IQWiG Institut für Qualität und Wirtschaftlichkeit im Gesundheitswesen

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Development of a prognosis model to identify effects of threshold values on health care[1]

Executive Summary

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Executive summary

Aim

The aim of the commission was to develop a model (referred to as a prognosis model in the following text) to identify the effects on health care in Germany of the introduction of minimum volumes for various inpatient services. The effect of the introduction of minimum volumes on health care is described by the change in the distance between the patient's place of residence and the treating hospital before and after the introduction of a minimum volume for a service. The prognosis model was to be designed in such a manner that it would in general be applicable to all future minimum volume regulations, under consideration in each case of procedure-specific parameters.

For this purpose, software was developed that contains all essential data, performs the necessary calculations, and presents the results. It was planned to apply this software in a procedure-specific manner within the framework of further commissions awarded by the Federal Joint Committee (Gemeinsamer Bundesausschuss; G-BA).

The following points should in particular be considered in the planning and development of the prognosis model:

- The determination of the number of hospitals that so far offer a procedure affected by the minimum volume regulation, as well as the number of treated cases.
- The calculation and presentation of distances between place of residence and the treating hospital.
- An extrapolation of the demand or expected frequency in the next years of the procedure imposed with a minimum volume.
- The calculation of the number of hospitals that do not fulfil the minimum volume for a procedure, as well as the affected number of treatment cases (absolute and relative).
- The redistribution of the affected treatment cases to hospitals that fulfil the minimum volume for the procedure, considering that the services should still preferably be offered close to home.
- The calculation and presentation of distances between place of residence and the treating hospital after the redistribution of affected cases.
- The evaluation should be presentable separately for Germany as a whole and for specific regions.

According to the objective of this commission, the effect of the introduction of a minimum volume for a procedure was only to be analysed with regard to the change in distance between the patient's place of residence and the treating hospital. In this context, it should be considered that the service for which a minimum volume has been agreed should still preferably be offered close to home.

Methods

The Federal Association of Local Health Insurance Funds, the Federation of Salaried Employees Health Insurance Funds, and the Federal Association of Company Health Insurance Funds provided baseline data on knee joint replacement and coronary surgery procedures to the Institute for Quality and Efficiency in Health Care (IQWiG), so that the Institute could develop and apply its prognosis model. These data were extracts of data acc. to § 301 Social Code Book V for the years 2002-2004 of persons insured in health insurance funds of the associations mentioned above.

The following baseline data were available for the generation of the prognosis model and the prognosis: treatment data for the relevant indication; 4-digit postal code of the place of residence of the treatment case; year of treatment; definite allocation key for the location where the treatment took place; hospital address; geographic data (size of surface area and population of all postal code regions in Germany, longitude and latitude of the geographic centres of all postal code regions, longitude and latitude of the hospital addresses).

The following data had to be determined at the beginning of the prognosis according to the specific procedures: corresponding operational and procedural keys (OPS-Codes); degree of completeness of the data; minimum volume; year of introduction of the minimum volume; if necessary, applicable transient regulations for the introduction of the minimum volume.

For technical and data protection reasons, only data of limited suitability for achievement of the formulated objectives could be provided. This made the generation of a prognosis model, as well as the interpretation of results, more difficult.

In particular, the following points were problematical:

- In the data provided, it was possible that not the address of the actual location of the hospital was stated, but the registration number of the hospital group and the group's address.
- The analysis of the baseline data showed that, for many of the treatment cases, there were long distances (more than 100 km) between place of residence and the treating hospital. This may have been due to the fact that, on the one hand, the address recorded was not the address of the discharging hospital, but the address of the hospital group, or, on the other, that the patient may have chosen a distant hospital because of his or her preferences. It was not determinable retrospectively which of the two possibilities was responsible for the long distance recorded.
- In the data provided, the only information given on the address of the treatment case was the 4-digit code of his or her place of residence. In order to calculate the distance between

the place of residence and treating hospital, a definite geographic point had to be assigned to the case (address of the treatment case).

- Not all relevant treatment data were available for calculations, but rather only a non-representative subset of cases of the statutory health insurance funds (SHI funds). Data for the following cases were not available: treatment cases of the remaining SHI funds, the private health insurance funds, foreign patients, and self-paying patients.

To generate an address, a distribution of cases was conducted within the relevant 4-digit postal code regions to the associated 5-digit postal code regions. Here the 5-digit postal code region was represented as a circle whose centre represented the geographic centre and whose surface area represented the actual 5-digit postal code region. In this context, it was assumed that the places of residence of the cases were equally distributed within the circle's surface area.

After the exemplary introduction of a minimum volume for the service investigated, it was assessed with the prognosis model which cases were treated in hospitals that did not fulfil the requirements for the minimum volume. These treatment cases were redistributed to a hospital that fulfilled the minimum volume and was closest to the place of residence. It was thus assumed that the patient consulted the hospital closest to his or her place of residence that fulfilled the minimum volume.

In order to make the situation before the introduction of the minimum volume comparable to the situation after the exemplary introduction of the minimum volume, an exemplary "actual situation" was created.

In the exemplary "actual situation", as in the situation after the exemplary introduction of the minimum volume, it was assumed that before the introduction of the minimum volume, care for a patient was provided close to the place of residence, i.e. that every patient consulted the hospital closest to home. For this purpose, all treatment cases for a procedure were distributed to the hospital closest to their allocated place of residence. This distribution represented the initial situation for calculation of the distance between the patient's place of residence and the hospital before the introduction of the minimum volume.

In the exemplary introduction of the minimum volume, it was initially determined which hospitals did not fulfil the minimum volume. The cases of these hospitals were then distributed to the hospital closest to home that fulfilled the minimum volume. The closest hospital was determined by measuring the linear distance. For the cases redistributed in the course of the introduction of the minimum volume, the shortest and fastest distance, as well as the relevant journey times to the hospital were determined. The calculation of the shortest and fastest distances, as well as the relevant journey times, were conducted with a geographic information system (GIS).

In the calculations of the prognosis model, 3 situations were differentiated:

1. Situation of the distribution of cases resulting from the underlying data and the allocated places of residence (baseline situation).

2. Assumption of care close to home before introduction of the minimum volume (exemplary "actual situation").

3. Redistribution of cases treated in a hospital that did not fulfil the minimum volume (the basis for this was formed by the data of Situation No. 2) to the hospital closest to home that fulfilled the minimum volume (situation after exemplary introduction of the minimum volume, assuming care close to home).

Each of the 3 situations was evaluated and compared by means of tables and graphs. Situations 1 and 2 were compared and the deviations presented. In this context, it was determined how many treatment cases in the exemplary "actual situation" were redistributed, compared with the baseline situation. The exemplary "actual situation" formed the basis for the identification of hospitals that did not fulfil the minimum volume. Their treatment cases were subsequently redistributed to the hospital closest to home that fulfilled the minimum volume. The shortest and fastest distance as well as the associated journey times for the exemplary "actual situation" and the situation after introduction of the minimum volume were determined and compared with each other with regard to the redistributed treatment cases. The minimum volume according to which the prognosis was generated was adapted for 2 reasons (computed minimum volume):

- The data that were incorporated into the prognosis model and formed the basis of the calculations did not correspond to the population of treatment cases (treatment cases of the SHI funds, private health insurance funds, foreign patients etc.) of the relevant indication in Germany, but rather represented only a subset. The minimum volume investigated was therefore adapted because of the incomplete data set (proportion of available case data of the total case data).

- The prognosis was made for the year of the introduction of the minimum volume (prognosis year) on the basis of the available data of the last year available (baseline year). As the case number in the prognosis year did not correspond to the case number in the baseline year, the minimum volume was adapted for the case number in the prognosis year (proportion of the case number from the baseline year of the extrapolated case number of the prognosis year).

This means that the prognosis was made for the last year available and the resultant data available. After the determination of the number of cases redistributed by the introduction of the minimum volume, this number was extrapolated to the prognosis year (year of the introduction of the minimum volume).

Validity of the prognosis model

The methodology applied in the prognosis model was validated for the following areas: Calculation of distance between place of residence and treating hospital, determination of the hospital closest to the home of the case, validation of the calculations performed.

The methodology of the assignment of geographic coordinates for each treatment case via the approximation of the 5-digit postal code region as a circle could not be validated. To conduct a validation in this regard, the exact address of the treatment case would have been required. The collection of the corresponding data would have meant a high investment in resources and time, and was not feasible within the framework of this project. Therefore, no statement can be made on the quality of the geographic distribution of the treatment cases compared with the actual distribution. The error caused by the non-availability of an exact address cannot be estimated.

Conclusion

The prognosis model was generated according to the methodology and procedures described in this report. Parts of the prognosis model were validated.

A validation of the methodology of the allocation of geographic coordinates for each treatment case via the approximation of the 5-digit postal code region as a circle could not be conducted. For such a validation, data would have been required that contained the exact address (street, house number, postal code, place of residence) of the treatment cases. Such data were not available to IQWiG for the processing of this commission. Furthermore, it was not possible to identify hospitals that belong to a hospital group and for which only the address of the hospital group was available, and to consider their actual address.

For the comparison of the exemplary “actual situation” with the situation after the exemplary introduction of a minimum volume, the prognosis model can readily be applied, under consideration of the assumptions and limitations described. However, the results of this comparison cannot be interpreted, because of the non-feasible validation of the prognosis model. A statement on the quality of the results cannot be made.

To apply the prognosis model for the indications “knee joint replacement” and “coronary surgery” to determine the effects of the introduction of minimum volumes on health care in Germany, a validation of the model on the basis of real data is mandatory, because of the described limitations of the data provided. However, despite a validation of the model, it needs to be considered that the quality of the baseline data available would still substantially limit the evidential value of the results of the prognosis model (problem of hospital groups, representativeness of the data sample, etc.).

IQWiG therefore does not recommend further processing of the sequential commissions “Application of the developed prognosis model for the indications knee joint replacement and coronary surgery” with the prognosis model currently available.

To determine the effects of minimum volumes for specific services on health care before the introduction of a minimum volume, a representative database would be required that clearly specifies in which hospital (address of the discharging hospital) the patient was treated. Furthermore, the database should contain the patient’s complete address, or, if this were not the case, a separate data collection would be required to validate the prognosis model. To extrapolate the demand in the year of the introduction of the minimum volume, prognostic factors relevant to the extrapolation should also be contained in the database. With the

fulfilment of these requirements, the prognosis model could be adapted and used for the processing of differently structured data sets.

Key words: Minimum volume, care close to home, software model, quality assurance, inpatient care