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Hospital reform in Germany: population-based calculation and simulation model for planning and impact assessment

A central component of the hospital reform proposed by the government commission for modern and needs-based hospital care is the concentration and centralisation of treatment capacities in the over-supplied metropolitan areas in order to ensure high-quality care for the population despite an increasing shortage of specialist staff, to counteract a further disproportionate increase in costs and to improve the quality of treatment [1]. 78% of people in Germany live in urban centres. The core elements of the proposals of the government commission and the planned hospital reform are planning according to service groups based on defined specifications for structural quality, the categorisation of hospitals into levels, at least in the form of transparent information for the general public, and the introduction of reserve financing, which is to form the third pillar of hospital operating cost financing alongside the reduced DRG flat rates per case and the nursing budget. Investment costs will continue to be financed independently by the federal states [1, 2]. In order to achieve the necessary structural optimisation, planning and reserve financing should be linked at the level of the service groups (LG). The LGs should essentially be based on the system developed in North Rhine-Westphalia [3]. For hospital planning and hospital authorisation by the federal states, service groups and associated care volumes should in future replace the previous planning according to specialties and beds.

>> Once the care mandate has been issued, the respective hospital sites are to receive a reserve budget that is independent of the actual number of cases provided [1, 2] .

The Government Commission recommended a population-based approach both in its first statement for short-term measures in paediatrics and obstetrics (Model C) and in its third statement for care management and planning [4]. To date, however, a generic model for the population-based determination of the importance of care and the need for a service group at a location is lacking.

A suitable instrument for simulating the two parameters per location under different scenarios is also necessary for risk management: Due to the lack of role models from comparable healthcare systems and a treatment figure of over 16 million per year, empirical modelling with consideration of different scenarios is urgently recommended in order to estimate the effects of the hospital reform with regard to ensuring comprehensive care and to be able to provide guidelines for hospital planning.

For the planning of individual hospitals and organisations as well as for the hospital planning of the federal states, there is a great need for an instrument for deriving decisions, a transparent and adaptable estimate of the reserve budgets under different scenarios and the expected effects in each case.

Against this background, the impact analysis working group of the Government Commission, together with representatives of the National Association of Statutory Health Insurance Funds, has created a generic model to determine the importance of care and need for the different LGs and simulated the effects using different scenarios, taking into account the choices made by citizens (patient preference) and accessibility. The starting point of the model presented is the population reference, i.e. not the actual DRG cases provided, but the potential DRG cases in a region.

Methodology

The data basis for the modelling presented below is formed by anonymised data of all full and partial inpatient cases according to Section 21 (1) KHEntgG (Section 21 data) with discharge in 2021, the population figures for Germany at the end of 2021 distributed across 84,000 small-scale market cells (approximately 1,000 inhabitants each) and the travel times generated by the company trinovis from each market cell to all hospital locations. The accessibility is calculated as the car journey time between the point of the market cell with the highest population density and the hospital locations. For this purpose, the market cells are divided into grid sections and local clusters of house number segments are determined. If a clustering can be determined, the point within the grid segment that is as central as possible in relation to the geographical centre of the market cell is selected as the starting point. If no significant clustering of settlement can be determined, the geographical centre of the market cell is used as the starting point. This is based on the data material from Digital Data

Streets, which is based on the navigation data from HERE (formerly Nokia and NAVTEQ). The actual journey time is measured using the routing software 'RW Net' (routeware), which takes different average speeds (km/h) into account when calculating the journey time depending on the traffic infrastructure, topography and average traffic situation.

All full and partial inpatient somatic hospital cases were assigned to an LG in accordance with the LG definition in the hospital plan of the state of North Rhine-Westphalia [5]. Treatment cases from individual speciality department codes not represented in NRW also had to be assigned to a service group. Even in the case of LGs for which the NRW planning process deviated from the algorithm (e.g. 'complex gastroenterology'), the allocation was carried out exclusively algorithmically.

A certified grouper was used to calculate the relative weights and the aG-DRG of the aG-DRG system 2021 was determined for all cases (including overstayers). Cases for which no standardised relative weight could be determined in this process were assigned the weight '1'. This applied to 0.6% of cases. The severity of a case was determined by the relative weight. As DRG revenues, the case mix volumes within the service groups were multiplied by the 2021 federal base rate. In order to simulate a possible control of the upkeep remuneration according to the model, 40% of the revenues were recognised as upkeep financing on a flat-rate basis (based on a flat-rate outsourced material cost share of 10%).

In order to realise the basic idea of aligning hospital planning and management with the population to be cared for in terms of services of general interest, our model is weighted according to the size of the potential population to be cared for. As the frequency of the illnesses underlying the reason for treatment and the urgency of the treatments vary significantly between the service groups, the service groups were divided into four categories with corresponding accessibility limits, based on the NRW model. Depending on the specialisation requirements and urgency of treatment, accessibility limits of 30, 45, 90 or 180 minutes by car were assigned to the service groups. The accessibility corridors can be varied for other model variants. When determining the service group-related importance of care, based on the 84,000 small-scale market cells, the hospital locations with the relevant LG whose residents can reach the location within the respective corridor were taken into account. In the sense of a gravity model, market cells with a particularly short journey were given greater consideration than those with a longer journey time (within the accessibility limit); see 'Basic model' below.

In future, service groups can only be allocated to locations that can prove that they fulfil the necessary structural quality requirements. At present, it is not yet possible to reliably determine which locations qualify for which service groups because, for example, the number of doctors employed is not systematically reported. Against the background of the intended structural optimisation, not all locations that currently provide services in a certain service group should beallocated to this service group in the future.This applies in particular to service groups in which locations currently only provide services occasionally. We therefore use different percentile limits in the simulation models as a substitute, namely 7.5% and 20%. To simulate a percentile limit of 7.5% (or 20%), the eligible service providers are those that cumulatively provide 92.5% (or 80%) of the total number of cases in a service group in descending order of number of cases (scenario capping at 92.5% or 80%). This results in a purely algorithmically determined minimum number of cases for consideration as a service provider.

Base model

Gravity models were used to simulate the population-related determination of the importance of supply based on the data for 2021. The basis of the base model is the assumption that the choice of hospital is not entirely dependent on the distance travelled and that other factors can dominate the choice. The nearest hospital is not always the only one chosen. In the gravity model, we therefore orientated ourselves on a model of the Federal Office for Building and Regional Planning (BBSR), in which the contact intensity halves every 10 minutes [6]. In our model, we assume that there are no travel time-dependent priorities within a travel time radius of one third of the service group-specific accessibility corridor, but that in this narrow range other reasons are decisive for prioritising a hospital choice, which we cannot map. Only when journey times exceed this range does the journey time begin to influence the decision in the assumed manner. Starting with this value, we assume that the priority of a location choice is halved every further third of the journey time corridor:

Variations of this model basis are possible, for example by assuming different minute limits for the halving of the choice decisions. Figure 1 shows an example of the population-related weighting for a market cell in the federal state of Saxony (Glaubitz centre) for the service group 'Knee arthroplasty' (LG 14.2; accessibility limit: 45 min.), where four locations within the accessibility corridor provide the LG.

Extended models

In the extended model, in addition to the population (basic model), we firstly take into account the historical number of cases at the hospital location in the LG. This makes sense because higher case numbers represent the preferences of the population when choosing a hospital, reflect the current care capacities and are generally associated with higher specialisation of the sites [7-14]. The higher the number of cases treated, the more residents an area attracts. In addition, not taking existing capacities into account would require enormous shifts in supply that cannot be realised in the short term. To reflect this in the model, the (historical) number of cases at the location is taken into account in addition to the population to be served. In our model, the weight of this factor is proportional to the number of cases. Variants are possible by exponentiating the number of cases. The corresponding exponent can be greater or less than 1 if the significance of the number of cases for gravity is to be more or less significant in the model.

Secondly, since case severity and complexity and thus the actual importance of care vary between different hospitals with the same LG, we take the historical case severity into account in an extended gravity model. In contrast to the unchanged CMI value as an expression of case severity, a modified form of the CMI is used, which results in heavier cases being given a disproportionately higher weight. The relative weight of each case was first raised to the power of 1.5 (relative weight 1.5) and the performance group-specific mean value of a location from these powers was included in the model as a (further) factor, i.e. multiplied by the value of the base model or the product of the base model and the case number factor. This exponent can also be varied depending on whether a stronger or weaker overestimation of particularly heavy and complex cases is to be included in the model. We present an extended gravity model with population reference, which only includes the number of cases, as well as a twofold extended model, which also integrates the case severity in addition to the number of cases.

To determine the importance of care, the sum of the products of the factors included in the respective model (population, number of cases, case severity) is calculated for each hospital location across all market cells in the accessibility corridor. The share of the location-specific sum in the total sum across all locations then corresponds to the relative importance of the location for healthcare provision.

The model works without rigid regional boundaries due to the chosen change of perspective - away from the supply- and hospital location-related perspective towards the demand-side, population-related perspective. It therefore also works in metropolitan areas and in the case of cross-border surrounding areas. The only decisive factor in each case is the view of the people potentially in need of hospital treatment with regard to the available services in the respective service group.

Necessity of need

Because nationwide care should be an additional goal of financing, we also present a utilitarian model in addition to the basic model and the extended models, which reflects the regional importance of the LG provided at a particular location. The model for the necessity of demand (singularity model) indicates how many additional minutes of travelling time would be required for the population to be supplied by other locations if this location were to be removed. This model is particularly important for service groups

Locations within the accessibility limit of 45 minutes of the Glaubitz centre market cell

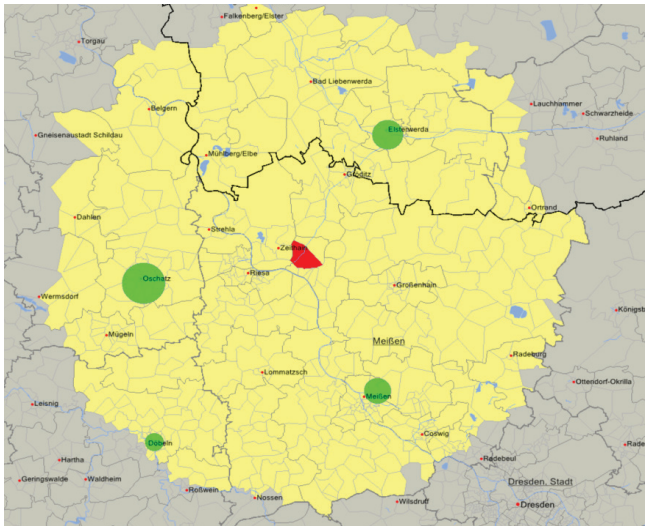


Fig. 1: Locations with the service group 'Knee arthroplasty' (LG 14.2) located within the 45-minute accessibility limit (yellow area) of the Glaubitz Centre market cell (Saxony). The area of the green circles around the four locations corresponds to the proportion of the population to be supplied from this market cell (basic model). Source: own illustration.

for which care is to be provided close to home (e.g. emergency medicine, general internal medicine, general surgery). As a further indicator of the relevance of a location, the number of people for whom no hospital within the accessibility limit of the respective LG would be accessible if the LG of this location were to be cancelled was calculated.

Impact analysis

In order to model the planning of the distribution of the service groups and any distribution of the service group-related reserve budget to the locations, a cap was initially applied for the year 2021 for exemplary redistribution scenarios with a percentile limit of 92.5% or 80%. When distributing the upkeep costs, the upkeep costs of the providers leaving a service group due to the capping were also distributed. In the status quo (before concentration), all locations that discharged at least one case in the LG in the reference year 2021 were taken into account. The effects of the concentration of services on accessibility are presented as population shares outside the accessibility corridor (presentation of the need for locations). In addition to nationwide impact simulations for all LGs, we show exemplary simulation results for the LG 'Endoprosthetics Knee' (LG 14.2) for the federal state of Saxony.

Results

Of the total of 16,570,345 inpatient somatic treatment cases in 2021, 16,314,551 cases (98.5%) could be assigned to one of the 60 somatic NRW service groups. Table 1 shows the total number of cases, the number of hospital sites providing services in the respective service group, the mean CMI value, total revenue, the actual median travel time and the accessibility at federal level for each service group for 2021, if each site to which at least one case of the service group could be assigned is assessed as a potential service provider in this service group (number of people and proportion of the population outside the accessibility corridor). The DRG revenues for the cases that can be allocated to a service group total approx. 55.7 billion euros. Assuming a 40% share of cases to be held in reserve, this would result in a cumulative volume of approximately 22.3 billion euros for all LGs. With more than 3 million treatment cases each, a total of 43% of all cases were allocated to the LGs 'General Internal Medicine' and 'General Surgery'. More than 1,300 locations were involved in the provision of services in each of these two LGs. The median journey times in the status quo (2021) were less than 20 minutes for 25 LGs, between 20 and 30 minutes for 21 LGs and more than 30 minutes for 14 LGs. For the majority of LGs (n=35), accessibility in the status quo (2021) was very good with less than 1% of the population with journey times outside the accessibility corridor. In relation to the accessibility corridors used as a basis, accessibility was limited in the LG 'General paediatrics and adolescent medicine' (13.5% outside the accessibility corridor of 30 min.) and the LG 'Stroke Unit' (13.8% outside the accessibility corridor of 30 min.) (Table 1).

Tables 2a and 2b show for the two scenarios with a percentile limit of 7.5% (i.e. with capping at 92.5%, Table 2a) and 20% (i.e. with capping at 80%, Table 2b) the effects on the number of LG locations, the lowest number of cases at a LG location, the range of CMI values of the respective LG locations and the effects on accessibility for the population. For the LG 'Pancreatic surgery', for example, the site-specific minimum case numbers for concentration with capping at 92.5% and 80% are 10 and 16 respectively. For the LG 'Hip arthroplasty', the corresponding minimum case numbers would be 60 and 104 respectively. Hypothetical minimum case numbers for the other LGs can be found in Tables 2a and 2b. A redistribution of cases from the smallest to the locations with higher case numbers would be associated with a significant reduction in the number of locations. In the 7.5% scenario, the number of sites would be reduced by between 20.7% (LG 'Complex gastroenterology') and 59.7% (LG 'ENT'). The concentration of services would have different effects on accessibility for the population in the different LGs. In more than half of the LGs (n=33), service concentration (capping at 7.5%) would mean that less than 1% of the population would no longer have an additional LG location within the accessibility limit. For 14 LGs in the same scenario, the additional proportion of the population without a LG location within the accessibility limit would be over 5% (Table 2a).

Even a concentration of services by 20% would only be associated with minor disadvantages for the accessibility of the population for around half of the LGs (n=29) (< 1% additional outside the accessibility limit). In the LGs with the highest number of cases, 'General internal medicine' (LG 01.1) and 'General surgery' (LG 09.1), in addition to the approximately 1.4% of the population (status quo), around 2.5% of the population would be outside the accessibility corridor with a concentration of 7.5% and around 5.7% with a concentration of 20%.

Figure 2 shows an example of the weighting of the individual locations for the LG 'Spinal interventions' (LG 14.5) with a hypothetical concentration of 7.5%. In the base model, the different locations are given a similarly high weighting due to the exclusive reference to the population. The locations cluster in regions with a high population density, without individual locations standing out as particularly relevant. However, when the historical number of cases (extended model 1) or the number of cases and the CMI value (extended model 2) are added, there are very clear differences in the relevance of the individual locations for the importance of care. In some regions, there is a clear concentration (e.g. in the west of Baden-Württemberg or in Saxony), but not in other regions (e.g. eastern Bavaria, Schleswig-Holstein).

A concentration of services with an expected improvement in quality could be aimed for by the planning of the federal states in particular where locations with a very low weight in the extended model 2 are close to locations with a high weight. In regions with several sites, each with a low weighting, merging could be attractive for the state and the hospital operators in order to concentrate retention budgets and thus ensure care in the region. The singularity model also shown in Figure 2 appears to be helpful for these considerations: Here, locations are particularly prominent, whose omission in the LG would limit accessibility for the population.

The model will be explained further using the example of the 'knee arthroplasty' service group (LG 14.2). In the status quo, 0.3% of the population live outside the accessibility corridor of 45 minutes.

Status quo der Krankenhausversorgung in den Leistungsgruppen im Jahr 2021

Leistungsgruppe	Fallzahl (n)	Anzahl Standorte (n)	Mittlerer CMI	Erlös (Mio. Euro)*	Mediane Fahrzeit (min)	Erreichbarkeitsgrenze	Anzahl Personen außerhalb der Erreichbarkeitsgrenze (n)	Anteil Bevölkerung außerhalb der Erreichbarkeitsgrenze (%)
01.1 Allgemeine Innere Medizin	3.925.317	1.312	0,665	9.788	14,0	30	1.122.318	1,3%
02.1 Komplexe Endokrinologie und Diabetologie	40.516	45	0,763	116	18,5	90	6.009.919	7,2%
03.1 Komplexe Gastroenterologie	589.086	270	0,678	1.497	13,7	90	265.408	0,3%
04.1 Komplexe Nephrologie	124.532	121	0,814	380	15,1	90	717.936	0,9%
05.1 Komplexe Pneumologie	303.684	159	0,865	985	19,5	45	11.855.958	14,2%
06.1 Komplexe Rheumatologie	63.898	66	0,686	164	30,6	90	2.573.669	3,1%
07.1 Stammzelltransplantation	7.614	98	7,837	224	33,1	180	45.245	0,1%
07.2 Leukämie und Lymphome	24.012	420	2,142	193	23,6	180	45.245	0,1%
08.1 EPU / Ablation	111.826	474	1,832	768	20,2	45	2.983.353	3,6%
08.2 Interventionelle Kardiologie	691.664	1.053	1,092	2.831	16,1	45	286.150	0,3%
08.3 Kardiale Devices	42.121	798	2,757	435	18,5	180	44.532	0,1%
08.4 Minimalinvasive Herzklappenintervention	26.482	100	6,319	627	30,4	180	45.245	0,1%
09.1 Allgemeine Chirurgie	3.250.449	1.304	0,996	12.128	16,1	30	1.145.146	1,4%
10.1 Kinder- und Jugendchirurgie	105.904	89	0,695	276	19,2	45	17.722.674	21,3%
11.1 Plastische und Rekonstruktive Chirurgie	74.405	122	1,198	334	22,9	180	45.245	0,1%
12.1 Bauchaortenaneurysma	12.760	514	4,618	221	19,7	90	50.964	0,1%
12.2 Carotis operativ/interventionell	28.933	626	1,932	210	19,1	90	50.552	0,1%
12.3 Komplexe periphere arterielle Gefäße	55.194	701	3,025	626	17,5	180	45.245	0,1%
13.1 Herzchirurgie	60.713	148	5,484	1.248	33,4	45	13.924.669	16,7%
13.2 Herzchirurgie – Kinder und Jugendliche	3.002	29	8,345	94	50,3	90	3.974.620	4,8%
14.1 Endoprothetik Hüfte	161.285	1.168	1,617	978	22,6	45	105.387	0,1%
14.2 Endoprothetik Knie	152.478	1.047	1,810	1.035	23,4	45	236.448	0,3%
14.3 Revision Hüftendoprothese	18.798	1.078	2,995	211	21,6	180	44.532	0,1%
14.4 Revision Knieendoprothese	20.400	1.024	2,686	205	24,4	180	44.532	0,1%
14.5 Wirbelsäuleneingriffe	223.227	1.056	1,939	1.622	22,8	90	28.859	0,0%
15.1 Thoraxchirurgie	14.709	373	3,519	194	23,5	45	3.775.639	4,5%
16.1 Bariatrische Chirurgie	21.557	260	1,701	137	26,2	180	45.245	0,1%
16.2 Lebereingriffe	6.165	550	4,785	111	23,7	180	45.245	0,1%
16.3 Ösophaguseingriffe	4.328	355	7,093	115	25,7	180	45.245	0,1%
16.4 Pankreaseingriffe	11.135	559	5,675	237	20,6	180	45.213	0,1%
16.5 Tiefe Rektumeingriffe	14.276	973	3,939	211	18,0	180	44.532	0,1%
17.1 Augenheilkunde	304.255	215	0,543	619	26,1	45	8.017.598	9,6%
18.1 Haut- und Geschlechtskrankheiten	221.305	114	0,580	481	24,6	45	13.640.249	16,4%
19.1 MKG	91.706	153	1,069	367	24,9	90	274.722	0,3%
20.1 Urologie	739.665	495	0,774	2.146	18,4	30	7.670.884	9,2%
21.1 Allgemeine Frauenheilkunde	648.598	759	0,636	1.545	16,6	30	3.723.404	4,5%
21.2 Ovarial-CA	7.497	658	2,823	79	18,8	180	44.564	0,1%
21.3 Senologie	77.407	674	1,195	347	18,6	180	36.276	0,0%
21.4 Geburtsklinik	763.749	666	0,617	1.766	15,2	30	4.655.512	5,6%
21.5 Geburtsklinik – Kinder	658.588	686	0,167	412	15,0	30	4.677.373	5,6%
22.1 Perinataler Schwerpunkt	10.283	350	3,384	130	19,5	30	12.010.959	14,4%
22.2 Perinatalzentrum Level 1	5.871	238	12,634	278	21,5	90	139.661	0,2%
22.3 Perinatalzentrum Level 2	3.105	254	6,693	78	20,5	45	4.731.434	5,7%
23.1 Allgemeine Kinder- und Jugendmedizin	802.003	383	0,569	1.711	19,4	30	11.260.301	13,5%
23.2 Kinder-Hämatologie und -Onkologie – Stammzelltransplantation	533	37	18,988	38	41,6	180	45.850	0,1%
23.3 Kinder-Hämatologie und -Onkologie – Leukämie und Lymphome	4.693	60	1,909	34	28,5	180	45.245	0,1%
24.1 HNO	410.957	521	0,647	996	21,6	30	8.877.404	10,7%
24.2 Cochleaimplantate	4.998	121	6,021	113	35,3	180	45.245	0,1%
25.1 Neurochirurgie	132.065	180	1,984	982	24,8	45	7.735.287	9,3%
26.1 Allgemeine Neurologie	639.668	484	0,659	1.580	19,1	90	50.449	0,1%
26.2 Stroke Unit	212.764	456	1,383	1.103	16,6	30	11.510.039	13,8%
26.3 Neuro-Frühreha (NNF, Phase B)	35.077	199	3,620	476	42,2	90	282.866	0,3%
27.1 Geriatrie	295.047	748	1,666	1.843	14,8	45	846.764	1,0%
29.1 Palliativmedizin	50.857	286	1,211	231	16,4	45	5.511.042	6,6%
30.1 Darmtransplantation	6	4	38,341	1	60,9	180	4.967.410	6,0%
30.2 Herztransplantation	313	21	30,160	35	58,9	180	103.579	0,1%
30.3 Lebertransplantation	816	25	14,915	46	52,9	180	49.714	0,1%
30.4 Lungentransplantation	284	12	21,321	23	91,2	180	100.466	0,1%
30.5 Nierentransplantation	1.893	43	6,138	44	39,7	180	45.850	0,1%
30.6 Pankreastransplantation	66	20	9,501	2	48,5	180	49.714	0,1%
Summe	1.6570.328	1.734	0,923	55.704	16,8			

Tab. 1: Status quo der Krankenhausversorgung in den Leistungsgruppen im Jahr 2021. Legende: *für Casemix bei Anwendung des Bundesbasisfallwertes 2021.

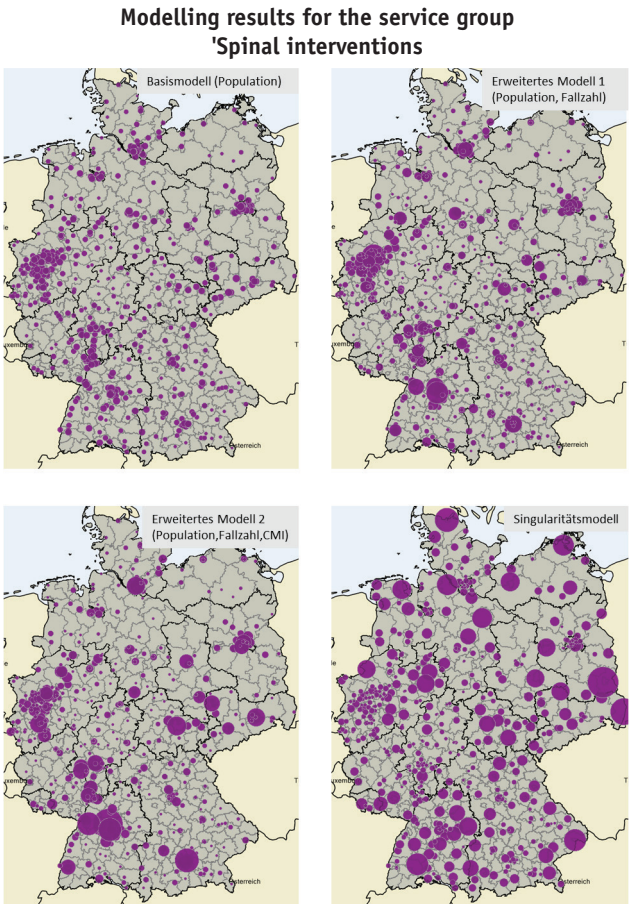


Fig. 2: *Modelling results for the service group 'Spinal interventions' (LG 14.5) with an exemplary concentration of 7.5%. Source: own illustration.*

With a concentration of 7.5% or 20%, this would be an additional 0.9% or 2.9% of the population (Tab. 2a and 2b). The algorithmically calculated minimum number of cases in the LG would be 63 or 104 cases/year in the case of concentration by 7.5% or 20%; the reserve budget to be redistributed from the outgoing to the remaining locations with the LG would be 33 or 86 million euros/year.

Table 3 shows the effects of an exemplary service concentration of 7.5% on accessibility in the basic model and the extended models for the service group 'knee arthroplasty' (LG 14.2) in Saxony and also the distribution of the reserve budget if it were distributed exclusively according to our model. In this scenario, 43 of the previous 53 hospital sites would receive a supply contract for this LG. A total of 345 cases (3.9% of cases from 2021) and €1.06 million of the reserve budget would be redistributed from the ten outgoing LG locations to the remaining locations. In 2021, these remaining locations treated between 69 and 580 cases in LG 14.2. The CMI varied substantially between the service providers in the range between 1.378 and 2.318 points. If only accessibility were taken into account in the base model and the retention fee were distributed on this basis, the individual sites would be allocated retention budgets for population sizes between 27,573 (site 17) and 148,044 (site 7). For locations with a higher number of cases (see upper part of Table 3), this would tend to lead to lower retention budgets compared to the budget update and, conversely, to a relative increase in retention budgets for locations with lower case numbers (lower part of Table 3).

The additional consideration of the number of cases and thus the participation in care as well as the presumed patient preference (extended model 1) changes the allocated population sizes considerably. For example, if the retention budget were allocated according to our model, site 1 would now be allocated a retention budget for 385,865 people (in the basic model for only 143,385 people). Additional consideration of the case severity and complexity (CMI value) and thus the approximated actual retention costs would result in further changes to the population sizes relevant for the retention budget allocation in the extended model 2. In the example selected, this approach would generally lead to moderate changes in the contingency budget compared to the budget update (Table 3). The singularity model provides further valuable information. Here, a high number of additional travelling minutes and a higher number of people outside the accessibility limit if the location is no longer available are an important indication of its singular regional need.

In the context of hospital planning, this information is important for assessing the relevance of individual locations for the population and for the provision of needs-based care. The hospital sites with low case numbers (at the bottom of the table) could possibly be merged with other sites in order to concentrate services. However, they differ significantly in terms of accessibility for the population. The elimination of site 40 and site 41 would require significantly more travelling time for the population compared to the other sites with a low number of cases and therefore appears to be more necessary than sites 37, 38, 39, 42 or site 43, for example. In the case of the latter sites, the elimination of the LG for no additional inhabitants would mean that no LG site within the accessibility corridor would be maintained (Table 3).
This information is of great value not only for hospital planning when deciding which site should receive which service group, but also for hospital operators in the context of financing when deciding which LG is economically viable.

Discussion

The objectives pursued with the planned hospital reform of ensuring high-quality hospital care for the population and de-economisation are derived, among other things, from the state's duty to provide services of general interest: it is the task of the welfare state to provide medical care that is necessary for the entire population. As the provision of services of general interest is a state task, the investment cost financing to be provided from state funds (taxes) initially serves as a source of financing. However, the federal states do not adequately fulfil their funding obligation. Operating cost financing from health insurance contributions is no longer adequate for many hospitals due to falling inpatient case numbers and cuts in services due to a lack of specialised staff. In addition, there are existing false incentives to increase volumes and thus overprovision due to the DRG flat rate system, which unilaterally rewards the

Simulation der Auswirkungen einer Leistungskonzentration um 7,5% (Kappung bei 92,5%) auf die Krankenhausversorgung in den Leistungsgruppen									
Leistungsgruppe	**Anzahl Standorte**	**Reduktion Standorte (n,%)**	**geringste Fallzahl (n)***	**geringster CMI**	**höchster CMI**	**Umverteilung Vorhaltevolumen (in Mio. Euro)**	**Umverteilung Fallzahl (n)**	**Zusätzliche Personen außerhalb der Erreichbarkeitsgrenze (n)**	**Zus. Bev.-anteil außerhalb der Erreichbarkeitsgrenze (%)**
01.1 Allgemeine Innere Medizin	972	25,9%	1.735	0,311	2,176	278	294.987	1.295.737	1,6%
02.1 Komplexe Endokrinologie und Diabetologie	31	31,1%	446	0,250	1,633	3	3.120	534.824	0,6%
03.1 Komplexe Gastroenterologie	214	20,7%	1.269	0,475	1,272	43	45.146	77.754	0,1%
04.1 Komplexe Nephrologie	88	27,3%	520	0,469	1,425	9	9.631	1.240.297	1,5%
05.1 Komplexe Pneumologie	118	25,8%	1.035	0,525	1,941	34	23.282	2.992.039	3,6%
06.1 Komplexe Rheumatologie	40	39,4%	509	0,469	1,023	5	5.032	1.358.537	1,6%
07.1 Stammzelltransplantation	65	33,7%	30	4,186	11,629	5	575	0	0,0%
07.2 Leukämie und Lymphome	186	55,7%	28	0,352	3,649	4	1.804	0	0,0%
08.1 EPU/Ablation	263	44,5%	126	1,328	2,239	22	8.492	4.725.647	5,7%
08.2 Interventionelle Kardiologie	521	50,5%	500	0,536	1,978	81	52.212	1.312.367	1,6%
08.3 Kardiale Devices	450	43,6%	26	1,736	5,511	13	3.182	713	0,0%
08.4 Minimalinvasive Herzklappenintervention	64	36,0%	163	6,061	6,690	21	2.114	0	0,0%
09.1 Allgemeine Chirurgie	992	23,9%	1.436	0,401	2,636	319	244.449	2.090.795	2,5%
10.1 Kinder- und Jugendchirurgie	63	29,2%	570	0,424	1,132	10	8.059	4.883.611	5,9%
11.1 Plastische und Rekonstruktive Chirurgie	81	33,6%	337	0,749	2,074	12	5.866	3.890	0,0%
12.1 Bauchaortenaneurysma	306	40,5%	13	3,094	8,163	7	970	14.378	0,0%
12.2 Carotis operativ/interventionell	379	39,5%	23	1,098	4,402	6	2.177	2.592	0,0%
12.3 Komplexe periphere arterielle Gefäße	415	40,8%	47	1,904	5,180	20	4.164	0	0,0%
13.1 Herzchirurgie	64	56,8%	436	4,299	6,667	43	4.942	4.713.250	5,7%
13.2 Herzchirurgie – Kinder und Jugendliche	16	44,8%	77	6,702	10,163	3	273	4.707.109	5,7%
14.1 Endoprothetik Hüfte	696	40,4%	60	1,226	3,207	32	12.137	969.526	1,2%
14.2 Endoprothetik Knie	700	33,1%	63	1,251	3,166	33	11.452	715.476	0,9%
14.3 Revision Hüftendoprothese	684	36,5%	7	1,578	6,652	7	1.415	681	0,0%
14.4 Revision Knieendoprothese	635	38,0%	8	1,293	6,280	7	1.534	681	0,0%
14.5 Wirbelsäuleneingriffe	542	48,7%	115	0,398	4,544	51	16.766	35.070	0,0%
15.1 Thoraxchirurgie	177	52,5%	20	2,332	6,587	6	1.114	5.636.217	6,8%
16.1 Bariatrische Chirurgie	138	46,9%	41	1,495	2,125	4	1.632	0	0,0%
16.2 Lebereingriffe	307	44,2%	4	2,755	14,447	3	466	0	0,0%
16.3 Ösophaguseingriffe	196	44,8%	6	1,630	20,177	3	326	0	0,0%
16.4 Pankreaseingriffe	334	40,3%	10	3,773	10,859	8	841	32	0,0%
16.5 Tiefe Rektumeingriffe	619	36,4%	6	1,279	11,735	7	1.076	0	0,0%
17.1 Augenheilkunde	107	50,2%	1.059	0,270	0,791	15	23.732	7.693.585	9,2%
18.1 Haut- und Geschlechtskrankheiten	83	27,2%	925	0,441	0,713	17	16.675	3.768.158	4,5%
19.1 MKG	73	52,3%	567	0,635	1,574	10	7.187	327.990	0,4%
20.1 Urologie	333	32,7%	955	0,362	1,530	48	56.224	5.952.812	7,2%
21.1 Allgemeine Frauenheilkunde	539	29,0%	456	0,363	1,001	45	48.921	4.982.672	6,0%
21.2 Ovarial-CA	405	38,4%	5	1,256	9,476	2	565	681	0,0%
21.3 Senologie	356	47,2%	67	0,846	2,377	10	5.858	8.969	0,0%
21.4 Geburtsklinik	492	26,1%	574	0,314	0,821	49	57.686	4.797.419	5,8%
21.5 Geburtsklinik – Kinder	498	27,4%	494	0,117	0,179	12	49.633	4.785.614	5,8%
22.1 Perinataler Schwerpunkt	219	37,4%	15	1,085	6,362	3	779	6.911.650	8,3%
22.2 Perinatalzentrum Level 1	144	39,5%	17	6,349	20,121	7	447	147.608	0,2%
22.3 Perinatalzentrum Level 2	172	32,3%	7	3,194	10,241	2	239	3.630.056	4,4%
23.1 Allgemeine Kinder- und Jugendmedizin	272	29,0%	1.048	0,294	1,207	55	60.841	3.397.905	4,1%
23.2 Kinder-Hämatologie und -Onkologie – Stammzelltransplant.	22	40,5%	8	9,096	32,076	1	42	53.272	0,1%
23.3 Kinder-Hämatologie u. -Onkologie – Leukämie u. Lymphome	42	30,0%	42	0,735	2,997	1	361	0	0,0%
24.1 HNO	210	59,7%	420	0,265	0,858	19	31.095	14.649.933	17,6%
24.2 Cochleaimplantate	64	47,1%	19	3,251	7,109	3	382	0	0,0%
25.1 Neurochirurgie	128	28,9%	396	0,446	3,195	23	9.974	2.585.427	3,1%
26.1 Allgemeine Neurologie	335	30,8%	961	0,382	4,910	67	48.077	1.311	0,0%
26.2 Stroke Unit	283	37,9%	362	0,909	3,001	33	16.087	4.303.131	5,2%
26.3 Neuro-Frühreha (NNF, Phase B)	111	44,2%	86	1,123	18,931	23	2.653	441.800	0,5%
27.1 Geriatrie	455	39,2%	220	1,021	2,885	65	22.165	3.273.934	3,9%
29.1 Palliativmedizin	193	32,5%	127	0,556	2,784	8	3.915	3.137.985	3,8%
30.1 Darmtransplantation	3	25,0%	1	1,000	106,647	<1	1	948.882	1,1%
30.2 Herztransplantation	12	42,9%	7	25,256	52,844	1	25	0	0,0%
30.3 Lebertransplantation	16	36,0%	19	10,408	22,606	2	66	49.408	0,1%
30.4 Lungentransplantation	7	41,7%	14	14,631	30,700	1	32	112.516	0,1%
30.5 Nierentransplantation	31	27,9%	28	5,102	6,880	2	151	7.754	0,0%
30.6 Pankreastransplantation	15	25,0%	2	4,765	16,108	<1	5	49.408	0,1%
Summe						1.621	1.233.054		

Tab. 2a: Simulation der Auswirkungen einer Leistungskonzentration um 7,5% (Kappung bei 92,5%) auf die Krankenhausversorgung in den Leistungsgruppen. Legende: *algorithmisch bestimmte Mindestfallzahl für Leistungsgruppe bei Konzentration um 7,5%.

volume of services.

Against this backdrop, the Government Commission for Modern and Needs-based Hospital Care [1] has proposed, among other things, that the range of services offered by hospitals should be more concentrated and that hospitals should be categorised into three levels for this purpose, and that part of the operating costs should be guaranteed to hospitals that need it, irrespective of the actual provision of services. In order to achieve the objectives of reserve financing, i.e. to reduce the volume incentive, to secure hospitals that are in need and to create incentives for hospital operators to optimise their structures, a redistribution of financial resources is required in the medium term [15]. However, the redistribution of a two-digit billion amount in the hospital system is not without risk and must therefore be empirically verified - precisely in order not to jeopardise the provision of services of general interest. This model attempts to bring together the various levels and instruments envisaged in the 2021 coalition agreement [16].

The starting point of the simulation tool presented here is the reference to the population. In line with the principle of services of general interest, we are changing the focus from the supply side to the demand side. Where many people live, hospital services must also be provided for more people than in regions where fewer people live. However, since patients do not always go to the closest hospital, a massive shift in the existing supply is not possible in the short term, the quality of service provision can differ between hospitals and the severity of the illnesses of the patients treated within a service group varies between locations, we have also taken historical case numbers and the CMI value into account in the extended models. The reorganisation of site planning and operating cost financing should take place gradually as part of a convergence phase [2].

The models should help the federal states and hospital operators to determine the care relevance of the LG of the hospital sites and to optimise the allocation of care contracts on this basis. The selected accessibility limits are to be regarded as exemplary. Actual accessibility limits for the various LGs should be defined in the sense of a standardised national target image with the involvement of the relevant stakeholders; these may also be higher than the values we have selected, for example for cardiac or thoracic surgery, in order to achieve an even better balance between accessibility and quality. The simulation model is not intended to create automatism, but rather to support the hospital planning of the federal states on the basis of a common target image. It creates transparency about the effects of a concentration of services in terms of accessibility for the population - at the federal, state and location levels.

The analysis at federal level shows a differentiated picture with regard to the relevance of care. For elective musculoskeletal interventions or some highly specialised services, a qualitatively desirable, high concentration, e.g. through a high percentile limit of 20%, would not lead to any relevant restrictions in accessibility. A nationwide concentration of services in the paediatric service groups, in ENT medicine, urology or dermatology, on the other hand, is not generally recommended, but possibly only regionally and to a lesser extent, insofar as the service group allocations currently determined according to the NRW algorithm are confirmed with an algorithm not based on specialist department codes.

The empirically based, comparative analysis of individual locations with regard to the residents to be treated, historical case numbers, case severity and the consequences for accessibility if a location is no longer available should support those responsible for planning in making standardised, transparent, legally compliant and evidence-based planning decisions and awarding corresponding care contracts. In our view, the aim of planning should be to achieve an appropriately high concentration of services in line with regional circumstances while minimising accessibility and improving quality.

In the form presented here, we have dispensed with various refinements that would make the model even more targeted. For example, the frequency of hospital utilisation by age and gender could be included in the model. In addition, we calculated the case severity on the basis of the CMI when calculating the corresponding factor. However, as this focuses on the hospital's monetary expenditure excluding bedside care, the cost types from the InEK calculation matrix that best reflect the relevant case severity can be used instead. Although this does not allow differences between individual cases with the same DRG to be mapped, it does allow different distributions of cost types between different DRGs within a service group. Our model does not currently differentiate between university and non-university sites. University hospitals should be weighted more heavily due to their overarching tasks and regional responsibility (e.g. in the context of pandemic preparedness). The consideration of historical case numbers in the extended model also implicitly honours existing overprovision, which could be addressed by correction factors, for example, as part of the further development of the model presented. Once the official LG grouper has been published, the model, which is currently based on the NRW-LG, should be updated accordingly. We offer to further develop the model based on a common target image between the federal and state governments and make it available.
In the status quo analysis, we have taken into account all hospital sites that provided at least one case in the LG in the base year 2021. Due to occasional incorrect documentation and the algorithm's focus on the discharging site, this leads to an overestimation of the number of sites currently involved in care and to an underestimation of the proportion of the population that would no longer find an LG site within the accessibility corridor if services were concentrated.

The algorithm used in the analysis for assigning a case to a service group is based on the discharging specialist department for different service groups. In the case of internal transfers between specialist departments, this can lead to the treatment events relevant to the hospitalisation not being reflected. Furthermore, the specialist department codes used in billing do not always clearly delineate the treatment events. For example, cases of complex gastroenterology are treated in many hospitals in appropriately equipped specialised departments for general internal medicine.

The location allocation based on the discharging location also sometimes leads to incorrect allocation for the same reasons when

Simulation der Auswirkungen einer Leistungskonzentration um 20% (Kappung bei 80%) auf die Krankenhausversorgung in den Leistungsgruppen									
Leistungsgruppe	**Anzahl Standorte**	**Reduktion Standorte (n,%)**	**geringste Fallzahl (n)***	**geringster CMI**	**höchster CMI**	**Umverteilung Vorhaltevolumen (in Mio. Euro)**	**Umverteilung Fallzahl (n)**	**Zusätzliche Personen außerhalb der Erreichbarkeitsgrenze (n)**	**Zus. Bev.-anteil außerhalb der Erreichbarkeitsgrenze (%)**
01.1 Allgemeine Innere Medizin	747	43,1%	2.494	0,311	1,605	748	785.613	3.954.530	4,8%
02.1 Komplexe Endokrinologie und Diabetologie	23	48,9%	772	0,250	1,633	9	8.319	2.530.944	3,0%
03.1 Komplexe Gastroenterologie	167	38,1%	1.853	0,486	1,272	115	118.167	397.275	0,5%
04.1 Komplexe Nephrologie	65	46,3%	810	0,469	1,425	29	25.209	2.705.988	3,3%
05.1 Komplexe Pneumologie	87	45,3%	1.437	0,525	1,582	90	60.739	7.322.549	8,8%
06.1 Komplexe Rheumatologie	28	57,6%	783	0,551	0,912	13	12.852	4.965.248	6,0%
07.1 Stammzelltransplantation	43	56,1%	59	4,994	11,478	15	1.564	0	0,0%
07.2 Leukämie und Lymphome	118	71,9%	59	0,572	3,649	12	4.854	0	0,0%
08.1 EPU/Ablation	182	61,6%	217	1,424	2,239	59	22.513	7.992.016	9,6%
08.2 Interventionelle Kardiologie	387	63,2%	769	0,536	1,978	210	138.943	2.987.579	3,6%
08.3 Kardiale Devices	305	61,8%	47	2,005	5,511	34	8.458	713	0,0%
08.4 Minimalinvasive Herzklappenintervention	48	52,0%	238	6,061	6,577	52	5.432	605	0,0%
09.1 Allgemeine Chirurgie	758	41,9%	2.009	0,401	2,636	858	651.176	4.748.412	5,7%
10.1 Kinder- und Jugendchirurgie	46	48,3%	979	0,424	1,125	24	21.241	0	10,7%
11.1 Plastische und Rekonstruktive Chirurgie	59	51,6%	556	0,749	1,602	31	15.436	3.890	0,0%
12.1 Bauchaortenaneurysma	214	58,4%	22	3,094	6,458	18	2.566	141.002	0,2%
12.2 Carotis operativ/interventionell	265	57,7%	40	1,113	4,402	16	5.803	21.950	0,0%
12.3 Komplexe periphere arterielle Gefäße	304	56,6%	78	1,904	5,180	50	11.046	-12.713	0,0%
13.1 Herzchirurgie	50	66,2%	564	4,299	6,667	106	12.449	8.748.802	10,5%
13.2 Herzchirurgie – Kinder und Jugendliche	12	58,6%	109	7,059	10,163	8	612	6.858.575	8,2%
14.1 Endoprothetik Hüfte	448	61,6%	104	1,229	2,176	83	32.345	2.428.999	2,9%
14.2 Endoprothetik Knie	467	55,4%	104	1,251	2,533	86	30.515	2.388.961	2,9%
14.3 Revision Hüftendoprothese	442	59,0%	13	1,759	5,248	18	3.770	681	0,0%
14.4 Revision Knieendoprothese	417	59,3%	15	1,400	6,280	17	4.091	713	0,0%
14.5 Wirbelsäuleneingriffe	374	64,6%	227	0,623	3,919	128	44.735	88.992	0,1%
15.1 Thoraxchirurgie	118	68,4%	42	2,792	5,767	16	2.958	10.438.023	12,5%
16.1 Bariatrische Chirurgie	90	65,4%	71	1,550	2,092	11	4.336	3.890	0,0%
16.2 Lebereingriffe	173	68,5%	8	3,102	8,007	8	1.237	0	0,0%
16.3 Ösophaguseingriffe	130	63,4%	11	1,800	14,003	9	872	0	0,0%
16.4 Pankreaseingriffe	227	59,4%	16	3,786	10,859	20	2.234	32	0,0%
16.5 Tiefe Rektumeingriffe	415	57,3%	12	1,279	10,203	17	2.859	713	0,0%
17.1 Augenheilkunde	78	63,7%	1.629	0,323	0,791	43	61.260	11.682.189	14,0%
18.1 Haut- und Geschlechtskrankheiten	60	47,4%	1.609	0,442	0,713	41	44.774	7.598.709	9,1%
19.1 MKG	56	63,4%	834	0,635	1,574	28	18.555	1.137.175	1,4%
20.1 Urologie	257	48,1%	1.467	0,429	1,530	145	148.676	10.817.674	13,0%
21.1 Allgemeine Frauenheilkunde	396	47,8%	679	0,397	1,001	117	129.894	10.005.374	12,0%
21.2 Ovarial-CA	266	59,6%	9	1,521	6,877	6	1.504	681	0,0%
21.3 Senologie	255	62,2%	124	0,900	2,377	28	15.578	8.969	0,0%
21.4 Geburtsklinik	357	46,4%	847	0,320	0,821	132	152.920	9.923.059	11,9%
21.5 Geburtsklinik – Kinder	363	47,1%	737	0,120	0,179	33	132.213	9.496.508	11,4%
22.1 Perinataler Schwerpunkt	156	55,4%	27	1,963	5,418	10	2.066	12.253.321	14,7%
22.2 Perinatalzentrum Level 1	109	54,2%	25	8,182	17,298	20	1.178	462.576	0,6%
22.3 Perinatalzentrum Level 2	128	49,6%	11	3,697	10,241	6	627	7.068.007	8,5%
23.1 Allgemeine Kinder- und Jugendmedizin	198	48,3%	1.698	0,374	1,152	126	160.631	8.906.639	10,7%
23.2 Kinder-Hämatologie und -Onkologie – Stammzelltransplant.	14	62,2%	12	14,621	32,076	3	117	117.402	0,1%
23.3 Kinder-Hämatologie u. -Onkologie – Leukämie u. Lymphome	30	50,0%	72	1,178	2,967	3	1.001	22.926	0,0%
24.1 HNO	142	72,7%	1.121	0,368	0,858	65	82.903	18.788.475	22,6%
24.2 Cochleaimplantate	41	66,1%	41	4,920	7,014	9	1.005	0	0,0%
25.1 Neurochirurgie	95	47,2%	594	0,446	3,195	69	26.560	6.048.614	7,3%
26.1 Allgemeine Neurologie	261	46,1%	1.227	0,382	1,895	151	128.773	28.036	0,0%
26.2 Stroke Unit	221	51,5%	484	0,918	3,001	83	42.644	7.631.682	9,2%
26.3 Neuro-Frühreha (NNF, Phase B)	74	62,8%	152	1,123	15,394	53	7.039	1.689.334	2,0%
27.1 Geriatrie	324	56,7%	342	1,021	2,885	168	59.046	9.227.700	11,1%
29.1 Palliativmedizin	150	47,6%	172	0,556	2,580	21	10.211	6.581.933	7,9%
30.1 Darmtransplantation	2	50,0%	1	1,000	34,086	<1	2	19.430.274	23,4%
30.2 Herztransplantation	7	66,7%	14	25,256	36,569	4	74	14.910	0,0%
30.3 Lebertransplantation	12	52,0%	35	10,408	19,603	4	169	50.752	0,1%
30.4 Lungentransplantation	5	58,3%	16	14,631	30,700	2	60	753.748	0,9%
30.5 Nierentransplantation	23	46,5%	41	5,312	6,880	4	391	7.754	0,0%
30.6 Pankreastransplantation	10	50,0%	3	4,765	16,108	<1	16	129.631	0,2%
Summe						4.284	3.272.831		

Tab. 2b: Simulation der Auswirkungen einer Leistungskonzentration um 20% (Kappung bei 80%) auf die Krankenhausversorgung in den Leistungsgruppen. Legende: *algorithmisch bestimmte Mindestfallzahl für Leistungsgruppe bei Konzentration um 20%.

patients change locations. This problem cannot be solved until there is a clean allocation algorithm with comparable criteria throughout Germany. Limitations of the model, which are currently based on insufficient data or data access, can be remedied in the future. When estimating demand in the basic model, each citizen is currently given the same weight in the calculations. Further development could take into account additional socio-demographic factors (e.g. women of childbearing age, children and adolescents) or underlying diseases, although real prevalences should be used and not utilisation prevalences. In the extended models, supply-induced needs are also taken into account by considering the number of cases. In the configuration presented, the model does not take federal state boundaries into account when assigning population weights. This is important for a cross-state analysis. To support the planning of the federal states, the model could also take state borders into account.

The proportion of the population that would no longer find a LG location within the accessibility corridor in the various scenarios depends on the accessibility limits set. Ideally, the accessibility corridors should reflect population preferences, quality aspects and resource shortages and be defined as nationwide supply targets [17, 18]. Regional, local provision with an accessibility corridor of 30 minutes is primarily required for frequent emergencies. For plannable interventions, wide accessibility corridors should be established, particularly if there is adequate evidence of a correlation between case volume and quality of outcome, such as for elective and specialised operations, thus exploiting the quality potential. In LGs with specialised treatments such as oncological diseases, organ transplants or elective surgical procedures, concentrations of services should also be considered beyond the 20% simulated here as an example in order to leverage the existing quality potential and thus optimise the treatment outcomes of affected patients [19]. Pre- and post-treatment close to home by telemedically networked primary care hospitals should be provided.

Any incentivisation can also lead to unintended false incentives. For example, the inclusion of case severity as a criterion could lead to service providers not transferring severe cases to specialised units, even if this would make sense from a medical point of view. The reference to population can favour hospitals that are geographically advantageous but have less expertise or potential, while others (which may be geographically less well located) have more potential for expansion.

In the future, service group bundles can be formed in the selected model - as is also done to some extent in the NRW model. In the selected model, all service groups were considered in isolation without any preconditions. It was assumed that specialised service groups can also be provided without the basic groups. However, a type of level construct (service group x is a prerequisite for service group y) or the definition of a specialised clinic could be integrated into the model.

Conclusion

The proposed, empirically based modelling, which takes into account accessibility, patients' choices and case severity, is intended to support and further develop the current planning based on hospital beds, particularly against the background of the state's duty of care and the obligation to use resources economically. We see the proposed model as an important support for the currently planned hospital reform. It shows the potential and predicts the effects of a regional restructuring of the range of services offered at hospital locations.

The model is intended to support hospital planning and help to assess its effects. It can also be used to distribute (additional) funds, for example as part of the planned transformation fund. However, the model should not dictate hospital planning algorithmically. Justified deviations should therefore be possible. This applies in particular to federal states such as North Rhine-Westphalia, where the process of allocating service groups is already well advanced. We offer to support the federal states in their planning by jointly developing and making available the simulation tool presented here. The weights of all parameters can be varied. However, the achievability limits and the parameterisation of the simulation model should be defined nationwide in the sense of a common target image. <<

Beispielhafte Modellierungsergebnisse bei LG „Endoprothetik Knie“ (LG 14.2) im Bundesland Sachsen auf Standortebene									
	Basismodell		Erweitertes Modell 1 (mit Fallzahl)		Erweitertes Modell 2 (mit Fallzahl und Fallschwere)		Erreichbarkeit		
Standort (Fallzahlrang)	versorgte Einwohner	% Abweichung Vorhaltebudget*	versorgte Einwohner	% Abweichung Vorhaltebudget*	versorgte Einwohner	% Abweichung Vorhaltebudget*	Zusätzliche Fahrzeitminuten bei Wegfall des LG-Standortes	Einwohner, für die der LG-Standort der nächste ist	davon Einwohner, die bei Wegfall des Standortes zusätzlich jenseits des maximale Fahrzeitradius wohnen
1	143.385	-54,1%	385.865	23,6%	378.419	21,2%	1.330.591	150.136	16.940
2	142.875	-45,3%	313.562	20,0%	320.933	22,8%	551.954	164.868	0
3	101.405	-55,8%	196.671	-14,4%	199.902	-12,9%	1.668.028	104.439	75.586
4	100.450	-54,5%	181.768	-17,6%	194.295	-12,0%	696.852	61.628	0
5	132.189	-35,0%	231.230	13,7%	227.791	12,0%	376.691	204.816	0
6	83.599	-55,0%	131.106	-29,4%	134.452	-27,6%	629.335	64.102	16.955
7	148.044	6,6%	180.656	30,0%	172.677	24,3%	490.012	93.469	0
8	104.180	-39,9%	124.229	-28,3%	173.188	-0,1%	316.453	48.037	0
9	72.310	-49,0%	84.212	-40,6%	89.468	-36,9%	1.538.009	98.797	5.773
10	132.666	-1,7%	153.888	14,0%	151.620	12,4%	994.426	162.412	0
11	146.273	1,7%	168.314	17,1%	188.379	31,0%	505.827	161.839	0
12	31.049	-77,6%	35.295	-74,5%	37.849	-72,7%	331.682	21.063	2.676
13	121.305	-3,2%	131.142	4,7%	128.606	2,6%	892.992	144.503	2.978
14	125.815	-11,1%	135.434	-4,4%	168.492	19,0%	266.364	109.351	0
15	108.036	-10,7%	115.794	-4,3%	110.319	-8,8%	682.461	81.602	468
16	96.119	-22,9%	102.575	-17,8%	105.453	-15,4%	848.020	107.507	3.379
17	27.573	-77,9%	29.297	-76,6%	29.413	-76,5%	192.922	19.407	0
18	112.039	-11,5%	119.045	-5,9%	122.093	-3,5%	127.962	32.780	0
19	86.352	-27,9%	89.748	-25,1%	87.182	-27,2%	332.434	45.302	0
20	58.719	-42,7%	58.576	-42,8%	48.440	-52,7%	718.156	59.170	0
21	101.423	-9,6%	94.589	-15,7%	102.119	-9,0%	1.311.578	181.690	0
22	85.733	-14,3%	72.000	-28,0%	73.652	-26,4%	89.444	30.569	0
23	78.795	-14,7%	59.593	-35,5%	64.025	-30,7%	380.030	54.163	0
24	77.876	-10,3%	56.368	-35,1%	58.517	-32,6%	1.636.067	89.310	10.393
25	124.647	39,9%	87.330	-1,9%	99.613	11,8%	794.653	155.411	0
26	83.358	4,3%	55.308	-30,8%	57.920	-27,5%	562.053	47.061	0
27	63.841	-12,4%	38.804	-46,8%	40.266	-44,8%	1.036.567	77.744	0
28	117.827	62,5%	69.978	-3,5%	74.694	3,0%	910.496	101.472	0
29	36.966	-44,3%	20.925	-68,4%	20.836	-68,6%	243.316	24.116	0
30	75.237	17,1%	41.192	-35,9%	41.184	-35,9%	372.639	66.630	0
31	96.983	52,0%	47.699	-25,3%	56.318	-11,7%	1.216.002	115.591	1.719
32	139.727	90,6%	68.073	-7,2%	109.459	49,3%	1.165.605	321.664	0
33	60.506	18,8%	27.512	-46,0%	25.654	-49,6%	487.559	52.152	0
34	71.187	24,2%	31.709	-44,7%	37.236	-35,0%	2.113.617	98.086	3.079
35	39.980	0,3%	17.808	-55,3%	11.861	-70,2%	623.775	33.618	6.418
36	92.305	69,2%	39.830	-27,0%	45.088	-17,4%	1.725.777	100.978	0
37	100.488	103,3%	41.496	-16,1%	43.086	-12,8%	403.012	100.101	0
38	91.235	98,1%	35.559	-22,8%	35.925	-22,0%	499.166	37.766	0
39	117.772	165,5%	44.809	1,0%	44.405	0,1%	559.693	73.956	0
40	97.196	129,2%	35.627	-16,0%	34.766	-18,0%	1.326.412	112.134	3.897
41	72.081	64,0%	26.087	-40,6%	27.571	-37,3%	1.093.616	76.106	950
42	134.902	262,3%	43.189	16,0%	42.472	14,1%	517.293	87.308	0
43	147.755	277,3%	47.304	20,8%	50.673	29,4%	392.079	128.634	0

Tab. 3: Beispielhafte Modellierungsergebnisse bei LG „Endoprothetik Knie“ (LG 14.2) im Bundesland Sachsen auf Standortebene (Szenario Konzentration mit Kappung bei 92,5%). Legende: *im Vergleich zu Budgetfortschreibung.

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Letter to the editor

Regarding the online-first publication of this article on www.m-vf.de

(https://www.monitor-versorgungsforschung.de/science/efirst/)

we received a letter to the editor from the German Society for Gastroenterology, Digestive and Metabolic Diseases (DGVS), which is available online.

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