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Research paper

Comparison of different methods to forecast hospital bed needs

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ABSTRACT

Objectives: This study compares three methods to forecast the number of acute somatic hospital beds needed in a Swiss academic hospital over the period 2010–2030.
Design: Information about inpatient stays is provided through a yearly mandatory reporting of Swiss hospitals, containing anonymized data. Forecast of the numbers of beds needed compares a basic scenario relying on population projections with two other methods in use in our country that integrate additional hypotheses on future trends in admission rates and length of stay (LOS).
Results: The total number of beds in the hospital under study is projected to increase from 960 beds in 2010 to a range of 1188 to 1332 in 2030. This estimated growth equals to 24% to 39% of the hospital size at baseline, and these different figures are largely due to hypotheses about future reduction in LOS. Conversely, as the models' hypotheses regarding future demand have balanced effects on global admission rates, the three methods lead to similar projections for the number of stays, which is estimated to increase by 33% between 2010 and 2030.
Conclusion: In the context of population aging, forecasting the number of hospital beds should not rely on a unique scenario. Using different hypotheses about admission rates and LOS, and comparing projected versus real use are important to avoid shortage of beds.

1. Background

Planning the appropriate number of hospital beds is a challenge that must take into account potential changes both in demand and length of stay (LOS). Population growth and aging is the major factor that has been shown to increase the demand for hospital care, and will continue to do so over the next decades. Indeed, persons aged 65 years and over are high users of hospital stays, showing both higher admission rates and longer stays [1,2]. Therefore, the large number of baby-boomers reaching this age in a near future must be taken into account in forecasting a sufficient number of hospital beds.

Changes in health status and health behaviors also likely influence these projections, as well as technological advances and the continuous search for efficiency in clinical care. An important determinant of future need for inpatient days is the reduction in LOS observed over the past decades, partly linked to the shift from inpatient to outpatient surgery and to the introduction of fixed payment systems with Diagnosis-Related Groups (DRGs) [3,4]. However, uncertainty remains regarding the real impact of these different factors and their evolution over time. Planning a sufficient number of hospital beds in the public sector must, therefore, rely upon reasonable assumptions about their future trends in order to ensure access to appropriate care.

Abbreviations: DRG, Diagnosis-Related Groups; CHOP, Classification Suisse des Interventions chirurgicales; CHUV, Centre Hospitalier Universitaire Vaudois; ICD, International Classification of Diseases; LOS, Length of stay; SHO, Swiss Health Observatory.

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In Switzerland, search for efficient care is one component of the 1996 new Health Insurance Law, and has been reinforced through the progressive introduction of hospital financing based on DRGs. In this context, the Swiss Health Observatory (SHO) proposed a method for hospital planning, which encompasses hypotheses on the evolution of admission rates and LOS [5]. Its main assumption is that, for each DRG, the mean LOS observed in one hospital could shrink over a 10-year period towards a shorter LOS observed in other Swiss hospitals at baseline. This benchmarking method uses the ranking of the hospitals based on their mean DRG-specific LOS. Among other options, the second shortest mean DRG-specific LOS can be chosen as a target. This method was elaborated to help planning the number of beds at the level of a region with several hospitals, and might not be suitable for use at the level of a single hospital. Moreover, the target might be more difficult to reach for university hospitals, because of their particular case-mix. Therefore, an additional variant was proposed, which ranks all stays that occurred in the five Swiss university hospitals based on length and uses the 40th percentile of the distribution as target.

It is to note that a range of different methods to plan the number of hospital beds are used in Switzerland at the time being. Therefore, the objective of this study was to estimate the need for acute somatic hospital beds in a Swiss academic hospital over the period 2010–2030 using three different methods. It compares a basic scenario relying on population projections only with the SHO method modified for the university hospitals and the method used by the Lausanne University Hospital.

2. Methods

2.1. Setting

The Lausanne University Hospital (centre hospitalier universitaire Vaudois, CHUV), with its nearly 1000 beds, serves as the city hospital for Lausanne (250,000 inhabitants), and as a secondary hospital for the population of the Canton de Vaud (750,000 inhabitants). It is one of the five university hospitals in Switzerland.

2.2. Hospital statistics

Information about inpatient stays is based on a yearly mandatory reporting of all cases discharged from Swiss hospitals. This exhaustive and reliable database contains variables pertaining to the hospital itself (infrastructure...), as well as socio-demographic information and medical data related to each patient's stay. Medical data include primary and secondary diagnoses, along with main interventions undertaken during the stay. Medical information is converted into ICD-10 (International Classification of Diseases, 10th edition) and CHOP codes (Classification Suisse des Interventions chirurgicales, based on ICD-9—CM) by trained coders, and then into DRGs using a specific grouper [6,7].

2.3. Baseline data

Baseline data comprised all acute somatic care stays registered among all patients discharged from the CHUV during the year 2010 (n = 33,643 stays, each classified into one of 811 different DRGs), except healthy neonates whose stay is included in the one of their mother. Patients residing outside the Canton of Vaud were also included into the analysis (n = 4183 stays, 12% of the total). Admission rates were computed by age, for each DRG.

2.4. Population projections data

The median scenario of the most recent projections of the number of residents in the Canton of Vaud until 2030, supplied by the Statistical Office of Canton de Vaud, were used [8].

2.5. Hypotheses

The hypotheses included in each model are described in Table 1:

- briefly, the basic scenario assumes that age-, and DRG-specific admission rates will remain constant, as will the mean LOS for each DRG;
- based on the proposed variant of the Swiss Health Observatory (SHO) model, the next scenario postulates that for each DRG, the

Table 1
Hypotheses of the three models for projecting hospital use.

Model	Hypotheses regarding changes in demand	Hypotheses regarding length of stay (LOS)
Basic	Age- and DRG-specific admission rate remains constant	Mean DRG-specific LOS remains constant
Swiss Health Observatory (SHO)	Age- and DRG-specific admission rate remains constant	DRG-specific LOS decreases over the next 10 years to reach the P40 of the stays observed in all 5 Swiss University Hospitals, ranked by length. This target does not apply: - when the stay is an outlier in its DRG - in case the difference exceeds 4 days or 20% of the CHUV-LOS, the method is to select the value closest to the CHUV-LOS (i.e. either the CHUV-LOS minus 4 days or the CHUV-LOS minus 20%) Outliers stays are projected with unchanged LOS
Lausanne University Hospital (CHUV)	Based on past trends in demand, the following hypotheses have been proposed: Medical DRGs: over the next 5 years: - admission rate decreases by 2% in population aged 15-64 years, and by 7% in population aged 65-74 years - admission rate increases by 5% in population aged 75-84 years, and by 7% in population aged 85+ years Then, admission rates remains constant. Surgical DRGs: admission rate increases by 10% over the next 5 years for population aged 75-84 years, then it remains constant	Medical DRGs: mean DRG-specific LOS remains constant Surgical DRGs: mean DRG-specific LOS decreases by 10% over the next 10 years (all age groups), then remain constant