Healthcare Fact Check

The Development of Regional Variations in German Health Care

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BertelsmannStiftung

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1. The „Healthcare Fact Check“ project – A provisional appraisal

Uwe Schwenk (Bertelsmann Stiftung)

The “Healthcare Fact Check” project was launched by the Bertelsmann Stiftung in 2011. The aim of the project is to highlight existing efficiency shortcomings and quality deficits in German health care. It is hoped that broad public debate will result in measures designed to make medical care more closely oriented to the actual needs of the patients.

The project was rolled out by launching the website www.faktencheck-gesundheit.de and publishing “Regional Variations in German Healthcare”, the central findings of which were presented at a conference of international experts in Berlin in September 2011. The report clearly showed that unwarranted regional variations in health care in Germany do not merely occur in exceptional cases but are systemic in nature. The healthcare patterns revealed are problematic because they can not be explained by reference to regional variations in the distribution of medical conditions or divergent preferences expressed by the population.

In the present publication, which is an update of the first report, the Bertelsmann Stiftung makes a provisional appraisal. The results of this new study confirm that there is still need for action: The regional variations remain considerable and have remained constant over time. The regional patterns of high or low utilisation have persisted unchanged. And many regional and urban districts are characterised by extreme rates of surgical intervention in both periods studied.

Even though the findings are somewhat sobering, they are far from surprising. We know from other countries that regional patterns of care often remain stable over a long period of time. It is very difficult to change structures, processes, habits and attitudes in such a way as to arrive at a more needs-based system of care. That is why it is important to repeatedly highlight existing shortcomings.

Since the first report appeared in 2011, the Bertelsmann Stiftung, together with partners and experts, has published a series of single-subject Fact Check reports on Antibiotic prescriptions for children (2013), Caesarean sections (2012), Tonsillectomy (2013), Knee operations (2013), Depression (2014) and Density of physicians (2014 and 2015). All subjects reported on present examples of structural shortcomings in the German healthcare system, such as a lack of planning and coordination, a lack of responsibilities, financial disincentives and a failure to involve the patient. For us, the fact that these reports have been consistently well received is a sign that there is still a need for commitment in this area.

The prime claim of the “Healthcare Fact Check” is to portray the results of our analyses as clearly as possible and to develop practical recommendations for action by health policy makers. Our aim is to continue systematically in this manner. The objective is to strengthen the citizens in their role as patients, to provide them with practical benefits, for example in the form of evidence-based decision aids, and to map the advantages and disadvantages of different forms of treatment against one another. This will form a key focus of our work in future.

In the “Healthcare Fact Check”, the Bertelsmann Stiftung collaborates with a large number of partners and experts from the field of health care who support the ideals and the goals of the project. Our thanks are due to them. It is only through this well-founded and professional, often interdisciplinary and cross-institutional, cooperation that the quality of the methods used in each Fact Check to analyse and interpret the results is assured.

We look forward to continuing to work with our partners in future, too, in our mutual endeavour to bring about more appropriate health care.

2. Unwarranted regional variations – What has changed in Germany?

Marion Grote-Westrick (Bertelsmann Stiftung) and
Prof. Dr. David Klemperer (OTH Regensburg)

Regional variations in health care exist for most medical examinations and treatments. Many variations are justified or even desirable, for example if the incidence of a medical condition is higher in a particular region and consequently examinations and treatments are more frequently found there than in other regions. However, many regional variations are not the result of differences in needs or preferences. It is important to identify and reduce such unwarranted variations, not only in order improve the appropriateness efficiency of care in our health system, but above all in order to protect patients from unnecessary stress, anxiety and harm.

2.1 Unwarranted variations: How and where do they occur?

International research into regional variations in health care has a long tradition in the Anglo-American countries. As early as 1938, in other words more than 70 years ago, James Alison Glover published findings on regional variations in care in the county of Kent in England: In his study, he showed that a schoolchild living in Margate was eight times more likely to undergo a tonsillectomy than a schoolchild in the neighbouring town of Ramsgate. The likelihood of having the tonsils removed did not depend on the nature of the child's medical condition, but above all on the personal opinion of the physician concerned (Glover 1938).

The seminal study by Wennberg and Gittelsohn (1973) of small-area variations in health care in the US state of Vermont raised fundamental questions for healthcare research such as, for example, how to evaluate regional differences in the density of supply, the take-up of services or the level of expenditure? How to distinguish warranted from unwarranted variations? What are the causes of unwarranted variations and how can these, and only these, be reduced?

The Dartmouth Institute has since pursued this further in numerous studies and publications and thereby not only created a new awareness of this problem, set methodological standards and encouraged political debate, but also aroused the interest of many research groups and health policy experts in other countries. In Australia, England, Spain and the Netherlands, detailed atlases of health care have been published and in recent years many scientists have defined variations in the provision or utilisation of services or the level of expenditure and analysed to what extent these are justified or not.[1]

Wennberg defines unwarranted variation as "variation that cannot be explained on the basis of illness, medical evidence, or patient preference" (Wennberg 2010, 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 the incidence and severity of a medical condition may be a reason for justified variations in utilisation. For example, an influenza epidemic that leads to more cases in one region than in another can result in differences in the number of patients treated in outpatient and inpatient care.

[1] Corallo et al. (2014) provide a systematic overview of international studies on the topic.

Medical Evidence: Variations in health care also occur when a lack of evidence regarding healthcare outcomes allows considerable scope for medical discretion.[2] Resulting differences cannot be evaluated as either warranted or unwarranted. However, they should provide the impetus for further research in order to increase certainty and define optimum care. Variations are unwarranted if care deviates from evidence-based guidelines, including standards, norms and limits of tolerance limits, without due justification.[3]

Patient Preference: Variations in health care are also justified if several options exist in respect of a medical issue and well-informed patients consciously decide on one option more often in one region than they do in another. The precondition for such a decision is the availability of objective, impartial information about possible options and their respective advantages, disadvantages, opportunities and risks regarding patient-relevant outcomes in terms of mortality, morbidity and illness-related quality of life.

Unwarranted variations represent quality deficits in health care. Quality of care is understood according to Gray (2008) 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) 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 – overuse, underuse and misuse of services (Chassin and Galvin 1998):

Overuse arises when the potential risk of a medical service exceeds its possible benefit. *Underuse* refers to the failure to provide a medical service which would have produced a favourable outcome for the patient. *Misuse* occurs when appropriate health care is provided but an avoidable complication occurs which prevents the patient from obtaining the maximum benefit from the service provided.

In his analyses of unwarranted variations, Wennberg concludes that some services are associated more often with overuse and/or misuse, others more often with underuse. He distinguishes between *effective care*, *preference-sensitive care*, and *supply-sensitive care* (Wennberg 2005 and 2010).

[2] To this day, for example, nobody knows – because of the meagre extent of the evidence – how many days bed rest produce the best results after an acute heart attack without complications, i.e. whether twelve days are better than two or even whether 24 hours would be enough (Herkner et al. 2007).

[3] However, it is sometimes difficult to determine how far deviations from the norm are to be regarded as objective and as from what degree of deviation variations are to be deemed unwarranted.

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 issue should receive them, provided there are no contraindications. 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 in the case of effective services for treating 30 acute and chronic conditions. Only slightly more than half the services defined as effective care were delivered. The Dartmouth Atlas also identified underuse for a range of effective interventions in the United States and found it to be subject to regional variations (Wennberg et al. 2008). In a further study, investigators identified underuse of drug therapy for stable coronary heart disease, along with the overuse of invasive measures (Borden et al. 2011).

For Germany, the SVR documented deficits in the provision of effective health care for ischemic heart disease, stroke, and chronic obstructive pulmonary diseases (SVR 2000). Another study indicates underuse in drug therapy for patients with myocardial infarction (Mangiapane and Busse 2011). In 2014, the "Depression Fact Check" identified underuse and misuse in the case of individuals suffering from severe depression (Melchior et al. 2014).

Preference-sensitive care

With preference-sensitive care, a patient can choose between two or more treatment options, weighing the trade-offs between their desired and undesired effects, their relative risks and benefits. It should be recognized, however, that medical outcomes can not be predicted for certain; they can only be expected with a certain probability. Indeed, in many cases there is little certainty about which of two or more treatment options leads to better health outcomes. In the case of preference-sensitive interventions such as a bypass operation for a symptomatically stable, coronary heart condition or an artificial knee implant, the focus is mainly on improving the quality of life. In this context, patients may evaluate the prospect of alleviated symptoms on the one hand and the sometimes serious side effects of an intervention on the other quite differently. Variations which reflect the actual preferences of the patient are to be regarded as desirable, but if the patient's preferences are not adequately taken into account, there is a danger of "preference misdiagnosis" (Mulley et al. 2012, 345) leading to overuse, since well-informed patients more often decide against an elective preference-sensitive intervention (Stacey et al. 2014).

Preference-sensitive decisions may represent the norm in health care; especially for chronic diseases, only few treatments are essential and have to be carried out without delay, and postponing or declining treatment may often be a reasonable option. Patients should therefore 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 in order to align demand with available resources. The supply of physical and human resources – hospital beds, intensive care beds, specialists, medical technology, etc. determines the take-up of services.

On the basis of interviews, Wennberg concludes that supply-driven treatment decisions often occur unconsciously.[4] If few intensive care beds are

[4] Wennberg calls this, in an allusion to Adam Smiths "invisible hand of the market", the "invisible hand of capacity" (Wennberg 2010, 128).

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 the use of diagnostic imaging and other tests are also supply-sensitive.

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, 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 carried out by the Dartmouth Institute 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 death than in regions with lower expenditure (Fisher et al. 2003). The problem here is not underuse in regions with lower expenditure, but overuse in regions with higher expenditure.

Wennberg's categorisation according to effective, preference-sensitive and supply-sensitive care has proven to be an appropriate concept to explain overuse, underuse, and misuse of services.[5] Table 1 below summarises the different forms of regional variations and their causes, consequences and possible solutions.

The division of unwarranted regional variations into the three categories of effective, preference-sensitive and supply-sensitive care is easy to grasp. The consequences shown in the table, which result from care which is not needs-based or preference-sensitive, are also well-known in Germany. The causes given for the unwarranted variations would also seem to apply to the whole of Germany – in any

Table 1: Causes and consequences of regional variations and possible solutions

Category	Cause	Consequence	Remedy
Unwarranted variations			
Evidence-based care	Clinician decisions ≠ science	Low probability of good medical outcomes	Clinical microsystem improvements
Preference sensitive care	Provider-driven decisions; patients uninformed and not involved in decisions	Patient doesn't receive preferred care: the care with highest individual patient utility	Improved decision quality; shared decision making & decisions aids; better outcomes research
Supply sensitive care	Capacity that is idiosyncratically located and poorly related to outcomes	Higher resource use with marginal or no patient benefit	Wiser capital and labor investments in health care
Desired State: Warranted variations			
Care in response to differences in patient needs and preferences	Application of evidence-based medicine and shared decision making	Better outcomes, including higher decision quality, and often lower costs	Perfect!

Source: David Goodman, The Dartmouth Institue. | BertelsmannStiftung

[5] Another model for interpreting regional variations is offered by the European Collaboration for Health Optimisation (ECHO). Here, care services are subdivided into three categories, "effective care" (services of proven efficiency), "effective care with marginal benefit" (services with a patient-dependent risk-benefit balance) and "lower-value care" (services with little or no effectiveness) and analyses regional variations against this background (ECHO 2014).

specific case, it is necessary to investigate which factors contribute to what extent to the unwarranted variations in care.

2.2 Regional variations in German health care: Background

In Germany, the findings of international research studies into geographic variations and the associated overuse, underuse and misuse of care services went largely unheeded until the 1990s. One exception to this was the work of Lichtner and Pflanz (1971) into surgical removal of the appendix (appendectomy) in Germany, which highlighted the high rate of appendectomies in Germany compared with other countries, the different rates for blue-collar and white-collar workers and seasonal fluctuations (e.g. fewer appendectomies during the holiday periods). In its 1988 report, the Advisory Council for the Concerted Action in Health Care (SVR) reported on a longitudinal study of supply and demand for hospital services that identified considerable variations among German states but stopped short of making an in-depth comparison with the findings of international research (SVR 1988, section 167). A 2000 study sponsored by the Federal Ministry of Health on the rates of surgery in Germany explicitly refers to the results of international research and presents clear evidence of regional variations in rates of surgery (Federal Ministry of Health 2000, Weitkunat et al. 2000).

A broad debate on issues relating to overuse, underuse and misuse of services was sparked off by the Advisory Council with its report on appropriateness and cost-effectiveness (2000/2001). In Volume III of the report, the Advisory Council illustrated that overuse, underuse, and misuse of services also occur in Germany, in particular for the very common conditions of ischemic heart diseases, cerebrovascular diseases, chronic obstructive pulmonary diseases, back pain, cancer, and depressive disorders.

Since then, numerous scientific studies have been published in Germany on regional variations as well as on the overuse, underuse, and misuse of services. Typical examples focus on the density of physicians (Klose and Rebein 2011), pharmaceutical consumption (Häussler et al. 2007), and special pharmaceutical regimens ((Müller-Nordhorn et al. 2005, Zullino et al. 2005, Heier et al. 2009), treatments for heart disease (Hochadel et al. 2007),cancer (Katalinic 2010) and rheumatic conditions (Zink et al. 2001), causes of mortality and life expectancy (Gaber 2011, Latzitis et al. 2011), avoidable mortality (Sundmacher et al. 2011), outpatient sensitive hospital cases (Naumann et al.) and regional variations in health care in individual German states (Swart et al. 2000, Swart et al. 2008). In addition, the Care Atlas project of the Central Institute of the Statutory Health Insurance Association reported on its web page on the (predominantly) outpatient regional care, supplemented by maps, tables and charts. The fact that the subject of small-area care research in Germany is becoming increasingly important in scientific and political circles, as well as in practice, is also illustrated by the "Federal Health Bulletin – health policy research – health protection" published at the beginning of 2014 with a focus on ten specialist articles.

Since 2011, the Bertelsmann Stiftung has been drawing attention to regional variations in health care by way of its "Healthcare Fact Check" project. The aim is to heighten the awareness of citizens by increasing public concern in the various regions about ongoing deficits in quality and efficiency and about the unsatisfactory level of patient-oriented care in the German healthcare system. The initial publication was the "Regional Variations in German Healthcare" Fact Check and this has since been followed by Fact Checks focusing on specific indications and system-related Fact Checks. The present Fact Check follows on from the studies published in 2011 and updates a selection of the subject areas considered at that time.

For the first "Healthcare Fact Check", the Bertelsmann Stiftung commissioned the IGES Institut to prepare an overview of regional variations in different areas of health care in Germany on the

basis of publicly available data, to determine the extent of regional variations, to identify regional patterns and to outline possible explanations and courses of action. In that first Fact Check, regional variations, in some cases vary considerable ones, were detected in 16 indicators representing quite different aspects of care.[6]

This new Fact Check now updates nine of the rate of surgery indicators selected at that time: caesarean section, tonsillectomy, appendectomy, hysterectomy, prostatectomy, cholecystectomy, coronary bypass surgery, implantation of a defibrillator and primary knee replacement. Many of these procedures have also been the subject of research in other countries because of the considerable regional variations observed and the OECD, too, in its latest study on regional variations in and between countries has also selected four of these indicators: caesarean section, coronary bypass surgery, primary knee replacement and hysterectomy (OECD 2014).

2.3 Overarching results

In the present Fact Check, the frequency of surgery and the regional variations for the periods 2007–2009 and 2010–2012 are updated or calculated for the first time.[7] Whereas the results and possible explanations for the regional variations for each specific indicator are set out in the chapter "Indicators selected", we present here a general overview.

The central overarching results of the update are as follows:

1. The extent of the variations is considerable.
2. The variations have remained constant over time.
3. The regional patterns are largely unchanged.
4. Many of the districts with extreme values are the same one in both periods.

Result 1: The extent of the variations is considerable.

There are considerable variations in the rates of surgery in Germany. The greatest variations occur in the area of tonsillectomy for children and adolescents: The likelihood of a child undergoing tonsillectomy is eight times higher in the district with the highest rate of surgery than in the district with the lowest rate of surgery (extremal quotient). Even if the 20 urban and rural districts with the highest and lowest rates of surgery are excluded from the analysis (extremal quotient $95^{th}/5^{th}$ percentiles), the regional variation is still a factor of 3.0.

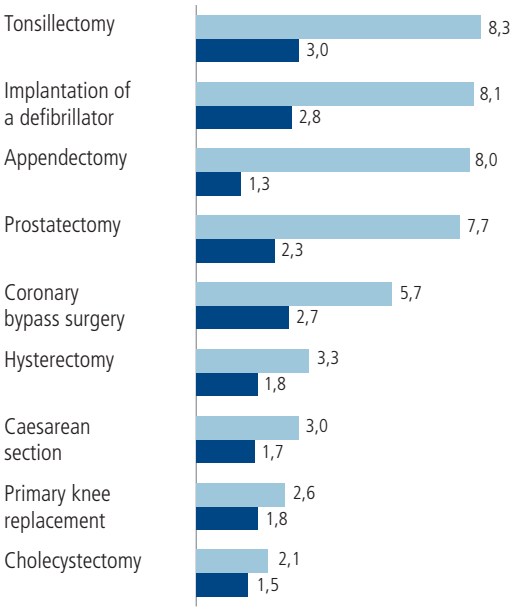
In the case of four interventions in all, the variation (extremal quotient[8]) between the districts with the highest and the lowest rates of surgery is a factor of 8, in the case of other interventions it is similarly more than or roughly equal to 3.[9] If the districts with the 20 highest and 20 lowest rates of surgery are excluded from the analysis, then the variation between the districts with the highest and the lowest rates of surgery ($95^{th}/5^{th}$ percentiles) is still a factor of between 1.5 and 3.

[6] Nolting et al. (2011).
[7] Cf. the explanations given in the chapter "Approach and methods".
[8] Minor deviations in the extremal quotient for the period 2007–2009 when compared to that published in the 2011 report arise from the changeover from direct to indirect standardisation (see the chapter entitled "Methods").
[9] An exception to this is cholecystectomy with an extremal quotient of 2.1.

Fig. 1 shows a comparison between the extremal quotient and the 95th/5th percentiles. In the case of tonsillectomy, implantation of a defibrillator, appendectomy, prostatectomy and coronary bypass surgery, the extremal quotient and the 95th/5th percentile vary considerably from one another; this means that the highest and/or the lowest rate of surgery in a district is exceptionally high or low.

The box whisker plots shown in Fig. 2 provide a good overview of the regional variations in the rate of surgery for each intervention.[10] They show first of all in which corridor half of the districts with average rates of surgery are to be found, namely in boxes between the 25th and 75th percentile. Secondly, the length of the vertical lines (whiskers) shows in which rate of surgery corridor the 20 percent of districts with the most extreme rates of surgery are in each case. Thirdly, it becomes clear how great the respective difference is between the district with the maximum and the one with the minimum value in each case. And fourthly, the gap between the asterisks and the ends of each whisker (i.e. between the 95th percentile and the maximum or between the 25th percentile and the minimum) indicate in each case how far the 20 highest or lowest rates of surgery are from one another, because between the end of each whisker and the respective asterisk, there are the rates of surgery for 18 other districts. Finally, the box whisker plots show that the maximum value and the 95th percentile both deviate more strongly upwards from the median than the minimum value and the 25th percentile, i.e. the districts with the highest rates of surgery are in a sense more striking than the districts with lowest values.

Figure 1: Comparison of extremal quotients and 95th/5th percentile quotient



Extremal quotient: ratio of the lowest value to the highest value.
95th/5th percentile quotient: extremal quotient without the 20 highest and the 20 lowest values.

Source: Own calculations. | BertelsmannStiftung

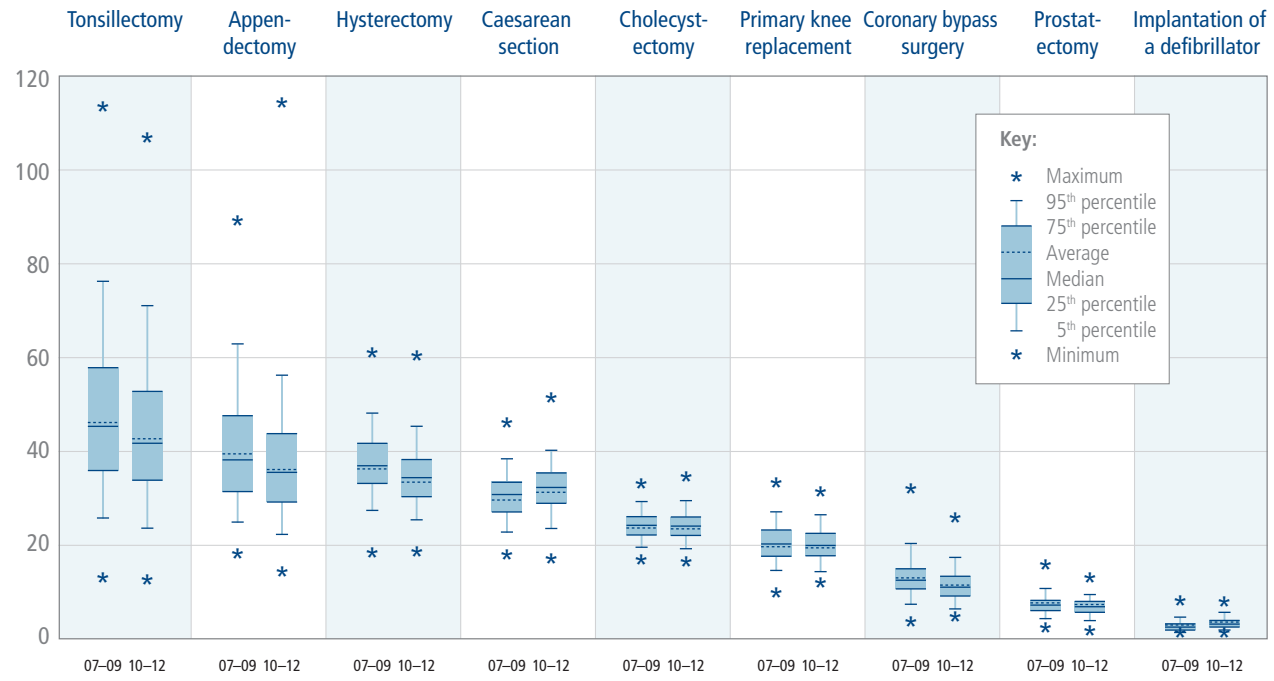
Result 2: The variations have remained constant over time.

For the present report, the rates of surgery for the period 2010-2012 were compared with those for the period 2007–2009 in order to ascertain how the regional variations change over time. The box whisker plots shown in Fig. 2 also provide some insights here, since they cover both periods. However, the box whisker plots only indicate the absolute differences (ranges) between the different values for each procedure, whereas the relative differences from the average are more significant (see

[10] It is less meaningful, even though the illustration may suggest otherwise, to make a general comparison on the basis of the box whisker plots, since the national average rates of surgery for each intervention (average and median) differ from one another. With a low median value, the variation around the median is lower in absolute terms, i.e. the individual percentile and extremal values mapped on a common scale for all interventions lie closer to the median.

Figure 2: Regional variations over time: box whisker plots

Number* of interventions per 10,000 inhabitants**, directly standardised*** according to age and gender



* Different measurement unit: number of children born by caesarean section as a percentage of all live births in Germany.
** Different reference population: tonsillectomy, appendectomy: per 10,000 children and adolescents up to 19 years of age, hysterectomy per 10,000 women, prostatectomy per 10,000 men.
*** Different standardisation: tonsillectomy, appendectomy for children and adolescents up to 19 years of age, hysterectomy women only, prostatectomy men only.

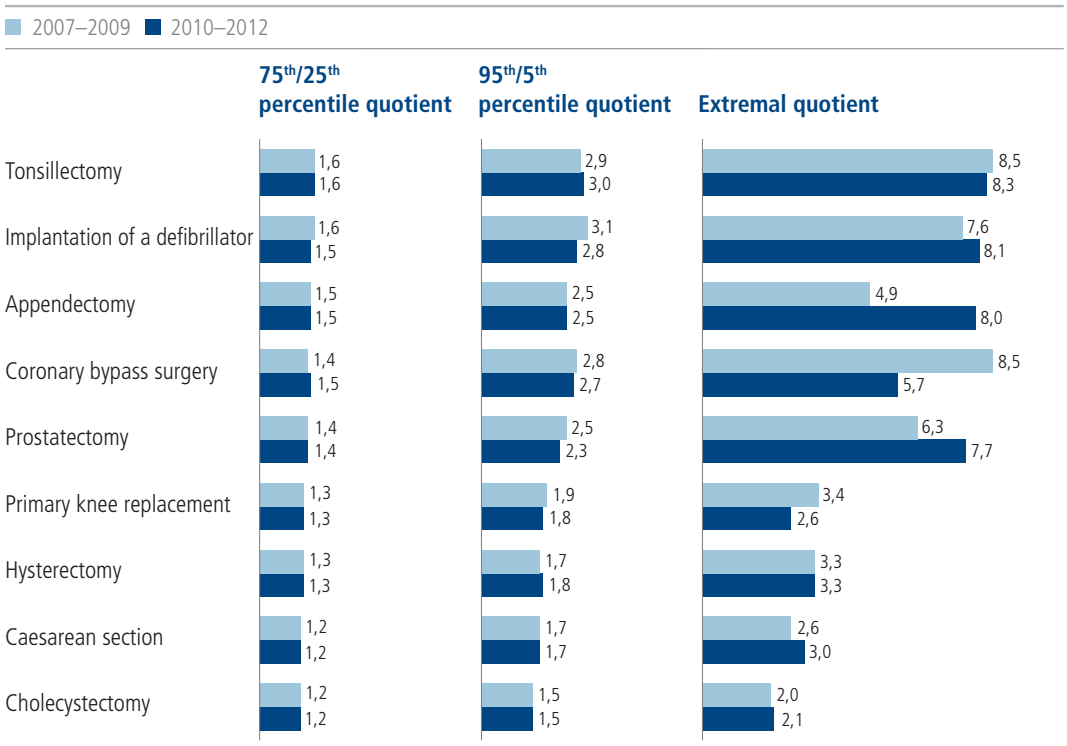
Source: Own calculations. | BertelsmannStiftung

result 4), as are the respective ratios (quotients) between the districts with the maximum and the minimum values, i.e. between the 95th and the 5th percentile and between the 75th and the 25th percentile in each case (see Fig. 3).

The comparison over time shows that the regional variations are constant. Unchanged are the variations in half of the districts with average rates of surgery, which are grouped around the median value, measured against the (interquartile) quotient from the 75th and 25th percentile.[11] The quotient from the 95th and 5th percentile, i.e. the values for all districts excluding the highest and lowest values, also remains virtually unchanged for all procedures included in the study. It is pleasing to note that these (95th /5th percentile) variations have decreased in the case of four procedures – implantation of a defibrillator, coronary bypass surgery, prostatectomy and primary knee replacement. In the case of three interventions – appendectomy, caesarean section and cholecystectomy – however, they remain unchanged and in the case of two procedures – tonsillectomy and hysterectomy – they have even increased.

[11] Whereas the quotient between the 75th and the 25th percentile remains the same, the difference between these two values (the 75th and 25th percentiles) decreases in the case of five procedures, whereby the median value also decreases in each of these cases (tonsillectomy, appendectomy, hysterectomy, coronary bypass surgery and primary knee replacement). It would therefore be incorrect to interpret the lower absolute difference as a reduction in the regional variation – because the relative difference remains unchanged.

Figure 3: Regional variations over time: quotients from percentile values



Source: Own calculations. | BertelsmannStiftung

The extremal quotients reflect the ratio of the values for the two most extreme districts. It is therefore almost surprising that in spite of including all exceptional anomalies the magnitude of these quotients remains virtually unchanged.[12] Moreover, the extremal quotient for five procedures even shows an increase, i.e. the difference between the district with the highest and the district with the lowest rate of surgery has become greater. Only the extremal quotient for tonsillectomy, coronary bypass surgery and primary knee replacement has decreased and only that for hysterectomy has remained the same.

Result 3: The regional patterns are largely unchanged.

But it is not only the extent of the regional variations that have remained stable over time; it is in fact often the same districts and regions which are marked by rates of surgery which are considerably above or below the average: a comparison of the respective maps for the period 2007–2009 with that for the period 2010–2012 reveals constant regional patterns for almost all procedures (cf. the respective maps in the chapter "Indicators selected").

The regional patterns for appendectomy and hysterectomy are especially stable, as are those for caesarean section and primary knee replacements. In the case of prostatectomies and coronary bypass operations, on the other hand, there are regions with constant values but also some districts in which the rate of surgery has changed over time (from below average to above average or vice versa).

[12] However, all rates of surgery were calculated as 3-year averages, so that anomalies are somewhat diminished.

Table 2: Number of districts among the group of 20 districts with the highest or lowest rates of surgery respectively in both periods studied

Surgical procedure	Total	Top 20	Bottom 20
Hysterectomy	28	13	15
Tonsillectomy	25	13	12
Coronary bypass surgery	24	13	11
Primary knee replacement	23	13	10
Appendectomy	22	13	9
Caesarean section	22	12	10
Cholecystectomy	18	9	9
Prostatectomy	17	8	9
Implantation of a defibrillator	14	8	6

Source: Own calculations. | BertelsmannStiftung

Result 4: Many of the districts with extreme values are the same ones in both periods.

Stability over time is confirmed even in the frequency of operations in the districts with the highest and lowest rates of surgery. Here, an analysis of the data shows a surprising result: the majority of districts which were among the group of 20 districts with the highest or lowest rates of surgery nationwide are once again in the top 20 or bottom 20 respectively in the period 2010–2012 (cf. Table 2).

That these districts are persistently in extreme positions is surprising, because these extremely high or low values had initially been interpretable as anomalies. But even after sorting these districts according to their respective confidence range limits, the extreme districts in the top 20 or bottom 20 remain largely the same. These persistently extreme values are also evident in the districts in which the rates of surgery really are statistical anomalies.[13] The majority of these districts are exceptional cases in both periods.

2.4 Interpretation of results

How are the results of the updated Fact Check on Regional Variations to 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?

The four central results of this Fact Check permit only one conclusion: The phenomenon of regional variations is not an arbitrary and temporary occurrence in Germany but a systemic one. Based on this assumption, the underlying causes would be stable over time.

The crucial question, therefore, is whether the constantly large regional variations detected are needs-based and preference-sensitive and therefore warranted, or whether they are to be interpreted as unwarranted. In order to answer this question, it is necessary to investigate whether there are regional variations in needs and preferences which are (roughly) of the same order of magnitude as the variations in rates of surgery. This investigation must be carried out for each individual surgical intervention.

[13] With reference to Sachs (2002, 366), we treated as a statistical anomaly those districts with a rate of surgery which deviated by more than 1.5 times from the interquartile range (between the 75th and the 25th percentile) from the 75th percentile or less than 1.5 times the interquartile range of the 25th percentile.

There do not appear to be any major regional variations in needs in respect of the indications studied, as is made clear by the notes on the individual procedures in the chapter "Indicators selected". At least, the differences in morbidity do not seem to be large enough to explain the extent of the regional variations.[14] General differences in needs on the basis of different age and gender patterns in the individual districts do not have any impact, since the rates of surgery for each district have been standardised for age and gender. The calculated variations in the number of interventions do not therefore result from variations in the needs of the population.

Regional variations in patient preferences can also be excluded as the cause of the regional variations in the rates of surgery, at least until genuine patient preferences are formed on the basis of extensive consultations between patient and doctor covering all options for treatment. In Germany at present, this is (still) not the case: Although more than half of the population would like to take decisions together with their doctor and just under a fifth would like to do so on their own after a detailed consultation, 70 percent or 65 percent respectively of patients have never found themselves in a decision-making situation in which their general practitioner or medical specialist set out a number of alternatives (Braun and Marstedt 2014).

Neither variations in needs nor in preferences can therefore be taken to be the main causes of the consistently large regional variations. The regional variations must therefore actually be interpreted as unwarranted. Wennberg's succinct statement, "In health care, geography is destiny" (Wennberg 2010, 3) therefore seems to apply to Germany, too, at least in respect of the surgical interventions studied.

In which of the 402 urban and rural districts of Germany, overuse, underuse or misuse of services can be found for all procedures taken together, or indeed for each individual procedure, is hard to say. It must be borne in mind that this Fact Check maps each indicator against the average for Germany (weighted mean value) as the basis for calculating regional differences and for drawing up the maps. A medical reference point for each indicator (e.g. 30 interventions per 10,000 inhabitants) has deliberately not been taken as a benchmark for the deviations, for three reasons: Firstly, the "right rate" for the provision of treatment is not known – there are no accepted norms for the indicators considered here. Secondly, for most interventions, it is simply not possible to define such a norm. Thirdly, taking the national average as a reference point has the advantage of focusing the interpretation of results mainly on the magnitude of the regional variations and not on the question of whether the chosen norm is indeed the "right" one.

The disadvantage of taking the national average as a reference point is that it is more difficult to make claims regarding possible overuse or underuse. Compared to a norm or normative range, deviations to the higher end would clearly indicate overuse, while deviations to the lower end would clearly indicate 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 for a given indicator is high or low overall in an international comparison, and that even minor deviations from the national average might need to be interpreted as problematic in the light of such a high or low overall level.[15]

Nevertheless, the extent of regional variations is great, medically incomprehensible and in need of

[14] Regional variations in morbidity might have an effect in the case of cholecystectomy and implantation of a defibrillator (cf. the respective sections in the chapter "Indicators selected").

[15] In addition to the different prevalences and individual preferences in other countries, the national rates of surgery may also depend on systemic factors (e.g. co-payments, waiting lists). These must be taken into account in any international comparison of rates of surgery, but are not relevant in a national context – at least not inasmuch as the prevailing conditions are the same nationwide.

explanation – especially because for all procedures considered there are districts where the rate of surgery is so high as to constitute a statistical anomaly. Here it seems safe to assume that in some districts of Germany there actually is overuse of services in respect of certain surgical interventions. In certain isolated cases, i.e. in the (very few) districts with statistically anomalous values on the low side, it should also be investigated whether there is underuse of surgical procedures. At first glance it seems less than plausible to assume that too few hysterectomies are being carried out on women in prosperous municipalities and districts such as Heidelberg, Freiburg im Breisgau, Munich or Starnberg. It would similarly be implausible to conclude that too few caesarean sections are being carried out in Dresden, Chemnitz, Bautzen or Potsdam.

In order to determine whether the assumptions made here regarding overuse or underuse of services are indeed valid, further quantitative and qualitative research would need to be conducted on the individual indicators in the individual regions. The Bertelsmann Stiftung, together with its partners from the academic world and clinical practice has already taken the first steps in this direction through the Fact Check reports on tonsillectomy, caesarean sections and primary knee replacements. The results of these Fact Checks are already taken into account in the individual analyses in the chapter "Indicators selected". In the case of other surgical interventions, too, it would be interesting to consider the interventions studied together with other performance data. For example, it would be very revealing to compare the regional rate of appendectomy with a regional rate of ruptured appendix cases, the regional rate of coronary bypass surgery with regional patterns of catheterisation treatment or the regional rate of prostatectomy with the rates of watchful waiting approaches, brachytherapy and radiotherapy. However, such extensive research, although it would no doubt be highly illuminating, is beyond the scope of this Fact Check, which is intended above all to provide an initial overview of the extent and development of regional variations.

2.5 Possible explanations for unwarranted regional variations

Regional needs-based or preference-sensitive variations are not responsible for the regional variations in the rates of surgery in Germany. The other factors which might have contributed to unwarranted regional variations are discussed in greater detail below. In the chapter "Indicators selected", subject-specific possible explanations are offered for each procedure. At this point, an attempt should be made to find overarching explanations for the regional variations in the surgical procedures considered.

Using Wennberg's concept, the surgical procedures considered can often, even if not in every single case, be assigned to the category of preference-sensitive care. This means that in addition to the respective procedure considered, there is at least one other treatment option. Each patient should therefore have the opportunity to decide, after weighing up the possible benefits and risks of each option and their impact on their future quality of life, which treatment alternative is the best for them personally. In many cases, however, the patient leaves this decision to the doctor, albeit for quite different reasons:

- One patient in four consciously leaves the decision about treatment to his or her physician. The percentage of patients in Germany who favour this paternalistic decision model has remained steady for many years (Braun and Marstedt 2014). This might reflect the reluctance of the patients to take or share the responsibility for decision making, a considerable amount of trust in the doctor concerned – or it may be due to the fear of being perceived as a difficult, mistrusting patient (Frosch et al. 2012).

- Many patients, on the other hand, are not informed by their doctor that alternative procedures exist. As already mentioned, the majority of patients state that they have never experienced a decision-making situation with several options. In this case, the patient unwittingly "delegates" their decision to the physician.

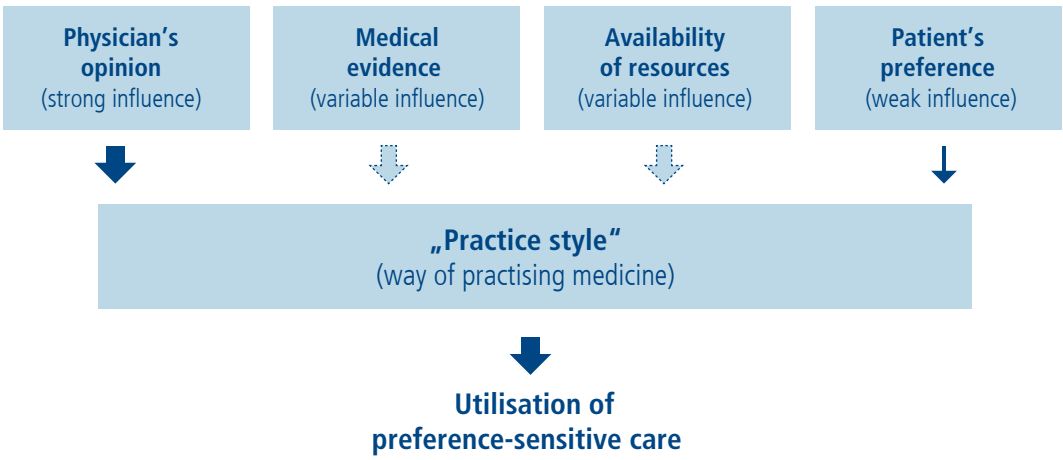
According to Wennberg, if the doctor has explicitly or implicitly been granted permission to decide, he or she makes treatment decisions based on their own "practice style"(see Fig. 4).

This "practice style" of the physician is influenced to different degrees by four main factors (Wennberg 2010, 38ff.):

1. **The 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 merely the fear of these – the physician advocates performing surgery as a preventative measure. 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, 46). Which principle a physician tends to follow is likely to depend on socialisation during medical school, the habits of colleagues, and personal experience.[16] This approach to explaining regional variations may apply to tonsillectomy, appendectomy, hysterectomy, prostatectomy, primary knee replacement and caesarean section.

2. **The medical evidence:** In numerous studies covering either individual US states, the entire United States, or several countries, a statistical relationship was found between medical evidence and the extent 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 decision-making

Figure 4: Model of preference-sensitive care when the patient delegates decision-making to the physician.



Source: Wennberg 2010, 10.

(Wennberg 2010, 48ff). For the indicators considered here, this hypothesis may apply to prostatectomy, appendectomy, tonsillectomy, hysterectomy and caesarean section and – in the light of a relatively clear state of medical evidence and consequently low degree of variation – cholecystectomy.

3. **The availability of resources:** The availability of the physical and human resources needed for the respective surgical intervention also influences the regional variability of services. The more resources there are available in the form of staff, hospital beds and medical technology, the greater the likelihood is of the respective surgery being performed. This hypothesis might apply to coronary bypass surgery, the implantation of a defibrillator, and caesarean section.[17]

4. **The patient's 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. A serious consequence of this, according to Wennberg, is that the "wrong patients" are frequently operated upon, namely those who would have decided against this option had they been fully informed. Wennberg calls for fundamental reform in this area, reform which would transform medical culture, championing the "democratisation" of the patient-doctor relationship and giving a more important role to the patient (Wennberg 2010, 9f.).

Another important cause of regional variations in the rates of surgery observed may be financial incentives. Hospitals in Germany receive a provisional budget anticipating the volume of services (number of primary knee replacements, prostatectomies, etc.) on the basis of historical patterns. This creates an incentive to offer services at least until the limit of the budget is reached. The hospital is paid for surgical procedures but not for treatment options such as watchful waiting.

It can be assumed that German hospital doctors find themselves under economic pressure to perform services in cases where the indications are unclear. It can be stated for a fact that operations are carried out in German hospitals for purely financial reasons in cases where they are not medically indicated (Reifferscheid et al. 2014). Whether there are regional patterns here or not can not be stated without further study.

2.6 Measures geared at achieving greater appropriateness in health care

Methods of reducing unwarranted variations in care should above all be seen as an ethical obligation towards the patients, who have a right to evidence-based preference-sensitive and needs-based health care. They should be protected from unnecessary services. The medical and health policy objective should therefore be to reduce the unwarranted variations, and only these. In the case of overuse of services, this would also eradicate the wasteful use of resources and in the case of underuse, would result in necessary services no longer being withheld but actually provided.

The main challenge is to tackle unwarranted variations while retaining those warranted variations which reflect patient-oriented care (Mulley 2010). Identifying unwarranted variations is an important first step, albeit a methodologically and medically demanding one. The second step is to seek out the causes and target them directly. This, too, is a challenging task, because there are

[16] On the influence of sociological factors on physician behaviour, see de Jong (2007) and Westert and Groenewegen (1999).
[17] An international comparison might also show that higher rates of surgery in a given country could be explained by a higher level of general availability of human and technical resources.

often a number of factors responsible for unwarranted regional variations.

The OECD specifies eight policy options in order to reduce unwarranted regional variations in care and provide more needs-based care (OECD 2014, 56ff.). Some measures are directed mainly at regional authorities, others at service providers or patients (see the text box on the next page). The first bundle of measures is certainly more effective or easier to implement if the regions concerned have administrative steering powers in matters of health care, as is the case in many countries with a national health system. The second and third bundles of measures relate to needs-based and preference-sensitive care in itself – quite regardless of whether they are to be provided in an anomalous region or "only" from an anomalous service provider in an otherwise unexceptional region.

In the case of system-related measures, publications on regional variations give cause for concern, especially where the use of care deviates considerably from the national average. Not only among expert circles but also among the general public, there is an increasing awareness that health care is not always provided according to needs. Specific targets for individual regions in respect of certain services (e.g. rates of caesarean section) sharpen the focus of all concerned on needs-based care. After all, a reallocation of human or capital resources (e.g. medical practices, specialist departments) would be appropriate in regions with an especially high degree of overuse or underuse. Building up new resources in regions with a lack of services would presumably be easier to implement than reducing overcapacities in regions marked by overuse.

In the case of performance-related measures, the development and implementation of guidelines is essential: acting according to evidence-based guidelines contributes directly to more needs-based care. Guidelines should be developed and updated and their implementation verified and sustained at an institutional level. Furthermore, direct, confidential and constructive reporting and feedback to providers who manifest anomalous service data can enhance the motivation to make improvements in the direction needs-based care. Finally, financial incentives can be used to control the nature and extent of services proved and thereby contribute to greater appropriateness in health care.

In the case of patient-related measures, the emphasis in on greater involvement of and focus on the patients, their experiences and preferences. Reliable and validly obtained patient experiences help to systematically include the patient's perspective in the evaluation of an intervention, in addition to the clinical endpoints. Evidence-based decision aids similarly enable the patient to understand the different treatment options before during and after consultation with the physician and to carefully weigh them against one another in order to reach a clear decision in accordance with the patient's own preferences.

Eight policy options to reduce unwarranted variations

Systemic measures

1. Public reporting
2. Regional targets
3. Reallocation of resources

Service provider related measures

4. Development and implementation of guidelines
5. Supplier-based reporting and feedback
6. Changes to remuneration incentives

Patient-related measures

7. Use of patient-reported outcomes
8. Application of decision-making aids for patients

Quelle: OECD 2014, 56ff.

2.7 Paradigm shift towards more patient-oriented care

Reducing or even eliminating unwarranted variations in health care is an important objective. The largely analytical strategy outlined above in which the unwarranted variations and their causes are first identified and then specifically tackled, is a complex and time-consuming process. This applies especially to Germany, where the regional units studied, namely urban and rural districts, are not in charge of healthcare governance in respect of their populations.

For this reason in particular, this should therefore provide an incentive in this country, too, to not only carry out healthcare research but also for decision-makers in (anomalous) regions to deal in greater detail with the specific features of local or regional health care and their effect on the population concerned. This can be carried out analytically by refining the healthcare reporting of the federal states or through qualitative scientific studies and also pragmatically by way of regional health conferences.

In the short and medium term, it will be more effective in Germany with its diverse responsibilities in terms of structural control, governance and supervision, as well as the provision and funding of services, to consistently pursue and implement non-regional, supplier-based or patient-related measures geared at achieving more appropriate health care.

This applies, for example, to the creation (or updating) and use of guidelines and the reporting and feedback processes to anomalous hospitals within the framework of external quality assurance. Even in the case of some of the nine interventions included in this study, there are still deficits in Germany. For instance, there are still no guidelines on appendectomy indications and the guidelines for tonsillectomy and hysterectomy indications have been pending since 2008/2014 and (again) since 2010 and are expected to be ready by early 2015; the guidelines on "gallstones, diagnostics and therapy", which also includes the indications for cholecystectomy, expired on 31 December 2012 with an update being announced for the end of 2015. At the same time, the indications for appendectomy and hysterectomy were deleted from external quality assurance under Section 137 of the German Social Code, Book V (§ 137 SGB V) and the indications for caesarean section and prostatectomy are not even included in external quality assurance.

In Germany there are even greater shortcomings in the lack of systematic inclusion of the patient's perspective, both at the macro level of evaluating services and on the micro level of involving patients in the decision-making process (Braun and Klemperer 2015). Specifically, it is the principle of shared decision making, in which doctor and patient share all relevant information and agree on the most suitable treatment option, that is still made too little use of in Germany. But it is precisely this shared decision making that corresponds to the concept of procedual justice: medical outcomes can differ (regionally) from one another as long as the decisions previously taken were arrived at through an agreed, fair and evidence-based process (Appleby et al. 2011).

Although patients benefit in many ways from a process of participative decision making, shared decision making is rarely exercised in everyday clinical practice in Germany. There are many different reasons for this. From the physician's point of view, there is still little actual awareness of the concept. This also leads to the misguided view that most patients do not want to be involved in shared decision making, or would be overtaxed by it, and to its benefits being underestimated. In addition, Germany still lacks sufficient independent evidence-based decision aids to support patients in their decision making and make the consultation with their doctor shorter and more effective. But the greatest barriers are presumably still to be found in the forms of remuneration, whereby action is rewarded more than waiting or refraining from action.

The aim of health policy must be for patients to receive the services which correspond to their needs and their personal preferences, and only these. Here, shared decision making – in addition to the other measures outlined - can make a valuable contribution. Shared decision making has the fundamental attraction of strengthening the original right of the patients to involvement and self determination. It thereby contributes in no small measure to reducing unwarranted regional variations and – in the words of Muir Gray and Gerd Gigerenzer – to making the 21st century the century of the patient (Gigerenzer and Gray 2011).

3. Methods

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3.1 Calculation of indicators

3.1.1 Definition of indicators and depth of analysis

Each of the nine topic sections in the updated "Regional Variations" Fact Check reports on the regional variations in the utilisation of services among the population. As in the 2011 report, these are described or expressed in respect of one specific indicator in each case. The indicators can not always cover the respective topic in its entirety. For example, in the case of the indicator "appendectomy", it would certainly have been desirable to also consider the indicator "ruptured appendix" in a similar manner, and in the case of the indicator "coronary bypass surgery", it would be highly desirable to map catheterisation treatment for coronary heart disease. Such requests have been expressed and collected anew in the harmonisation carried out by the reviewers of the present report. These "gaps" in the "Regional Variations" Fact Check remain part of its conceptional structure and are dealt with in a pro-active manner. It is hoped that this will encourage a more intensive, regionally oriented discussion of the topics studied.

In recent years, some of the nine topics considered here have been analysed in greater detail by way of specific Fact Checks. In order to explain the possible causes of the regional variations for each topic, many other indicators have also been included: in the case of caesarean sections, for example, the number of re-sectios or the percentage of inpatient wards for gynaecology and obstetrics, in the case of tonsillectomy, the indication and inpatient service structures and in the case of knee replacements, for example, the socioeconomic structure and the importance of arthroscopy for subsequent endoprosthetic interventions. The single subject Fact Checks have filled the conceptional gaps discussed above, at least in part. The relevant sections of the present report include the key insights from the subject-specific Fact Checks.

3.1.2 Sources of information

The data sources and the methods used to calculate the indicators are set out clearly in Chapter 5, "Data sources and use". This chapter also describes possible limitations of the raw statistics and transformations. The case-based hospital statistics (DRG statistics) are taken from special evaluations carried out by the Federal Statistical Office. This approach may limit the significance of regional variations in the rates of take-up, since 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 surgery itself or to individually consider the operations documented for the various cases). Overall, however, it is reasonable to assume that the extent of regional variations observed does not primarily depend on such features and limitations (as described in the chapter "Data sources and use") but that such features 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 (referred to simply as "districts". This prevents distortions arising from patient flows across district boundaries.

3.1.3 Standardisation and aggregation over time

Regional variations in the utilisation 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 gender), in the prevalence of disease, in the totality of services already delivered at the time of the study (e.g. number of children and adolescents whose

tonsils were removed prior to the selected timeframe) and in anomalies arising from social status (income, employment status, etc.) and lifestyle. Therefore, an attempt is generally made to "clear" these differences between populations as far as possible.

For the indicators covered in the updated "Regional Variations" Fact Check, a direct standardisation according to age group and gender was carried out. In direct standardisation, the districts are statistically weighted against a uniform age and gender distribution – for example, the population of Germany as a whole. The directly standardised values obtained in this way are thereby "cleared" of the district's specific age and gender distribution. With the exception of the indicator on caesarean sections, the standard population is the population of Germany in the year 2012 (prior to the census) according to age group and gender.

A detailed description of the method of standardisation used for each indicator is given in the chapter "Data sources and use". For further information, see the Federal Statistical Office's descriptions of statistical methods (in German) at www.gbe-bund.de/gbe10/owards.prc_show_pdf?p_id=9768&p_sprache=d. If this standardisation were not carried out and if only the frequencies actually observed were to be presented, it would not be possible to discern to what extent lower or especially high values were actually due to the characteristics of the age and gender profiles of the respective district.

In addition to direct standardisation, regional studies can also be subjected to indirect standardisation. This was applied for most indicators in the first "Regional Variations" Fact Check. With indirect standardisation, the utilisation of services observed for a reference population (here, national average by age group and gender) is applied to the population of a particular region by age group and gender in order to calculate an expected utilisation rate. The data is then presented as a ratio of actual to expected rates. If the ratio is greater than 1, utilisation in the region is above the national average. If the ratio is less than 1, utilisation is below the national average. This ratio (or index) denotes the relative position of a region compared to the national average (index value 1). Theoretically, however, a direct comparison of two individual districts on the basis of indirectly standardised values can under certain circumstances give a distorted picture.[18]

The direct standardisation used here offers the advantage over direct standardisation in that the standardised values for individual districts can be compared directly with one another. In addition, the standardised rate of surgery in a district is more comprehensible to and more meaningful for a broad (lay) readership than an abstract index value. It is hoped that this will attract greater attention and encourage debate among the persons responsible and decision makers about the reasons for the exceptional rates of surgery in those districts which have a relatively high or low standardised rate of surgery.

In the respective sections on each indicator, reference is made to any known potential influences due to differences in prevalence, social and/or lifestyle specific features, etc. on the variations detected, but without any claim to completeness.

The value in respect of all indicators described does not represent the value for a year but a value calculated from data gathered over a three-year period in each case (2007–2009 and 2010–2012). This approach reduces the effect on the analysis of any random annual fluctuations in small regional units. This enables meaningful statements to be made about the utilisation rate of services even in districts with a comparatively small population. Furthermore, following further district reforms

[18] For a detailed discussion of methods, see: Tsai SP, Wen CP. A Review of Methodological Issues of the Standardized Mortality Ratio (SMR) in Occupational Cohort Studies, International Journal of Epidemiology 1986, 15: 8-21. A possible distortion in the regional comparison using indirectly standardised indicators was investigated in the first "Regional Variations" Fact Check report and found to be empirically insignificant.

which were implemented since the original study, all data records for the years 2007 to 2011 have been transferred to the district structure of 2012.

3.2 Presentation and evaluation of regional variations

3.2.1 Description of variation and categorisation

The regional variations in utilisation determined for each topic are described under the subheading "Extent of regional variations". The urban and rural districts can be directly compared to one another by means of the standardised rates of surgery.[19] In each case, this section sets out by how much lower the result in the district with the highest standardised rate of surgery is in comparison with the district with the lowest rate of surgery; these differences are expressed as the "ratio of the upper extremal value to the lower extremal value" (extremal quotient). Extremal values can, even if the data used covers a long period of time, include so-called statistical artefacts. For this reason, a further deviation parameter is calculated into the indicators mapped for the 402 districts. In this process, the 20 districts (some 5% of all districts) for which the population as standardised for age and gender recorded the highest or the lowest take-up of services in the comparison were excluded when calculating the range of variation. And the differences between the remaining 362 districts are also expressed in terms of the "ratio of the district with the highest value to the district with the lowest value" ($95^{th}/5^{th}$ percentile).

The main parameters of regional variation are compared in a separate box – the weighted average, the median, the range between maximum and minimum values, the extremal quotient and the $95^{th}/5^{th}$ percentile – for both periods under consideration. In addition, a bar chart illustrates the regional variations at national level with the respective weighted averages for both periods.

For each topic, the data observed on regional variations for the earlier period 2007 to 2009 and the current period 2010 to 2012 are each depicted on a map. For each topic and period, the results for the individual districts are grouped in fixed variation bands (classes). The seven classes range from a "lower extremal group of variation" (rate of surgery more than 30% below the national average) through five classes with the same relative range of 10 % approaching the national average rate of surgery, encompassing this in a range of +/– 10% and then exceeding the average by ranges of the same magnitude. The rate of surgery in the population of districts assigned to the group of districts with the upper extremal value, exceeds the national average rate of surgery by more than 30%.

- Deviations of more than -30% from the national average
- Deviations of -30% to -20% from the national average
- Deviations of -20% to -10% from the national average
- Deviations of -10% to +10% from the national average
- Deviations of +10% to +20% from the national average
- Deviations of +20% to +30% from the national average
- Deviations of more than +30% from the national average

In contrast to grouping in flexible variation bands that are equal in size (e.g. quartiles or quantiles), the chosen method of grouping has the key advantages of allowing the extent of variation to be compared across the various topics and also that this consistent (static) method of classification is more easily understood by the lay reader.

The individual classes are coloured using a neutral colour spectrum ranging from dark blue (for lower extreme value classes) through lighter blue tones to pale green for the middle group. Above-average rates of surgery groups are coloured in brown using an increasingly darker shade tone toward the

[19] Anyone interested can compare their district with the rates of two other selected districts on an interactive map at www.faktencheck-gesundheit.de.

higher extreme value groups. This scaling system and colour scheme are also used to map the results on the website www.faktencheck-gesundheit.de.

Using a process of class formation which is consistent across all indicators and time periods means that even a cursory overview of the maps for all indicators can provide an assessment of whether the population of a given district (and the surgical interventions investigated in the Fact Check) is characterised by a high, medium or low utilisation of hospital services. If a district is coloured green on the map, the rate of surgery for the population of this district is close to the weighted national average. If it is coloured blue, the rate of surgery is below average; increasingly dark shades indicate that the index is further below the national average. Similarly, an increasingly dark shade of brown indicates that the rate of surgery is increasingly higher than the national average.

3.2.2 Comparison of the two maps according to indicator for the different periods and groups

For each indicator, two maps of Germany are shown, each subdivided into districts, one map for the period 2007–2009, the other for the period 2010–2012. For one and the same indicator, the class delimiters for the period 2010-2012 differ from the class delimiters for the period 2007–2009, since the process of class formation described in the previous section always takes the national average rate of surgery as a point of reference and this is not usually the same for both periods. If the rates of surgery for Germany as a whole are changed, the classes defined by the limits of their percentage deviation from the average shift accordingly. For example, if the national average rate of surgery in the period 2010–2012 is lower in comparison with the earlier period, as is the case for six of the nine indicators studied, then the limit values of the classes, and therefore their ranges, are lower. The class sizes are therefore firmly defined for each period and indicator via the percentage deviation from the average rate (weighted average) and remain constant; only their limits change in accordance with the value of the average rate.

Contrasting two maps of Germany showing fixed class sizes but with different class limits enables an intertemporal representation of the "relative position" of a district in comparison with the national average rate of surgery, irrespective of whether this rate of surgery has increased in the intervening period. Comparing a district over a period of time above and beyond the two respective maps enables statements to be made as to whether the rate of surgery in this district has tended to remain constant, become closer to the national average, or diverge further from it. This method of observation has the advantage of making it apparent at a glance whether, for example, a district has a rate of surgery in both periods under study which is far above the national average (dark brown) or far below it (dark blue)– in other words, if the extreme relative deviation of a district from the national average has remained unchanged, although the rate of surgery in the district may have increased or decreased along with the trend in the national average. This form or representation therefore enables an instant assessment whether regional patterns in variation for a given indicator have changed significantly over time or remained constant. When comparing the maps, it is important to bear in mind that these may be slightly distorted since the rates of surgery in many districts are close to the defined class limits, so that even minor changes can result in a considerable number of changes from one class to another in the periods compared.

3.3 Possibilities and constraints

The possibilities and constraints of the "Regional Variations" Fact Check have been addressed in the previous sections and are summarized here. The indicators selected for this Fact Check cover a wide range of topics, although they focus largely on the inpatient hospital sector. The main reason for this focus was the lack of official, public data on small-area populations for many other interesting

areas of health care (outpatient care, pharmaceutical care, nursing, etc.). A further reason was that additional sources of data fell outside the time frame and resources of the project. An example of this is the long-planned implementation of Article 303a of Book V of the German Social Insurance Code (SGB) on "Data Transparency". Its limited database is to be expanded to support longitudinal studies over longer periods of time, analyses of treatment workflows and analyses of healthcare processes in order to identify shortcomings and establish points of departure for reforms relating to overuse, underuse and misuse of services. The Improvement of Healthcare Structures in Statutory Health Insurance Act sets out new regulations on data transparency. In addition, performance-related information (e.g. the provision of outpatient services [EBM codes] and the DRG-based reimbursement of hospitals) is also of importance to health policy research.

Because of the chosen limit of two pages per indicator/topic, in combination with a focus on the lay reader, this Fact Check can only be the first step toward investigating and interpreting the reasons for the reported regional variations in the utilisation of services or the available capacities for health care. Further research will be required in order to explain the sometimes considerable differences between regions for each indicator or topic and to identify relevant options for action in the regions concerned.

On the whole, it can be said that the variations reported can not be explained, at least not in all cases, solely by reference to differences within the populations. The "Regional Variations" Fact Check formulates initial explanatory hypotheses, largely on the basis of scientific publications, and sets out possible recommendations for action. The meetings and discussions held among the authors, reviewers, and experts from the Bertelsmann Stiftung during the preparation of this Fact Check have impressively confirmed that the method chosen for this report of a limited presentation of selected topics is able to stimulate fruitful debate on causes, solutions and pathways to change.

4. Indicators selected

4.1 Caesarean sections

Background and significance

The percentage of caesarean sections among all hospital deliveries in Germany increased from about 17% in 1994 to 32.2% in 2011 (GBE 2014a). A similar trend has been observed in other developed countries (GBE 2014b). In 2012, the rate of caesarean sections in Germany fell slightly for the first time (GBE 2014a).

Obstetricians distinguish between absolute and relative indications for a caesarean section. An absolute indication applies when a medical condition in the expectant mother or in the foetus, 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 risks. Examples of such are pelvic presentation, multiples or previous caesarean sections. The German Society for Gynaecology and Obstetrics (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 developed countries, the status of this intervention, and in particular the appropriateness of caesarean delivery on maternal request, are the subject of discussion among gynaecologists and obstetricians (Schücking, 2004; DGGG 2010). In the case of caesarean section on maternal request, there is not even a relative medical indication. 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).

Studies point to the negative consequences of Caesarean sections for the mother (Liu et al. 2007, Blanchette 2011, Solheim et al. 2011), whereby particular attention is attached to the risks for all subsequent pregnancies (DGGG 2012). For example, the percentage of caesarean sections performed because a previous sectio or other uterus operation had been carried out has continued to increase and amounted to about one quarter in 2012 (AQUA 2013). Recent years have seen an increase in research into the consequences of caesarean sections for the newborn child, an aspect which had previously been neglected (DGGG 2012). Areas of study include long-term risks for children after a caesarean delivery, such as type 1 diabetes, asthma and obesity (Thavagnanam et al. 2007, Cardwell et al. 2008, Ziegler et al. 2011, Huh et al. 2012, Cho and Norman 2012).

Extent of regional variations

In Germany, depending on where the mother lives, the percentage of caesarean sections per 1,000 live births was between 18% and 46% in the period 2007 to 2009 and between 17% and 52% in the period 2010 to 2012. This means that in some districts more than thee times as many caesarean sections were performed as in other districts. In

Key parameters for regional variations

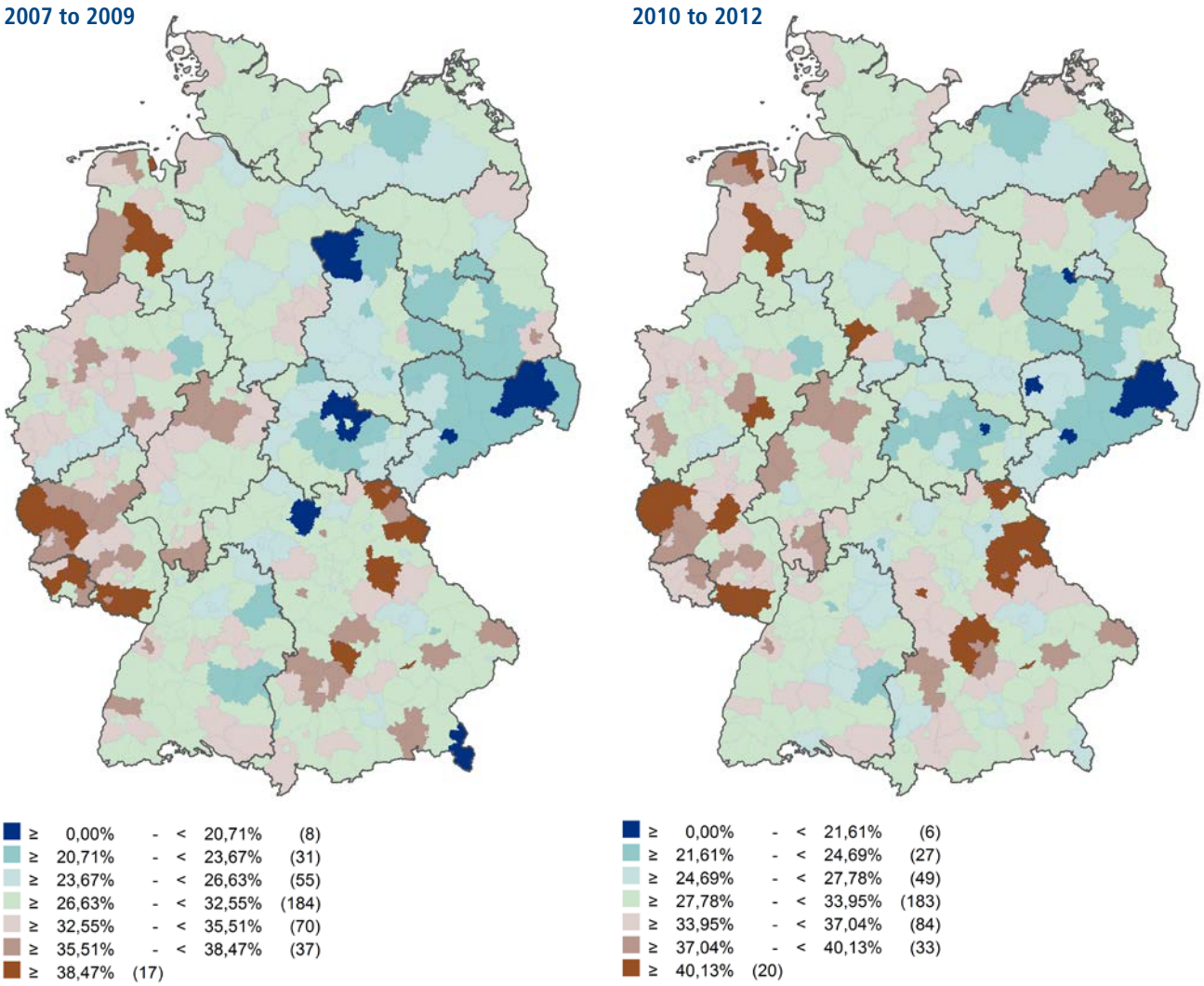
	2007–2009	2010–2012
Average	30 %	31 %
Median	30 %	32 %
Range	18–46 %	17–52 %
Extremal quotient	2,6	3,0
Percentile quotient	1,7	1,7

both periods under study, the rate of caesarean sections in about half of the districts (184 and 183 respectively) occupied a narrow corridor of 10 percent around the national average.

Many regional anomalies, such as the considerably higher than average rates of caesarean section in many districts of Rhineland Palatinate and below average rates in most districts of Eastern Germany, remain unchanged.

Figure 5: Rate of caesarean sections by district

District of residence of mother, only live births, directly standardised to live births according to age groups of mother in 2012



Source: German Federal Statistical Office (DRG_DRG, Stat_Geburt), own calculation and presentation (IGES 2014).

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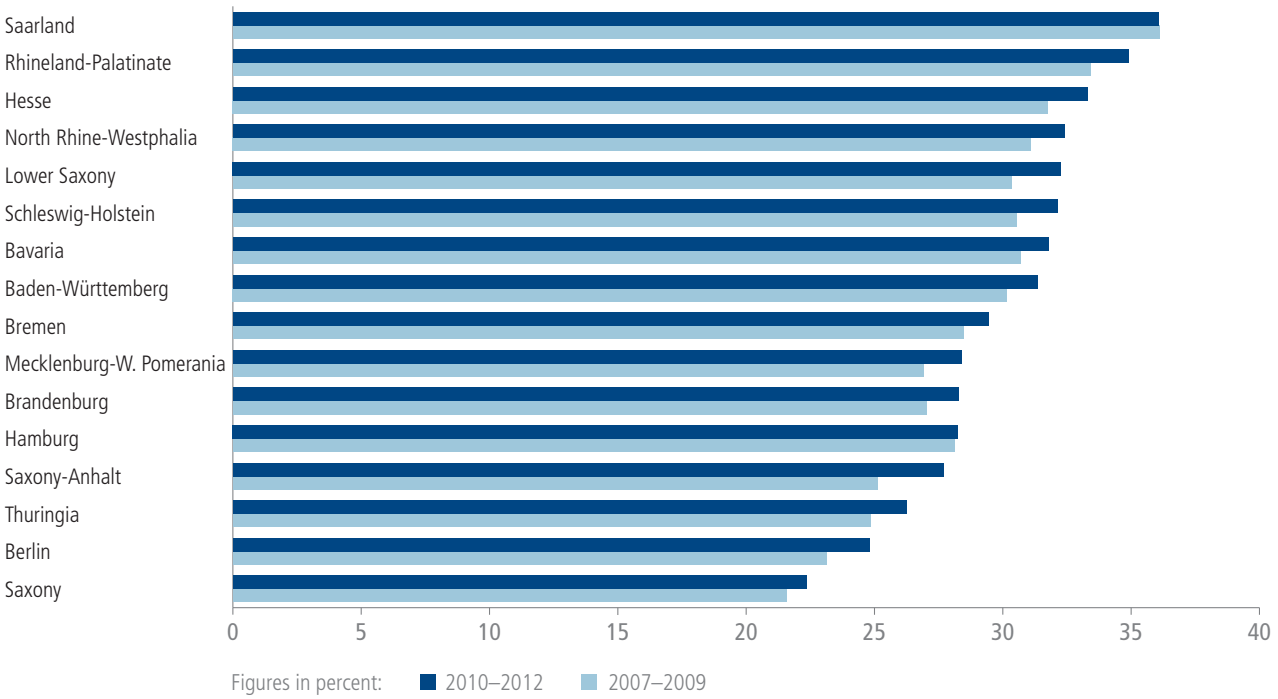
Possible explanations and courses of action

A detailed Fact Check conducted by the Bertelsmann Stiftung studied both the overall increase in caesarean deliveries and the possible causes of regional variations in the rate of caesarean sections (Kolip et al. 2012). This revealed that some of the reasons often cited for the overall increase in the number of caesarean deliveries, such as the increasing average age of mothers, an increase in the prevalence of medical conditions in mothers (such as adipositas or diabetes mellitus) and a tendency toward overweight children, multiple births, premature births or elective caesarean sections, do not significantly impact on the increase in the rate of caesarean sections. Furthermore, these factors are not subject to any marked regional variations and are therefore not a suitable explanation for the regional variations in the rate of caesarean sections.

Changes in obstetricians' risk assessments of the relative indications for a caesarean section, however, are largely responsible for the increase in the number of caesarean sections. These are increasingly due in part to legal liability risks, changes in hospital organisation, staffing issues and an increasing lack of experience in dealing with complex spontaneous deliveries, together with a defensive attitude on the part of obstetricians; this means that practitioners consider factors relating to hospital organisation (staffing levels) and a lack of obstetric experience to constitute a relative indication for caesarean sections

Figure 6: Rate of caesarean sections by federal state

District of residence of mother, only live births, directly standardised to live births according to age groups of mother in 2012



Source: German Federal Statistical Office (DRG_DRG, Stat_Geburt), own calculation and presentation (IGES 2014).

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(DGGG 2010). The scope for decision making in the case of relative indications is assessed differently by obstetricians in different regions and this gives rise to considerable variations in the resultant obstetric procedures. For example, deliveries in external consultant wards are much more frequently performed by caesarean section than in regular specialist wards. The importance of external consultant wards for obstetric care varies considerably in Germany. The external consultant structure accounts for about 9% of the regional variations in caesarean sections and over 14% of the variation in primary (planned) caesarean sections (Kolip et al. 2012).

Of particular relevance to the variation in the rate of caesarean sections is the effect of so-called re-sectios, in other words caesarean sections performed as a consequence of a previous caesarean delivery. A previous caesarean section is extremely likely to lead to a further caesaren section. Both the DGGG and the British NICE recommend attempting a vaginal birth as a matter of course, even after a previous caesarean section (DGGG 2010, NICE 2011). This recommendation is not followed to the same degree in all regions and is on the whole not implemented frequently enough (Kolip et al. 2012).

Since the regional variations in the rate of caesarean sections over time has proven to remain more or less constant, it must be assumed that, in addition to the structural causes referred to, regional differences in the scope for decision making in the case of "soft" caesarean indications apply or the advantages and disadvantages of types of delivery are assessed differently by obstetricians who accordingly give different advice to expectant mothers. Against this background, there is a call for initiatives to provide comprehensive information for expectant mothers. For example, at the end of 2013, the health ministry of North Rhine Westphalia set up a "Round Table of Obstetricians" to look into the causes of the rising rate of caesarean sections (MGEPA 2013). In the spring of 2014, in Baden-Württemberg, a broad-based state-wide campaign to provide extensive information to expectant mothers and their relatives was launched and scheduled to run for six months. By filling the gaps in the available information, this campaign sought to help those concerned to make informed decisions for or against a natural birth. The campaign is also designed to heighten awareness those who are professionally involved with the birth of children. The medium-term reduction in the rate of caesarean sections in Baden-Württemberg was formulated as the explicit objective of this campaign (BW 2014). It will be of particular interest to observe whether this campaign and the measures introduced in Baden-Württemberg in connection with it can contribute to a further reduction in the rate of caesarean sections.

4.2 Tonsillectomy in children and adolescents

Background and significance

The complete surgical removal of the tonsils (tonsillectomy), in some cases together with the removal of the adenoids (adenoidectomy), is still one of the most common surgical interventions carried out on children. Although the number of operations decreased significantly from about 78,000 to about 60,000 between 2007 and 2012, applying the age-group specific rates of surgery used in 2007 to the population of 2012 reveals that only about a third of this reduction in the number of cases is due to the fact that the number of children and adolscent living in Germany in the period under study fell by about 1.12 million. Two thirds of the reduction in the number of cases can not be explained by demographic changes.

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 requirement is also based on the fact that the risk of post-operative bleeding represents the most serious and potentially life-threatening complication of this surgical intervention (Stuck et al. 2008).

Recurring infections of the tonsils or the peritonsillary area account for over 50% of cases and are the most common indication for tonsillectomy (Nolting et al. 2013). Guidelines exist as to how many instances of tonsillitis within specific time periods indicate that tonsillectomy should be considered (Stuck et al. 2008, HNO 2007). Before this indication leads to a complete tonsillectomy, however, the available conservative and pharmaceutical treatment options should first be exhausted. In cases where these first-line therapeutic approaches are not effective, this is often because patients do not adequately follow the doctor's recommendations (HNO 2007).

In over one third of tonsillectomies carried out, the deciding factor in favour of a surgical intervention is enlargement of the tonsils (hyperplasia) (Nolting et al. 2013).

Extent of regional variations

In spite of a reduction in the number of interventions and in the frequency of surgery, the regional variations have hardly decreased in recent years. At district level, the standardised rate of surgery in the period 2010 to 2012 lay between 13 and 107 operations per 10,000 children and adolescents (2007 to 2009: 13 to 114). In the district with the highest rate of surgery, there were still about eight times as many tonsillectomies performed on children and adolescents as in the district with the lowest number of interventions. If the 20 districts with the lowest and the 20 districts with the highest rates of surgery are excluded from consideration, then the maximum difference is still about a factor of three (24 to 71 operations per 10,000). Even then, there is no discernible reduction in the range of variations compared to the period 2007 to 2009. In the period 2010 to 2012, however, there were 17 districts more in the area of the national average than was the case in the period 2007 to 2009 (111 compared with 94).

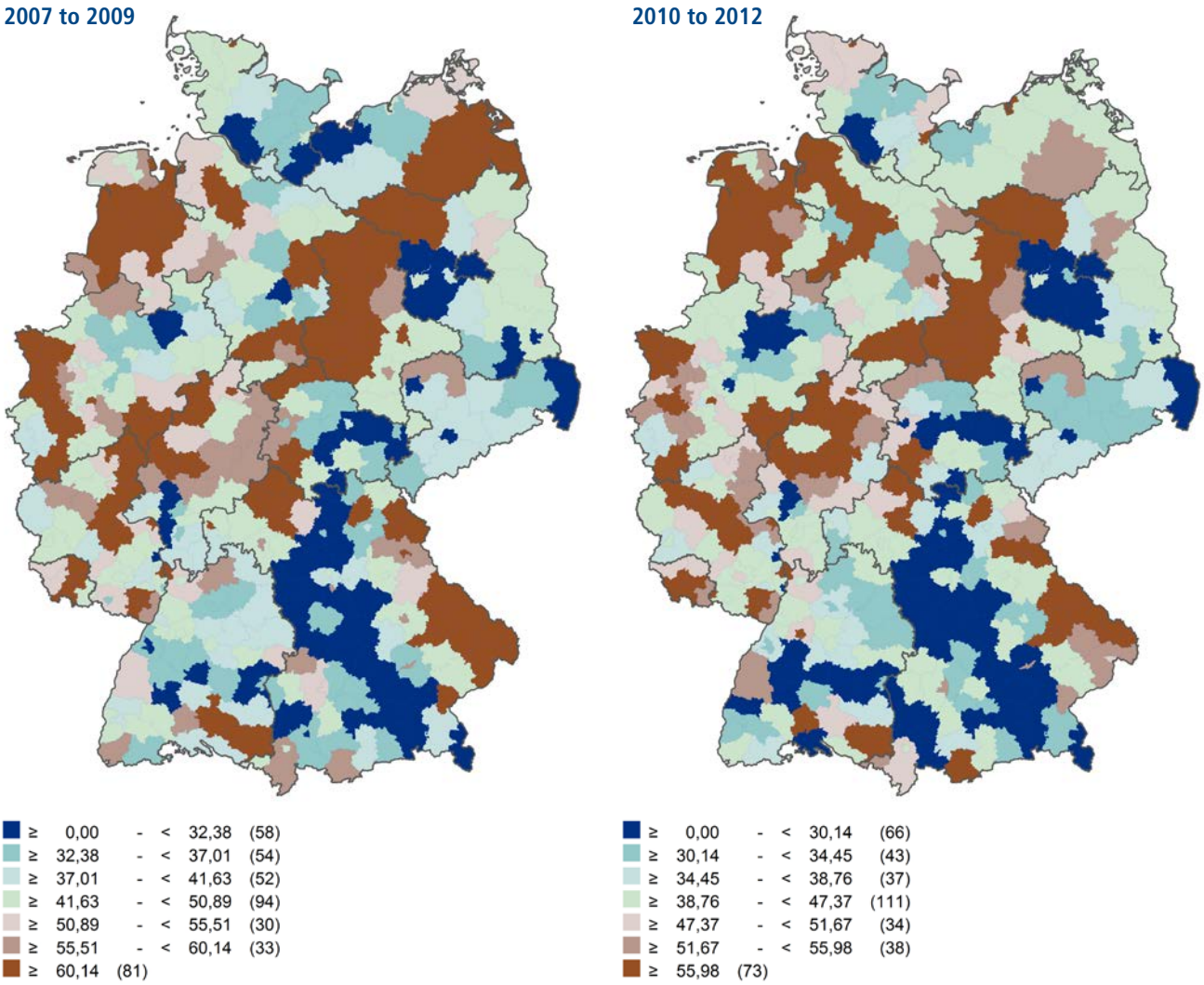
Key parameters for regional variations

	2007–2009	2010–2012
Average	46	43
Median	45	42
Range	13–114	13–107
Extremal quotient	8,5	8,3
Percentile quotient	2,9	3,0

A comparison of the regional variations in the rates of surgery in the periods 2007 to 2009 and 2010 to 2012 shows on the one hand a very stable picture of the regions overall, with rates of surgery both above and below the average. In the federal states of Saarland and Schleswig-Holstein, on the other hand, all districts, or many more districts in the period 2010 to 2012 than in the period 2007 to 2009, now show a higher than average rate of surgery.

Abbildung 7: Tonsillectomy by district per 10,000 children and adolescents

District of residence of patients, children and adolescents up to 19 years of age, directly standardised to the population of 2012 by age and gender



Source: German Federal Statistical Office (DRG_OPSvier, Stat_Bev_EA), own calculation and presentation (IGES 2014).

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Possible explanations and courses of action

The observation that tonsillectomy rates exhibit considerable regional variations is not new. The appropriate rate of tonsillectomy has been the subject of international discussion since the 1920s (Klemperer 1990).

There is no evidence that the indications for tonsillectomy specified in the literature vary as strongly between regions as the frequency of surgical interventions in this analysis suggests. The fact that the regional patterns of high and low rates of surgery remain the same over time confirms the assumption that there are major differences in diagnostic practices leading to a complete tonsillectomy.

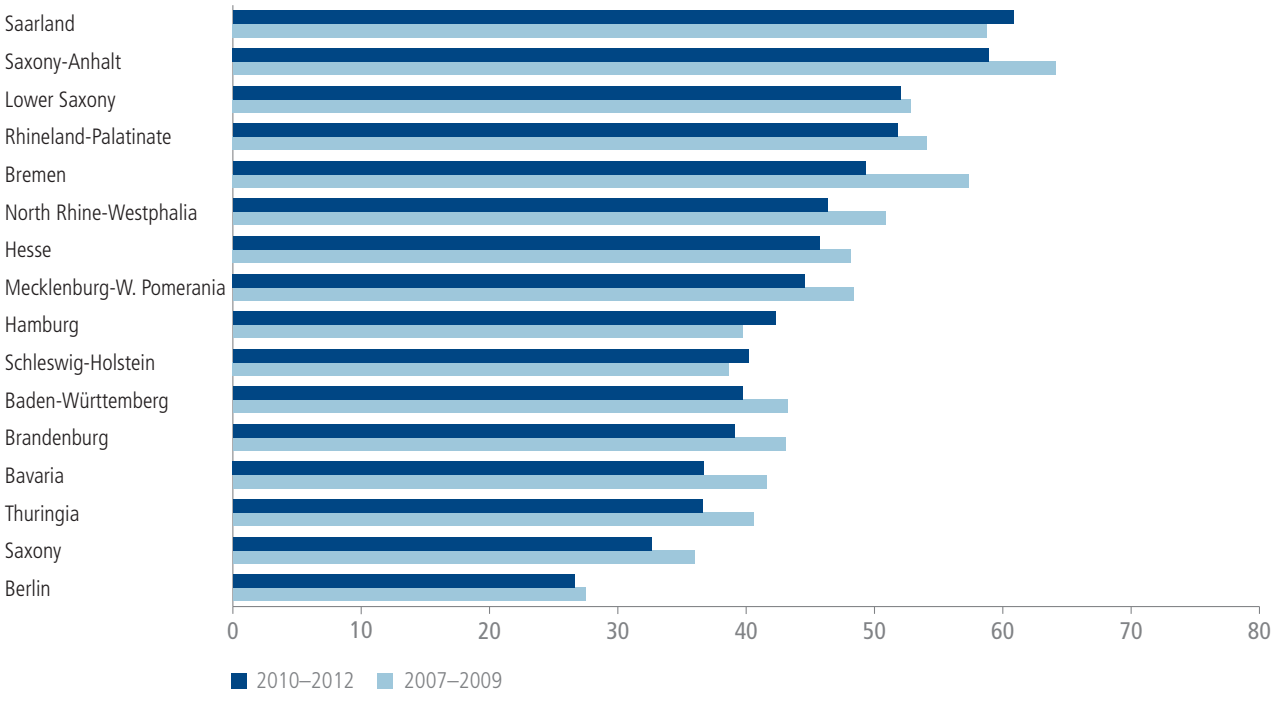
In the Fact Check on tonsillectomy initiated by the Bertelsmann Stiftung in 2013 it was found that the variation among districts in the rate of surgery carried out for "chronic inflammation" was more than twelve times, and for surgery carried out on the basis of "enlargment of the tonsils", more than 58 times (Nolting et al. 2013), i.e. even greater than in the overall rate of tonsillectomy for all indications.

Tonsillectomy is a preference-sensitive procedure but one which is affected by supply-sensitive factors. The rate of surgery among children and adolescents from districts in which there is no (longer) an independent ENT department is by far the lowest.

In any case, the rate of surgery is high in the case of children and adolescents from those districts in which the percentage of ENT external consultant beds is high, in which large ENT departments are involved in care or there is at least still an ENT

Figure 8: Tonsillectomy by federal state per 10,000 children and adolescents

District of residence of patients, children and adolescents up to 19 years of age, directly standardised to the population of 2012 by age and gender



Source: German Federal Statistical Office (DRG_OPSvier, Stat_Bev_EA), own calculation and presentation (IGES 2014).

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department (Nolting et al. 2013). This information could serve as a point of departure for quality assurance measures.

However, the assumption that a high rate of tonsillectomy in all ENT facilities of the hospitals in a given district would also lead to a high regional rate of surgery and vice versa, does not bear scrutiny. Nor can any correlation be found between the regional density of outpatient physicians (paediatricians, ENT specialists and general practitioners) and the rate of surgery (Nolting et al. 2013).

In Germany, unlike in many other countries, there are still hardly any reliable guidelines for deciding when tonsillectomy should be preferred over other forms of treatment. The unchanged variations in the take-up of this option clearly underscore the need for development in this area. The proposed guidelines announced in 2008 by the German Society of Oto-Rhino-Laryngology, Head and Neck Surgery (DGKCH) ("Tonsillitis, chronic and recurring"), in which it was intended among other things to set out "... which medical conditions can be regarded as chronic or recurring tonsillitis, which forms of treatment are to be considered, what requirements are to be placed on preoperative diagnostics..." (AWMF 2011), could not be completed as planned by the end of 2012. The new proposal for guidelines announced in 2014 ("Treatment of inflammation of the tonsils / tonsilitis") aims to compare the conservative and surgical options and is scheduled to be completed by the second quarter of 2014 (AWMF 2014). If and when these guidelines are published, it would be advisable to investigate whether the rate of surgery can be aligned to the incidences of "chronic inflammation".

Since there is no immediate prospect of the previously existing national quality assurance procedures in respect of which indications justify surgery in hospitals being reinstated, the Bertelsmann Stiftung has for the first time had a new instrument developed.

The regional data sheet which can be downloaded from the Internet, provides numerous options for comparing indicators for rates of tonsillectomy at the level of individual rural and urban districts (BST 2014). This provides a basis for physicians, hospitals and patients, if appropriate with the support of local government institutions and health funds, etc., to join the debate and look into the causes of especially high or low rates of surgery. The development of such area indicators, to be used for the purposes of quality monitoring in particular, was recommended a few years ago by the Advisory Council for the Concerted Action in Health Care (SVR 2007).

4.3 Appendectomy in children and adolescents

Background and significance

Appendicitis (inflammation of the appendix) is one of the most common causes of hospitalisation. According to 2012 DRG statistics, appendicitis occurs most frequently in children and adolescents and young adults. A third of all appendectomies (surgical removal of the appendix) is performed on children and adolescents (5 to 19 years of age). If young adults are included (5 to 29 years of age), then this population group accounts for 56% of all appendectomies. The number of appendectomies carried out on all patients fell from about 129,000 to about 121,000 between 2007 and 2012. This decrease in the asolute number of surgical interventions is entirely due to the fact that nearly 10,000 fewer children and adolescents were operated on. One third of this reduction in the number of cases is due to the decline in the number of children and adolescents in Germany between 2007 and 2012.

The onset of appendicitis usually occurs all of a sudden. Suspected appendicitis is an indication for appendectomy. No diagnostic method is yet available which can confirm or exclude appendicitis with certainty. The surgeon's judgement is central to the decision whether or not to perform surgery (DIMDI 2006).

Acute appendicitis is not easy to diagnose, since diagnosis relies mainly on rather vague symptoms such as right lower abdominal pain, fever and elevated inflammatory markers, along with the patient's medical history. An uncritical or liberal decision may increase the number of unnecessary surgical interventions, whereas watchful waiting may increase the rate of potentially life-threatening perforations. However, between 12% and 28.8% (depending on the literature) of appendices removed subsequently prove to be normal (BQS 2004). More recent studies have enlivened the debate about the extent to which unnecessary operations can be avoided by means of (extended) imaging diagnostics (Drake et al. 2012, Sahm et al. 2011) or – in the case of patients with uncomplicated acute appendicitis – through primary treatment with antibiotics (Krishna et al. 2012). The DGKCH points out that patients should not only be examined physically but also by use of ultrasound, which in experienced hands can considerably increase the accuracy of diagnosis (DGKCH 2013). A recommendation in favour of conservative treatment for children, on the other hand, can not be made (Szavay 2013).

Extent of regional variations

In 2012, 41,000 appendectomies were carried out in Germany on children and adolescents aged between 5 and 19 years. At district level, the standardised rate of surgery in the period 2010 to 2012 lay between 14 and 114 surgical interventions per 10,000 children and adolescents (2007 to 2009: 18 to 90). This means that some eight times as many appendectomies were performed on children and adolescents in the district with the highest rate of surgery than in the district with the lowest rate of surgery. This maximum difference between the districts with the "most extreme" variations in the rate of surgery was "only" a factor of five in the period 2007 to 2009. If the 20 districts with the lowest and highest rates of surgery are excluded from consideration, then the maximum variation is a factor of 2.5 (23 to 56 surgical interventions per 10,000). Even then, there is no noticable reduction in the degree of variation compared to the period 2007 to 2009 (25 to 63 surgical interventions per 10,000).

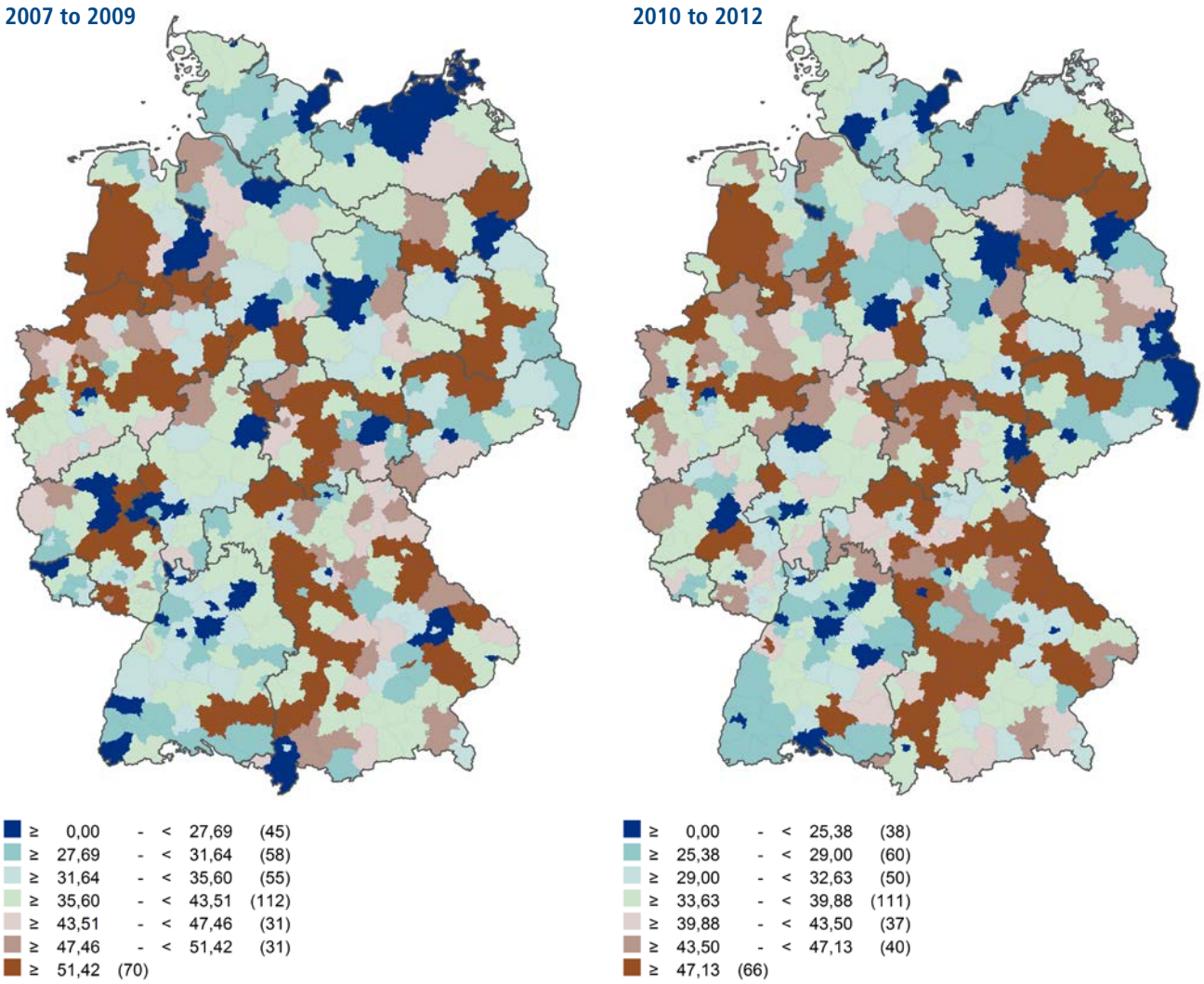
Key parameters for regional variations

	2007–2009	2010–2012
Average	40	36
Median	38	36
Range	18–90	14–114
Extremal quotient	4,9	8,0
Percentile quotient	2,5	2,5

A comparison of the regional variations in the rates of surgery for the periods 2007 to 2009 and 2010 to 2012 shows that there has been little change in the regions with above-average or below-average rates of surgery. It is notable that there are still some states in which there are no above-average rates of surgery in any (Schleswig-Holstein) or hardly any of the districts (Baden-Württemberg) whereas in Bavaria there are still many districts with an above-average rate of surgery.

Figure 9: Appendectomy by district per 10,000 children and adolescents

District of residence of patients, children and adolescents aged 5 to 19 years of age, directly standardised to the population of 2012 by age and gender



Source: German Federal Statistical Office (DRG_OPSvier, Stat_Bev_EA), own calculation and presentation (IGES 2014).

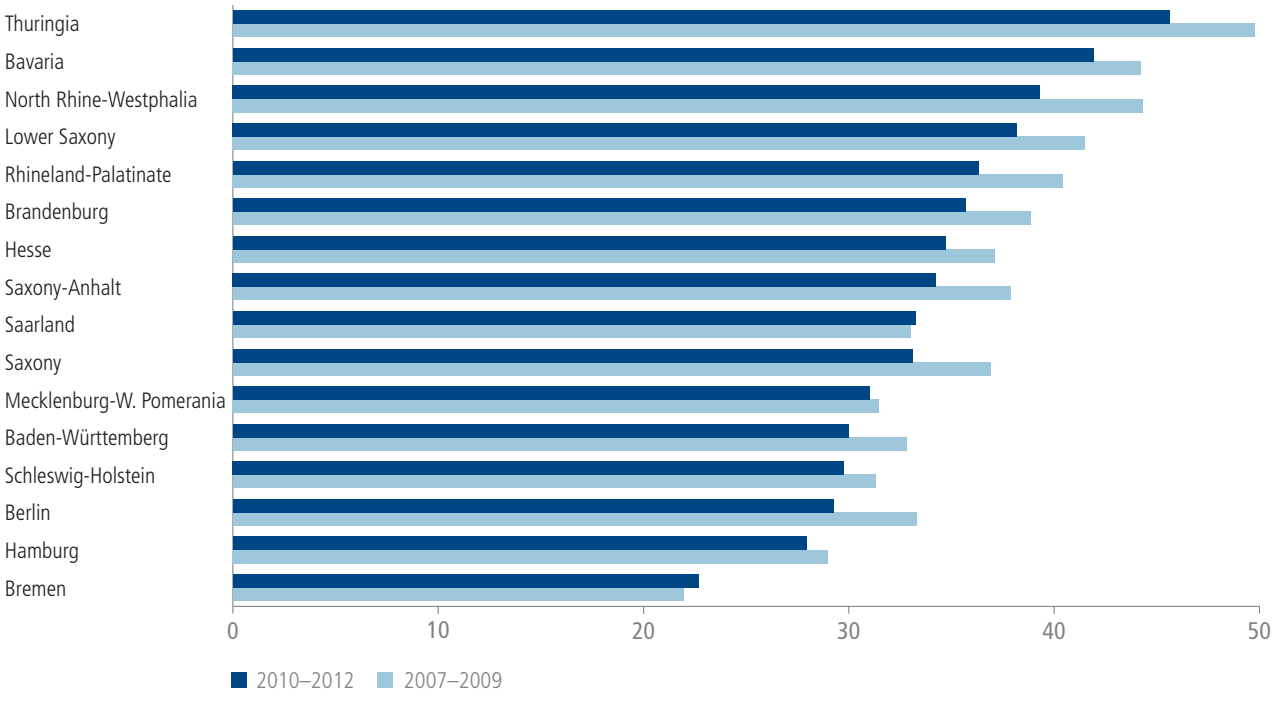
Possible explanations and courses of action

The main reason for the considerable variation in the rate of surgery is probably due to the evident regional differences in diagnostic patterns. Whether low rates of surgery in some regions represent a medically appropriate level of care or whether they correlate with a higher incidence of perforations or other complications would require further study. Until 2003, appendectomy was included in the statutory external quality assurance audit for all hospitals. The audit encompassed such aspects as the proportion of cases with suspected acute appendicitis that were postoperatively confirmed. In 2003, this proportion was below 50% in 53 of 1,092 hospitals. This means that over half of all patients who underwent surgery in these 53 hospitals did not have an inflamed appendix and the operation was therefore unnecessary. These hospitals were advised to conduct a structured analysis of the causes ("structured dialogue") and 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 hospitalised for more than one day prior to surgery.

Passing on the results of external quality assurance audits to the individual surgeons could help them in future decision-making situations, whereby they will still be responsible for assessing the risks when making their decisions on the indications for an appendectomy. The surgeon

Figure 10: Appendectomy by federal state per 10,000 children and adolescents

District of residence of patients, children and adolescents aged 5 to 19 years of age, directly standardised to the population of 2012 by age and gender



Source: German Federal Statistical Office (DRG_OPSvier, Stat_Bev_EA), own calculation and presentation (IGES 2014).

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must weigh the risk of possible perforation against the risk of an appendectomy, which is lower than that of other abdominal operations. In the case of less experienced surgeons, this consideration might result in a tendency to avoid risks and a consequently higher rate of surgery.

Since 2004, however, German hospitals have no longer been required to document appendectomies for the purposes of external quality assurance – based on the argument that the care situation in Germany has been at a consistently stable level for many years (BQS 2004). The documented variations in the rate of surgery could be taken as a justification that after ten years this area of service should included once again – even if only for a brief period – in the external quality assurance audit in order to establish whether the current status of the care situation is appropriate.

The consistently high regional variations in the rate of surgery and the largely unchanged regional "patterns" should also provide impetus for further studies into the medical disciplines concerned. It should be determined which procedures in the decision-making process may help to minimise the risk of perforation whilst keeping the rate of surgery down as far as possible. In order to reduce the considerable regional variations in the rate of surgery, the presumed different methods of diagnosing appendicitis and the use of alternative treatment options should be harmonised. A helpful step in this direction would be for the physicians concerned to share information with any nearby districts which have higher or lower rates of surgery.

4.4 Hysterectomy

Background and significance

The partial or complete removal of the uterus is one of the most common surgical interventions in obstetrics and gynaecology. In recent years, however, the rate of surgery has decreased in all relevant age groups (with a more or less unchanged population). Accordingly, the number of interventiions fell from 157,000 in 2007 to 134,000 in 2012. In 2012 alone, the number of inpatient hysterectomies performed in hospitals fell by almost 6,000.

There are many different indications for the surgical removal of the uterus and the proportion of different indications reported varies according to source. The most common 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 representing about 9% of cases (Thill et al. 2008). According to the latest findings of a study into the health of adults in Germany, 6.1 % of women included in the survey who had undergone a hysterectomy specified cancer of the uterus or the ovaries as the reason for the intervention (Prütz and von der Lippe 2014). The settlement data of the hospitals, however, reveals that only 81 % of women who had undergone a hysterectomy had been diagnosed with a benign condition of the female genital organs (Stang et al. 2011).

Depending on the main indication and the non-medical situation of the patients, a number of treatment options are available, especially in the case of benign conditions of the uterus. Hysterectomy is an intervention which can be associated with a wide range of complications and which always results in infertility. For this reason, hysterectomies are regarded as especially critical in the presence of benign medical conditions in women under the age of 35 years. Until 2012, the diagnostic trend in this patient group was monitored within the framework of the statutory external quality assurance for German hospitals. As from 2013, however, hysterectomies have been completely excluded from the quality assurance system (AQUA 2013).

Extent of regional variations

In spite of the reduction in the number of surgical interventions and the rate of surgery, the regional variations have not decreased in recent years. At district level, the standardised rate of surgery in the period 2010 to 2012 lay between 18 and 61 interventions per 10,000 women and therefore occupied exactly the same corridor as that observed between 2007 and 2009. In the case of women living in the district with the highest rate of surgery, more than three times as many hysterectomies were performed as in the district with the lowest rate of surgery. If the 20 districts with the lowest and the 20 districts with the highest rates of surgery are excluded from consideration, then the maximum variation is 1.8 times (26 to 46 interventions per 10,000 women). Even if the most extreme values are excluded, there is no discernible reduction in the extent of variation compared to the period 2007 to 2009 (a factor of 1.7).

Key parameters for regional variations

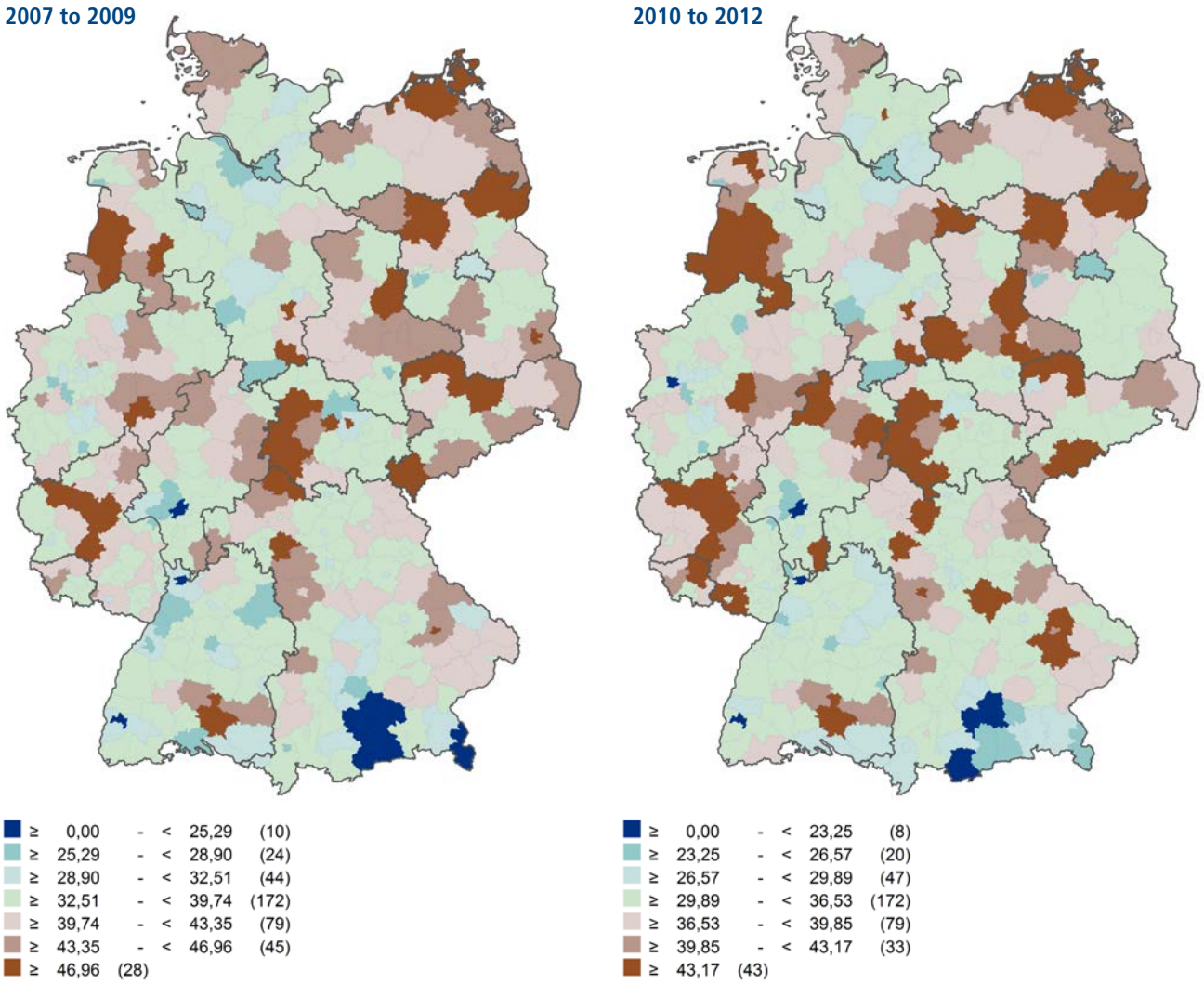
	2007–2009	2010–2012
Average	36	33
Median	37	35
Range	19–61	18–61
Extremal quotient	3,3	3,3
Percentile quotient	1,7	1,8

A comparison of the regional variations in the rates of surgery for the periods 2007 to 2009 and 2010 to 2012 shows that there has been little change overall in the regions with above-average or below-average rates of surgery. This also means that the rates of surgery for women living in cities are still either average or below average.

There are signs that hysterectomies are increasingly being carried out as outpatient interventions (Salfelder et al. 2007). The extent and the possible regional variations of this shift in services from inpatient hospital treatment are not known.

Figure 11: Hysterectomy by district per 10,000 women

District of residence of patients, directly standardised to the female population of 2012 by age



Source: German Federal Statistical Office (DRG_OPSvier, Stat_Bev_EA), own calculation and presentation (IGES 2014).

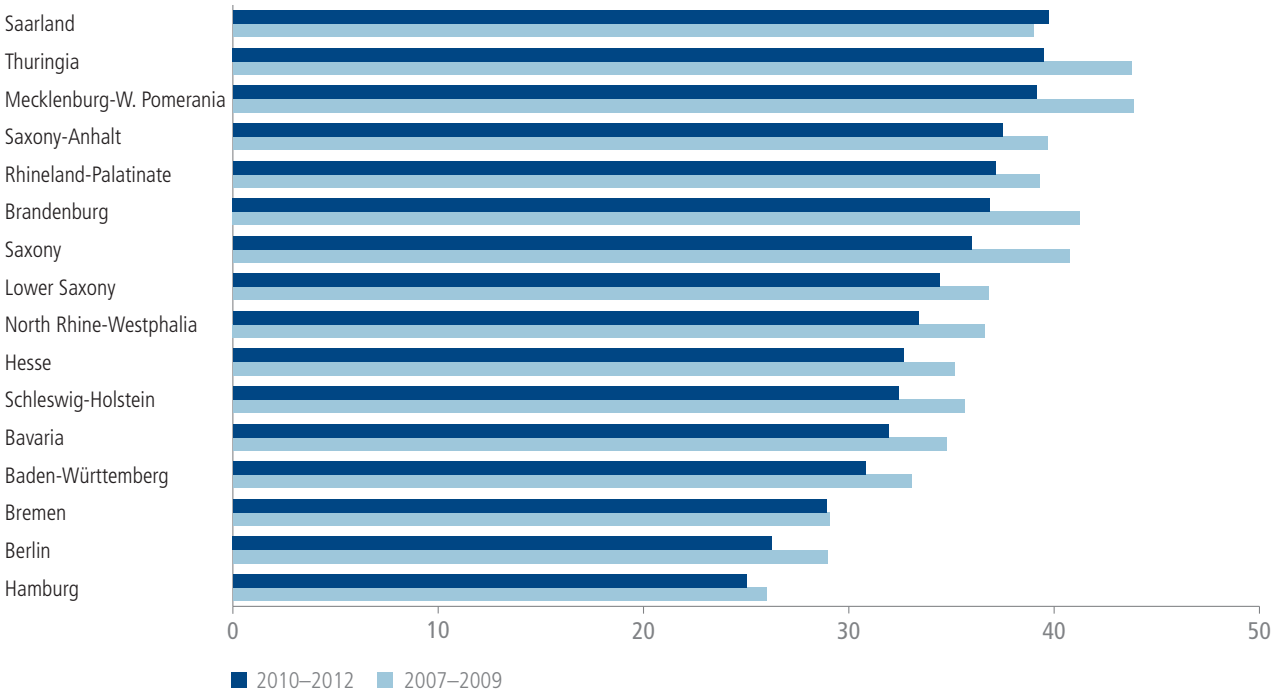
Possible explanations and courses of action

The regional differences in the rate of hysterectomies and the diagnosis leading to this surgical intervention have been the subject of discussion in many countries for several decades, since studies have shown that a substantial number of hysterectomies were performed without sufficient indication (Klemperer 1990), that physicians assessed the indications for the intervention differently (Bickell et al. 1995) and that even public information campaigns about regional rates of hysterectomy and the necessity for surgery can be enough to substantially reduce the rates of surgery (Domengighetti et al. 1988).

The unchanged variations are a sign that, in spite of the reduction in the number of inpatient interventions, the indications for a hysterectomy continue to be more liberally interpreted in some regions than in others. The stability of the regional pattern over time supports this interpretation. No statements can be made about the "appropriate" level of hysterectomy. In specialist circles there is an ongoing debate about which indications are uncontroversial and which indications – also in the light of the continuing development of treatment options – allow scope for decision-making on the part of patients and/or physicians and which may render a hysterectomy avoidable (e.g. Taran et al. 2008, Rein et al. 2009, David and Ebert 2012). The reduction in the overall number of hysterectomies and the rate of surgery might indicate a more critical attitude to the indications for a hysterectomy and be a sign that the use of treatments previously thought to be inadequate, in particular conserva-

Figure 12: Hysterectomy by federal state per 10,000 women

District of residence of patients, directly standardised to the female population of 2012 by age



Source: German Federal Statistical Office (DRG_OPSvier, Stat_Bev_EA), own calculation and presentation (IGES 2014).

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tive procedures such as treatment for uterus myomatosus (Taran et al. 2008), have now become more widespread.

In recent years the possible factors affecting the regional rates of hysterectomy have been the subject of increased study. A suspected correlation with the density of hospital beds in gynaecology wards in Germany could not be confirmed (Geraedts and Malik 2012). The latest DEGS1 data confirm that a series of international proven correlations also apply to Germany, but these can not fully explain the variations in care. For example, there are significant differences between women from lower educational groups (prevalence of hysterectomies: 31.0 %) and women from medium (15.6 %) or higher educational groups (11.6 %) and in respect of the number of births (prevalence in women with no children = 8.6%; with one or two children: 20.9 %; with 3 and more children: 28.0 %) (Prütz and von der Lippe 2014). If the explanations given in the literature for a correlation between a high level of educational attainment and a lower probability of a hysterectomy (better health care, more frequent take-up of early detection screening, more knowledge of different treatment options and a greater willingness to be hear explanations from physicians) (Prütz and von der Lippe 2014) be found to apply to Germany, too, then the need for action would be evident and addressable.

With its project announced in 2010 to develop guidelines for the "Indication and Methods of Hysterectomy", the German Society for Gynaecology and Obstetrics (DGGG) is striving to develop guidelines for gynaecologists in hospitals and private practice on the indication, performance and postoperative care of hysterectomy, including an evaluation of different surgical procedures (AWMF 2011). The target patient group includes patients with symptoms which do not unequivocably indicate surgery (AWMF 2014). The project was originally due to be completed by the end of 2011 (AWMF 2011). At the current state of progress (mid May 2014), the guidelines are set to be published by 30 September 2014 (AWMF 2014). Against the background of the constant regional variations in rates of hysterectomy, it is a matter of urgency that the content of the guidelines be incorporated into materials which will expand the patients' knowledge of the treatment options available for each indication so as to support them in their preferences and priorities.

The exclusion of hysterectomies from quality assurance as from 2013 (see above) is viewed very critically by the German Gynaecology Group – also with reference to the need for a more specific definition of indications. By referring to the guidelines mentioned above, and by incorporating a survey of patients, new indicators could be developed in order to adequately define the indications for a hysterectomy (AQUA 2013). In 2012, 37.3% of cases with the indicator "hysterectomy for patients with no malign condition and under the age of 35 years" among 891 hospitals who provide this service were statistically noticeable (2011: 34.6 %) and even greater variations were detected among the German federal states (AQUA 2014).

4.5 Prostatectomy

Background and significance

In 2011, over 65,000 men were diagnosed with prostate cancer and 13,300 men died from the condition in Germany (GEKID). The number of new cases has continued to rise in recent years but when adjusted for age, the incidence of the condition has remained more or less constant since 2003 (RKI 2013). Radical prostatovesiculectomy (complete removal of the prostate, seminal vesicles and if necessary, the associated lymph nodes) is a treatment option following a diagnosis of prostate cancer. Between 2007 and 2012, the number of complete prostatectomies document by hospitals fell by approx.32,000 to approx. 26,000.

Nerve-sparing surgery is becoming increasingly important (Barmer GEK 2012). Carcinoma of the prostate is a very slow-growing tumour which, especially in the early stages, causes hardly any pain or discomfort. The prognosis for most instances of prostate cancer diagnosed today are good. Four out of five men with prostate cancer do not die from this disease but from another condition (PATLL_ProstataCa I). In many cases, the tumour is discovered by chance (e.g. when examining tissure removed from a benign enlargement of the prostate) or in the course of medical examinations (rectal-digital examination, PSA measurement in the blood). Over recent decades, these examinations have led to more and more tumours being discovered in the early stages, which may lead to overdiagnosis and overuse of treatment (AWMF 2011, AWMF 2012, Draisma et al. 2009, Robra et al. 2013).

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

In addition to surgical intervention, which can entail complications and adverse effects, other prostate-preserving treatment options exist. These include percutaneous radiotherapy and internal radiotherapy (brachytherapy) as well as hormone therapy to support the treatment of locally advanced or metastasising cancer. These methods likewise entail undesirable side effects, the severity and extent of which can be comparable to those of radical prostatectomy (Wilt et al. 2008). Under some circumstances, active surveillance may also present an alternative to surgical intervention, radiotherapy or pharmacotherapy.

In the case of active surveillance "...the objective is to delay, under close observation, including taking a control biopsy, the timely curative treatment for otherwise healthy patients who are candidates for radical treatment until such a time as there is a change in the biology of the tumour or in the patient's wishes" (AWMF 2011).

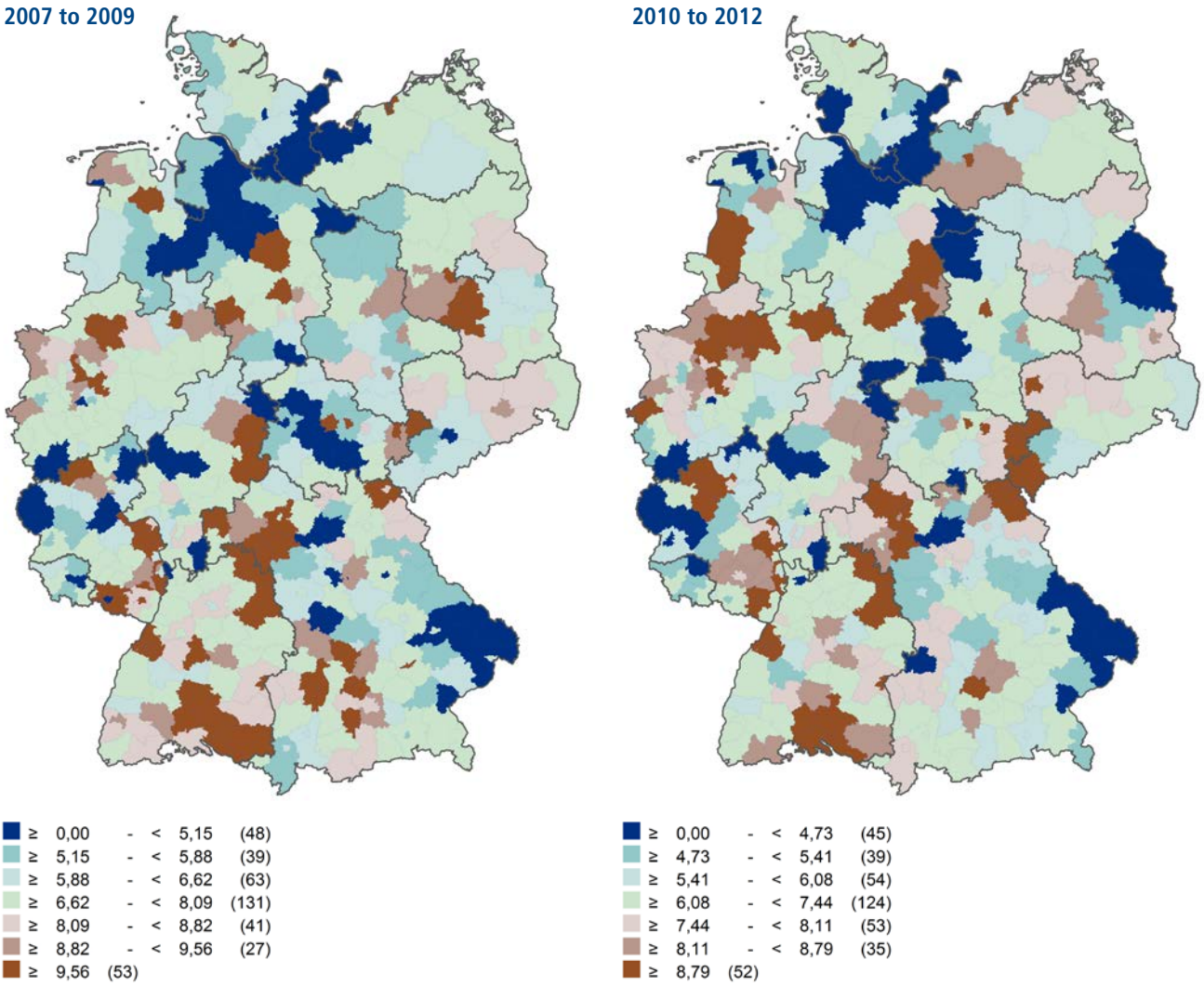
Other forms of interventional treatment are hyperthermia, cryotherapy, and high intensity focused ultrasound (HIFU, for localised prostate cancer) but these do not recommend themselvers as routine treatment options (AWMF 2011, PATLL_ProstataCa II 2013, PATLL_ProstataCa I 2009).

Extent of regional variations

The regional variations in the rate of surgery for radical prostatectomy have hardly decreased in recent years. At district level, the standardised rate of surgery in the period 2010 to 2012 lay between 2 and 13 surgical interventions per 10,000 men (2007 to 2009: 3 to 16). In the district with the highest rate of surgery, radical prostatovesiculectomies were carried out on men in the target group almost eight times times more frequently than in the district with the lowest rate of surgery. If the districts with the 20 highest and the 20 lowerst rates of surgery are excluded from consideration, the maximum variation is a factor of 2.3 (4.1 to 9.6 surgical interventions per 10,000 men). Excluding these extreme values gives a slight reduction in the range of variations compared with the period 2007 to 2009 (variation by a factor of 2.5).

Figure 13: Prostatectomy by district per 10,000 men

District of residence of patients, directly standardised to the male population of 2012 by age



Source: German Federal Statistical Office (DRG_OPSvier, Stat_Bev_EA), own calculation and presentation (IGES 2014).

In contrast to other indicators studied, a comparison of the regional variations in the rate of prostatectomy for the periods 2007 to 2009 and 2010 to 2012 also reveals a considerable change in the regions with above-average or below-average rates of surgery. No correlation between the variations in the rate of new cancer cases (RKI 2013) and the rate of surgery could be determined at the level of the German federal states.

Key parameters for regional variations

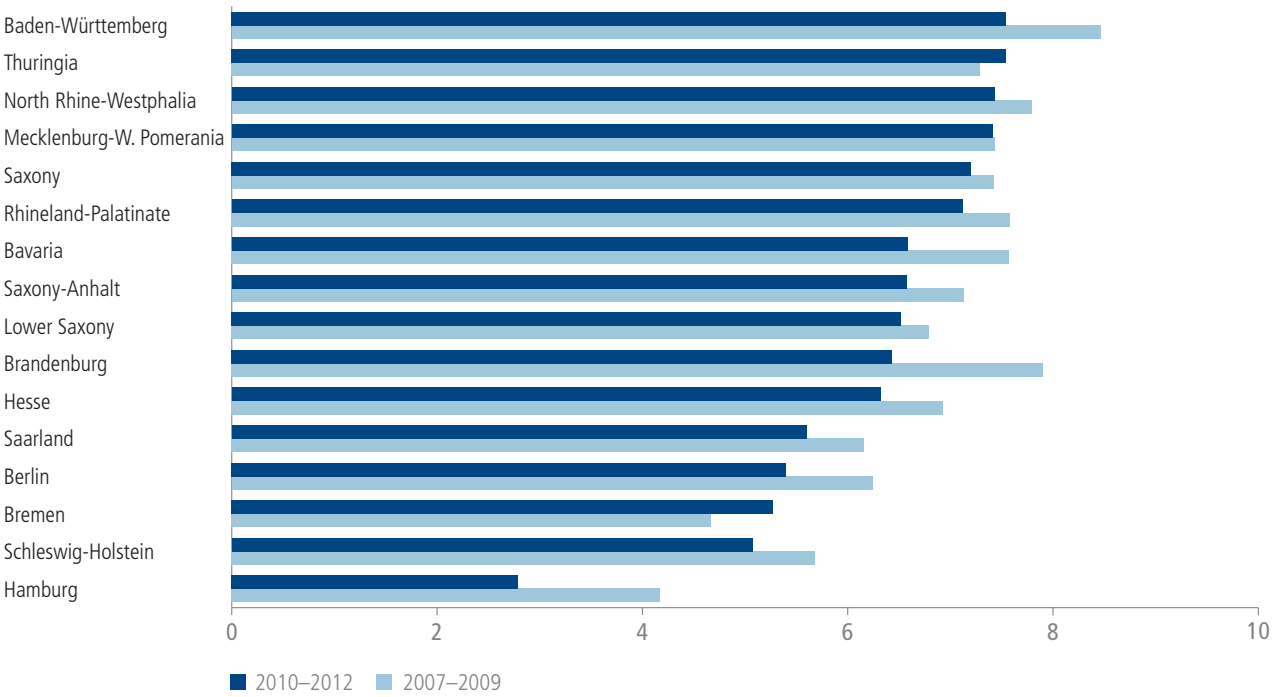
	2007–2009	2010–2012
Average	7,4	6,8
Median	7,3	6,8
Range	2,5–15,8	1,7–13,0
Extremal quotient	6,3	7,7
Percentile quotient	2,5	2,3

Possible explanations and courses of action

In the case of radical prostatectomy, biomedical findings alone are not sufficient to justify this intervention or to favour it over other treatment options. The patient should have the opportunity to assess the expected desirable and undesirable treatment outcomes in the light of his own personal situation and state of health. This applies all the more since, 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 a waiting strategy (active surveillance, watchful waiting) and undergo invasive treatment only if the tumour shows signs of progression. The guidelines (AWMF 2011) point out that the new defensive strategies for dealing with patients suffering from prostate cancer necessitate a considerable amount of consultation and care and have a considerable professional impact on the work of practice-based urologists. It is not known to what extent these defensive strategies

Figure 14: Prostatectomy by federal state per 10,000 men

District of residence of patients, directly standardised to the male population of 2012 by age



Source: German Federal Statistical Office (DRG_OPSvier, Stat_Bev_EA), own calculation and presentation (IGES 2014).

are being implemented uniformly at regional level. Studies show that in about half of all men with prostate cancer, the tumour has a low risk profile (Copperberg et al. 2007).

Research should be conducted to establish whether the observed regional variations in radical prostatectomy are significantly influenced by the frequency of PSA testing, the regional proportion of care carried out in external consultant urology wards and/or the availability of radiotherapy. However, it is also suspected that the variations in the rate of surgery arise because the degree to which patients are involved by their physician in assessing all treatment options to the required extent is not (yet) uniform due to regional differences in resources, facilities, knowledge and experience. The regional variations and partly unchanging pattern in the rate of radical prostatectomy may be due to the fact that the main treatment options available are being recommended and carried out to different degrees in different regions.

The clinical guidelines of the Germany Society for Urology (AWMF 2011) call for patients with local, non-metastasising prostate cancer to be informed about possible options (timely curative local treatment, delayed intervention, active surveillance and palliative care) and for patients for whom local curative treatment is advisable to be informed not only about radical prostatectomy, percutaneous radiotherapy and brachytherapy, but also about active surveillance.

The need to conclude agreements beyond those for regular health care in order to ensure that this demand is met, such as the local agreement to promote the "active surveillance method" concluded for the first time in 2014 within the framework of the special outpatient remuneration for physicians (SGB V Article 73c) (BDU 2014), can be taken as an indication that there is a low level of compliance with the guidelines.

Moreover, patients with prostate cancer should take the opportunity – explicitly recommended in the clinical guidelines (AWMF 2011) – to consult both a urologist and a radiotherapist about the advantages and disadvantages of radical surgery and radiotherapy, before they make a treatment choice. The guidelines expressly view this dual information concept as desirable, whereby they also point out that human resources and organisational factors may render this impossible. The contents of the guidelines have already been made available in the form of evidence-based patient information material.

There is now also a decision-making aid available to help patients make decide whether to be screened for prostate cancer and which describes and illustrates the advantages and disadvantages of the services available (AWMF 2012). In the updated guidelines which (as at mid May 2014) are available in the form of a consultative document, it is recommended in principle to inform men as from the age of 45 years, provided they have a presumed life expectancy of 10 years, and to recommend early detection screening for these men. This information can be provided 5 years earlier in the case of men who are at increased risk (AWMF 2014). Assessments differ, however, with regard to weighing up the benefits and the harm of early detection screening. A recent article which takes stock of the current state of research comes to the following conclusion: "In any case, men should not actively be encouraged to undergo early prostate cancer screening." (Robra et al. 2013).

4.6 Cholecystectomy

Background and significance

The percentage of gallstone carriers in Germany amounts to about 15% to 20% of the population. According to the 2007 S3 guidelines for the "Diagnosis and Treatment of Gallstones", which are now outdated and currently under revision (due to be completed on 31 December 2015), the surgical remove of gallstones (cholecystectomy) is indicated in the case of medical conditions brought on by verified gallstones (cholecystolithiasis) or acute cholecystitis (inflammation of the gallbladder). Cholecystitis represents the most frequent complication of gallstone disease and is caused when a gallstone temporarily or permanently obstructs the cystic duct. However, most people with gallstones never experience symptoms, so that the mere presence of gallstones does not indicate surgery. Surgery may be indicated if there is also calcification of the gallbladder wall, in the case of stones with a diameter of more than 3 cm or if there are also gallbladder polyps measuring more than 1 cm in diameter, since this increases the risk of a malignant bladder condition. Options for conservative treatment of cholelithiasis are rather limited. Litholysis by medication (dissolving of the gallstones) can only be considered in a very few cases and extracorporeal shock wave lithotripsy (ESWL) shows poor long-term results compared to laparoscopic cholecystectomy (S3 Guidelines 2007).

In Germany, about 190,000 cholecystectomies are performed each year –. usually as laparoscopic surgery – and this rate is fairly constant. In 2012, however, a new record of 195,000 cholecystectomies was reached.

Extent of regional variations

The rates of surgery in the individual districts were not notably different in the period 2010 to 2012. In the district with the highest number of cholecystectomies, the standardised rate of surgery is approximately twice that of the district with the lowest rate of surgery (17 as opposed to 34 interventions per 10,000 inhabitants). This means that the rate of surgery corridor in the updated period is almost exactly the same as in the period 2007 bis 2009. This also remains true if the 20 districts with the highest and the 20 districts with the lowest rates of surgery are excluded from the comparison. The range of variation in the other districts is then only a factor of 1.5 (20 to 30 interventions per 10,000 inhabitants).

If we look at the districts within the low range of variation which deviate most from the average, it is evident, as it was in the period 2007 to 2009, that rate of surgery in the urban districts is either average or below average. In rural districts of individual federal states (Mecklenburg-Western Pomerania, Brandenburg, North Rhine Westphalia and Bavaria), on the other hand, the rate of surgery is above the national average.

Key parameters for regional variations

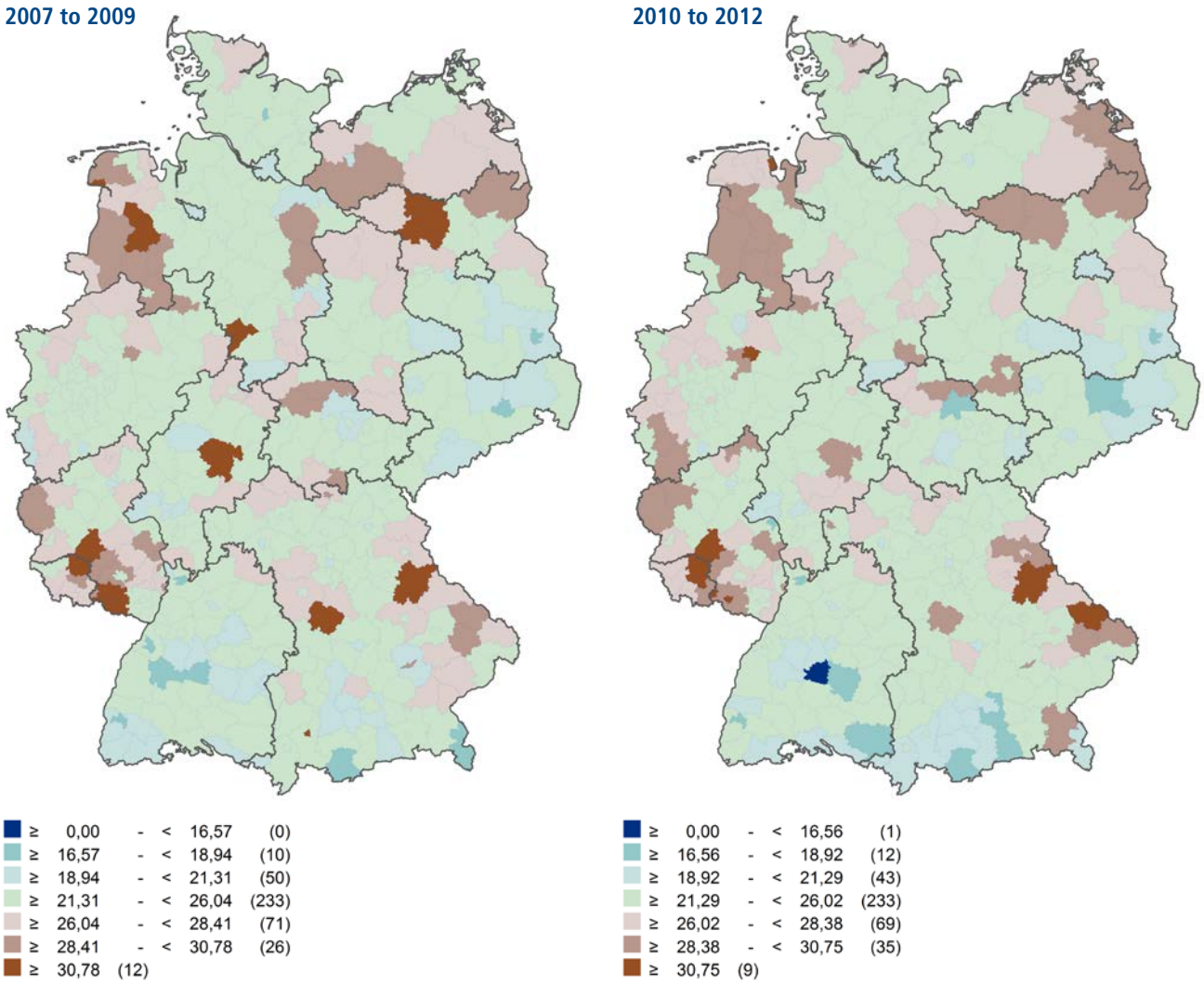
	2007–2009	2010–2012
Average	24	24
Median	24	24
Range	17–33	17–34
Extremal quotient	2,0	2,1
Percentile quotient	1,5	1,5

For the period 2007 to 2009, the regional study was also carried out at an earlier point of time, excluding the "simultaneous cholecystectomies" which were performed for different reasons during a laparatomy or a laparoscopy.

This reveals no noteworthy deviations from the regional rates of surgery set out above so that it was decided not to carry out a new study of this kind for the period 2010 bis 2012.

Figure 15: Cholecystectomy by district per 10,000 residents

District of residence of patients, directly standardised to the population of 2012 by age and gender



Source: German Federal Statistical Office (DRG_OPSvier, Stat_Bev_EA), own calculation and presentation (IGES 2014).

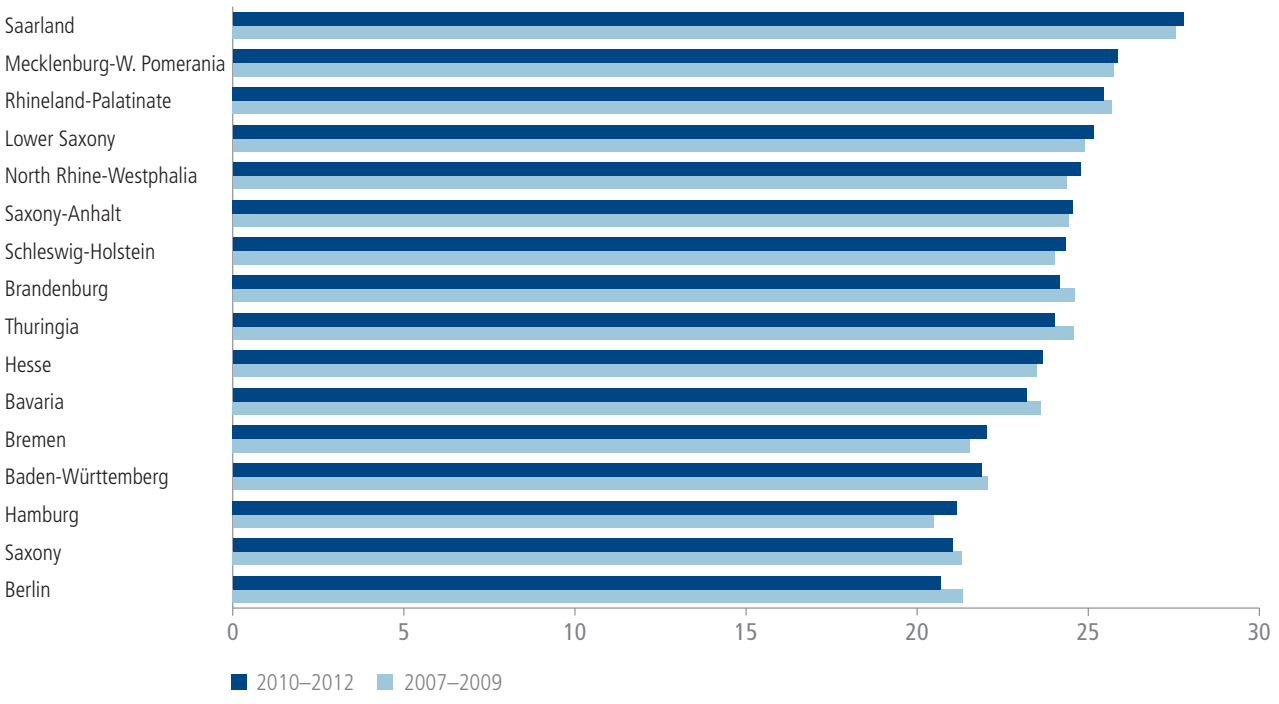
Possible explanations and courses of action

Previous studies had already found no substantial regional variation in the rate of cholecystectomy. For example the study by Gerste based on statistics from the years 1998 to 2001 gouped by federal state found that the rate of surgical intervention varied from 2.2 to 2.9 per 1,000 inhabitants (Gerste 2004). This observation is confirmed for 2007 to 2009 in the present small-area study. The fact that the regional variations in cholecystectomy rates are lower than those for other surgical interventions may reflect the fact that indications for surgery are clearly defined. On the whole, patients were able to opt for a cholecystectomy on the basis of the symptoms experienced.

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 disorders among the population (e.g. obesity), the availability of hospital beds for visceral surgery and local structures for outpatient surgery. It is therefore conceivable that regional variations in cholecystectomy rates might correspond to surgical capacity in terms of hospital beds and operating facilities, as well as their utilisation rates. Higher cholecystectomy rates in regions with below-average capacity utilisation might indicate that cholecystectomies are still being performed too often. The call made in the 2011 Fact Check report for the findings of the study of regional rates of surgery to be included in the results of the external hospital quality assurance for the quality indicator "cholecystectomy performed without indication criteria being fulfilled" (Nolting et al. 2011) is no longer possible in the near future. This indicator has no longer been considered since the 2012 data collection

Figure 16: Cholecystectomy by federal state per 10,000 residents

District of residence of patients, directly standardised to the population of 2012 by age and gender



Source: German Federal Statistical Office (DRG_OPSvier, Stat_Bev_EA), own calculation and presentation (IGES 2014).

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year, since there are no valid guidelines for the diagnosis and treatment of cholelithiasist. "The national specialists' group for visceral surgery recommends that the specialist community should develop guidelines on the basis of agreed scientific evidence to set out the ideal care situation" (AQUA 2013: 12). Once the proposed guidelines, "Gallstone, Diagnostics and Treatment" have been drawn up, updated information about the appropriate medical procedures for gallstone conditions will be available (AWMF 2014). For example the prophylactic removal of the gallbladder when gallstones are present but are not causing any symptoms was cited at the 131st Congress of the German Society of Surgery (DGCH) as an example of an intervention which is carried out too frequently, exposing patients to unnecessary risks (Merkel 2014).

The regional variations in the rates of inpatient cholecystectomy may also be affected by whether and to what extent gallstones are removed by way of outpatient surgery. To date, simple laparoscopic cholecystectomy without bile duct revision (approx. 79 % of all inpatient cholecystectomies in 2010) is not considered standard outpatient surgery in Germany. In other countries, this trend is already much more advanced. For example, in the United States about 50 % (of Medicare patients only), in Sweden 11% and in Norwary 12 %, of cholecystectomis are performed using minimally invasive surgical procedures on an outpatient basis (Oberender & Partner 2010). The results of a recent systematic review indicate that in the case of laparoscopic cholecystectomy perfomed on the basis of gallstone symptoms, surgical interventions carried out as outpatient surgery are as safe as inpatient interventions (Vaughan et al. 2013).

4.7 Primary knee replacement

Background and significance

Knee replacement surgery is usually necessary when the wear to the knee causes severe pain and substantially limits the patient's mobility and when other forms of treatment (medication, physiotherapy, orthopaedic measures, lifestyle changes, etc.) or conservative knee surgery can no longer provide long-term relief. Primary knee replacements are among the more expensive hospital services. This is due both to the high cost of the intervention, the implant itself, initial mobilisation and the relatively long periods of hospitalisation.

The implantation of a knee endoprosthesis is one of the most common inpatient surgical procedures performed in Germany. Between 2007 and 2009, the number of primary knee replacements rose from about 129,000 to some 159,000, an increase of about 23%.

In recent years, this trend has been the subject of intense debate both among specialist circles and in the public arena. 2012 saw the first noteworthy reduction in the number of primary knee replacements, to 155,000 interventions.

Extent of regional variations

There is a substantial regional variation in the rate of primary knee replacements carried out. At district level, the standardised rate of surgery in the period 2010 to 2012 was between 11.8 und 30.8 primary knee replacements per 10,000 inhabitants (2007 to 2009: 9.6 to 32.8). If the 20 districts with the lowest and the 20 districts with the highest rates of surgery are excluded from consideration, the range of variation is 14.7 to 26.6 surgical interventions per 10,000 inhabitants and is therefore almost exactly the same as the range of 14.7 to 27.3 per 10,000 inhabitants observed in the period 2007 to 2009. In comparison with the previous period, the regional variation overall hardly decreased at all in the period 2010 to 2012.

A comparison of the regional pattern of the rate of surgery in the periods 2007 to 2009 and 2010 to 2012 shows only minor changes. In particular, the marked variations among the individual federal states have remained unchanged. In most districts of Bavaria, for example, the rate of surgery is still above the national average, whereas the opposite is the case in the districts of Schleswig-Holstein and Mecklenburg-Wester Pomerania. Unchanged is also the fact that metropolitan districts of Germany often record only average rates of surgery.

Key parameters for regional variations

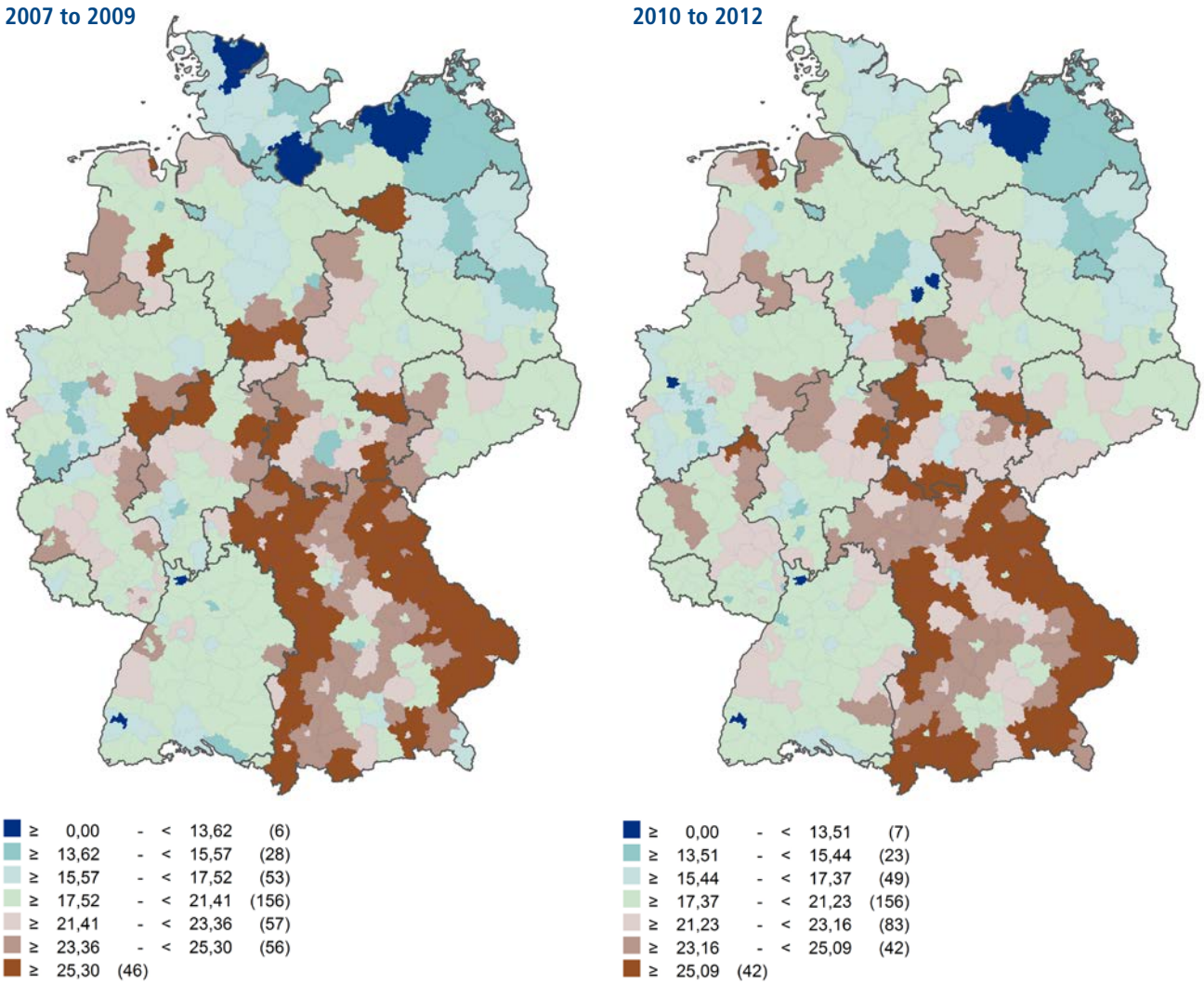
	2007–2009	2010–2012
Average	19	19
Median	20	20
Range	10–33	12–31
Extremal quotient	3,4	2,6
Percentile quotient	1,9	1,8

Possible explanations and courses of action

Earlier studies have already called into question the widespread assumption that demographic changes are mainly responsible for the increase in the number of knee replacements in the first decade (Bitzer et al. 2010). It has been pointed out that the indications for an initial knee replacement are now being interpreted somewhat more liberally (Bitzer et al. 2010). More liberal diagnosis means that primary knee replacements are now becoming more common among patients who would previously 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. This means that clinical findings alone do not define the need for surgery, whereas the patient's subjective

Figure 17: Primary knee replacement by district per 10,000 residents

District of residence of patients, directly standardised to the population of 2012 by age and gender



Source: German Federal Statistical Office (DRG_OPSvier, Stat_Bev_EA), own calculation and presentation (IGES 2014).

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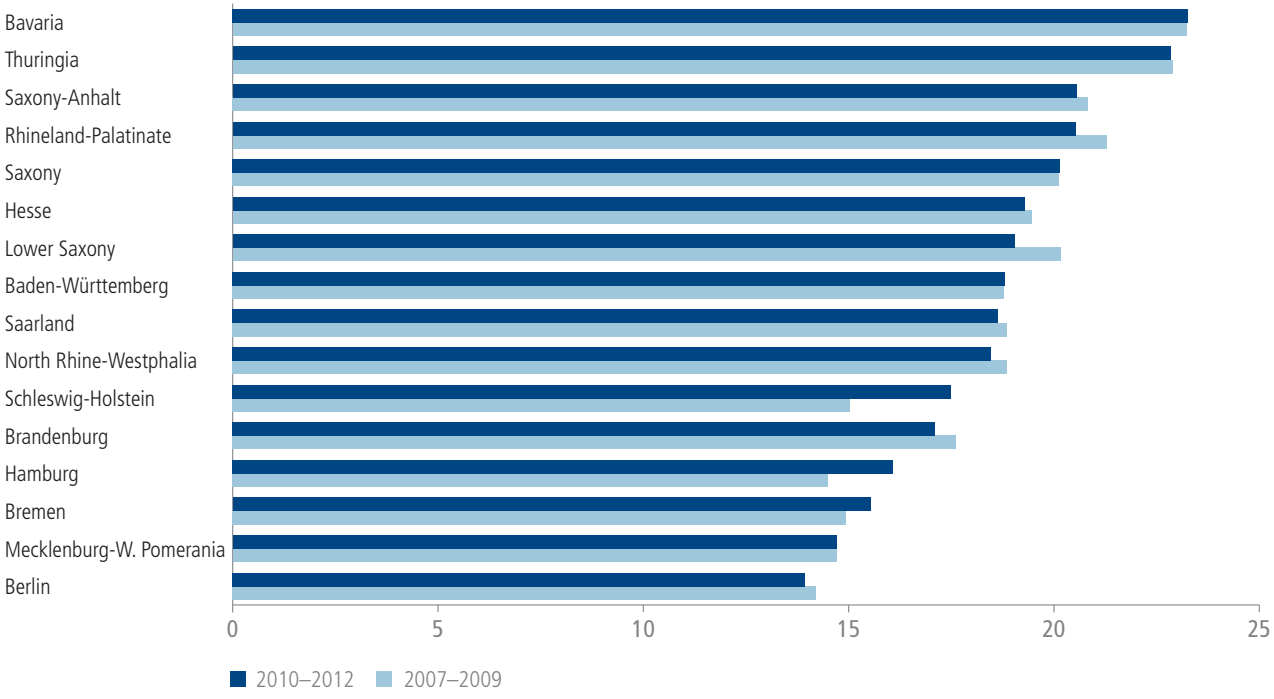
assessment of symptoms and the consequences of alternative courses of treatment have a key role to play.

The frequency with which patients decide for or against surgery therefore depends to what extent the patient is empowered to independently evaluate the different treatment options. In this context, it is conceivable that primary knee replacement is increasingly being regarded by the general population as a low-risk standard operation which in view of the good prospects of success is increasingly in demand even with a relatively low level of pain and disability. This can result in the prospects of success being overestimated and the risks underestimated (Schäfer et al. 2012). A non-technical evidence-based overview of the benefits and risks of knee replacement surgery for patients is provided by the "Knee Replacement Fact Box" prepared by the Bertelsmann Stiftung in collaboration with the Harding Center for Risk Literacy at the Max Planck Institute in Berlin (Bertelsmann Stiftung 2013).

Since primary knee replacement is an intervention that can bring considerable financial rewards to a clinic, hospitals generally have an incentive to excercise available diagnostic discretion with the objective of increasing the number of interventions. In this connection it is also significant that Germany "lacks an up-to-date, generally valid and accepted set of guidelines on the indications for the implantation of an artificial knee" (Bertelsmann Stiftung 2013). However, the quality of assessing the indications for a primary knee replacement is documented annually within the framework of the external hospital quality assurance audits. Whereas a "particluar need for action" was deter-

Figure 18: Primary knee replacement by federal state per 10,000 residents

District of residence of patients, directly standardised to the population of 2012 by age and gender



Source: German Federal Statistical Office (DRG_OPSvier, Stat_Bev_EA), own calculation and presentation (IGES 2014).

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mined for the year 2009 (AQUA 2010), the need for action for this quality indicator was downgraded to "normal" in 2012, a sign of a stable level of care and a more consistent alignment to the required quality assurance criteria diagnosing this indication. In 2012, however, 108 of those hospitals which perform primary knee replacement surgery recorded statistically discrepant results in terms of the quality of establishing the indication for surgery, results which must be subjected to scrutiny (AQUA 2013).

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In the "Healthcare Fact Check – Knee Replacement" published in 2013, further possible reasons for the marked and highly consistent regional variations were investigated. Negative correlations between knee replacements and social deprivation (higher index of deprivation, fewer knee replacements), density of orthopaedists (more orthopaedists, fewer knee replacements) and population density (fewer knee replacements in urban areas, more in the country) were detected (Bertelsmann Stiftung 2013). However, it was not possible to make any statements about the causes of the correlations.

It would still appear to be the case that the regional variations in the rate of surgery are mainly due to differences in assessing the indications for surgery. The trend in the number of interventions since 2009 supports the thesis that there is scope for determining the indications for a primary knee replacement and that this scope for decision making can be exercised differently. If the rate of surgery observed in 2009 (differentiated by gender and grouped in 5-year age bands) were to be applied unchanged to the population of 2012 between the ages of 60 and 84 years, we would expect to arrive at about 170,000 operations in 2012 (in other words, about 11,000 more surgical interventions). The trend in the number of interventions was, in spite of the demographic increase in the relevant population group, on the whole negative, since the rate of surgery per 10,000 inhabitants in 2012 was lower than in 2009 in almost all age groups observed, and especially so in the case of women.

The backround to this trend must be investigated thoroughly, since this might lead to conclusions which could be of use when developing suitable strategies in other areas of care (in particular, "preference-sensitive" care). For example, it is conceivable that a greater level of awareness about the subject has been achieved. This might have been achieved through wider coverage in the media, a more intense exchange between the transferring physician and the surgeon and/or the quality assurance measures in place. However, it is also feasible that the numer of primary knee replacements in some regions has reached a plateau after increasing for many years and that the number simply can not increase much further.

4.8 Coronary bypass surgery

Background and significance

Coronary heart disease (CHD) is a narrowing of the coronary arteries that supply blood to the heart (atherosclerosis) and is one of the most widespread diseases. Although CHD mortality has fallen again in recent years, CHD and and acute myocardial infarction (as an acute complication of CHD) remain the two most common causes of death in Germany (accounting together for 14.3 percent of all deaths in 2012) (GBE 2014). The incidence of CHD increases considerably with age.

Depending on the stage and the symptoms of the condition, treatment takes the form of medication, interventional treatment such as percutaneous angioplasty (catheterisation) or bypass surgery. According to Germany's national healthcare guidelines for chronic CHD, one of the two surgical interventions referred to above may be considered if angina pectoris can no longer be treated by medication, (NVL Chron KHK 2013). According to these guidelines, bypass surgery is preferable to percutaneous treatment (catheterisation) if the patient has more than one diseased coronary artery or if the left main coronary artery is affected.

In coronary bypass surgery, the flow of blood is diverted around constricted or obstructed coronary arteries to improve the 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. The numer of bypass operations fell between 2007 and 2012, whereby this negative trend levelled off somewhat in the years under study.

Extent of regional variations

The regional variations in the rate of bypass surgery have decreased in recent years. At district level the standardised rate of surgery in the period 2010 to 2012 was between 5 and 26 surgical interventions per 10,000 inhabitants (2007 to 2009: 4 to 32). Among patients living in the district with the highest rate of surgery, coronary bypass surgery is carried out about six times more often than among those living in the district with the lowest rate of surgery (2007 to 2009: factor 8.5). If the 20 districts with the lowest and the 20 districts with the highest rates of surgery are excluded from consideration, the maximum variation is a factor of 2.7 (6.6 to 17.5 surgical interventions per 10,000 inhabitants). Excluding the most extreme values gives a slight reduction in the range of variation compared to the period 2007 to 2009 (variation of 2.8 times). In the period 2010 to 2012, however, there were only 109 districts in a narrow corridor around the national average rate of surgery, which is 10 districts fewer than between 2007 and 2009.

In Baden-Württemberg, in which most districts already recorded lower than average rates of surgery between 2007 and 2009, this finding is even more extreme between 2010 and 2012. In contrast, Saarland and Saxony-Anhalt recorded either no or hardly any districts with average or below average rates of bypass surgery in the period 2010 to 2012. In addition, the remaining federal states also recorded very differing trends at district level in the intertemporal comparison, whereby regional anomalies remained more or less unchanged.

Key parameters for regional variations

	2007–2009	2010–2012
Average	13	11
Median	13	11
Range	4–32	5–26
Extremal quotient	8,5	5,7
Percentile quotient	2,8	2,7

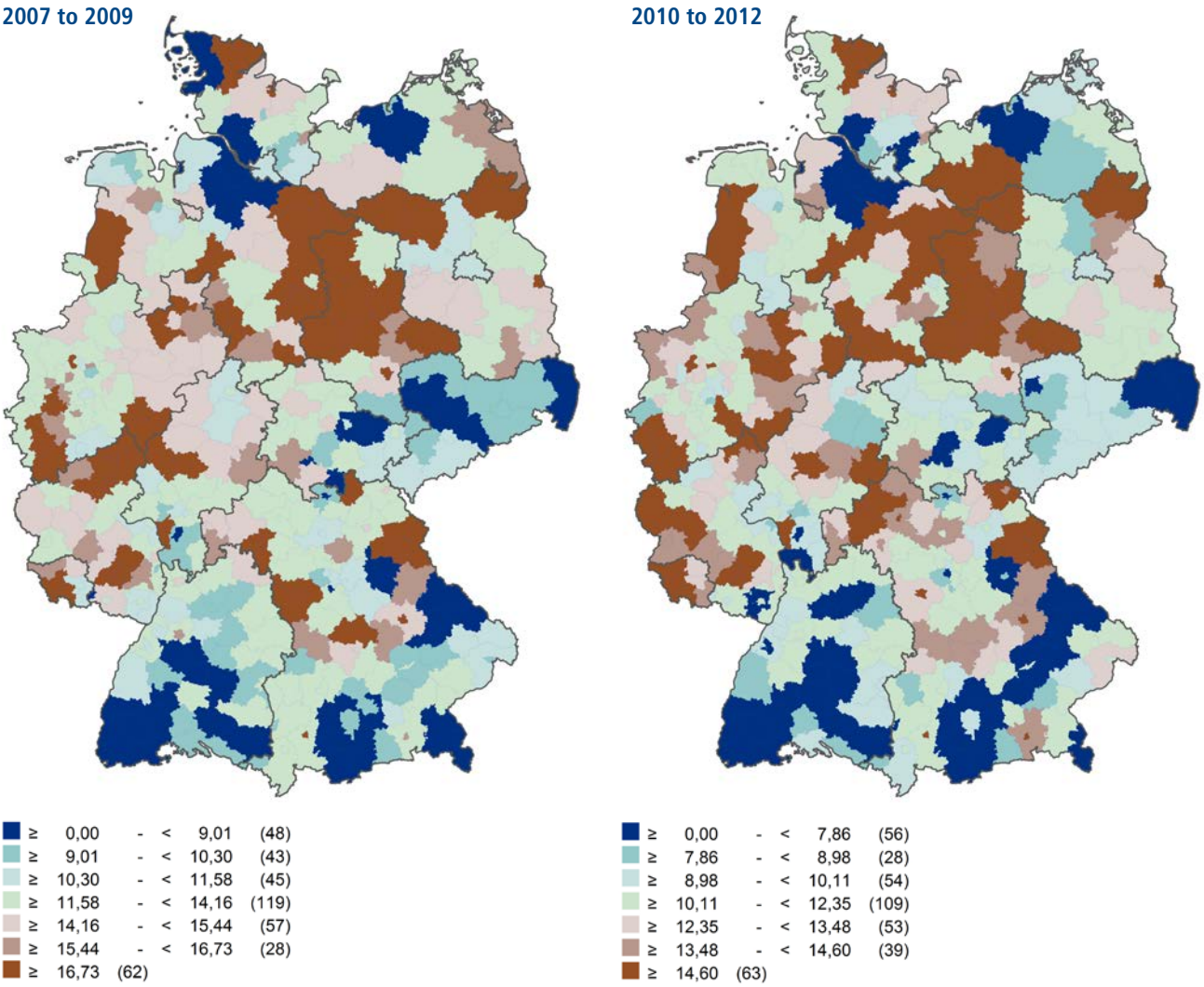
Possible explanations and courses of action

The vast majority of patients whose condition can no longer be managed by way of medication currently undergo angioplasty (percutaneous coronary intervention). The rate of bypass surgery has been declining for years, while angioplasty rates have increased (Bruckenberger 2009). This trend has continued in recent years, although not as dynamically as in previous periods. For example, no further increase in the rate of catheterisation was expected in 2013 (Deutsche Herzstifung 2013).

As the most invasive form of treatment, bypass surgery should be limited to cases in which the prospect of success justifies the greater surgical risk. The national guidelines on chronic CHD as at July 2013 (cf. Backround and significance) describe two constellations which, at the present state of medical knowledge, fulfil this condition.

Abbildung 19: Coronary bypass operations by district per 10,000 residents

District of residence of patients, directly standardised to the population of 2012 by age and gender



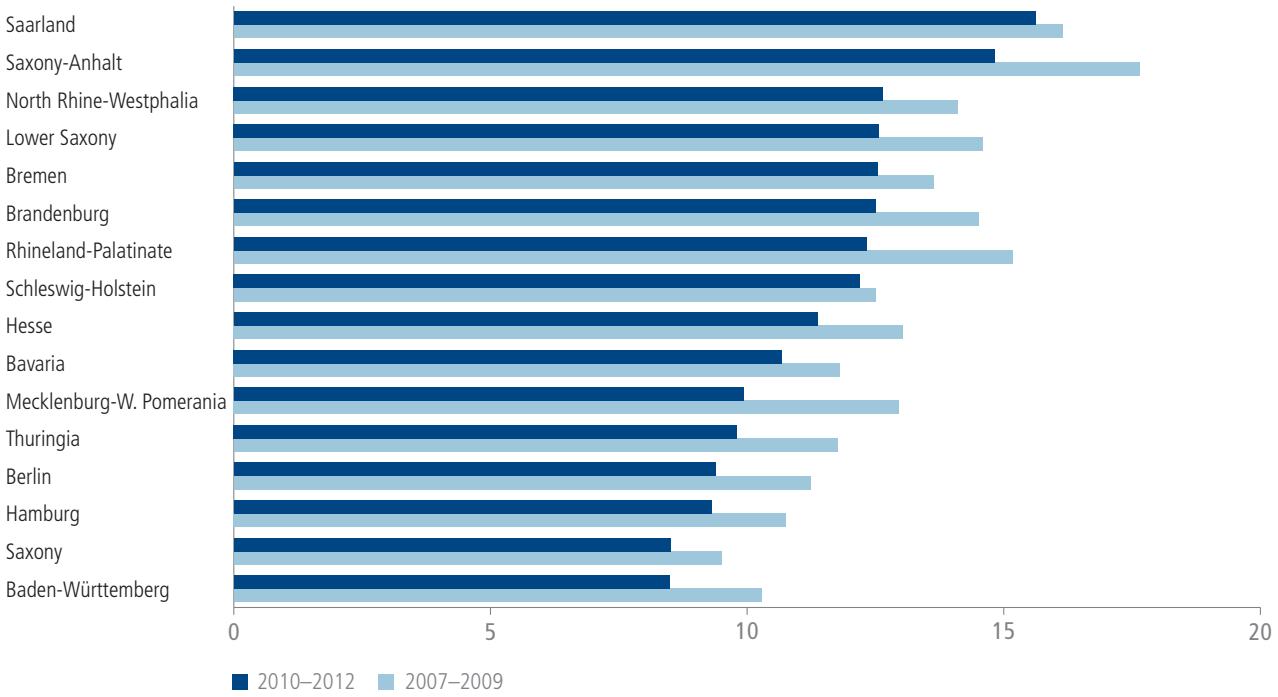
Source: German Federal Statistical Office (DRG_OPSvier, Stat_Bev_EA), own calculation and presentation (IGES 2014).

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. With regard to the primary form of CHD, there is evidence of regional differences in prevalence (RKI 2011, RKI 2012) which might correlate to the variations in the need for bypass surgery; the regional variation observed for this intervention is, however, much higher than can be explained by differences in CHD prevalence alone and furthermore, the variation in prevalence only partly corresponds to the variation in the rate of surgery (e.g. in the case of Baden-Württemberg).

The medically appropriate rate of bypass surgery is not known. To our knowledge, no in-depth study has yet been carried out to determine whether the low rates of bypass surgery observed in certain regions indicate underuse of services arising from an overemphasis on the other two treatment options (medication, angioplasty) or whether the very high rates of bypass surgery in other regions indicate overuse of services with a concomitant potential for greater exploitation of less invasive procedures. This view is not contradicted by the latest German Heart Report, which deals in part with these questions on the basis of broad data; this report found neither underuse nor overuse of bypass surgery at national level. With regard to interventional procedures, the German Heart Report pointed out that no more than 5 % of all patients with a heart catheter who were included in the external quality assurance process were without the signs of ischaemia which would indicate CHD (Deutsche Herzstiftung 2013). The exter-

Figure 20: Rate of coronary bypass operations by federal state

District of residence of patients, directly standardised to the population of 2012 by age and gender



Source: German Federal Statistical Office (DRG_OPSvier, Stat_Bev_EA), own calculation and presentation (IGES 2014).

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nal quality assurance audit for 2012, however, points out that 63 of 816 of these medical facilities did not attain the required reference range for this indicator. Furthermore, a different form of documentation, which would set the constellation of each individual case against the background of all diagnostic recommendations included in the guidelines, would be desirable (AQUA 2013).

The "National Guidelines for Chronic CHD" recommend informing patients before commencing any form of treatment about how it can help achieve treatment objectives such as relief of symptoms, better quality of life and a more favourable course of disease (NVL Chron KHK 2013). In order to promote shared and informed decision-making between physician and patient and to help patients cope with their disease, patient guidelines on chronic coronary heart disease were published in 2007 (PL Chron KHK 2008). The results of the intertemporal comparison of regional rates of bypass surgery continue to support the assumption that patients are still not being uniformly nor extensively included in the decision-making process.

4.9 Implantation of a defibrillator

Background and significance

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 and 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 and Buschek 2010).

The main objective in implanting a defibrillator implantation is to prevent sudden cardiac arrest, which is one of the most common causes of death (Jung et al. 2006). Researchers estimate that 13% to 18.5% of all 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 2012, with approx. 4,400 fatalities (GBE 2014). The actual rate is presumably higher, since 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 as a result 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 the occurrence of life-threatening cardiac dysrhythmia (primary prevention) is recommended only under very specific conditions (Hoppe et al. 2008, NVL Chron Herzinsuff 2013). Clinical guidelines state that the implantation of a defibrillator 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). The number of defibrillators implanted increased considerably from about 19,000 in 2007 to about 28,000 in 2012 but the rate of increase declined.

Extent of regional variations

The regional variations in the rate of ICD implantations have not reduced significantly in recent years. At district level the standardised rate of surgery in both periods studied was between one and eight surgical interventions per 10,000 inhabitants. In the district with the highest rate of surgery, more than eight times as many patients received an ICD as in the district with the lowest rate of surgery. If the 20 districts with the lowest and the 20 districts with the highest rates of surgery are excluded from consideration, the variation in the period 2010 to 2012 is a factor of 2.8 (2.0 to 5.6 surgical interventions per 10,000 inhabitants). Excluding the most extreme values gives a slight reduction in the range of variation compared to the period 2007 to 2009 (variation of 3.1 times).

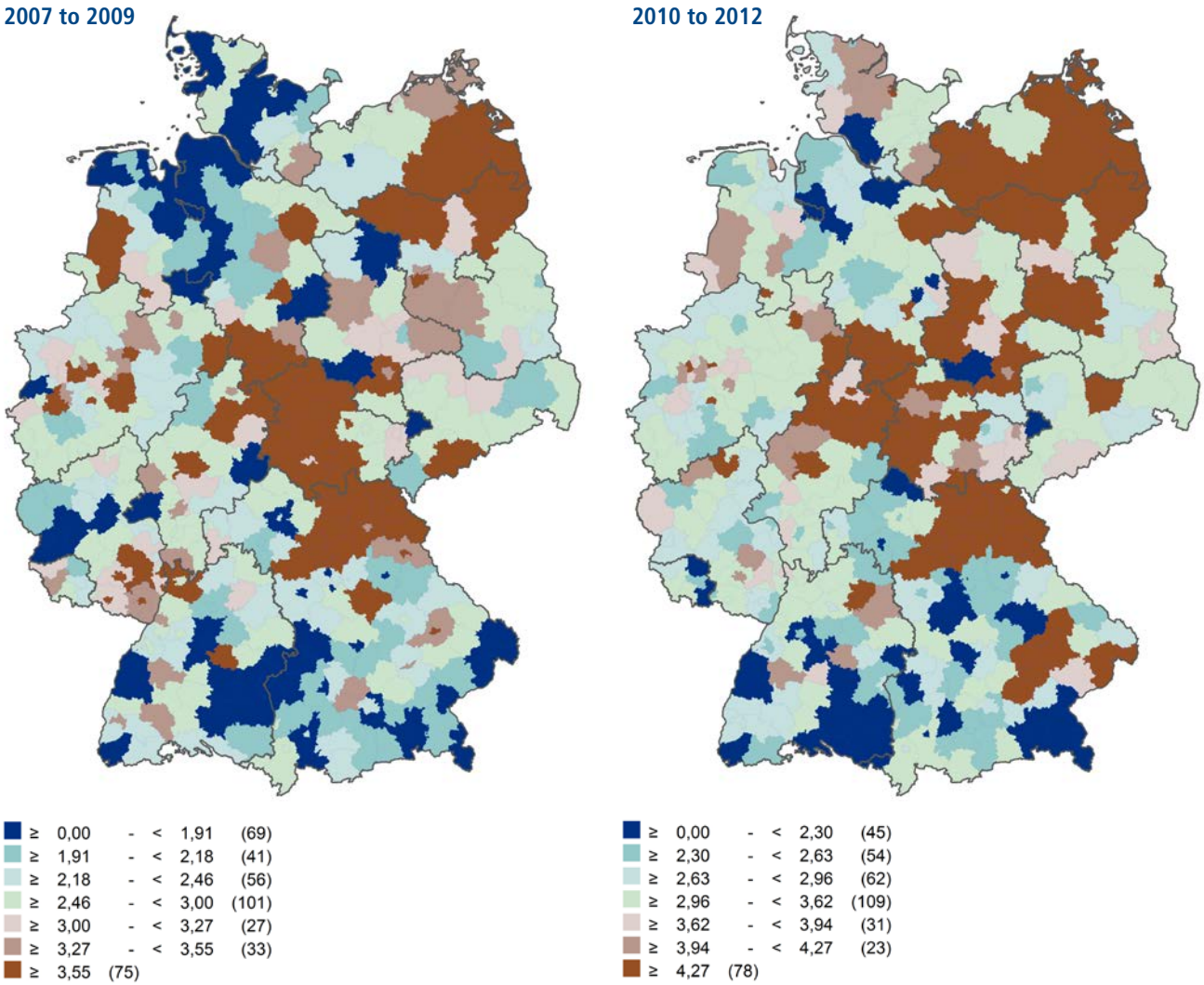
Key parameters for regional variations

	2007–2009	2010–2012
Average	2,7	3,3
Median	2,6	3,2
Range	1,1–8,0	1,0–7,7
Extremal quotient	7,6	8,1
Percentile quotient	3,1	2,8

The higher rate of surgery in central Germany (in the north of Bavaria, in Thuringia and in the south of Lower Saxony) and in eastern Mecklenburg-Western Pomerania described in the previous Fact Check is also evident in the period 2010 to 2012. Moreover, the trends observed are not uniform. For example, the number of districts in Schleswig-Holstein with an above-average rate of surgery has increased, whereas in Saarland and in Rhineland Palatinate the number has decreased significantly.

Figure 21: Implantation of a debrillator by district per 10,000 residents

District of residence of patients, directly standardised to the population of 2012 by age and gender



Source: German Federal Statistical Office (DRG_OPSend, Stat_Bev_EA), own calculation and presentation (IGES 2014).

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Possible explanations and courses of action

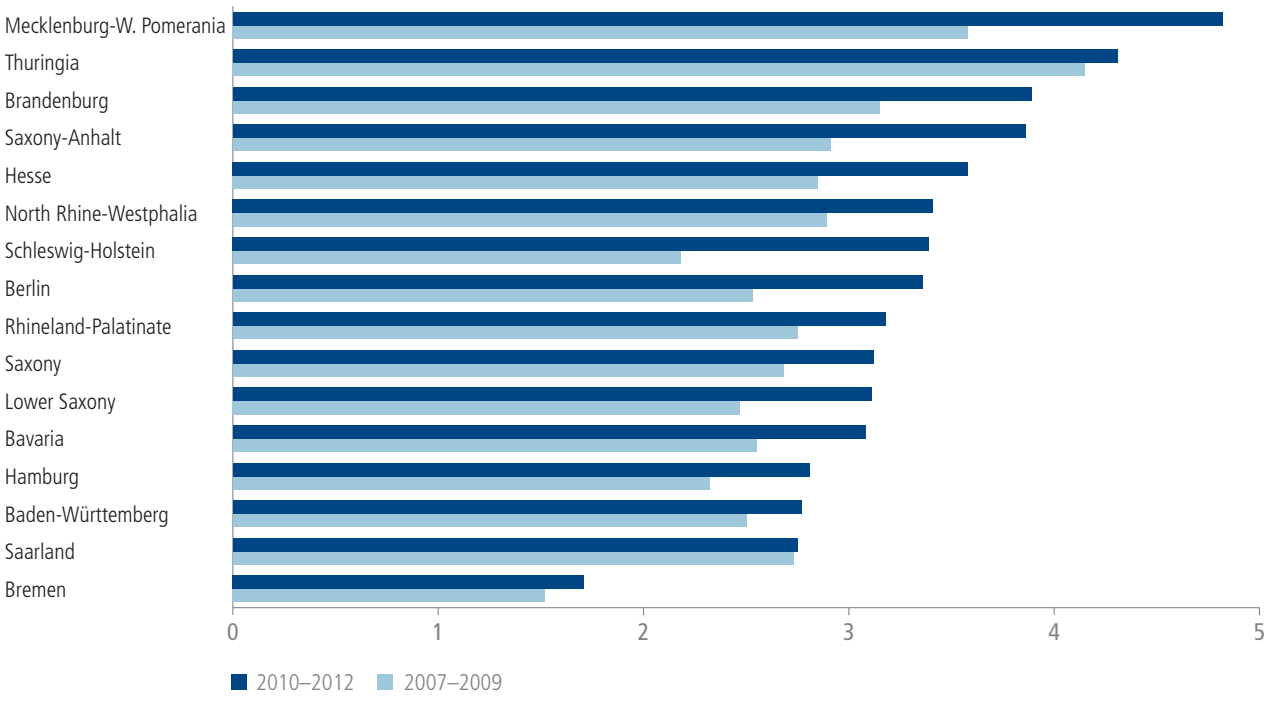
It is known that both the incidence of cardiac disease and cardiac mortality are subject to regional variations (RKI 2006). The regional variations in the implantation of ICDs could therefore be due in part to actual variations in the regional populations.

The rate of ICD implantations, the trend in the number of ICDs implanted and the differences in establishing the indications for implantation have been the subject of intense discussion in recent years. "In both absolute and relative terms, the most ICDs are implanted in Germany ... and furthermore, it can be assumed that Germany is at the forefront in this respect, possibly together with the United States and Italy ..."(Register 2011: 30). The finding that the number of older patients who have received a new IDC is greater than, for example, in Sweden, does not alone account for the higher rate of surgery. It is not possible to say whether the rate of surgery here corresponds to the actual need – which would indicate underuse of services in the area of treatment with ICDs – or whether there is a general overuse of services in Germany (Register 2011).

The latest German Heart Report refers to the results of the external hospital quality assurance audits and on this basis does not assume that the high rate of surgery is due to a more liberal interpretation of indications in Germany, since in over 90 % of all cases it can be established that the indications correspond to the current guidelines (Deutsche Herzstiftung 2013). The 2012 Quality

Figure 22: Implantation of a debrillator by federal state per 10,000 residents

District of residence of patients, directly standardised to the population of 2012 by age and gender



Source: German Federal Statistical Office (DRG_OPSend, Stat_Bev_EA), own calculation and presentation (IGES 2014).

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Report confirms for the year 2012 a considerable improvement in compliance with the guidelines compared to previous years, but still sees the need for further action. Despite conforming to guidelines, 654 hospitals in which ICDs were implanted in 2012, 137 (20.9 %) recorded computationally conspicuous values relating to the choice of treatment option. These medical facilities must be investigated by way of structured dialogue. In addition the report calls for those concerned "... to make the determination of indications and the choice of ICD as a treatment option the subject of discussion at specialist conferences and in scientific publications" (AQUA 2013: 43). The quality of the determination of indications may contribute significantly to the regional variations in the rate of surgery. In 2012, Mecklenburg-Western Pomerania, for example, recorded by far the most frequent incidence (13.1 % of all cases) of the indications for implanting an ICD not being determined in accordance with guidelines (AQUA LW 2013). In the period 2010 to 2012, Mecklenburg-Western Pomerania had by far the highest rate of surgery of all federal states and and much higher than average rate of surgery in the majority of districts.

On the supply side, it should be noted that the increase in the number of ICDs implanted is mainly due to some hospitals offering this service for the first time and to an increase in others that had previously offered it only rarely. This diffusion of innovation may result in a reduction in the regional variations in the rate of surgery. The increase in the number of ICDs implanted in hospitals in districts with below-average rates of surgery has increased much more than it has in regions with above-average rates of surgery (Fürstenberg und Schiffhorst 2013). It can probably also be assumed that all hospitals which have already included the implantation of cardiac pacemakers among their range of services will also endeavour to add the implantation of ICDs to their portfolio. However, these developments will only lead to the desired objectives if the quality of care is not jeopardised thereby and if the new market participants fulfil the structural requirements for providing this service. The surgical implantation of an ICD can only be performed in specialist clinics which fulfil certain requirements in terms of technical facilities, staff and hygiene (Jung et al. 2006). In this connection, it may also be that regional rates of surgery are affected by differences in the use of hospital planning instruments by the federal states and by different approaches taken by hospitals in budget negotiations.

As a matter of principle the patient must be included in the decision whether or not to proceed with the implantation of an ICD, since particular importance is, or should be, attached to his or her assessment of the potential advantages and the unwanted side-effects. The patient guidelines on "Cardiac insufficiency" (PLL 2011) does not in its present form describe the advantages and disadvantages of the intervention fully enough to be considered a suitable decision aid for patients.

5. Data sources and use

Karsten Zich (IGES Institut GmbH)

The first section of this chapter (5.1) lists and describes the statistics used. Possible limitations of the individual statistics are set out in section 5.2. The chapter closes with a description of the indicators, the calculations and potential special factors.

5.1 General description of the statistics used

This section describes the data sources on which the calculation of the individual indicators is based.

Abbreviation	DRG_OPSend
Data source	German Federal Statistical Office
Official name	Diagnosis-related group (DRG) statistics
Special analysis carried out	yes
Notes on the statistics	■ OPS-codes without duplicates ■ including deaths and day cases
Structure of the data	OPS end-digit codes according to ■ patient's place of residence (district level) ■ patient's age group (under 1 year, 1–4 years, 5–9 years ... 90–94 years, 95 years and older) ■ number of OPS codes
Years included	All individual years in the period 2007 to 2012
Changes made to the original data set	■ Clearing of data for individuals with – unknown age group – place of residence abroad, unknown or undeclared ■ For 2007, values for Saxony districts were classified according to the district boundaries of 2009 (following the district reform). ■ For all years, values for Berlin districts (code 110*) were cumulated under "Berlin, city" (code 11000). ■ For 2007 and 2008, values for Aachen districts (code 05354) and "Aachen, city" (code 05313) were cumulated under "Aachen, urban region" (code 05334). ■ For the years 2007 to 2010, the district boundary reform in Mecklenburg-Western Pomerania was completed in 2011. The values for the following districts were cumulated: – Neubrandenburg (code: 13002), Demmin (code: 13052), Mecklenburg-Strelitz (code: 13055), Müritz (code: 13056) zu Mecklenburgische Seenplatte (code: 13071) – Bad Doberan (code: 13051), Güstrow (code: 13053) the district Mittleres Mecklenburg (code: 13072) – Stralsund (code: 13005), Nordvorpommern (code: 13057), Rügen (code: 13061) to Nordvorpommern (code: 13073) – Wismar (code: 13006), Nordwestmecklenburg (code: 13058) to Nordwestmecklenburg (code: 13074) – Greifswald (code: 13001), Ostvorpommern (code: 13059), Uecker-Randow (code:13062) to Südvorpommern (code: 13075) – Ludwigslust (code: 13054), Parchim (code: 13060) to Südwestmecklenburg (code: 13076)

Abbreviation	DRG_OPSvier
Data source	German Federal Statistical Office
Official name	Diagnosis-related group (DRG) statistics
Special analysis carried out	yes
Notes on the statistics	■ OPS codes without duplicates ■ including deaths and day cases
Structure of the data	OPS four-digit codes according to ■ patient's place of residence (district level) ■ patient's age group (under 1 year, 1–4 years, 5–9 years ... 90–94 years, 95 years and older) ■ number of OPS codes
Years included	All individual years in the period 2007 to 2012
Changes made to the original data set	■ Clearing of data for individuals with – unknown age group – place of residence abroad, unknown or undeclared ■ For 2007, values for Saxony districts were classified according to the district boundaries of 2009 (following the district reform). ■ For all years, values for Berlin districts (code 110*) were cumulated under "Berlin, city" (code 11000). ■ For 2007 and 2008, values for Aachen districts (code 05354) and "Aachen, city" (code 05313) were cumulated under "Aachen, urban region" (code 05334). ■ For the years 2007 to 2010, the district boundary reform in Mecklenburg-Western Pomerania was completed in 2011. The values for the following districts were cumulated: – Neubrandenburg (code: 13002), Demmin (code: 13052), Mecklenburg-Strelitz (code: 13055), Müritz (code: 13056) zu Mecklenburgische Seenplatte (code: 13071) – Bad Doberan (code: 13051), Güstrow (code: 13053) the district Mittleres Mecklenburg (code: 13072) – Stralsund (code: 13005), Nordvorpommern (code: 13057), Rügen (code: 13061) to Nordvorpommern (code: 13073) – Wismar (code: 13006), Nordwestmecklenburg (code: 13058) to Nordwestmecklenburg (code: 13074) – Greifswald (code: 13001), Ostvorpommern (code: 13059), Uecker-Randow (code:13062) to Südvorpommern (code: 13075) – Ludwigslust (code: 13054), Parchim (code: 13060) to Südwestmecklenburg (code: 13076)

Abbreviation	DRG_DRG
Data source	German Federal Statistical Office
Official name	Diagnosis-related group (DRG) statistics
Special analysis carried out	yes
Notes on the statistics	■ including deaths and day cases
Structure of the data	DRGs according to: ■ patient's place of residence (district level) ■ patient's age group (under 1 year, 1–4 years, 5–9 years ... 90–94 years, 95 years and older) ■ patient's sex ■ number of DRGs
Years included	All individual years in the period 2007 to 2012
Changes made to the original data set	■ Clearing of data for individuals with – unknown age group – place of residence abroad, unknown or undeclared ■ For 2007, values for Saxony districts were classified according to the district boundaries of 2009 (following the district reform). ■ For all years, values for Berlin districts (code 110*) were cumulated under "Berlin, city" (code 11000). ■ For 2007 and 2008, values for Aachen districts (code 05354) and "Aachen, city" (code 05313) were cumulated under "Aachen, urban region" (code 05334). ■ For the years 2007 to 2010, the district boundary reform in Mecklenburg-Western Pomerania was completed in 2011. The values for the following districts were cumulated: – Neubrandenburg (code: 13002), Demmin (code: 13052), Mecklenburg-Strelitz (code: 13055), Müritz (code: 13056) zu Mecklenburgische Seenplatte (code: 13071) – Bad Doberan (code: 13051), Güstrow (code: 13053) the district Mittleres Mecklenburg (code: 13072) – Stralsund (code: 13005), Nordvorpommern (code: 13057), Rügen (code: 13061) to Nordvorpommern (code: 13073) – Wismar (code: 13006), Nordwestmecklenburg (code: 13058) to Nordwestmecklenburg (code: 13074) – Greifswald (code: 13001), Ostvorpommern (code: 13059), Uecker-Randow (code:13062) to Südvorpommern (code: 13075) – Ludwigslust (code: 13054), Parchim (code: 13060) to Südwestmecklenburg (code: 13076)

Abbreviation	Stat_Geburt
Data source	German Federal Statistical Office (Regional data base)
Official name	Birth statistics
Special analysis carried out	no
Notes on the statistics	Births: live births according the gender, nationality and age group of mothers – annual total –
Structure of the data	Births according to ■ maternal place of residence (district level) ■ 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)
Years included	All individual years in the period 2007 to 2012
Changes made to the original data set	■ Clearing of data for individuals with – unknown age group – place of residence abroad, unknown or undeclared ■ For 2007, values for Saxony districts were classified according to the district boundaries of 2009 (following the district reform). ■ For all years, values for Berlin districts (code 110*) were cumulated under "Berlin, city" (code 11000). ■ 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). ■ For the years 2007 to 2010, the district boundary reform in Mecklenburg-Western Pomerania was completed in 2011. The values for the following districts were cumulated: – Neubrandenburg (code: 13002), Demmin (code: 13052), Mecklenburg-Strelitz (code: 13055), Müritz (code: 13056) zu Mecklenburgische Seenplatte (code: 13071) – Bad Doberan (code: 13051), Güstrow (code: 13053) the district Mittleres Mecklenburg (code: 13072) – Stralsund (code: 13005), Nordvorpommern (code: 13057), Rügen (code: 13061) to Nordvorpommern (code: 13073) – Wismar (code: 13006), Nordwestmecklenburg (code: 13058) to Nordwestmecklenburg (code: 13074) – Greifswald (code: 13001), Ostvorpommern (code: 13059), Uecker-Randow (code:13062) to Südvorpommern (code: 13075) – Ludwigslust (code: 13054), Parchim (code: 13060) to Südwestmecklenburg (code: 13076)

Abbreviation	Stat_Bev_EA
Data source	German Federal Statistical Office (Regional data base)
Official name	Population at year's end according to urban and rural districts and age
Special analysis carried out	yes
Notes on the statistics	Status prior to 2011 census
Structure of the data	Population at year's end according to ■ rural and urban districts ■ gender ■ individual age (under 1 year, 1 to under 2 years, 2 to under 3 years, ..., 84 to under 85 years, 85 years and over)
Years included	All individual years in the period 2007 to 2012
Changes made to the original data set	■ Clearing of data for individuals with – unknown age group – place of residence abroad, unknown or undeclared ■ For 2007, values for Saxony districts were classified according to the district boundaries of 2009 (following the district reform). ■ For all years, values for Berlin districts (code 110*) were cumulated under "Berlin, city" (code 11000). ■ 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). ■ For the years 2007 to 2010, the district boundary reform in Mecklenburg-Western Pomerania was completed in 2011. The values for the following districts were cumulated: – Neubrandenburg (code: 13002), Demmin (code: 13052), Mecklenburg-Strelitz (code: 13055), Müritz (code: 13056) zu Mecklenburgische Seenplatte (code: 13071) – Bad Doberan (code: 13051), Güstrow (code: 13053) the district Mittleres Mecklenburg (code: 13072) – Stralsund (code: 13005), Nordvorpommern (code: 13057), Rügen (code: 13061) to Nordvorpommern (code: 13073) – Wismar (code: 13006), Nordwestmecklenburg (code: 13058) to Nordwestmecklenburg (code: 13074) – Greifswald (code: 13001), Ostvorpommern (code: 13059), Uecker-Randow (code:13062) to Südvorpommern (code: 13075) – Ludwigslust (code: 13054), Parchim (code: 13060) to Südwestmecklenburg (code: 13076)

5.2 Possible limitations

This section lists possible limitations of the DRG_OPSend, DRG_OPSvier and DRG_DRG statistics. If an indicator is known to be subject to any significant limitations, this is specifically indicated under the heading "Note" in the appropriate subsection of 5.3.

The data collected from the DRG statistics is documented according to standardised rules. In particular, these include the general and special German coding guidelines (DKR) in the versions applicable to the years concerned.

Limitation 1: The DRG-based statistics cover only hospitals that use the DRG billing system and are regulated under Article 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 the services provided for these cases.

Limitation 2: The statistical data is not available at the level of the individual case. The German Federal Statistical Office clears the data of duplicates on the basis of the final digit of the OPS code, but cases for which two or more OPS codes with differing final digits of a four-digit code have been documented at the same time, may be counted more than once. [The OPS, "Operationen- und Prozedurenschlüssel", or OPS code, is the official German classification for operational procedures].

Limitation 3: The statistical data is 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 at the same time and which are reported (including at the level of four-digit codes) for different indicators.

Limitation 4: The statistical data is 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: With regard to the OPS classification system, the German Institute for Medical Documentation and Information (DIMDI) publishes new versions each year so the series of codes for a particular indication may have been revised during the time frame of the study. This means that the number of codes included may have increased or decreased or the delimiters may have changed.

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

Limitation 7: For the time period investigated, it was beyond the control of the study to determine whether and to what extent hospitals (must) also document in the statistics such cases/services that fall within the scope of full inpatient treatment in the context of integrated care agreements pursuant to Articles 140a-d of the German Social Insurance Code Book V (SGB V).

Further information is provided in the Quality Report of the German Federal Statistical Office.

Clearing of denominators

Most of the indicators selected for this Fact Check are examined according to the rates of surgery, i.e. the number of surgical interventions carried out per 10,000 inhabitants. Most of these indicators relate to the removal of an organ (womb, gallbladder, etc.), the primary implantation of an artificial joint (primary knee replacement) or the first insertion of a medical device (ICD implantation) within the period under study.

Especially in the case of procedures which have had a high or rapidly increasing rate of surgery for a number of years, the proportion of the population which is still "at risk", i.e. who have not yet had the organ removed or not yet had a (primary) joint replacement or had a device implanted (for the first time), diminishes from year to year. The portion of the population who are still "at risk" is comparatively low in regions with consistently above-average rates of surgery and in regions with consistently below-average rates of surgery comparatively high. The consequence of this is that in regions which have already recorded a high rate of surgery over a prolonged period of time, the actual rate of surgery in the period under study tends to be underestimated, and vice versa.

Ideally, the denominators should be cleared so that the number of operations performed in a given region in the period under study refers not to the inhabitants of this region as a whole but to the portion of the population who are "at risk" in order to determine the prevalence-corrected, age-standardised rates of surgery. The deviations between the uncorrected and corrected rates of surgery could be significant.[20] Such a clearing of the denominators would, however, exceed the bounds of the present Fact Check.

Each indicator for which the denominators could in theory be cleared in this way is indicated in the following section under the heading "Notes" in the appropriate subsection.

[20] cf. Stang A, Merill RM, Kuss O. Prevalence-corrected hysterectomy rates by age and indication in Germany 2005–2006. Arch Gynecol Obstet. DOI: 10.1007/s00404-012-2415-2.

5.3 The indicators: Calculation methods and notes

Caesarean sections as a percentage of total births

Statistics 1:	**DRG_DRG**
Years:	2007 to 2012
DRGs included:	DRGs (O01*)
Demarcation:	None
Statistics 2:	**Stat_Geburt**
Years:	2007 to 2012
Groups included:	All
Method of calculation:	The rates of surgical intervention for caesarean sections for the years 2007 to 2009 and 2010 to 2012 were calculated by direct standardisation to live births according to the age groups of the mothers in 2012 (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). In doing so, the rate of caesarean section for each age group in each district is multiplied by the nationwide number of live births in these age groups in 2012. The resultant values for each age group are added up and divided by the total nationwide number of live births in 2012.
Notes:	The indicators were calculated by reference to the DRGs for caesarean section. Because of the logic of DRG grouping, cases in which a caesarean section is performed can be allocated to a DRG group other than a caesarean section DRG, for example a "ventilation DRG" from a pre-MDC. Furthermore, the DRG_DRG statistics do not distinguish between single and multiple births whereas the Stat_Geburt statistics include all live births. Births outside outpatient hospital care are included in the Stat_Geburt statistics and do not distort the result. The allocation of the mothers to districts of residence in the DRG_DRG statistics and the Stat_Geburt statistics is carried out when the data set is generated and not necessarily by the same process. Accordingly, there may be differences in the allocation to a district of residence, especially when individual post codes cover more than one region of a district.

Tonsillectomy in children and adolescents

Statistics 1:	**DRG_OPSvier**
Years:	2007 to 2012
DRGs included:	5-281: Tonsillectomy (without adenoidectomy) 5-282: Tonsillectomy with adenoidectomy
Demarcation:	Exclusive focus on OPS codes up to 19 year of age (male and female)
Statistics 2:	**Stat_Bev_EA**
Years:	2007 to 2012
Groups included:	Population of the age groups up to 19 years (male and female)
Method of calculation:	The rates of surgical intervention for the years 2007 to 2009 and 2010 to 2012 were calculated by direct standardisation to the population of 2012. In doing so, the rate of surgery for each age group and gender in each district is multiplied by the nationwide population figure for this age group and gender in 2012. The resultant values for each age group and gender are added up and divided by the total nationwide population for these age and gender groups in 2012.
Notes:	Limitations 2 and 7 as set out in the section “Possible limitations” may apply to a particular extent. No clearing of denominators was carried out.

Appendectomy in children and adolescents

Statistics 1:	**DRG_OPSvier**
Years:	2007 to 2012
DRGs included:	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 2:	**Stat_Bev_EA**
Years:	2007 to 2012
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:	The rates of surgical intervention for the years 2007 to 2009 and 2010 to 2012 were calculated by direct standardisation to the population of 2012. In doing so, the rate of surgery for each age group and gender in each district is multiplied by the nationwide population figure for this age group and gender in 2012. The resultant values for each age group and gender are added up and divided by the total nationwide population for these age and gender groups in 2012.
Notes:	No clearing of denominators was carried out.

Hysterectomy

Statistics1:	**DRG_OPSvier**
Years:	2007 to 2012
DRGs included:	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 (women only)
Statistics 2:	**Stat_Bev_EA**
Years:	2007 to 2012
Demarcation:	All age groups (women only)
Method of calculation:	The rates of surgical intervention for the years 2007 to 2009 and 2010 to 2012 were calculated by direct standardisation to the population of 2012. In doing so, the rate of surgery for each age group in each district is multiplied by the nationwide population figure for this age group in 2012. The resultant values for each age group are added up and divided by the total nationwide population for these age groups in 2012.
Notes:	No clearing of denominators was carried out.

Prostatectomy

Statistics 1:	**DRG_OPSvier**
Years:	2007 to 2012
ICD codes included:	5-604: Radical prostatovesiculectomy
Constraint:	All age groups (men only)
Statistics 2:	**Stat_Bev_EA**
Years:	2007 to 2012
Demarcation:	All age groups (men only)
Method of calculation:	The rates of surgical intervention for the years 2007 to 2009 and 2010 to 2012 were calculated by direct standardisation to the male population of 2012. In doing so, the rate of surgery for each age group in each district is multiplied by the nationwide population figure for this age group in 2012. The resultant values for each age group are added up and divided by the total nationwide population for these age groups in 2012.
Notes:	No clearing of denominators was carried out.

Cholecystectomy

Statistics 1:	**DRG_OPSvier**
Years:	2007 to 2012
DRGs included::	5-511: Cholecystectomy
Demarcation:	All age groups (male and female)
Statistics 2:	**Stat_Bev_EA**
Years:	2007 to 2012
Demarcation:	All age groups (male and female)
Method of calculation	The rates of surgical intervention for the years 2007 to 2009 and 2010 to 2012 were calculated by direct standardisation to the population of 2012. In doing so, the rate of surgery for each age group and gender in each district is multiplied by the nationwide population figure for this age group and gender in 2012. The resultant values for each age group and gender are added up and divided by the total nationwide population for these age and gender groups in 2012.
Notes:	Limitation 2 as set out in the section “Possible limitations” may apply to a particular extent. No clearing of denominators was carried out.

Coronary bypass surgery

Statistics 1:	**DRG_OPSvier**
Years:	2007 to 2012
DRGs included:	5-361: Aortocoronary bypass 5-362: Aortocoronary bypass by means of minimally invasive technique
Demarcation:	All age groups (male and female)
Verwendete Statistik 2:	**Stat_Bev_EA**
Years:	2007 to 2012
Groups included:	All age groups (male and female)
Method of calculation:	The rates of surgical intervention for the years 2007 to 2009 and 2010 to 2012 were calculated by direct standardisation to the population of 2012. In doing so, the rate of surgery for each age group and gender in each district is multiplied by the nationwide population figure for this age group and gender in 2012. The resultant values for each age group and gender are added up and divided by the total nationwide population for these age and gender groups in 2012.
Notes:	Limitations 2 as set out in the section “Possible limitations” may apply to a particularly large extent.

Implantation of a defibrillator

Statistics 1:	**DRG_OPSend**
Years:	2007 to 2012
DRGs included::	5-377.5: Implantation of a defibrillator with unicameral stimulation 5-377.6: Implantation of a defibrillator with bicameral stimulation 5-377.7: Implantation of a defibrillator with biventricular stimulation
Demarcation:	All age groups (not separated by gender)
Statistics 2:	**Stat_Bev_EA**
Years:	2007 to 2012
Groups included:	All age groups (not separated by gender)
Method of calculation	The rates of surgical intervention for the years 2007 to 2009 and 2010 to 2012 were calculated by direct standardisation to the population of 2012. In doing so, the rate of surgery for each age group in each district is multiplied by the nationwide population figure for this age group in 2012. The resultant values for each age group are added up and divided by the total nationwide population for these age groups in 2012.
Notes:	No clearing of denominators was carried out.

Primary knee replacement

Statistics 1:	**DRG_OPSvier**
Years:	2007 to 2012
DRGs included::	5-822: implantation of a knee joint endoprosthesis
Demarcation:	All age groups (male and female)
Statistics 2:	**Stat_Bev_EA**
Years:	2007 to 2009
Groups included:	All age groups (male and female)
Method of calculation:	The rates of surgical intervention for the years 2007 to 2009 and 2010 to 2012 were calculated by direct standardisation to the population of 2012. In doing so, the rate of surgery for each age group and gender in each district is multiplied by the nationwide population figure for this age group and gender in 2012. The resultant values for each age group and gender are added up and divided by the total nationwide population for these age and gender groups in 2012.
Notes:	Limitation 7 as set out in the section “Possible limitations” may apply to a particularly large extent. No clearing of denominators was carried out.

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