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How minimum volumes influence patient migration

When a new minimum volume is introduced for an inpatient service, some of the service providers are below the required number of cases. Their service volumes have to be redistributed among the remaining providers. This leads to a regional increase in the number of cases, which can also lift those providers that are below the minimum volume above the threshold. In a new simulation study, Vebeto illustrates the relationship between minimum volumes and patient migration. Only publicly available data is used.

>> Legislation stipulates minimum volumes for certain complex services in inpatient care in order to ensure the quality and necessary experience for these interventions. Hospitals may only provide these services if they reach a lower limit of cases per year. Minimum volumes currently apply to complex operations on the pancreas and total knee replacements, for example. The minimum volume regulations are discussed and decided by the Federal Joint Committee (G-BA) (1). They are continuously being expanded: from 2024, for example, minimum volumes will apply for the first time for certain operations in breast surgery and thoracic surgery. If a hospital wishes to provide a service for which a minimum volume applies, it must submit a forecast by 7 August of each year that it is likely to achieve the required minimum volume in the following year. The most important criterion here is that the minimum volume was achieved in the previous calendar year. In order to provide services in 2024, it would therefore have to submit a forecast by 7 August 2023 based on its case numbers for 2022 (and the first half of 2023). In individual cases, personnel and structural changes can also be used as justification for the forecast, as well as special effects such as the Covid-19 pandemic. If the minimum volume is not expected to be reached or if the forecast is questioned by the health insurance funds, the hospital may no longer provide the service in future.

Patient migration due to new minimum volumes

For established minimum quantities, such as for total knee joint endoprostheses, only hospitals that regularly reach the lower limit will generally participate in the provision of care. The situation is different when a minimum volume is introduced for the first time: It can be expected that the corresponding service will previously be performed at a substantial number of hospitals in small quantities that are below the minimum quantity. The first-time introduction of the minimum volume means that hospitals with low case numbers are largely no longer allowed to offer the service. The service volumes previously provided by these hospitals will have to be redistributed among the remaining providers. This results in a migration of patients to the larger providers (which is also intended as a quality assurance measure).

An interesting effect arises here: The elimination of small service providers and the resulting patient migration lead to an increase in the number of cases at the remaining providers. This can push a provider that did not reach the minimum volume in the previous year above the required threshold. How often this occurs and how strong the effect is is difficult to predict without a precise analysis. In detail, the regional provider structure - i.e. the number, location and caseload of the hospitals - plays a role, as does the distribution of the population and the accessibility of the hospitals in terms of transport. We have analysed this redistribution in a simulation study, which we present below.

The Institute for Quality Assurance and Transparency in Health Care (IQTIG) carries out impact assessments on minimum volumes for the Federal Joint Committee, which also simulate the redistribution of patients (2). These calculations are similar to the idea behind our study. A key difference is that the IQTIG has access to the full data set according to § 21 KHEntgG, which contains detailed data on all inpatients and is not available to the public. Our study, on the other hand, is based only on publicly available data sources and can therefore be adapted and disseminated without restrictions.

Simulation study with the Vebeto patient model

We use the Vebeto patient model to simulate patient migration. This models the distribution of patients across hospitals. It includes the following parameters: Population density, age and gender of the population, incidence of main diagnosis or procedure per year of age and gender, geographical distribution of providers, complete road atlas of Germany and car journey times of the population to the hospitals. Each case is allocated proportionally to the relevant providers in the neighbourhood. The proportion of a hospital, i.e. the probability that a patient in the model will visit this hospital, is greater the shorter the patient's car journey time to the hospital.

We usually use the model to analyse the market position of hospitals: For a given principal diagnosis or procedure, we calculate the number of cases that would be expected at a hospital based on the population density and location of the relevant providers. We compare the modelled number of cases with the number reported by the hospital. We call the ratio VMP - multiple of the modelled number of patients. If a hospital reports more cases than expected, this indicates a strong market position. If, on the other hand, fewer cases are reported, it appears that patients tend to avoid the clinic and accept longer travelling times to more distant clinics. This indicates a weak market position. The model does not require the manual definition of catchment areas.

Our patient model can be used just as well to estimate patient migration after the loss of a provider. To do this, we simulate the patient distribution twice: with the provider in question and wit-

hout it. From the comparison of the results, we conclude how we need to redistribute the patients of the omitted provider. Here we also include the market position of the relevant hospitals, in addition to the journey times: The higher the VMP of a hospital, the greater the proportion of patients allocated to it in the patient migration.

We use these tools to simulate the patient migration that results from the introduction of a new minimum volume. The simulation study illustrates the effect by way of example. Therefore, we do not refer to a specific minimum volume decided by the G-BA. Instead, we use the number of cases of an ‚arbitrarily' chosen OPS number, which will not be named here. The case number distribution and geographical location of the providers therefore corresponds to real conditions. We exclude providers with fewer than five cases from the analysis. We assume a minimum of 30 cases.

The simulation runs as follows:

1. we use the initial number of cases at all German hospital locations as the starting point, in this case for 2021
2. we determine the provider with the smallest number of cases and remove it from the analysis
3. we redistribute the cases of the removed provider to the neighbouring hospitals. The number of cases of the remaining providers increases accordingly.
4. if all remaining providers have reached the minimum quantity in the sum of the initial number of cases and redistributed cases, we end the simulation. Otherwise, we go back to step 2 and remove the smallest remaining provider.

Our simulation does not correspond to the real processes as they exist in the hospital market after the introduction of the minimum quantity. As the minimum volume applies to all providers at the same time, successive redistribution in this form is not possible. However, the study illustrates the effects that could be expected if patient migration were included in the considerations. It is also similar to the approach taken by InEK in its impact assessments.

Results of the simulation study

Figure 1 shows the results of the simulation study. The presentation is explained in the caption. 745 providers took part in the simulation. Initially, 510 of these are below the minimum quantity of 30 cases and 235 are above. In the simulated redistribution, 79 providers who had fewer than 30 cases are raised above the minimum quantity by patient migration. As expected, providers with higher case numbers are ultimately more likely to reach the threshold. However, there is a clear variation: one provider with only 12 cases finally reaches over 30, while many competitors with similarly low case numbers end up below the minimum quantity. However, there are also hospitals with 29 cases that remain below the minimum quantity of 30 at the end of the simulation.

As described above, this variation is due to the regional conditions around the individual homes: If a house is surrounded by others with a lower number of cases, which are removed first in the simulation, it receives many additional cases. If, on the other hand, it only has larger regional competitors, it does not benefit from patient migration.

Conclusion

Our simulation study shows that patient migration caused by the introduction of a minimum volume can play a decisive role for the individual provider in achieving the minimum volume. However, this effect can only be estimated using complex, regionally resolved simulations. As the minimum volume regulations also allow ‚structural changes' as a justification for the case number forecast, the simulated patient migration for individual hospitals could represent an important factor in the forecast. This is all the more true as redistribution is an important component of the InEK's impact assessments, which serve as the basis for the G-BA's decisions.

Aspects of accessibility also play a role here: if, for example, there are three providers in a region just below the minimum volume, they could all expect a negative prognosis. Taking patient migration into account, on the other hand, would reflect the concentration on one or two of the three providers and preserve them. The aim of the minimum volume regulations to ensure sufficient experience in treatment would still be met.

A practical problem with such analyses is that the case numbers relevant for minimum volumes are only published with the hospitals' quality reports more than a year after the end of the data year. Therefore, an analysis for the forecast for 2024, which must be submitted in August 2023, could only refer to the case numbers from 2021 (which were published in the quality reports at the beginning of 2023).

These case numbers are available to the health insurance funds much earlier, as the AOK's ‚minimum volume transparency map' shows: There, the positive forecasts for 2024, including case numbers up to the first half of 2023, were already published in October 2023 as maps (3) and as a PDF file (4). This publication is naturally also after the deadline for submitting the forecast. However, an earlier, complete and machine-readable publication of

Literature

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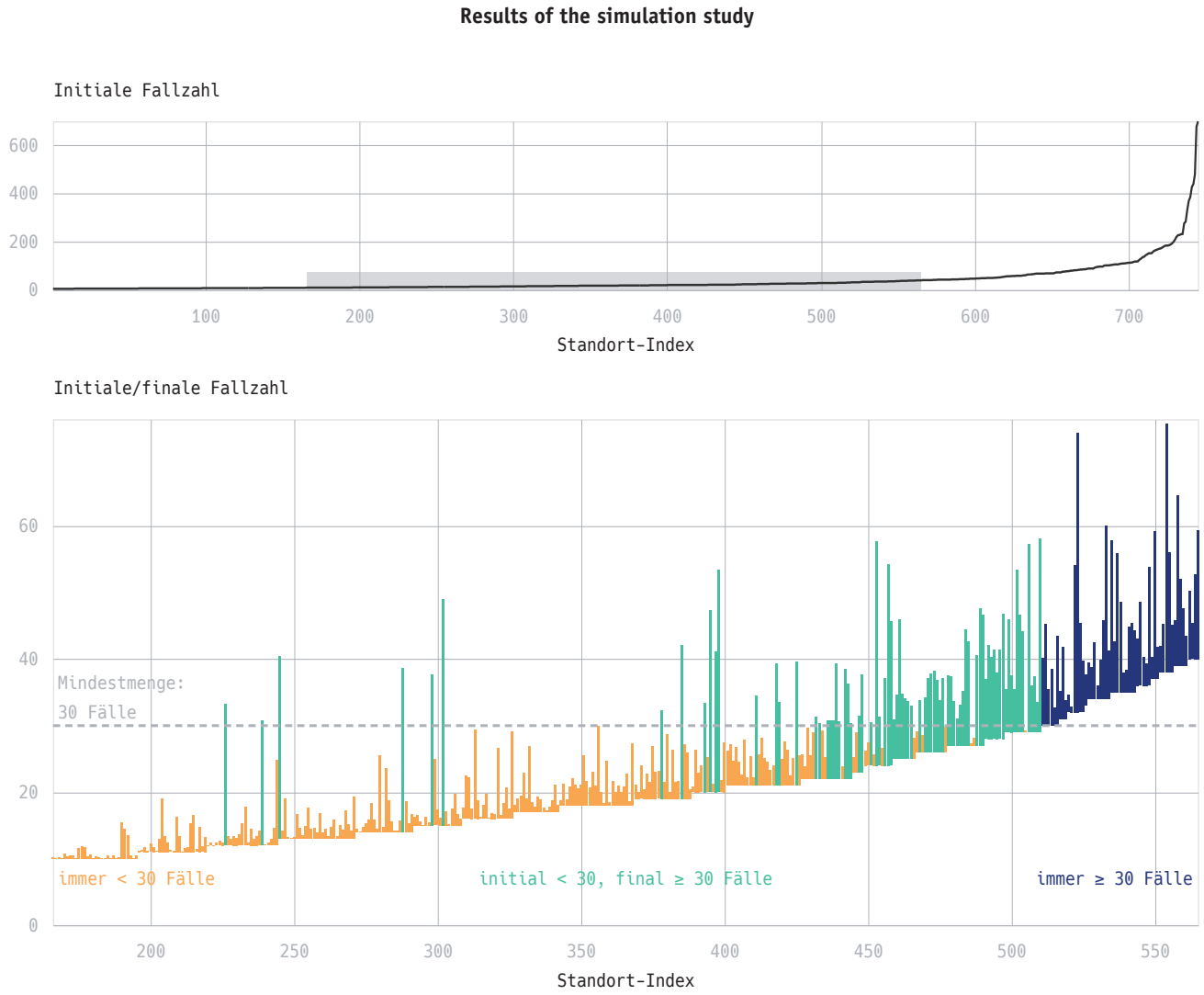


Fig. 1: Results of the simulation study: The upper half of the graph shows the distribution of case numbers across all hospitals, sorted by the initial number of cases. A large number of providers with low case numbers and a small number of specialised providers with high case numbers can be seen. The shaded area is shown enlarged in the lower half . Each vertical line marks a provider. Providers shown in blue already had at least 30 cases before the simulated redistribution (dashed horizontal line). The lower end of a blue line indicates the initial number of cases of the provider, the upper end the final number of cases after the simulated redistribution. The length of the line thus shows the increase in the number of cases due to the redistribution. Providers shown in turquoise initially have fewer than 30 cases; however, they reach the threshold as a result of the redistribution and are retained. Here too, the lower and upper ends of the line indicate the initial and final number of cases. Providers shown in orange remain below the minimum quantity of 30 cases both initially and finally. These service providers are omitted from the simulation and their cases are redistributed. Here, the upper end of the line marks the number of cases that the hospital had reached in the redistribution before it was excluded as the smallest provider and the cases were redistributed.

the case numbers would provide much more transparency about the service providers and could help hospitals in appeal proceedings, for example.

An additional aspect of the simulation is that it also allows an assessment of whether the remaining providers may be overwhelmed by the additional patient volume. This could be the subject of a follow-up study. <<

Authors' statement

The authors are managing directors and shareholders of Vebeto GmbH in Hamburg. They declare that there are no conflicts of interest.

Citation

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Note

Data from the hospitals' quality reports were used for the calculations. The quality reports of the hospitals are used here only in part or in extracts and in conjunction with other sources of information. The recommendations and results given therefore do not represent an authentic reproduction of the quality reports.
A complete, unaltered presentation of the hospitals' quality reports can be found at www.g-ba.de. For questions on other data sources and their processing: daten@vebeto.de.

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