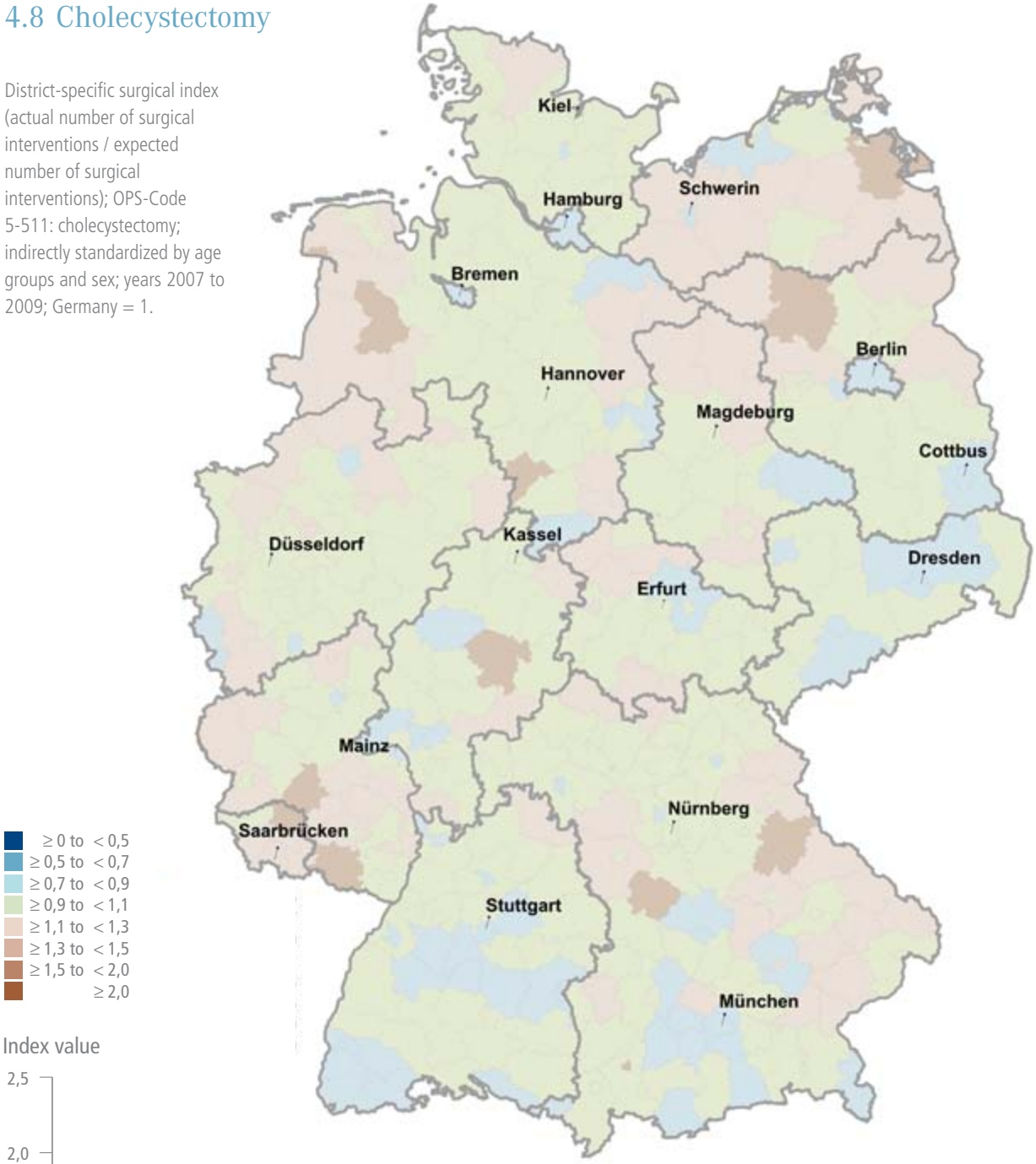
Biomedical findings are not sufficient to justify radical prostatectomy. The patient should have the opportunity to weigh the expected desirable and undesirable treatment outcomes depending on his personal situation and health status. In contrast to almost all other types of cancer, patients with a low risk profile (low spread of the tumor, well-differentiated cells and low PSA values) can choose watchful waiting and undergo invasive treatment only if the tumor shows signs of progression.

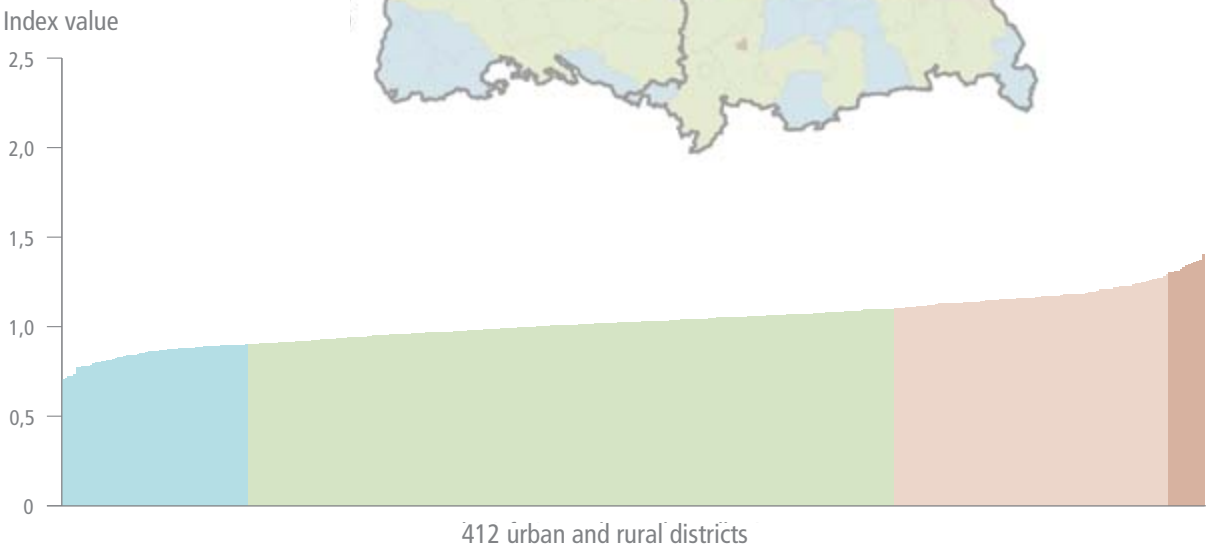
Studies show that in about half of all men with prostate cancer, the tumor has a low risk profile (Copperberg et al. 2007). Further research is needed to determine whether the observed regional variations in radical prostatectomy are influenced by the frequency of PSA testing and/or the availability of radiotherapy. But regional variations may also arise because shared decision-making to weigh the tradeoffs among all treatment options is not uniformly prevalent across regions. The clinical guidelines of the Germany Society for Urology (DGU 2011) call for educating patients with local, non-metastasizing prostate cancer about possible options (timely local therapy, watchful waiting, palliative care) and informing patients for whom local curative treatment is advised not only about radical prostatectomy, percutaneous radiotherapy, and brachytherapy, but also about watchful waiting.

Moreover, patients with prostate cancer should take the opportunity – explicitly recommended in the clinical guidelines (DGU 2011) – to consult both an urologist and a radiotherapist about the advantages and disadvantages of radical surgery and radiotherapy, before they make a treatment choice. The clinical guidelines have already been translated into evidence-based patient guidebooks.

## 4.8 Cholecystectomy

District-specific surgical index (actual number of surgical interventions / expected number of surgical interventions); OPS-Code 5-511: cholecystectomy; indirectly standardized by age groups and sex; years 2007 to 2009; Germany = 1.




Sources: Federal Statistical Office (DRG_OPSvier, Stat_Bev_EA)

## Context

Around 15% to 20% of the German population can be said to be gallstone carriers. According to the S3-Guidelines for Diagnosis and Treatment of Gallstones, surgery is indicated in the case of medical conditions due to verified gallstones or acute cholecystitis (inflammation of the gallbladder). Cholecystitis represents the most frequent complication of gallstone disease caused when a gallstone temporarily or permanently obstructs the cystic duct. Most individuals with gallstones will never have symptoms. Therefore, the mere presence of gallstones does not indicate surgery. Possible reasons for surgery include calcification of the gallbladder wall, stones with a diameter greater than 3 cm, or gallbladder polyps measuring more than 1 cm in diameter indicating elevated risk for gallbladder cancer. Options for conservative treatment of cholelithiasis are rather limited. Litholysis (dissolving gallstones by special medication) might be considered in a very few cases. Extracorporeal shock wave lithotripsy (ESWL) shows poor long-term results compared to laparoscopic cholecystectomy (S3-Leitlinie 2007). Removal of the gallbladder is performed about 190,000 times a year in Germany rather consistently – usually as laparoscopic surgery.

## Magnitude of regional variation

Districts show comparatively little variation in terms of surgery rates. The rate of cholecystectomies is twice as high in the district with the highest surgical index (1.4) as in the district with the lowest index (0.7). When the 20 districts at each extreme are excluded, the range drops to 1.5fold (0.8 to 1.3). A look at the outliers shows that residents of major cities tend to have below-average or average surgery rates. In contrast, rural inhabitants in certain federal states (Mecklenburg-Western Pomerania, Brandenburg, Lower Saxony, North Rhine-Westphalia, Bavaria, and Rhineland Palatinate) have surgery rates above the national average.

In some cases, the gallbladder is removed in the course of laparotomy or laparoscopic surgery undertaken for other reasons. When these cases were excluded, the patterns of regional variation showed no appreciable change.

## Hypotheses and options for action

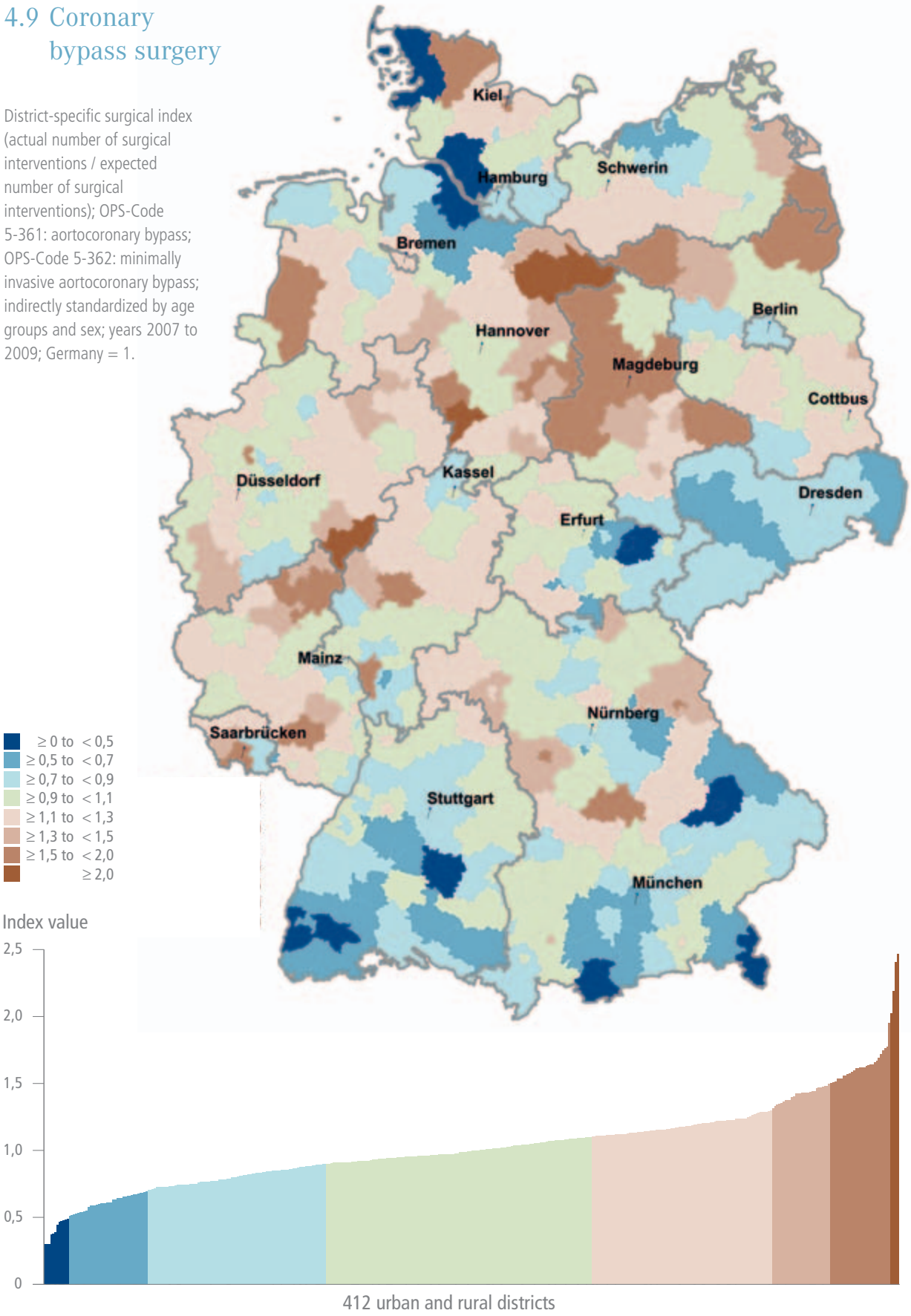
Previous studies had already found no substantial regional variation in gallbladder removal. Based on 1998–2001 data grouped by federal state, a survey found that the rate of surgical intervention varied from 2.2 to 2.9 per 1,000 inhabitants (Gerste 2003). That observation is confirmed for 2007 to 2009 in this analysis by region. The fact that the regional variations in cholecystectomy rates are lower than those for other surgical interventions may reflect longstanding and well-embedded standards of decision making.

Nevertheless, findings such as the local variations between urban and rural areas could provide a starting point for further investigation and discussion. Studies should include indicators such as risk factors for gallstone disease (e.g., obesity), availability of hospital beds for visceral surgery, and local structures for outpatient surgery. It is conceivable that regional variations in cholecystectomy rates might correlate with surgical capacity in terms of hospital beds and operating rooms, as well as their utilization rates when available. Higher cholecystectomy rates in regions with below-average capacity utilization could suggest that cholecystectomies are performed too often. It would be useful for analyses to allow comparison with hospital-specific results from external quality management that also include nearly all cholecystectomies. One quality indicator concerns the percentage of cholecystectomies performed under a questionable indication, such as nonspecific right upper abdominal pain with no signs of cholestasis, no evidence of gallstones, and no signs of acute inflammation. For the clear majority of hospitals, however, external quality management results in this area tend to lie below defined discrepancy thresholds (AQUA 2010).

Whether and how frequently cholecystectomy is done as outpatient surgery might also influence regional variations in inpatient cholecystectomy data. To date, simple laparoscopic cholecystectomy without bile duct revision (78 % of inpatient cholecystectomy) is not considered standard outpatient surgery in Germany. Other countries are more progressive in this field. In the United States about 50 % (among Medicare patients), in Sweden 11% and in Norway 12% of cholecystectomies are performed using minimally invasive surgical methods on an outpatient basis (Oberender & Partner 2010).

## 4.9 Coronary bypass surgery

District-specific surgical index (actual number of surgical interventions / expected number of surgical interventions); OPS-Code 5-361: aortocoronary bypass; OPS-Code 5-362: minimally invasive aortocoronary bypass; indirectly standardized by age groups and sex; years 2007 to 2009; Germany = 1.




Sources: IGES; Federal Statistical Office (DRG_OPSvier, Stat_Bev_EA)

## Context

Coronary heart disease (CHD) is a narrowing of the coronary arteries that supply blood to the heart (atherosclerosis). It is one of the most widespread diseases. Accounting for 15.8 % of total mortality in Germany (2009), CHD and myocardial infarction are among the leading causes of death. Frequency of CHD markedly increases with age.

Depending on the stage and symptoms of the disease, treatment involves medication, percutaneous intervention with angioplasty and possibly stenting, or coronary bypass surgery. According to Germany's national healthcare guidelines for chronic CHD, intervention or surgery are considered if angina pectoris (chest pain) can no longer be managed with medication (NVL Chron KHK 2011). Bypass surgery is preferred over catheterization if the patient has more than one diseased coronary artery or the left main coronary artery is affected (ibid.).

In coronary bypass surgery, the flow of blood is diverted around constricted or obstructed coronary arteries to improve blood supply to the heart. Ordinarily, the procedure uses healthy blood vessels taken from the patient´s own body, such as lower leg veins or chest wall arteries.

## Magnitude of regional variation

Districts show substantial variation in the frequency of bypass surgery. Surgery is performed eight times as often in the district with the highest surgical index (2.5) as in the district with the lowest index (0.3). When the 20 districts at each extreme are excluded, the range is still threefold (0.5 to 1.6).

## Hypotheses and options for action

Currently, most patients for whom drug therapy fails will undergo angioplasty (percutaneous coronary intervention). The rate of bypass surgery has been declining for years, while angioplasty rates have risen (Bruckenberger 2009).

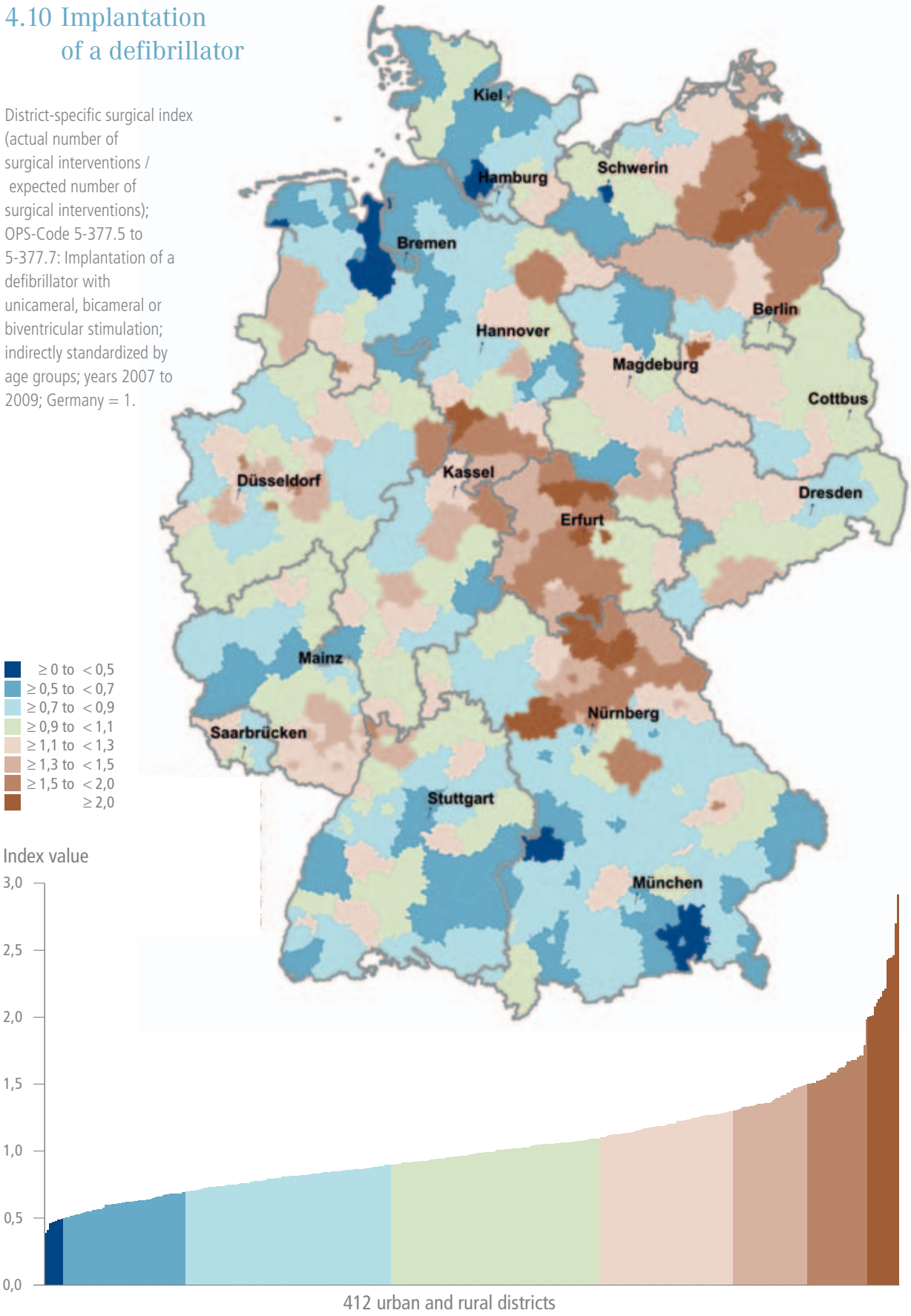
As the most invasive form of treatment, bypass surgery should be limited to cases in which the prospect of success justifies the higher surgical risk. The 2011 national guidelines (see Context, above) describe two constellations meeting this criterion according to current medical knowledge. Existing evidence for regional differences in prevalence of CHD (RKI 2011) might partly explain the regional variation in demand for bypass surgery. Nevertheless, the observed regional variation in bypass surgery far surpasses that expected due to differences in CHD prevalence alone.

There is no medical definition of an appropriate rate of bypass surgery. Further in-depth research is needed to determine whether the low rates of bypass surgery observed in certain regions indicate undersupply due to overemphasis on the other two treatment options (medication, angioplasty) or the very high rates of bypass surgery in other regions indicate oversupply and the potential for greater use of less invasive procedures.

The national guidelines for chronic CHD recommend informing patients before any form of treatment about how it can help achieve therapeutic goals such as relief of symptoms, better quality of life and a more favorable course of disease (NVL Chron KHK 2011). To promote shared and informed decision-making between doctor and patient and help patients cope with their disease, patient guidelines on chronic coronary heart disease were published in 2007 (PL Chron KHK 2008). Studies are also needed to determine whether patient involvement in medical decision-making has already been implemented consistently nationwide.

## 4.10 Implantation of a defibrillator

District-specific surgical index (actual number of surgical interventions / expected number of surgical interventions); OPS-Code 5-377.5 to 5-377.7: Implantation of a defibrillator with unicameral, bicameral or biventricular stimulation; indirectly standardized by age groups; years 2007 to 2009; Germany = 1.




Sources: IGES; Federal Statistical Office (DRG_OPSend, Stat_Bev_AG, Stat_Bev_EA)

## Context

An implantable cardioverter defibrillator (ICD) is a small battery-powered device that is implanted into patients with life-threatening cardiac arrhythmia. A defibrillator monitors the heart rhythm. If the heart beats with an abnormal rate or rhythm, the ICD delivers an electrical pulse to get the heart beating normally again. Like a cardiac pacemaker, the battery-powered defibrillator is implanted near the patient's heart. Defibrillators come in various types (single chamber, dual chamber, biventricular) to suit the patient's condition (Hemmer et al. 2009; Larisch und Buschek 2010).

The major purpose of defibrillator implantation is to prevent sudden cardiac death, one of the most common causes of death (Jung et al. 2006). Researchers estimate that 13–18.5% of deaths are caused by sudden cardiac arrest (Tebbenjohanns et al. 2008). In Germany, sudden cardiac arrest (diagnosis code ICD-10 I46) ranked among the 50 most common causes of death in 2009, with 4.1 deaths per 100,000 inhabitants (www.gbe- bund.de). Presumably the rate is higher, as some sudden cardiac deaths are probably reported with another diagnosis as the cause of death.

Various treatment guidelines define which clinical pictures warrant an implanted defibrillator. One prerequisite is considerable risk of sudden cardiac death because of severe dysrhythmia (ventricular tachyarrythmia) (Jung et al. 2006). Moreover, the patient must have a life expectancy of at least one year. The implantation of a defibrillator prior to occurrence of life-threatening cardiac dysrhythmia (primary prevention) is recommended only under very specific conditions (Hoppe et al. 2008; NVL Chron Herzinsuff 2011).

Clinical guidelines state that defibrillator implantation is indicated for patients who have survived a cardiac arrest or who suffer from a specific form of cardiac dysrhythmia (ventricular tachycardia) with a long-term disruption of blood circulation and whose clinical values fall within a critical range (secondary prevention).

## Magnitude of regional variation

In the timeframe from 2007 to 2009, on average there were about 21,500 defibrillator implantations per year in Germany. However, the frequency varied between regions: In the district with most ICD-implantations, 7.5 times as many defibrillators were implanted as in the district with the fewest ICD-implantations. The large regional difference is not only due to extreme outliers: When the 20 districts at each extreme are excluded, the range is still threefold (0.5 to 1.7).

A regional clustering of ICD implantations in central Germany (northern Bavaria, Thuringia, southern Lower Saxony) and in eastern Mecklenburg–Western Pomerania. Relatively few ICD implantations are reported for the south and north of Germany.

## Hypotheses and options for action

The frequency of heart disease as well as cardiac mortality are known to exhibit regional variations (RKI 2006). A small part of regional differences in ICD implantations could thus be attributable to actual differences in population need across regions.

Surgical implantation of cardioverter defibrillators may only be performed in specialized hospitals that comply with certain technical, staffing, and hygiene requirements (Jung et al. 2006). Furthermore, ICD implantations are a relatively new treatment option. Innovations are normally introduced in a few specialized hospitals (centers) and then gradually spread to other hospitals. This may mean that frequencies of implantation are higher in the area immediately surrounding such centers than in more distant regions. It is difficult to determine the extent to which one instance reflects overuse while another signals underuse.

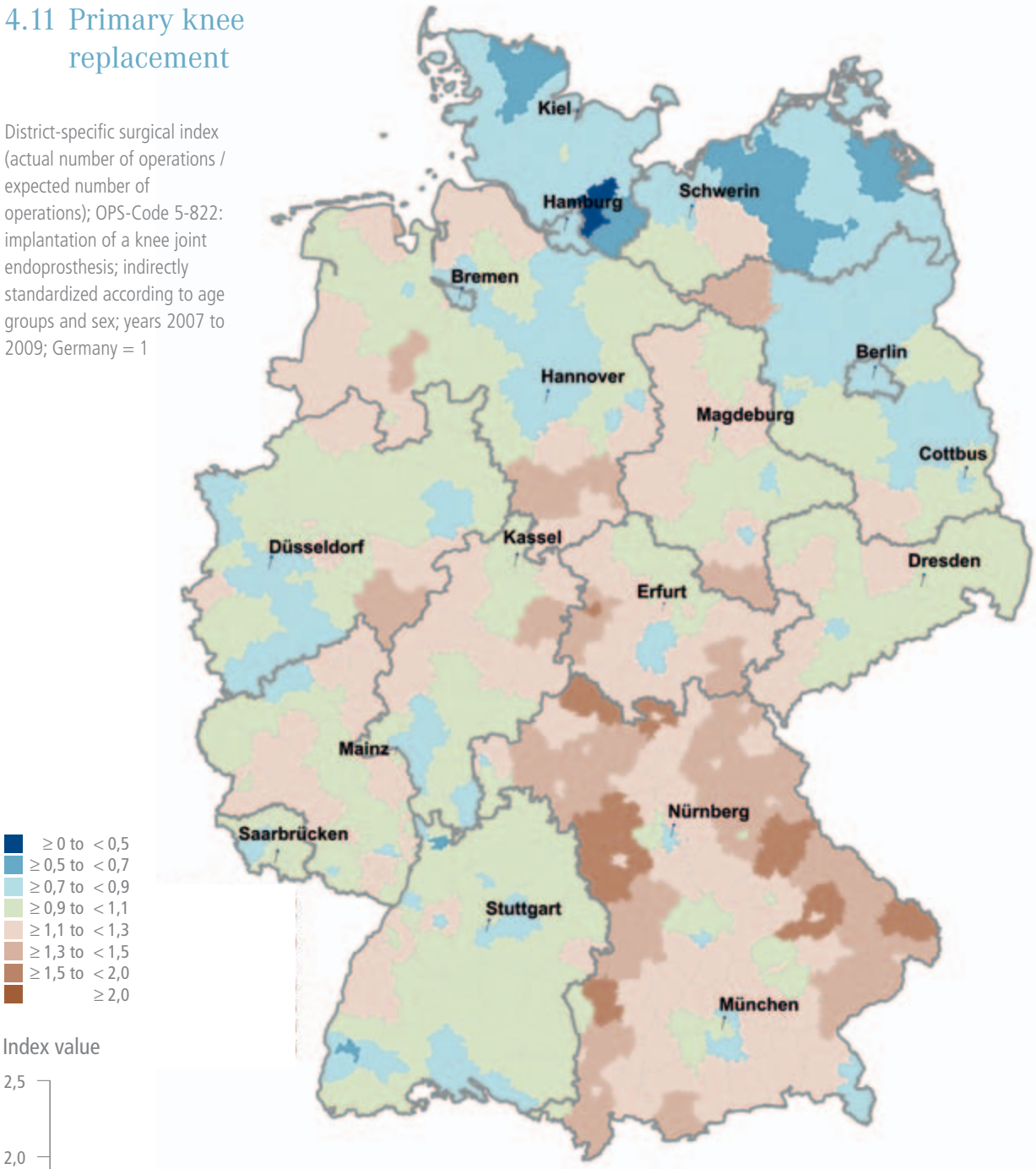
Another consideration is that defibrillator implantation is a cost-intensive procedure and that a hospital might be able to generate financial advantages from higher volumes. Sickness funds and hospitals might well discuss volume trends, which could certainly lead to regional variations in the level of services.

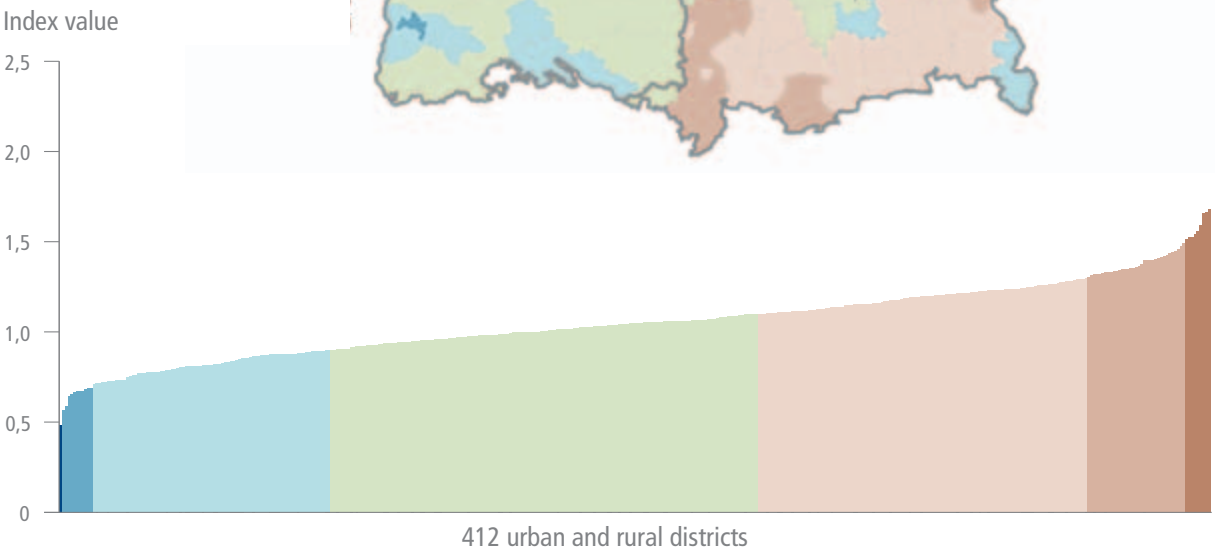
Moreover, regional variations may reflect differences in interpretation of clinical guidelines, which especially for primary prevention merely give Level 2 ("we suggest") recommendations regarding ICD implantation (NVL Chron Herzinsuff 2011). For specific clinical constellations, alternative therapies (catheter ablation, medication) are recommended (Tebbenjohanns et al. 2008). A study in the United States showed that among 23% of patients there, treatment did not conform to international clinical guidelines. In particular, for many patients a defibrillator was implanted too early in the treatment process or without an indication for such treatment (Al-Khatib et al. 2011).

This form of therapy inherently demands full participation by the patient in shared decision-making. Other countries have already developed "decision aids" for this purpose (e.g. Canada – www.healthwise.net).

## 4.11 Primary knee replacement

District-specific surgical index (actual number of operations / expected number of operations); OPS-Code 5-822: implantation of a knee joint endoprosthesis; indirectly standardized according to age groups and sex; years 2007 to 2009; Germany = 1




Sources: IGES; Federal Statistical Office (DRG_OPSvier, Stat_Bev_EA)

## Context

Knee replacement surgery most often becomes necessary when the joint damage causes severe pain and limited mobility and when other treatment methods (medication, physical therapy, orthopedic measures, lifestyle changes, etc.) or conservative surgery can no longer provide long-term relief. In Germany, professional societies now provide precise guidelines concerning indications for total knee replacement (AQUA 2010). Knee replacement ranks among the more expensive hospital services, due to high costs for the operation, the implant itself, and early mobilization services as well as a relatively long hospital stay.

Implantation of a knee endoprosthesis is one of the most frequent inpatient surgical procedures in Germany. The number of primary knee replacements (excluding knee revision, replacement or removal of prostheses) rose from 129,000 in 2005 to 159,000 in 2009, an increase of about 23%. In Germany, unlike certain other European countries, there is no evidence of substantial waiting lists for this surgery, which is almost always planned in advance.

## Magnitude of regional variation

Districts show substantial variation in the rate of primary knee replacement. The surgery rate is 3.5 times higher in the district with the highest surgical index (1.7) than in the district with the lowest index (0.5). When the 20 districts at each extreme are excluded, the range is still twofold (0.7 to 1.4).

Considerable variation exists in the surgery rate between federal states. In most Bavarian districts, the rate of operations exceeds the German average. The opposite is true for the northern states of Schleswig-Holstein and Mecklenburg–Western Pomerania. Meanwhile, Germany's larger cities often have only average surgery rates. However, these differences may occur in part because primary knee replacement surgery performed under integrated care contracts is not always documented in the databases used for this report.

## Hypotheses and options for action

The rising numbers of knee replacement surgery are caused by demographic aging – at least this is a widespread assumption. Based on recent studies, however, the sickness fund BARMER GEK takes the view that demographic change over the past few years is not the major cause of this increase. There are indications that primary knee replacement has become recommended more freely, raising the question of oversupply (Blitzer et al. 2010). It may be that surgery is now performed on patients who, in the past, would have been advised to wait or forego surgery altogether. Adding to the plausibility of this view is that knee replacement is a typical example of "preference-sensitive" treatment. That is, clinical findings alone do not define the need for knee replacement; the patient's subjective assessment of complaints as well as of the consequences of alternative courses of treatment should play a crucial role. Therefore, one factor in decisions for or against surgery is how fully patients are informed about different treatment options and involved in shared decision-making.

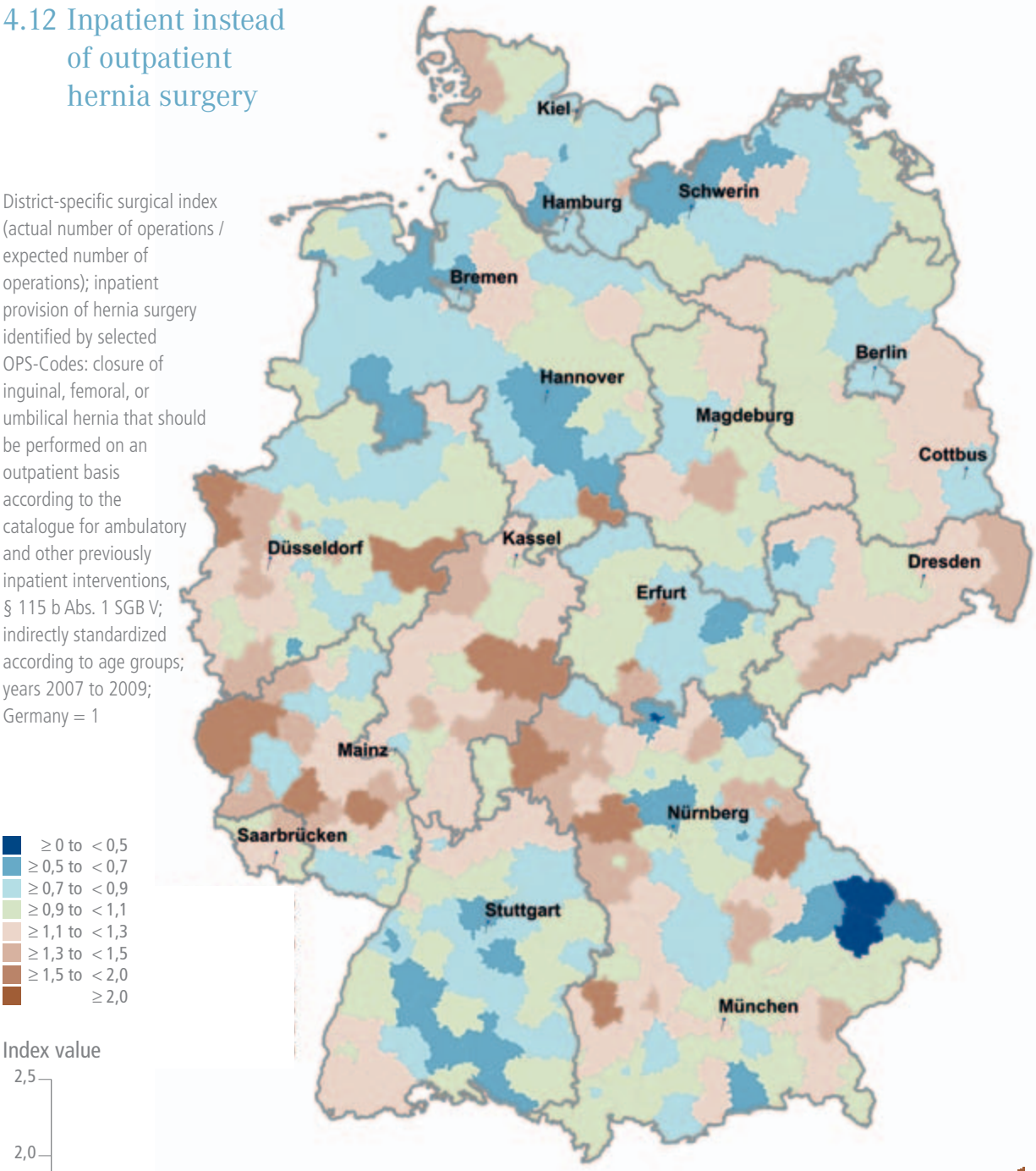
Primary knee replacement is an intervention that can generate economies of scale for a clinic. Therefore, hospitals always have an incentive to identify more patients as "in need of surgery" when this is within the range of clinically appropriate diagnoses.

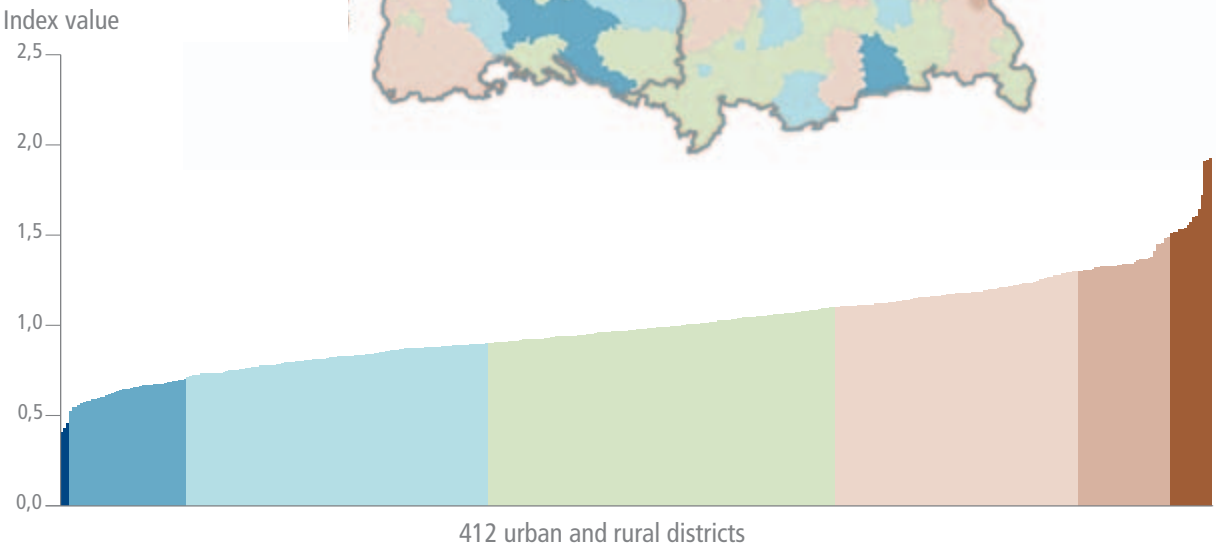
Additionally, primary knee replacement may increasingly be perceived by the public as a low-risk standard procedure, which, given good prospects of success, is requested even when pain and disability are at relatively low levels.

Thus, there is much to suggest that regional variations in utilization arise from different approaches to the decision-making process from one region to another. The results of Germany's public external quality assurance support this hypothesis. In 2009, almost 200 out of 1,022 hospitals reported computationally discrepant results for rendering the appropriate indication for primary knee replacement. This included 114 hospitals that had shown statistically discrepant results the year before. Therefore, the Federal Expert Committee for Orthopaedics and Trauma Surgery sees a "particular need for action" in regard to this quality target: Discrepant results are to be discussed among specialists; existing guidelines updated and new ones developed; and hospitals provided targeted support for implementation. In addition, analysis is necessary "as to whether inappropriate indications for primary knee joint implantations might be caused by wrong incentives within the remuneration system" (AQUA 2010).

## 4.12 Inpatient instead of outpatient hernia surgery

District-specific surgical index (actual number of operations / expected number of operations); inpatient provision of hernia surgery identified by selected OPS-Codes: closure of inguinal, femoral, or umbilical hernia that should be performed on an outpatient basis according to the catalogue for ambulatory and other previously inpatient interventions, § 115 b Abs. 1 SGB V; indirectly standardized according to age groups; years 2007 to 2009; Germany = 1




Sources: IGES; Federal Statistical Office (DRG_OPSvier, Stat_Bev_EA)

## Context

Surgery for inguinal, femoral or umbilical hernia ranks among the most common surgical procedures performed in hospital in combination with inpatient admission in Germany. Depending on the surgical approach, however, hernia surgery can also be performed without hospital admission. Such outpatient surgery is performed by office-based statutory health insurance physicians or by salaried hospital specialists. Outpatient surgery is usually less costly than inpatient surgery and also allows patients to spend the night after surgery at home in a familiar environment.

A catalogue published in 2004 lists outpatient and other previously inpatient procedures in accordance with §115 b Par. 1 of Social Code Book V (SGB V), clearly specifying hospital procedures that should in principle be performed on an outpatient basis. As a result, outpatient surgery delivered by hospitals has increased substantially since 2004. Exceptions to outpatient surgery may be made if the patient's situation meets certain criteria related to such factors as the severity of the disease, co-morbidities, the need for intensive care, and social situations.

Between 2007 and 2009, on average 111,000 hernia operations per year were performed as inpatient surgery that should in principle have been performed on an outpatient basis. This implies the presence of exceptional circumstances, as described above. In two thirds of these cases, the patient was up to 70 years old.

## Magnitude of regional variation

The rate of inpatient hernia surgery is 4.5 times higher in the district with the highest index value (surgical index 1.9, national average 1) than in the district with the lowest index value (0.4). When the 20 districts at each extreme are excluded, the range is still twofold (0.6 to 1.4).

Closer examination, however, reveals differences among federal states and for the majority of larger cities. Thus, the rate of hernia cases indicated for outpatient surgery but instead performed as inpatient procedures is above the national average in most districts in Saxony, Hessen and Rhineland-Palatinate, and below the national average in most districts in Lower Saxony, Mecklenburg–Western Pomerania and Schleswig-Holstein.

## Hypotheses and options for action

The clear regional differences in the rate of inpatient instead of outpatient hernia surgery are surprising. For one thing, standard guidelines exist; for another, sickness funds have greatly expanded their monitoring procedures (inappropriate admissions audits) especially for such hospital cases. Ultimately, sickness funds have to pay for the additional costs incurred in inpatient treatment. Possible causes of such variations should be examined further.

Outpatient surgery is performed not only by hospitals, but also by office-based statutory health insurance physicians. The proportion of hernia operations performed on an outpatient basis (whether or not in compliance with guidelines) thus also depends on regional differences in capacity and on the willingness of office-based SHI physicians to perform outpatient surgery.

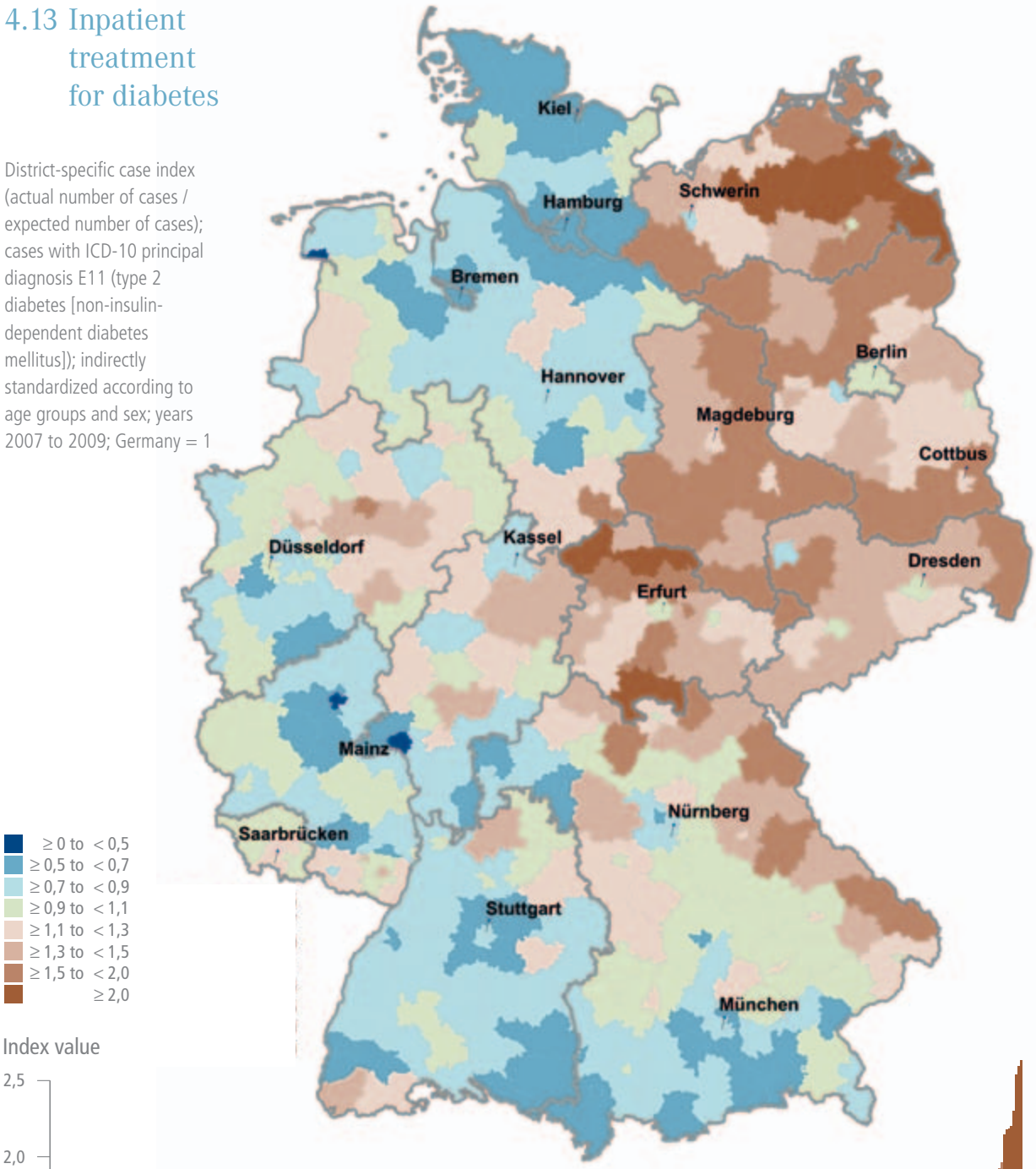
It may be that individual hospitals apply broader discretion in determining when to perform inpatient surgery, as this is economically more attractive than day-case outpatient surgery. However, it is reasonable to assume that the latitude for discretion is interpreted broadly for the patient's sake, since such factors as the availability of appropriate emergency and post-operative treatment or at-home care differ among regions.

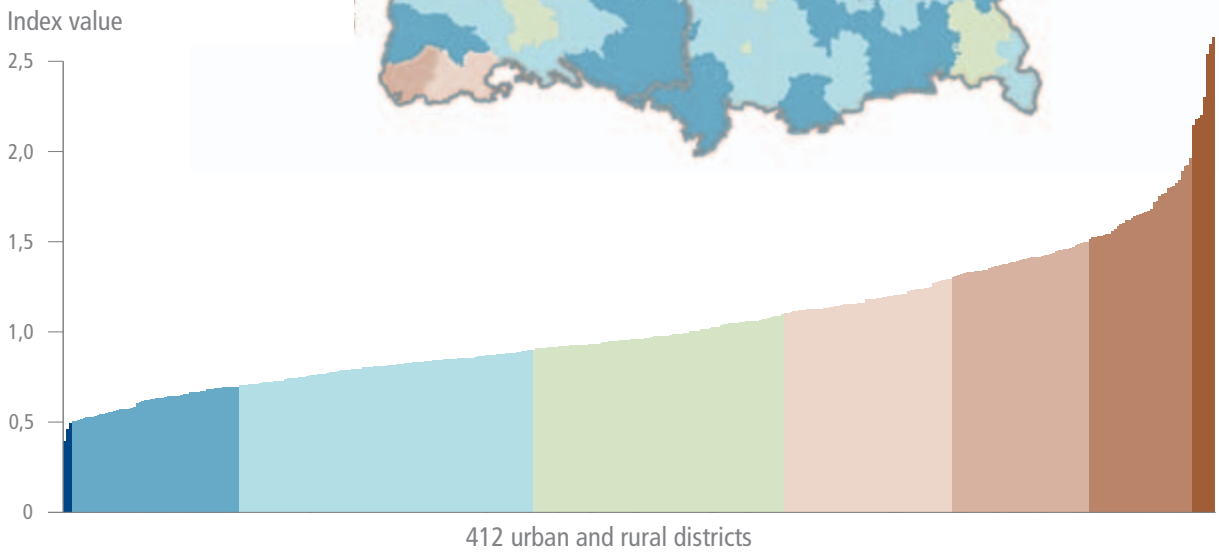
Another cause of regional variations may be that many hospitals have further developed outpatient surgery in connection with their commitment to sustainable outpatient delivery structures and to a more patient-centered profile (Fürstenberg et al. 2011). In regions where hospitals have developed economically viable structures for outpatient surgery, the number of inpatient hernia operations might decrease accordingly.

If in-depth analyses show that patient circumstances are responsible for an above-average rate of inpatient hernia surgery in some regions, models for better post-operative care might contribute to a rise in outpatient hernia surgery. For comprehensive analyses of this topic, performance information for both the outpatient statutory health insurance sector and the hospital sector needs to be considered in parallel. However, public availability of data for the outpatient SHI sector is limited compared to the inpatient sector.

## 4.13 Inpatient treatment for diabetes

District-specific case index (actual number of cases / expected number of cases); cases with ICD-10 principal diagnosis E11 (type 2 diabetes [non-insulin-dependent diabetes mellitus]); indirectly standardized according to age groups and sex; years 2007 to 2009; Germany = 1




Sources: IGES; Federal Statistical Office (DRG_OPSvier, Stat_Bev_EA)

## Context

Diabetes mellitus refers to a disruption of the carbohydrate metabolism that leads to elevated levels of sugar (glucose) in the blood. In the long term, this can damage blood vessels and entail various comorbidities or complications. In Germany, about 5.5 million people have been diagnosed with diabetes mellitus. Among these, about 90% have type 2 and about 5–10% have type 1 (Häussler et al. 2010). In the majority of new federal states (Saxony, Saxony-Anhalt, Thuringia, Brandenburg), the reported prevalence of diabetes is significantly higher among women, and in Brandenburg among men, than the national average (RKI 2011). Type 1 diabetes occurs mostly in children and young people and is characterized by a destruction of insulin-producing cells. Type 2 diabetes commonly affects older adults. The body produces too little insulin, and/or the cells no longer use insulin correctly to absorb glucose (RKI 2005). Because of demographic aging and a rise in risk factors such as obesity, an increase in disease prevalence is expected (Häussler et al. 2010).

Recommendations for the diagnosis and treatment of diabetes are enshrined in several guidelines. An important element of medical care for patients with diabetes are structured disease management programs (DMPs), which were introduced into the German Statutory Health Insurance in 2002. As of February 2011, more than 3.4 million people were enrolled in a DMP for type 2 diabetes (BVA II).

The frequency of inpatient treatment for diabetes is considered an indicator of the appropriateness and utilization level of outpatient care structures (ambulatory care sensitive condition, ACSC). For example, the DMP for type 2 diabetes specifies that patients should be treated first by their general practitioner, see an office-based specialist in case of complications or comorbidities, and be admitted to a hospital only in case of emergency (RSAV Appendix 1). A higher level of inpatient care utilization in a region may thus also signal insufficiencies in outpatient care.

In 2009, more than 170,000 patients with a principal diagnosis of type 2 diabetes were hospitalized, with almost three fourths of these in internal medicine departments.

## Magnitude of regional variation

The rate of inpatient hospitalizations for diabetes mellitus varies substantially across German districts. Inpatient treatment for diabetes is 6.6 times more frequent (relative to the expected number of cases) in the district with the highest case index (2.6) than in the district with the lowest case index (0.4). When the 20 districts at each extreme are excluded, the range is still threefold (0.6 to 1.7). Regional variations suggest a strong East-West differential and in some regions an urban-rural differential. Especially in the new federal states, but also in some rural regions in Bavaria, Hessen and North Rhine–Westphalia, the case index for inpatient diabetes treatment is considerably above the national average, while for larger cities fewer hospitalizations are reported.

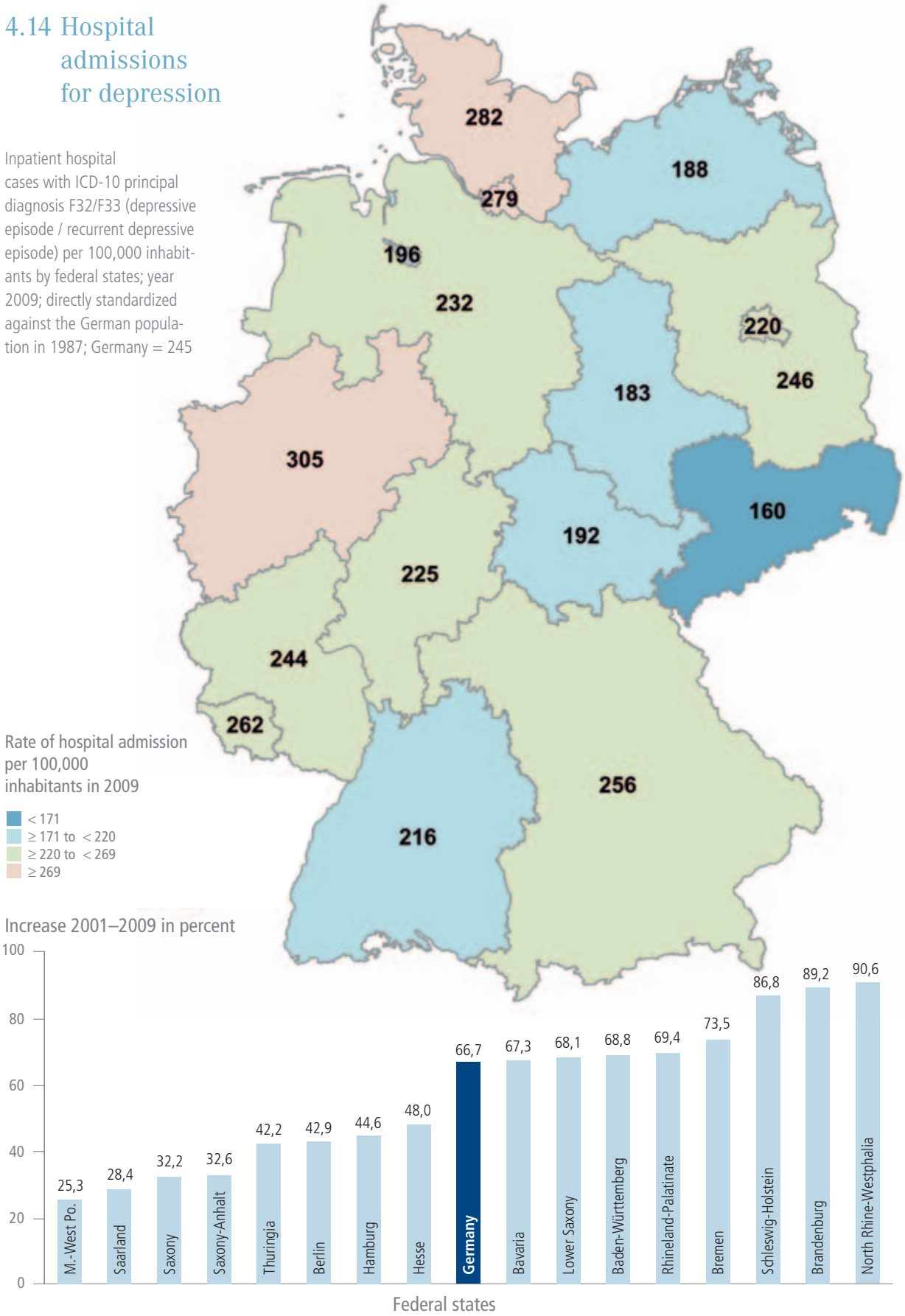
## Hypotheses and options for action

There are various possible reasons for regional variations in hospitalizations for type 2 diabetes. The above-average rate of hospitalizations in many regions in the east of Germany might reflect a greater prevalence of diabetes in these districts (RKI 2011). On the level of health care delivery, a higher hospitalization rate could arise from a lower density of physicians or more limited access to general practitioners and appropriate specialists, for example in rural areas. Resulting lapses in blood glucose control might increase the frequency of metabolic imbalances, which in turn might lead to hospitalization. On the other hand, the new federal states have an above-average density of medical practices specializing in diabetes care (Siegel 2010).

In general, inhabitants of rural areas have a higher risk of avoidable hospitalizations (Frank 2009), which might be reflected in the observed differences in inpatient treatment for type 2 diabetes. These health care differences should receive further study. For example, analyses of hospitalizations that could have been prevented with appropriate primary care structures would be helpful. Moreover, model projects for diabetic care in rural regions could yield approaches to appropriate management of the condition and help relieve existing bottlenecks in primary care. In addition, recent surveys among people with diabetes show that they do not make adequate use of regular check-ups or preventive care services, and many have low levels of physical activity (DBB 2011). Further education is still needed, especially to provide information on diabetic complications, along with effective behavioral and situational prevention (Häussler et al. 2010).

## 4.14 Hospital admissions for depression

Inpatient hospital cases with ICD-10 principal diagnosis F32/F33 (depressive episode / recurrent depressive episode) per 100,000 inhabitants by federal states; year 2009; directly standardized against the German population in 1987; Germany = 245




Sources: IGES; Federal Statistical Office (Stat_ICDKHStat)

## Context

Depression-related disorders are widespread. According to the 1998 Federal Health Survey, about 18% of the German population experience depression at least once in their lifetime. On any given day, about 6% of people 18 to 65 years of age have experienced depression requiring professional help within the last four weeks (Wittchen et al. 2000). Depressions follow an episodic course, that is, they usually fade away after some time even without treatment. But a substantial proportion of patients suffering from depression for the first time experience further episodes and even chronic depression. In addition to the risk of chronic illness, it is above all the high risk of suicide that makes depression a very severe problem.

Mild and moderate depressive disorders are usually treated by general practitioners and office-based psychiatrists or psychotherapists. Admission to a clinic is necessary especially in case of acute danger of suicide or psychotic symptoms such as delusions or hallucinations. Hospitalization is also indicated in severe courses of depression or if outpatient care is not sufficient (S3-Leitlinie 2011).

## Magnitude of regional variation

For this report, we analyzed the number of admissions because of initial or recurrent depressive episodes at the level of German federal states (Bundesländer). North Rhine–Westphalia, with 305 cases per 100,000 inhabitants in 2009, reported almost twice as many cases as Saxony (160 cases). Strikingly, the total number of cases increased by 67 % from 2001 to 2009 in Germany, and even by 90% in North Rhine–Westphalia, but by only 25 % in Mecklenburg–Western Pomerania. The substantial increase in admissions was not accompanied by a corresponding decrease in length of hospital stays. Thus, it cannot be concluded that a shift from long hospital stays to several shorter stays (a "revolving door effect") explains the higher number of admissions.

## Hypotheses and options for action

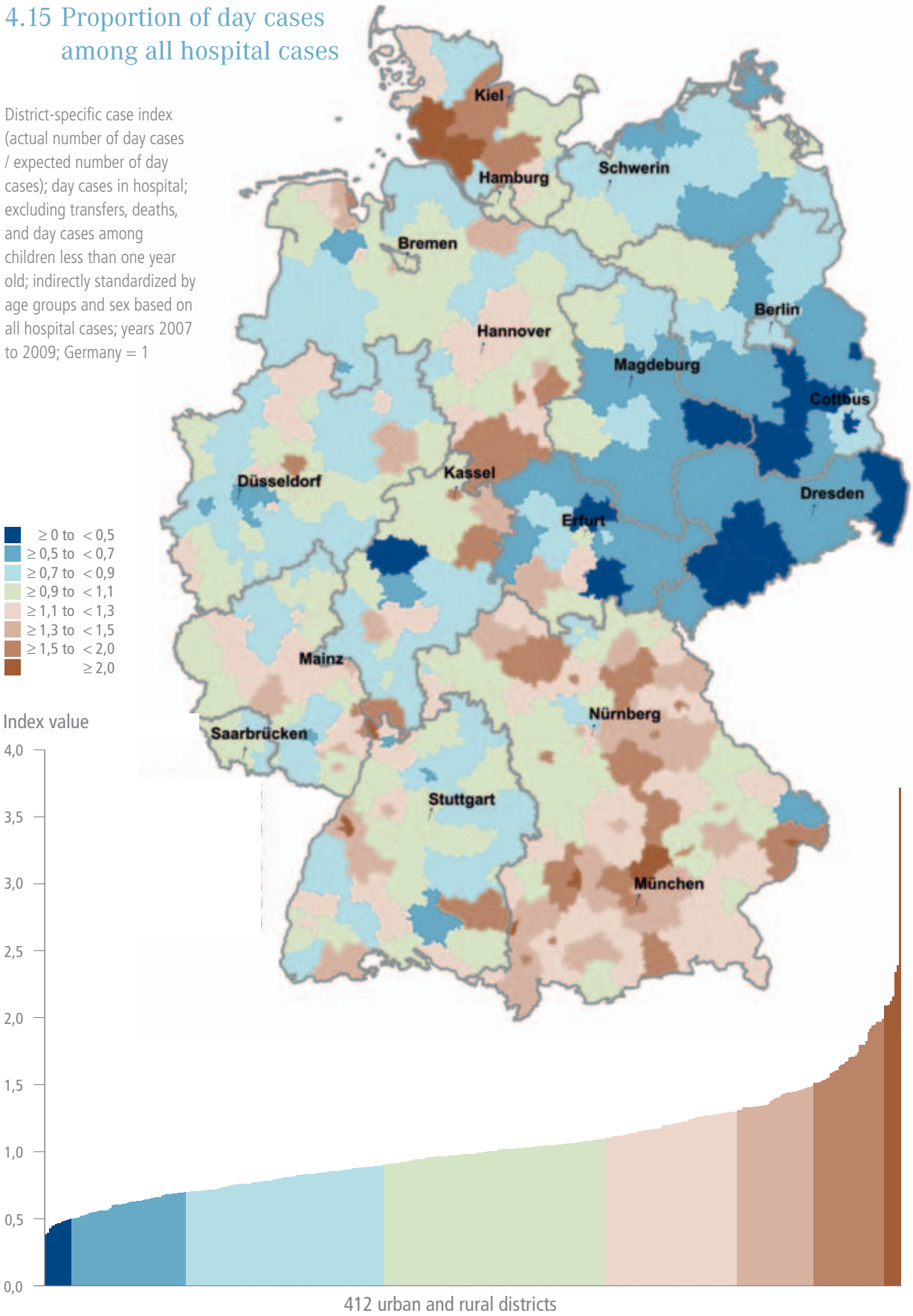
It is unlikely that these marked regional differences reflect differences in the distribution of severe major depression or suicidal risk across Germany's federal states. Rather, the regional availability of outpatient care also has an influence on whether patients make use of inpatient psychiatric care. All patients, and particularly the chronically or severely ill, need well-developed structures of outpatient care – psychiatrists and psychotherapists, but also occupational therapy, day clinics, assisted accommodations, homes for patients with psychic disorders, and structures for crisis intervention. A lack of these outpatient structures presumably triggers more hospitalizations.

In addition to the regional variation, the increase in hospitalizations over time seems remarkable. Nationwide, hospitalizations for major depression rose by 5% to 10% every year from 2001 to 2009. Occasionally, better diagnostic efforts are discussed as a reason for the rising numbers. But at most, that would seem to apply to less severe cases (DAK Gesundheitsreport 2005). There is no evidence for a rising incidence of severe major depression requiring inpatient treatment. Nor can it be said that outpatient care capacities have been so markedly reduced.

To prevent a further rise in hospital admissions for psychiatric care for depression, improvements in outpatient community-based psychiatric care structures and in particular better coordination among existing services can be worthwhile. On the other hand, correlations between the rate of inpatient treatment and the degree of development of outpatient care seem to be complex. In a recent survey, the German Chamber of Psychotherapists (BPtK 2011) revealed extremely long waiting lists for outpatient first-line psychotherapy in the new states of the eastern part of Germany, where (except in Brandenburg) hospitalization rates for an initial or recurrent episode of depression are below average. This underscores the need for further investigation of other factors relating to supply-sensitive care, such as the regional supply of psychiatric hospital beds as well as financial incentives for hospitals.

## 4.15 Proportion of day cases among all hospital cases

District-specific case index (actual number of day cases / expected number of day cases); day cases in hospital; excluding transfers, deaths, and day cases among children less than one year old; indirectly standardized by age groups and sex based on all hospital cases; years 2007 to 2009; Germany = 1




Sources: IGES; Federal Statistical Office (DRG_Stundenfälle, DRG_ICD10vier)

## Context

Hospital day cases ("Stundenfälle") is a technical term describing patients who have been admitted to a hospital and are discharged, are transferred to another hospital, or die on the same day (Stat. Bundesamt 2011a). In Germany, medical care should follow the principle "outpatient trumps inpatient care." A full inpatient admission is justified only if medical care cannot be delivered on an outpatient or partial inpatient basis. Full inpatient hospital services are remunerated differently than other services, such as ambulatory surgery, that are part of the outpatient service spectrum. Reimbursement of full inpatient treatment depends among factors such as the diagnosis (or diagnoses), procedures performed, and length of stay. Day cases can be billed as a full inpatient day and thus ordinarily tend to generate higher payment than the corresponding fee for outpatient care.

In 2009, German hospitals treated more than 516,000 patients as day cases in line with the above definition; this corresponds to just under 3% of all hospital cases. The number of day cases increased between 2008 and 2009 by 1.8%, somewhat more than the overall number of hospital cases (up by 1.6%) (Stat. Bundesamt 2011a). The principal diagnoses for day cases cover a broad spectrum of diseases. In 2009, the most common reasons for treatment were diseases of the circulatory system at 14.9% (about 78,000 cases); mental and behavioral disorders at 14.4% (about 78,000 cases, including about 49,000 cases alcohol-related); and injuries, poisoning, and other consequences of external forces at 11.8% (Stat. Bundesamt 2011a, own calculations).

In this analysis, day cases are cleared of cases referred elsewhere on the day of admission, deaths on the same day, and infants less than one year old. Also excluded are day cases in psychiatric, psychosomatic, and/or psychotherapeutic specialist departments. For the years 2007 to 2009, the total remaining number of day cases averaged about 330,000 per year.

## Magnitude of regional variation

The number of day cases billed in the district with the highest index value was 9.7 times the number in the district with the lowest index value. When the 20 districts at each extreme are excluded, the range drops to 3.2-fold (0.5 to 1.7). Regionally, a clustering of day cases can be observed in many regions of Bavaria and some districts in Hessen, in the south of Lower Saxony, and in the west of Schleswig-Holstein. Day cases tend to be below the national average in the new federal states, but also in some districts of all the other federal states.

## Hypotheses and options for action

At the interface between outpatient and inpatient care – especially in emergency care – it sometimes happens that a full inpatient admission seems necessary and yet the patient can be discharged that same day. For example, the patient's health status may unexpectedly improve within a short time; diagnostic results may not confirm the initially suspected condition; or patients may refuse to stay in hospital (e.g., with alcohol abuse). Hospitals can bill such cases as day cases.

Hypotheses for the strong regional variations in day cases take a number of factors into consideration. For cases in the interface between outpatient and inpatient care, hospitals have several billing options. They can consider classifying treatment as a day case, but also as emergency care or as pre-admission treatment without subsequent hospitalization. The assignment of a case to a billing category may well be influenced by the incentives for each option – that is, the financial consequences, but also how closely such invoices are scrutinized by sickness funds (or by the Medical Review Board of the Statutory Health Insurance Funds).

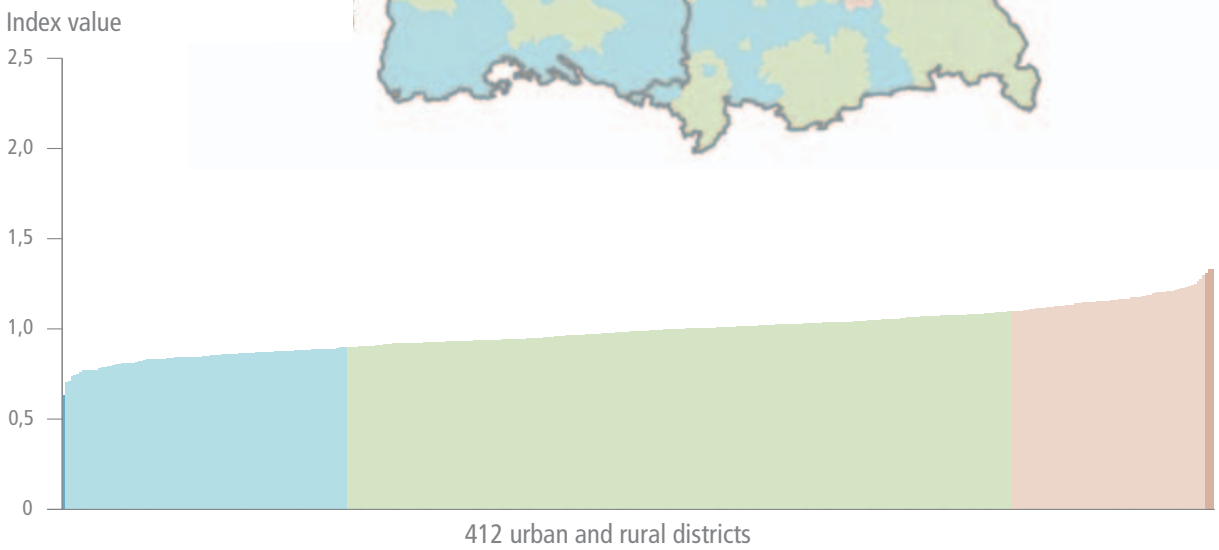
Under certain circumstances, deliberate avoidance of same-calendar-date discharges can reduce the number of day cases. Incentives are subject to regional variation, because different remuneration regulations and monitoring systems apply. It may also be assumed that hospitals and sickness funds have agreed to specific protocols for the classification of borderline cases and that these could contribute to the marked regional variations in the number of day cases.

However, regional differences in the frequency of day cases can also be influenced by ambulatory care structures. It is plausible to assume that some patients who become hospital "day cases" could have been treated entirely as outpatients if the appropriate structures had been in place. Emergency room capacities might likewise influence the frequency of day cases: In cases of doubt, the decision whether to admit a patient depends on the outpatient physicians' experience but also on the resources actually available to adequately determine the patient's health status. When the emergency department is overburdened, the number of "defensive" inpatient admissions might rise.

The underlying reasons for the marked regional variation in day cases merit further study, as do the possibilities for moving such cases into outpatient care structures.

## 4.16 Proportion of deaths in hospital among people at least 75 years old

District-specific proportional quotient: (actual number of deaths in hospital / actual number of all deaths) ÷ (expected number of deaths in hospital / expected number of all deaths); deaths in hospital and all deaths among people at least 75 years old; indirectly standardized according to age groups and sex based respectively on all deaths in hospital and all deaths; years 2007 to 2009; Germany = 1




Sources: IGES; Federal Statistical Office (DRG_Sterbefälle, Stat_Sterbe, Stat_BEV_EA)

## Context

Deaths in hospital are defined as deaths that occur during fully inpatient hospital stays (Federal Statistical Office 2011). In 2009, a total of 408,310 patients died in hospital. This represents about 48% of all deaths in Germany as well as 2.2% of all hospital cases. The number of deaths in hospital increased by 1.8% between 2008 and 2009, a rate slightly higher than the growth in the total number of cases (up 1.6%). Among all people who died in hospital, just under 60% (243,272 patients) were at least 75 years old. Frequent principal diagnoses among people at least 75 years old who died in hospital were diseases of the circulatory system (35.4%), malignant tumors (12.6%), and pneumonia (8.7%) (Federal Statistical Office, in part own calculation).

Regional variations in the proportion of people dying in hospital can be expected especially when there are relevant differences in family structures and alternative institutional structures for terminal care (nursing homes, hospice care, outpatient care).

## Magnitude of regional variation

The proportion of deaths in hospital of people at least 75 years old among all deaths in this age group varies among districts. In the district with the highest proportion, the value was 2.1 times higher than in the district with the lowest proportion (index value 0.6 to 1.3, national average 1). When the 20 districts at each extreme are excluded, the range remains 1.5-fold (0.8 to 1.2). Districts with a higher proportion of deaths in hospital are mainly located in the new federal states, in the east of Bavaria, and in the center of North Rhine–Westphalia. In contrast, for most districts in Baden-Württemberg, Schleswig-Holstein, the west of Bavaria, and Lower Saxony, the proportion often falls below the national average.

## Hypotheses and options for action

Only a minority of people at the end of life die at home nowadays; most die in an institution. Just under half of all deaths occur in hospital.

One reason such a large proportion of deaths occur in hospital is that even in the final stage of life, many people undergo medical interventions intended to prevent or delay death. Another is that because of changes in family structures, living conditions, and the like, fewer and fewer people are in a situation that allows them to die at home in a familiar environment. Instead, in many cases the hospital constitutes the only institution that is always available for and receptive to caring for the dying. If the hospital is neither the preferred nor the most suitable place for end-of-life care, alternative medical and nursing care arrangements should (be able to) take on the hospital's role. Another issue for consideration is that in most cases, in-hospital care may well be the costliest form of care. Furthermore, observational studies in hospitals have found deficits in systematic care for incurable patients (palliative care) and terminal care (Göckenjahn 2008).

Since the variations among districts remain within a moderate range, consideration must also be given to the overall proportion of deaths in hospital. Regarding alternative arrangements for terminal care, elderly and nursing homes are a prevailing option. The proportion of deaths in nursing institutions among all deaths is estimated to be about 20% to 30% (Gaber and Wildner 2011). Experts expect another reduction in the share of hospitals and a shift to elderly and nursing homes (Bickel 1998; Fischer et al. 2004). Regional differences in the proportion of deaths in hospital may also be due to variations in the extent to which nursing homes offer terminal care. According to a recent study, about 30% of terminally ill residents of nursing homes spent their last days of life in hospital (Ramroth et al. 2006).

Under statutory health insurance, legislative requirements for palliative care are in place and have been expanded over the past years (§ 37b, § 39a SGB V). Requisites for needs-based care for severely ill and terminally ill patients have been defined at the federal level (GKV-Spitzenverband 2010). Nevertheless, there will probably be regional variations in the development of inpatient (hospice) and outpatient supply capacities. The degree of development may influence the proportion of deaths in hospital.

Terminal care by family physicians and nursing services is another alternative. A question for further analysis would be to what extent strengthened primary care structures and management of the interfaces with outpatient nursing services could reduce the proportion of deaths in hospital.

# 5. Data sources and use

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The statistics used are described in section 6.1. Possible limitations are explained in section 6.2. The chapter closes with a description of the indicators, the calculations, and potential special factors (section 6.3).

## 5.1 General description of statistics

In the following section, we describe each of the data sources used to calculate the results for each indicator. Apart from the Stat_KuJ statistics provided by the Stiftung Gesundheit (Health Foundation of Germany), these are publicly available statistics.

| Abbreviation | DRG_OPSend |
|---|---|
| Data source | Federal Statistical Office |
| Official name | Diagnosis-related group (DRG) statistics |
| Special analysis of the statistics | yes |
| Information regarding the statistics | • OPS codes without duplicates<br>• including deaths and day cases |
| Structure of the data | OPS end-digit codes according to<br>• patient's place of residence (district level)<br>• patient's age group (under 1 year, 1–4 years, 5–9 years ... 90–94 years, 95 years and older)<br>• number of OPS codes |
| Years included | 2007, 2008, 2009 |
| Changes in the original data set | • Clearing of data for individuals with<br>• unknown age group<br>• place of residence abroad, unknown or undeclared<br>• For 2007, values for Saxony districts were classified according to the district boundaries of 2009 (following the district reform).<br>• For all years, values for Berlin districts (code 110*) were cumulated under "Berlin, city" (code 11000).<br>• For 2007 and 2008, values for Aachen districts (code 05354) and "Aachen, city" (code 05313) were cumulated under "Aachen, urban region" (code 05334). |
| Data transformations | Calculation of the average value based on the number of OPS codes of years 2007 to 2009 (sum of the number of OPS codes of the years 2007 to 2009 divided by 3) |

| Abbreviation | DRG_OPSvier |
|---|---|
| Data source | Federal Statistical Office |
| Official name | Diagnosis-related group (DRG) statistics |
| Special analysis of the statistics | Yes |
| Information regarding the statistics | • OPS codes without duplicates<br>• Including deaths and day cases |
| Structure of the data | OPS end-digit codes according to<br>• patient's place of residence (district level)<br>• patient's age group (under 1 year, 1–4 years, 5–9 years ... 90–94 years, 95 years and older)<br>• patient's sex<br>• number of OPS codes |
| Years included | 2007, 2008, 2009 |
| Changes in the original data set | • Clearing of data for individuals with<br>– unknown age group<br>– place of residence abroad, unknown or undeclared<br>• For 2007, values for Saxony districts were classified according to the district boundaries of 2009 (following the district reform).<br>• For all years, values for Berlin districts (code 110*) were cumulated under "Berlin, city" (code 11000).<br>• For the years 2007 and 2008, values for Aachen districts (code 05354) and "Aachen, city" (code 05313) were cumulated under "Aachen, urban region" (code 05334). |
| Data transformations | Bildung des Mittelwertes über die Anzahl der OPS-Codes der Jahre 2007 bis 2009 (Summe der Anzahl der OPS-Codes der Jahre 2007 bis 2009 dividiert durch 3) |

| Abbreviation | DRG_ICD10vier |
|---|---|
| Data source | Federal Statistical Office |
| Official name | Diagnosis-related group (DRG) statistics |
| Special analysis of the statistics | yes |
| Information regarding the statistics | Including deaths and day cases |
| Structure of the data | Four-digit principal diagnoses according to<br>• patient's place of residence (district level)<br>• patient's age group (under 1 year, 1–4 years, 5–9 years ... 90–94 years, 95 years and older)<br>• patient's sex<br>• number of four-digit principal diagnoses |
| Years included | 2007, 2008, 2009 |
| Changes in the original data set | • Clearing of data for individuals with<br>– unknown age group<br>– place of residence abroad, unknown or undeclared<br>• For 2007, values for Saxony districts were classified according to the district boundaries of 2009 (following the district reform).<br>• For all years, values for Berlin districts (code 110*) were cumulated under "Berlin, city" (code 11000).<br>• For the years 2007 and 2008, values for Aachen districts (code 05354) and "Aachen, city" (code 05313) were cumulated under "Aachen, urban region" (code 05334). |
| Data transformations | Calculation of the average value based on the number of principal diagnoses of years 2007 to 2009 (sum of the number of OPS codes of the years 2007 to 2009 divided by 3) |

| Abbreviation | DRG_Sterbefälle |
|---|---|
| Data source | Federal Statistical Office |
| Official name | Diagnosis-related group (DRG) statistics |
| Special analysis of the statistics | Yes |
| Information regarding the statistics | • Demarcation of the selection based on the cause of discharge/ relocation "death"<br>• Including day cases |
| Structure of the data | Patients discharged from hospital (including day cases) with a cause of discharge/ relocation "death" according to<br>• patient's place of residence (district level)<br>• patient's age group (under 1 year, 1–4 years, 5–9 years ... 90–94 years, 95 years and older)<br>• patient's sex |
| Years included | 2007, 2008, 2009 |
| Changes in the original data set | • Clearing of data for individuals with<br>– unknown age group<br>– place of residence abroad, unknown, or undeclared<br>• For 2007, values for Saxony districts were classified according to the district boundaries of 2009 (following the district reform).<br>• For all years, values for Berlin districts (code 110*) were cumulated under "Berlin, city" (code 11000).<br>• For the years 2007 and 2008, values for Aachen districts (code 05354) and "Aachen, city" (code 05313) were cumulated under "Aachen, urban region" (code 05334). |
| Data transformations | Calculation of the average value based on the number of deaths of years 2007 to 2009 (sum of the number of OPS codes of the years 2007 to 2009 divided by 3) |

| Abbreviation | DRG_Stundenfälle |
|---|---|
| Data source | Federal Statistical Office |
| Official name | Diagnosis-related group (DRG) statistics |
| Special analysis of the statistics | Yes |
| Information regarding the statistics | • Demarcation of the selection based on the day cases (day cases includes patients who were fully admitted to hospital but are discharged, are relocated to another hospital, or die on the same day)<br>• Including deaths |
| Structure of the data | Patients discharged from hospital (including deaths) counted as day cases according to<br>• patient's place of residence (district level)<br>• patient's age group (under 1 year, 1–4 years, 5–9 years ... 90–94 years, 95 years and older)<br>• patient's sex |
| Years included | 2007, 2008, 2009 |
| Changes in the original data set | • Clearing of data for individuals with<br>– unknown age group<br>– place of residence abroad, unknown, or undeclared<br>• For 2007, values for Saxony districts were classified according to the district boundaries of 2009 (following the district reform).<br>• For all years, values for Berlin districts (code 110*) were cumulated under "Berlin, city" (code 11000).<br>• For the years 2007 and 2008, values for Aachen districts (code 05354) and "Aachen, city" (code 05313) were cumulated under "Aachen, urban region" (code 05334). |
| Data transformations | Calculation of the average value based on the number of day cases of years 2007 to 2009 (sum of the number of OPS codes of the years 2007 to 2009 divided by 3) |

| Abbreviation | Stat_Geburt |
|---|---|
| Data source | Federal Statistical Office (Regional data base) |
| Official name | Birth statistics |
| Special analysis of the statistics | No |
| Information regarding the statistics | Births: live births according to maternal place of residence (district level), nationality, and age group – annual total – |
| Structure of the data | Births according to<br>• maternal place of residence (district level)<br>• age group (under 20 years, 20 to under 25 years, 25 to under 30 years, 30 to under 35 years, 35 to under 40 years, 40 years and older)<br>• number of four-digit principal diagnoses |
| Years included | 2007, 2008, 2009 |
| Changes in the original data set | • Clearing of data for individuals with<br>– unknown age group<br>– place of residence abroad, unknown, or undeclared<br>• For 2007, values for Saxony districts were classified according to the district boundaries of 2009 (following the district reform).<br>• For the years 2007 and 2008, values for Aachen districts (code 05354) and "Aachen, city" (code 05313) were cumulated under "Aachen, urban region" (code 05334). |
| Data transformations | Calculation of the average value based on the number of births of years 2007 to 2009 (sum of the number of OPS codes of the years 2007 to 2009 divided by 3) |

| Abbreviation | Stat_Sterbe |
|---|---|
| Data source | Federal Statistical Office (Regional data base) (table 179-41-4) |
| Official name | Death statistics |
| Special analysis of the statistics | No |
| Information regarding the statistics | Deaths: deaths according to sex, nationality, and age groups – annual total – |
| Structure of the data | Deaths (number) according to<br>• rural and urban districts<br>• age group (under 1 year, 1 to under 5 years, 5 to under 10 years ... 80 to under 85 years, 85 years and older)<br>• sex |
| Years included | 2007, 2008, 2009 |
| Changes in the original data set | • Clearing of data for individuals with<br>– unknown age group<br>– place of residence abroad, unknown, or undeclared<br>• For 2007, values for Saxony districts were classified according to the district boundaries of 2009 (following the district reform).<br>• For the years 2007 and 2008, values for Aachen districts (code 05354) and "Aachen, city" (code 05313) were cumulated under "Aachen, urban region" (code 05334). |
| Data transformations | Calculation of the average value based on the number of deaths of years 2007 to 2009 (sum of the number of OPS codes of the years 2007 to 2009 divided by 3) |

| Abbreviation | Stat_Bev_EA |
|---|---|
| Data source | Federal Statistical Office (Regional data base) |
| Official name | Population at year's end according to urban and rural districts and age |
| Special analysis of the statistics | Yes |
| Information regarding the statistics | No |
| Structure of the data | Population at year's end according to<br>• rural and urban districts<br>• age group (under 1 year, 1 to under 2 years, 2 to under 3 years ... 89 to under 90 years, 90 years and older)<br>• sex |
| Years included | 2007, 2008, 2009 |
| Changes in the original data set | • For 2007, values for Saxony districts were classified according to the district boundaries of 2009 (following the district reform).<br>• For the years 2007 and 2008, values of the Aachen districts (code 05354) and "Aachen, city" (code 05313) were cumulated under "Aachen, urban region" (code 05334). |
| Data transformations | • Calculation of the average value for the population of years 2007 to 2009 (sum of the population of the years 2007 to 2009 divided by 3)<br>• For the calculations, data were ordinarily summarized according to sex and age groups under 1 year, 1 to under 5 years, 5 to under 9 years, 10 to under 14 years, ... 85 to under 90 years, 90 years and older |

| Abbreviation | Stat_PerinatSterb |
|---|---|
| Data source | Federal Statistical Office (Federal Health Reporting) |
| Official name | Stillbirths and deaths within the first 7 days of life per 100,000 live births and stillbirths. Stratification: years, region, sex. Statistics of natural population demographics |
| Special analysis of the statistics | no; download from: http://www.gbe-bund.de/oowa921-install/servlet/oowa/aw92/dboowasys921.xwdevkit/xwd_init?gbe.isgbetol/xs_start_neu/&p_aid=3&p_aid=46071754&nummer=377&p_sprache=D&p_indsp=-&p_aid=92017068; accessed 04/07/2011 |
| Information regarding the statistics | According to the statistics for natural population dynamics of the Federal Statistical Office: Stillbirths include (as of 01/04/1994) only children whose birth weight is at least 500 g (previously as of 01/07/1979 below 1,000 g, previously at least 35 cm body length). Miscarriages (as of 01/04/1994 under 500 g birth weight, previously as of 01/07/1979 below 1,000 g, previously less than 35 cm body length) are not registered by the registrars and are not included. |
| Structure of the data | Stillbirths and deaths within the first 7 days of life per 100,000 live births and stillbirths according to<br>• federal states<br>At least some federal states can no longer provide district-specific data. |
| Years included | 2005, 2006, 2007, 2008, 2009 |
| Changes in the original data set | No |
| Data transformations | No |

| Abbreviation | Stat_ICDKH |
|---|---|
| Data source | Federal Statistical Office (Federal Health Monitoring System) |
| Official name | Hospital statistics – diagnosis data for patients in hospitals, 2000 to 2009 (cases/deaths, cases per 100,000 population [age-standardized], billing and occupancy days, average length of stay). Stratification: years, residence, age, sex, length of stay, ICD10<br>In combination with: annually updated census results (Federal Statistical Office) |
| Special analysis of the statistics | no; download from: http://www.gbe-bund.de/oowa921-install/servlet/oowa/aw92/WS0100/_XWD_FORMPROC; accessed 17/06/2011 |
| Information regarding the statistics | Direct age standardization (standard population "Germany1987") |
| Structure of the data | Cases with a hospital principal diagnosis ICD10: F32 or F33 per 100,000 residents (age-standardized) according to:<br>• federal states |
| Years included | 2000 to 2009 |
| Changes in the original data set | No |
| Data transformations | No |

| Abbreviation | Stat_KuJ |
|---|---|
| Data source | Stiftung Gesundheit (gemeinnützige rechtsfähige Stiftung bürgerlichen Rechts)<br>Health Foundation of Germany (a nonprofit public foundation) |
| Official name | Analysis of number of child and adolescent psychiatrists and/or psychotherapists who provide care under statutory health insurance |
| Special analysis of the statistics | No |
| Information regarding the statistics | Not included are exclusively privately working physicians, hospital physicians and hospital physicians authorized to provide care under statutory health insurance |
| Structure of the data | Child and adolescent psychiatrists and/or psychotherapists according to districts |
| Years included | Data retrieved by Stiftung Gesundheit at the beginning of August 2011 |
| Changes in the original data set | • Values for older Saxony districts were allocated to districts according to the boundaries of 2009 (following the district reform).<br>• Values for the Aachen districts (code 05354) and "Aachen, city" (code 05313) were cumulated under "Aachen, urban region" (code 05334).<br>• For the older Saxony-Anhalt districts and for the districts Eisenach and Hoyerswerda, information was provided by postal code and allocated to the current districts accordingly. |
| Data transformations | No |

## 5.2 Possible limitations

Possible limitations of the statistics are identified here. If an indicator is known to be subject to any of these limitations, this is specifically pointed out in section 5.3 under the heading “Note” for that indicator.

### 5.2.1 Basic statistics for DRG_OPSend, DRG_OPSvier

In principle, the documentation of data included in the DRG statistics follows uniform standards. In particular, these include the general and special German coding guidelines (DKR) for the respective years.

Limitation 1: The DRG statistics cover only hospitals that follow the DRG billing procedure and are regulated under §1 of the Hospital Remuneration Act (KHEntgG). These statistics exclude the majority of cases treated in psychiatric, psychosomatic and/or psychotherapeutic specialist departments or treated in special facilities with indications that are very rare or difficult to standardize, as well as services provided for these cases.

Limitation 2: The data are not available at the level of the individual case. The data were cleared based on the final digit for duplicates by the Federal Statistical Office. Nevertheless, there is multiple counting of cases for which two or more OPS codes with differing final digits of a four-digit OPS code have been documented simultaneously. This includes OPS codes that document a change of procedure during an operation.

Limitation 3: The data are not available on an individual case basis: There may be multiple counting of cases for which two or more OPS codes with differing final digits have been documented simultaneously and which are reported (also on the level of OPS four-digit codes) for different indicators.

Limitation 4: The data are not available on an individual case basis: For some interventions, the side of the body can or must also be documented, and interventions performed on both sides are counted only once.

Limitation 5: For the OPS classification, the German Institute for Medical Documentation and Information (DIMDI) publishes new versions each year; the spectrum of OPS codes may be revised for a given indication within the time frame covered. This implies that the number of included OPS codes may have increased or decreased or changed in terms of content.

Limitation 6: Beyond the uniform standards (e.g., DKR), coding practices may differ among physicians, departments and hospitals. Accordingly, some OPS codes may be over- or underrepresented across regions.

Limitation 7: For the time frame under investigation, the regulations did not clearly specify whether and to what extent hospitals (must) also document those cases (services) that can be treated (provided) on a fully inpatient basis in the context of so-called Integrated Care Contracts according to Volume V §§140a-d of the Social Insurance Code (SGB V).

The Quality Report of the Federal Statistical Office provides further information.

### 5.2.2 Basic statistics for DRG_ICD10vier

In principle, the documentation of data included in the DRG statistics follows uniform standards. In particular, these include the general and specific German coding guidelines (DKR) for the respective years. The DKR also define which treatment diagnosis is to be documented as the principal diagnosis for the case: The condition established after study to be chiefly responsible for occasioning the admission of the patient to the hospital (DKR 2009).

Limitation 1: The DRG statistics cover only hospitals that follow the DRG billing procedure and are regulated under §1 of the Hospital Remuneration Act (KHEntgG). These statistics exclude the majority of cases treated in psychiatric, psychosomatic and/or psychotherapeutic specialist departments or treated in special facilities with indications that are very rare or difficult to standardize, as well as services provided for these cases.

Limitation 2: Beyond the uniform standards (e.g., DKR), coding practices may differ among physicians, departments and hospitals. Accordingly, some ICD codes may be over- or underrepresented across regions.

Limitation 3: For the ICD classification, the German Institute for Medical Documentation and Information (DIMDI) publishes new versions each year; the spectrum of ICD codes may be revised for a given indication within the time frame covered. This implies that the number of included ICD codes may have increased or decreased or changed in terms of content.

Limitation 4: The data are analyzed only by principal diagnosis. ICD codes that have been coded as secondary diagnoses (conditions or complaints either coexisting with the principal diagnosis or arising during the hospital stay; DKR 2009) and could have influenced patient management in such a way as to require therapeutic or diagnostic measures, more nursing care, or surveillance are not included.

Limitation 5: For the time frame under investigation, the regulations did not clearly specify whether and to what extent hospitals (must) also document those cases (services) that can be treated (provided) on a fully inpatient basis in the context of so-called Integrated Care Contracts according to Volume V §§140a-d of the Social Insurance Code (SGB V).

The Quality Report of the Federal Statistical Office provides further information.

### 5.2.3 Other statistics (cf. Section 5.1)

The Quality Report of the Federal Statistical Office provides further information on all other statistics (exception: Stat_KuJ statistics).

## 5.3 The indicators – calculation methods and notes

### 5.3.1 Perinatal mortality

| | |
|---|---|
| **Statistics:** | **Stat_PerinatSterb** |
| Years: | 2005 to 2009 |
| Included cases: | Stillbirths and deaths within the first 7 days of life per 100,000 live births and stillbirths according to Federal states |
| Calculation method: | No own calculation of basic data. The data were provided by the Federal Statistical Office without standardization. |

### 5.3.2 Proportion of caesarean sections among all births

| | |
|---|---|
| **Statistics:** | **DRG_OPSend** |
| Years: | 2007, 2008, 2009 |
| Included OPS codes: | 5-740.0: Classical caesarean section: primary<br>5-740.1: Classical caesarean section: secondary<br>5-740.y: Classical caesarean section: not further specified<br>5-741.0: Caesarean section, supracervical and corporal: primary, supracervical<br>5-741.1: Caesarean section, supracervical and corporal: secondary, supracervical<br>5-741.2: Caesarean section, supracervical and corporal: primary, corporal, T-incision<br>5-741.3: Caesarean section, supracervical and corporal: secondary, corporal, T-incision<br>5-741.4: Caesarean section, supracervical and corporal: primary, corporal, longitudinal incision<br>5-741.5: Caesarean section, supracervical and corporal: secondary, corporal, longitudinal incision<br>5-741.x: Caesarean section, supracervical and corporal: other<br>5-741.y: Caesarean section, supracervical and corporal: not further specified<br>5-742.0: Caesarean section extraperitonealis: primary<br>5-742.1: Caesarean section extraperitonealis: secondary<br>5-742.y: Caesarean section extraperitonealis: not further specified<br>5-745.0: Caesarean section in combination with other obstetric interventions: with hysterectomy<br>5-745.1: Caesarean section in combination with other obstetric interventions: with tubal ligation<br>5-745.x: Caesarean section in combination with other obstetric interventions: other<br>5-745.y: Caesarean section in combination with other obstetric interventions: not further specified<br>5-749.10: Other caesarean section: Misgav Ladach: primary<br>5-749.11: Other caesarean section: Misgav Ladach: secondary<br>5-749.x: Other caesarean section: other<br>5-749.y: Other caesarean section: not further specified |

| | |
|---|---|
| Demarcation: | none |
| **Statistics:** | **Stat_Geburt** |
| Years: | 2007, 2008, 2009 |
| Included groups: | all |
| Method of calculation: | OPS ratio (surgical index). Calculation of the expected OPS numbers at district level by means of indirect standardization according to maternal age groups (under 20 years, 20 to under 25 years, 25 to under 30 years, 30 to under 35 years, 35 to under 40 years, 40 years and over). As a first step, the nationwide number of caesarean sections (demarcated by means of the above OPS codes of the DRG OPSend statistics) is related to live births (according to maternal age groups) of Stat_birth statistics and the age group-specific nationwide rate of caesarean sections is calculated (caesarean sections per 1,000 live births nationwide). This age group-specific caesarean section rate is multiplied by the number of live births by maternal age group in all districts to obtain the regionally expected number of caesarean sections. The sum across all age groups results in the expected number of caesarean sections for the population of a district. This refers to the number of caesarean sections that would be expected if utilization were the same as in the reference population. As a second step, the expected number of caesarean sections is related to the actual number of caesarean sections given the population of a district, which leads to the standardized OPS ratio (simplified: surgical index). |
| Note: | Limitations 2 and 6 listed in section 6.2.1 may particularly apply. Furthermore, the DRG_OPSend statistics do not differentiate between singletons and multiples, while the Stat_Geburt Statistics covers all live births. Births outside inpatient hospital care are included in the Stat_Geburt statistics and do not distort the result. Furthermore, based on the available data and the desired linkage to maternal place of residence, other approaches to calculating the rate of caesarean sections could not be followed. |

### 5.3.3 Tonsillectomy

| | |
|---|---|
| **Statistics:** | **DRG_OPSvier** |
| Years: | 2007, 2008, 2009 |
| Einbezogene OPS-Codes: | 5-281: Tonsillectomy (without adenoidectomy)<br>5-282: tonsillectomy with adenoidectomy |
| Demarcation: | exclusive focus on OPS codes up to 19 years (male and female) |
| **Statistics:** | **Stat_Bev_EA** |
| Years: | 2007, 2008, 2009 |
| Groups included: | Population up to 19 years (male and female) |
| Method of calculation: | OPS ratio (surgical index). Calculation of the expected OPS numbers at district level by means of indirect standardization according to age groups and sex. As a first step, the age group–specific and sex-specific OPS rates for the reference population (the national population) are weighted by the number of people having that age and sex distribution in each district population. The result refers to the number of OPS that would be expected if utilization were the same as in the reference population. The sum across all age and sex groups leads to the expected number of OPS for the population of a district. As a second step, the actual number of OPS is related to the expected number of OPS given the population of a district, which yields the standardized OPS ratio (simplified as: surgical index). |
| Note: | The limitations (see section 6.2.1) apply in particular. |

### 5.3.4 Appendectomy

| | |
|---|---|
| **Verwendete Statistik:** | **DRG_OPSvier** |
| Years: | 2007, 2008, 2009 |
| Included OPS code: | 5-470: Appendectomy |
| Demarcation: | Exclusive focus on OPS codes of age groups from 5 to 9 years, 10 to 14 years and 15 to 19 years (male and female) |
| **Statistics:** | **Stat_Bev_EA** |
| Years: | 2007, 2008, 2009 |
| Groups included: | Population of age groups from 5 to 9 years, 10 to 14 years and 15 to 19 years (male and female) |
| Method of calculation: | Standardized OPS ratio (surgical index). Calculation of the expected OPS numbers at district level by means of indirect standardization according to age groups and sex. As a first step, the nationwide age group–specific and sex-specific OPS rates for the reference population (the national population) are weighted by the number of people having that age and sex distribution in each district population. The result refers to the number of OPS that would be expected if utilization were the same |

as in the reference population. The sum across all age and sex groups leads to the expected number of OPS for the population of a district. As a second step, the actual number of OPS is related to the expected number of OPS given the population of a district, which yields the standardized OPS ratio (simplified as: surgical index).

Note: The limitations (see section 6.2.1) apply in particular.

### 5.3.5 Specialists for child and adolescent psychiatry and psychotherapy

**Statistics:** **Stat_KuJ**

Years: early August 2011

Groups included: Specialists for child and adolescent psychiatry and psychotherapy taking part in the provision of care contracted by social health insurance

**Statistics:** **Stat_Bev_EA**

Years: 2009

Groups included: Each single age group under 18 years (male and female)

Method of calculation: specialist/ therapist index. At the level of 412 regions, the reported number of specialists for child and youth psychiatry and psychotherapy taking part in the provision of care contracted by social health insurance is related to the population aged under 18 years. The identical calculation is performed at national level as well. The district-specific value is then divided by the national value.

### 5.3.6 Hysterectomy

**Statistics:** **DRG_OPSvier**

Years: 2007, 2008, 2009

Included ICD codes:
5-682: subtotal uterus extirpation
5-683: uterus extirpation [hysterectomy]
5-684: extirpation of the cervix
5-685: radical extirpation of the uterus
5-686: radical extirpation of the cervix

Demarcation: all age groups (both sexes)

**Statistics:** **Stat_Bev_EA**

Years: 2007, 2008, 2009

Method of calculation: Standardized OPS ratio (surgical index). Calculation of the expected OPS numbers at district level by means of indirect standardization according to age groups and sex. As a first step, the nationwide age group–specific and sex-specific OPS rates for the reference population (German population) are weighted by the number of people having that age and sex distribution in each district population. The result refers to the number

of OPS that would be expected if utilization were the same as in the reference population. The sum across all age and sex groups leads to the expected OPS frequency for the population of a district. As a second step, the actual number of OPS is related to the expected number of OPS given the population of a district, which yields the standardized OPS ratio (simplified as: surgical index).

### 5.3.7 Prostatectomy

| | |
|---|---|
| **Verwendete Statistik:** | **DRG_OPSvier** |
| Years: | 2007, 2008, 2009 |
| Included ICD code: | 5-604: radical prostatovesiculectomy |
| Demarcation: | all age groups (both sexes) |
| **Statistics:** | **Stat_Bev_EA** |
| Years: | 2007, 2008, 2009 |
| Demarcation: | all age groups (both sexes) |
| Method of calculation: | Standardized OPS ratio (surgical index). Calculation of the expected OPS numbers at district level by means of indirect standardization according to age groups and sex. As a first step, the nationwide age group–specific and sex-specific OPS rates of the reference population (the national population) are weighted by the number of people having that age and sex distribution in each district population. The result refers to the number of OPS that would be expected if utilization were the same as in the reference population. The sum across all age and sex groups leads to the expected OPS frequency for the population of a district. As a second step, the actual number of OPS is related to the expected number of OPS given the population of a district, which yields the standardized OPS ratio (simplified as: surgical index). |

### 5.3.8 Cholecystectomy

| | |
|---|---|
| **Statistics:** | **DRG_OPSvier** |
| Years: | 2007, 2008, 2009 |
| Included ICD codes: | 5-511: cholecystectomy |
| Demarcation: | all age groups (both sexes) |
| **Statistics:** | **Stat_Bev_EA** |
| Years: | 2007, 2008, 2009 |
| Demarcation: | all age groups (both sexes) |
| Verfahren der Berechnung: | Standardized OPS ratio (surgical index). Calculation of the expected OPS numbers at district level by means of indirect standardization according to age groups and sex. As a first step, the nationwide age group–specific and sex-specific OPS rates of the reference population (the |

national population) are weighted by the population in the respective age and sex distribution of the district population. The result refers to the number of OPS that would be expected if utilization were the same as in the reference population. The sum across all age and sex groups leads to the expected OPS frequency for the population of a district. As a second step, the actual number of OPS is related to the expected number of OPS given the population of a district, which yields the standardized OPS ratio (simplified as: surgical index).

Note: The limitations (see section 6.2.1) apply in particular.

### 5.3.9 Coronary bypass surgery

**Statistics:** **DRG_OPSvier**

Years: 2007, 2008, 2009

Included OPS codes: 5-361: aortocoronary bypass,
5-362: aortocoronary bypass by means of minimally invasive technique

Demarcation: all age groups (both sexes)

**Statistics:** **Stat_Bev_EA**

Years: 2007, 2008, 2009

Demarcation: all age groups (both sexes)

Method of calculation: Standardized OPS ratio (surgical index). Calculation of the expected OPS numbers at district level by means of indirect standardization according to age groups and sex. As a first step, the age group–specific and sex-specific OPS rates for the reference population (the national population) are weighted by the number of people having that age and sex distribution in each district population. The result refers to the number of OPS that would be expected if utilization were the same as in the reference population. The sum across all age and sex groups leads to the expected OPS frequency for the population of a district. As a second step, the actual number of OPS is related to the expected number of OPS given the population of a district, which yields the standardized OPS ratio (simplified as: surgical index).

Note: The limitations (see section 6.2.1) apply in particular.

### 5.3.10 Implantation of a defibrillator

**Statistics:** **DRG_OPSend**

Years: 2007, 2008, 2009

Included OPS codes: 5-377.5: Implantation of a defibrillator with unicameral stimulation
377.6: Implantation of a defibrillator with bicameral stimulation
5-377.7: Implantation of a defibrillator with biventricular stimulation

| | |
|---|---|
| Demarcation: | all age groups (both sexes) |
| **Statistics:** | **Stat_Bev_EA** |
| Years: | 2007, 2008, 2009 |
| Groups included: | all age groups (not stratified by sex) |
| Method of calculation: | Standardized OPS ratio (surgical index). Calculation of the expected OPS numbers at district level by means of indirect standardization according to age groups. As a first step, the age group-specific OPS rates for the reference population (the national population) are weighted by the number of people having that age and sex distribution in each district population. The result refers to the number of OPS that would be expected if utilization were the same as in the reference population. The sum across all age groups leads to the expected OPS frequency for the population of a district. As a second step, the actual number of OPS is related to the expected number of OPS given the population of a district, which yields the standardized OPS ratio (simplified as: surgical index). |

### 5.3.11 Primary knee replacements

| | |
|---|---|
| **Statistics:** | **DRG_OPSvier** |
| Years: | 2007, 2008, 2009 |
| Included OPS code: | 5-822: implantation of a knee joint endoprosthesis |
| Demarcation: | all age groups (both sexes) |
| **Statistics:** | **Stat_Bev_EA** |
| Years: | 2007, 2008, 2009 |
| Groups included: | all age groups (both sexes) |
| Method of calculation: | Standardized OPS ratio (surgical index). Calculation of the expected OPS numbers at district level by means of indirect standardization according to age groups and sex. As a first step, the age group-specific and sex-specific OPS rates for the reference population (the national population) are weighted by the number of people having that age and sex distribution in each district population. The result refers to the number of OPS that would be expected if utilization were the same as in the reference population. The sum across all age and sex groups leads to the expected OPS frequency for the population of a district. As a second step, the actual number of OPS is related to the expected number of OPS given the population of a district, which yields the standardized OPS ratio (simplified as: surgical index). |
| Note: | Limitation 7 (see section 6.2.1) applies in particular. |

### 5.3.12 Inpatient hernia surgery preferably performed on an outpatient basis

**Statistics:** **DRG_OPSend**

Years: 2007, 2008, 2009

Included OPS codes: The following services which according to the catalogue for outpatient and other inpatient-substitutive interventions, § 115 b Abs. 1 SGB V, should be provided on an outpatient basis:

5-530.00: closure of inguinal hernia: without plastics: with high mesh and partial resection
5-530.01: closure of inguinal hernia: without plastics: with resection of hydroceles
5-530.02: closure of inguinal hernia: without plastics: with funiculolysis and testicular displacement
5-530.1: closure of inguinal hernia: with plastics
5-530.2: closure of inguinal hernia: with autogenous material
5-530.30: closure of inguinal hernia: with alloplastic material: open surgery
5-531.0: closure of femoral hernia: without plastics
5-531.1: closure of femoral hernia: with plastics
5-531.2: closure of femoral hernia: with autogenous material
5-531.30: closure of femoral hernia: with alloplastic material: open surgery
5-534.01: closure of umbilical hernia: without plastics: with extirpation of umbilical cyst
5-534.1: closure of umbilical hernia: with plastics

Demarcation: all age groups (not stratified by sex)

**Statistics:** **Stat_Bev_EA**

Years: 2007, 2008, 2009

Groups included: all age groups (not stratified by sex)

Method of calculation: Standardized OPS ratio (surgical index). Calculation of the expected OPS numbers at district level by means of indirect standardization according to age groups and sex. As a first step, the age group–specific OPS rates for the reference population (the national population) are weighted by the number of people having that age and sex distribution in each district population. The result refers to the number of OPS that would be expected if utilization were the same as in the reference population. The sum across all age and sex groups leads to the expected OPS frequency for the population of a district. As a second step, the expected number of OPS is related to the actual number of OPS given the population of a district, which yields the standardized OPS ratio (simplified as: surgical index).

Note: Limitations 3 and 4 (see section 6.2.1) apply in particular. In addition and as also stated in the indicator text, outpatient surgery may not be possible given specific patient characteristics or other reasons for exclusion related to the setting.

### 5.3.13 Hospitalizations for diabetes

| | |
|---|---|
| **Statistics:** | **DRG_ICD10vier** |
| Years: | 2007, 2008, 2009 |
| Included ICD codes: | Principal diagnosis E11: not primarily insulin-dependent diabetes mellitus [type 2 diabetes] |
| Demarcation: | all age groups (both sexes) |
| **Statistics:** | **Stat_Bev_EA** |
| Years: | 2007, 2008, 2009 |
| Groups included: | all age groups (both sexes) |
| Method of calculation: | Standardized case ratio (case index). Calculation of the expected principal diagnoses at district level by means of indirect standardization according to age groups and sex. As a first step, the age group–specific and sex-specific principal diagnosis rates for the reference population (the national population) are weighted by the number of people having that age and sex distribution in each district population. The result refers to the number of principal diagnoses that would be expected if utilization were the same as in the reference population. The sum across all age and sex groups leads to the expected number of principal diagnoses for the population of a district. As a second step, the actual number of principal diagnoses is related to the expected number of principal diagnoses given the population of a district. This yields the standardized case ratio (simplified as: case index). |

### 5.3.14 Hospitalizations for depressionn

| | |
|---|---|
| **Statistics:** | **Stat_ICDKHStat** |
| Years: | 2000 bis 2009 |
| Included ICD codes: | Principal diagnosis F32: depressive episode by German state<br>F33: recurrent depressive disorder by German state |
| Demarcation: | all age groups (both sexes) |
| Method of calculation: | no own calculations. The data were provided by the Federal Statistical Office, based on direct age-standardization using the reference population “Germany 1987.” |

### 5.3.15 Day cases in hospital

| | |
|---|---|
| **Statistics:** | **DRG_Stundenfälle** |
| Years: | 2007, 2008, 2009 |
| Included cases: | all hospital day cases |

Demarcation: all age groups, excluding children up to 1 year old (both sexes)

**Statistics:** **DRG_ICD10vier**

Years: 2007, 2008, 2009

Included cases: all hospital cases

Demarcation: all age groups, excluding children up to 1 year old (both sexes)

Method of calculation: standardized day case ratio (case index). Calculation of the expected number of day cases by means of indirect standardization by age groups and sex. As a first step, the age group–specific and sex-specific day case rates for the reference population (here, all inpatient cases) are weighted by the number of inpatient cases for the corresponding age and sex distribution in each district population. The result refers to the number of day cases that would be expected if utilization were the same as in the reference population. The sum across all age and sex groups leads to the expected number of day cases for the population of a district. As a second step, the actual number of day cases is related to the expected number of principal diagnoses given the population of a district, which yields to the standardized day case ratio (simplified as: case index).

Note: Possibly, at the level of German states or of individual hospitals, there are special agreements between payers and providers regarding remuneration or "management" of day cases, which might then be reflected in the documentation of these hospital cases.

### 5.3.16 Deaths in hospital among older patients

**Statistics:** **DRG_Sterbefälle**

Years: 2007, 2008, 2009

Included cases: all deaths in hospital

Demarcation: all age groups 75 years and older (both sexes)

**Statistics:** **Stat_Sterbe**

Years: 2007, 2008, 2009

Included cases: all deaths

Demarcation: all age groups 75 years and older (both sexes)

**Statistics:** **Stat_BEV_EA**

Years: 2007, 2008, 2009

Demarcation: all age groups 75 years and older (both sexes)

Method of calculation: proportional quotient, defined as (actual number of in-hospital deaths / actual number of all deaths) ÷ (expected number of in-hospital deaths / expected number of all deaths). In step one, district-specific expected numbers of in-hospital deaths are calculated using indirect standard-

ization. In this process, age group–specific and sex-specific in-hospital death rates for the reference population (the national population) are weighted by the number of people having that age and sex distribution in each district population. In step two, following the same sequence of calculations, district-specific expected numbers of all deaths are calculated using indirect standardization by age groups and sex. In this process, age group–specific and sex-specific overall death rates for the reference population (the national population) are weighted by the number of people having that age and sex distribution in each district population. In step three, these two expected death rates for each district are expressed as a ratio (expected number of in-hospital deaths / expected number of all deaths). This yields the proportion of the deaths in each district that would have occurred in hospital if the in-hospital death rate and the overall death rate were the same as in the reference population. In step four, for each district, the ratio of the actual in-hospital deaths to the actual deaths in the district's entire population (actual number of in-hospital deaths / actual number of all deaths) is divided by the expected outcome (the proportion calculated in step three). The result is the standardized proportional quotient (simplified as: proportional quotient).

# 6. References

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## 6.2 Indicator-related references

### 6.2.1 Perinatal mortality


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