KCE REPORT 289Cs

Federaal Kenniscentrum voor de Gezondheidszorg
Centre Fédéral d'Expertise des Soins de Santé
Belgian Health Care Knowledge Centre

SHORT REPORT

REQUIRED HOSPITAL CAPACITY IN 2025 AND CRITERIA FOR RATIONALISATION OF COMPLEX CANCER SURGERY, RADIOTHERAPY AND MATERNITY SERVICES

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HEALTH SERVICES RESEARCH

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REQUIRED HOSPITAL CAPACITY IN 2025 AND CRITERIA FOR RATIONALISATION OF COMPLEX CANCER SURGERY, RADIOTHERAPY AND MATERNITY SERVICES

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■ FOREWORD

It has been more than two years since the ‘Action Plan for a reform of the hospital payment system’ was announced by the Minister, but in the field one sometimes hears that nothing has been done yet. However, several preparatory studies and work have been performed by the KCE, but also by the FOD – SPF, the RIZIV – INAMI, academic teams, etc. Over the past two years, KCE has published reports on the governance of hospital collaborations (KCE report 277), day surgery (KCE report 282), emergency care and trauma systems (KCE reports 263 and 281) and the clustering of pathology groups (KCE report 270). There is an ongoing study on payment systems for high-variability care (publication October 2017). The current report fits in this list and goes into the hospital landscape with horizon 2025.

Anyhow, also the Belgian hospital landscape, where so to speak nothing happens, is changing profoundly. The announced reforms and more in particular the redesign of the landscape with hospital networks caused a shock at the higher end of the scale of Richter. Hospitals are diligently anticipating on the near future; positions are taken and alliances are formed.

Indeed, our calculations and projections show that the downsizing of the number of hospital beds will be substantial, departments will be closed and the organisation of some complex, rare or expensive services on hospital sites where the volume is too low will no longer possible. This is not an easy message, but if it is decided to follow this route it is best to underpin it with robust analyses and studies.

To perform this work the KCE could count on the expertise and support from the Belgian Cancer Registry, ESTRO (European Society for Radiotherapy & Oncology) and the *Radbouduniversiteit* Nijmegen. We would like to thank them for this fruitful collaboration. We also would like to thank our colleagues from the FOD – SPF and the RIZIV–INAMI who supported us on many fronts, and also the collaborators of the policy unit of the Minister which is, after all, the epicentre of the reforms.

Christian LÉONARD	Raf MERTENS
Deputy general director	General director

■ SHORT REPORT

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1. BACKGROUND

In Belgium as well as internationally, health systems face a number of challenges that are predicted to intensify in the future: increasing costs, workforce shortages, the development of new diagnostic and treatment technologies, an ageing population, a rise in chronic diseases associated with multi-morbidity and changes in human attitude with increasing public expectations. Countries around the world are increasingly responding to the above-mentioned pressures through the redesign of service delivery. Questions that arise with respect to such redesign are: What is the optimal size of a hospital? How should hospitals be distributed within a geographical area? What is the role of each (type of) hospital? What are possible advantages and challenges of different collaboration forms between hospitals and between hospitals and other care settings?

Two overarching but contrasting trends that have altered the environment in which hospitals operate, are discernible in the reforms or reform plans of many western countries: care is becoming more specialised and concentrated, but is also delivered closer to home. Moreover, services are increasingly integrated, with traditional community, primary, secondary and specialist/tertiary services becoming better linked. And hospitals have increased their reliance on partnerships with other hospitals and deliver care through clinical networks. Much more than before, hospitals will have to integrate their activities with many other actors in the healthcare system, providing what essentially are fragments in the long-term chain of care for patients with one or multiple chronic conditions.

Health authorities have different instruments at their disposal to respond to these challenges such as hospital payment systems, planning, licensing, etc. In this report we focus on elements that can help policy makers in the planning of healthcare services.

1.1. Diagnosis of the Belgian healthcare landscape

In contrast with these international reforms an evaluation of the Belgian healthcare landscape showed that Belgian hospitals are still mainly operating as stand-alone organisations providing the full range of services, including very specialised and complex services.[1] Belgium has a relatively high number of licensed acute-care hospital beds (5.7 acute hospital beds per 1 000 population versus 3.6 for the OECD average in 2014), a decreasing but still high average length of stay and a large number of hospital stays which result in an even higher number of nursing days per inhabitant per year. Although day surgery has steadily and significantly grown and for some surgical procedures Belgium keeps pace with other Western European countries, for other procedures it falls far behind.[2]

Hospitals want to provide the broadest possible number of services with the latest technological innovations, resulting in a wide diffusion of technologies and major equipment, even when it is not supported by evidence (e.g. robot-assisted surgery[3]). This ambition to invest in (highly) specialised services is observed in all hospital types, resulting in local hospitals evolving towards secondary care hospitals, and secondary care hospitals actively competing with university hospitals. Although the number of collaborations between Belgian hospitals has vastly increased during the last decade, the reasons for collaboration vary and include financial pressure, bypassing minimum thresholds of caseloads that are obliged by law, sharing scarce human resources and providing patient-centred integrated care.[4] Task distribution has in most cases not been one of the goals. For sure, it did not (yet) result in a rationalisation of the services nor did it have a drastic impact on the concentration of specialised complex services.

1.2. Redesign of service delivery

The solution proposed in KCE Report 229 (September 2014)[1] was a redesigned landscape having the following main characteristics:

- *A landscape designed in function of the needs of the population in geographically circumscribed care areas.*
- *Community hospitals, offering the more common and the more frequent part of the care spectrum, are organised in a network structure which is based on proximity and population needs. Their localization, number and size have to be determined on a geographical, needs-driven basis. Within the network there is a division of tasks and functions.*
- *Rare or complex conditions, requiring highly specialised or complex skills, expensive equipment or infrastructure, or specific multidisciplinary staffing, should only be treated in reference centres (or rather: reference services/functions) that can prove sufficient experience (volume), expertise and quality assurance. Their number and location should be defined on a regional scale, and not per care area.*

Reform plans of the minister

In April 2015, Minister De Block of Social Affairs and Public Health launched an 'Action Plan for a reform of the hospital payment system'[5] defining the 'healthcare landscape 2025' as a landscape with the following characteristics:

- Population needs should determine the hospital capacity planning (beds, equipment, care programmes, etc.).
- More collaboration initiatives between hospitals and between hospitals and other care settings are needed.
- Hospitals/hospital services (including expensive equipment and infrastructure) should be part of a network. Payments and the permission to perform certain activities should (increasingly) be granted to networks instead of to individual hospitals.
- More task division between hospitals is needed.

The Action Plan also mentions the objectives of a reform of the current healthcare landscape (and possible approaches to realise these objectives): improvement of care quality (by centralisation of complex, expensive or technology-intensive services); care provided in the most appropriate care setting (by supply based on population needs); accessible care (by basic care in the proximity of patients); long-term affordability of healthcare (by division of tasks between hospitals, reduction of capacity (beds, wards), reduction of the number of hospital stays, shorter length of stay).

Instruments for the redesign of service delivery are divided between the federal government and federated authorities

The government disposes of three instruments to regulate the hospital sector. To enter the market, a hospital has to meet two general conditions. First, it has to fit into the national planning determined at the federal level. This national planning is translated into programming standards and criteria which determine the number of hospitals, the number and type of departments, care programmes, etc. and the number of beds. Second, a hospital has to fulfil several licensing standards and criteria, for example concerning staff and equipment of infrastructure, before it can operate and claim reimbursement by the compulsory health insurance. The third regulatory instrument of the government in the hospital sector is price regulation which determines the payments of hospitals and physicians.[1]

Since the 6th State reform, transferring competences from the federal government to the federated authorities (since 1 July 2014), these have the power to define the licensing standards that hospitals, departments, functions, services, care programmes, etc. have to comply with to be licensed. However, these standards have to respect the organic legislation, the federal programming criteria and the federal power to regulate the practice of medicine. If necessary, the federal government can appeal to its veto right against licensing standards that have a negative impact on the budget of the federal government or of social security.[6]

Capacity planning and role of evidence in programming

Programming as outlined in the current Hospital Act[7] takes the form of targets measured by, for example, the number of beds per 100 000 inhabitants or the number of beds per 1 000 births for maternity services.[8] These target measures are based on the size, age structure, and morbidity of the population as well as on the geographical dispersion. In 1982 the government decided to introduce a moratorium and set the number of licensed hospital beds for general hospitals at the number of licensed beds on 1 July 1982. The moratorium still applies today: any new bed results in the closure of another bed somewhere else in the hospital system. Also the programming standards defining the number of beds for specific services (such as a maternity service) date from the late seventies and have never been changed since then. While at first programming criteria mainly targeted the number of hospital beds, during the last decades programming regulation has been extended to major medical equipment, medical and medico-technical services or care programmes.

The current study fits in the reform plans of the federal minister of Social Affairs and Public Health, and more specifically in the capacity planning and programming part of the reforms, which are federal competences. The basic principles in the Action Plan (April 2015) have recently been operationalised in a vision statement (October 2016) and were given concrete shape in an *integrated concept report* (June 2017). The main lines of this report concerning capacity planning and programming are listed in Box 1. Evidence-informed programming will be a keystone in the reforms.

Box 1 – Capacity planning and programming in the reform plans of the minister (June 2017)

- The healthcare landscape consists of 25 loco-regional clinical hospital networks, covering catchment areas of about 400 000 to 500 000 potential patients. The partners in the loco-regional network are hospitals (not hospital functions, departments, care programmes, etc.).
- Each loco-regional network provides general and specialised care assignments. General care assignments can be provided in each hospital of the loco-regional network while specialised care assignments are provided in a limited number of hospitals of the loco-regional network.
- Care assignments that are not provided in each loco-regional network are called ‘supraregional care assignments’. The latter can be categorised into reference assignments (that can be provided by university and non-university hospitals) and university assignments (that are only provided by some university hospitals). The partners in such a ‘supraregional collaboration’ are the loco-regional networks and the hospital providing the care assignment at the supraregional level (called ‘reference point’).
- In addition to the creation of clinical hospital networks, a programme of ‘supply management’ (‘*aanbodbeheersing*’/’*maîtrise de l'offre*’) is considered as an instrument to rationalise the care supply. This programme consists of applying current regulation concerning minimum activity volumes, programming of care assignments and conventions with the National Institute for Health and Disability Insurance (RIZIV – INAMI). A new procedure for programming care assignments (evidence-based, transparent, evolving and proactive in case of new technologies) will be implemented.

1.3. Objective of the report: hospital capacity planning

This report has been commissioned by Minister De Block and has two main objectives. The first objective concerns overall hospital capacity planning with horizon 2025, which can be operationalised by the more concrete question: **how many hospital beds will be needed by 2025**?

The second objective is to **assess the required hospital capacity for a selection of care assignments**, on the basis of criteria for programming or conventions with RIZIV – INAMI, as determined in the integrated concept note of the minister.

The selection of care assignments was done in consultation with the policy department of the minister. This selection follows the political priorities of the supply management programme and contains both loco-regional as well as supraregional care assignments: **maternity services, radiotherapy centres and complex surgery for pancreatic, oesophagus and lung cancer**. For some other programming priorities the minister can rely on previous KCE studies (e.g. emergency care, trauma care).

1.4. Methods

Given the broad range of topics covered in this report, each with a specific scope and research methods, a description of the scope and methods used is provided in the respective sections of this Short Report.

In addition to the specific research methods applied in the different sections, a comprehensive country analysis was performed for England, France and the Netherlands. The three countries were selected because of recent reforms reshaping the hospital and healthcare landscape. Due to time limits, no more countries could be included. The advantage of a comprehensive country review as compared to a more in depth analysis of one or two reform measures is that it allows to get a complete picture of the impact of reforms.

2. HOSPITAL CAPACITY PLANNING WITH HORIZON 2025

2.1. Rationale behind hospital capacity planning

Hospitals are large physical structures demanding substantial investments. Yet, the changing context in which hospitals operate, will impose new roles: hospitals will have to integrate their activities with many other actors in the healthcare system, providing what essentially are fragments in the long-term chain of care for patients with one or multiple chronic conditions. The changing context will also have an impact on the future number and type of hospitals and hospital infrastructure that will be needed.

Health systems aim to provide a comprehensive range of services to the entire population. The challenge is to reconcile health needs, public and professional expectations and available resources. Most developed health systems have set up mechanisms for planning healthcare resources to ensure access to healthcare, preserve quality, avoid a waste of resources and guarantee its long-term sustainability. The main objective of capacity planning is to tune healthcare supply to population needs, by defining the availability and distribution of resources.[9]

International practice of hospital capacity planning

Planning approaches abroad are divergent in many aspects, such as planning goals, frequency (ad hoc or systematic), geographic granularity or planning horizon.

In most cases, capacity planning projections provide an early warning of pressure points: what region, pathology, bed type, or medical equipment, is most likely to face an increase/decrease in utilisation that may generate imbalances between supply and demand. The way hospital care planning is embedded in a region's or a country's healthcare policy can be divided in two approaches. First, hospital care planning is produced as a one-off report e.g. commissioned by the government. Second, hospital care plans are updated or created systematically at regular time intervals. The latter approach adheres to the perspective that health systems are continuously evolving and healthcare planning is inherently dynamic.

Health services planning occurs at different jurisdictions: it can be at the national level, regional level or even (sub)-provincial levels. In some countries we found an important interaction between planning levels. For example in the Canadian province Ontario, the provincial legislator has delegated the requirement for healthcare planning to the 14 local health integration networks. The intention was to adapt planning better to local circumstances and to give a stronger voice to stakeholders, especially patients, in healthcare planning.[10, 11] This situation has led to different planning approaches, inconsistent planning due to cross-boundary patient flows and a lack of strategic planning.[12] As a result a provincial-level framework was developed to support consistent and comprehensive capacity planning.[13] In this set-up, projections can be further adjusted at the local level, but deviations from the provincial framework need to be justified.

Most planning studies have a planning horizon between 8 and 17 years, the median planning horizon is 10 years which seems logical given the lead time for capacity investments.

Bed numbers are (still) the preferred metric in hospital planning

In most countries, planning focuses on hospital care and involves several dimensions: capital investments in existing facilities and new developments, investment in expensive equipment and technology, service delivery and the allocation of human and financial resources. The unit of hospital capacity planning most used remains bed occupancy and the ratio of beds per population.[14] However, the use of bed numbers or bed occupancy as a measure of the services provided by hospitals has several limitations. For example, the trend towards growing numbers of day cases and shorter lengths of hospital stay invalidates beds as a measure of capacity. Some countries, such as England and France, are moving towards planning with respect to service volume and activity.

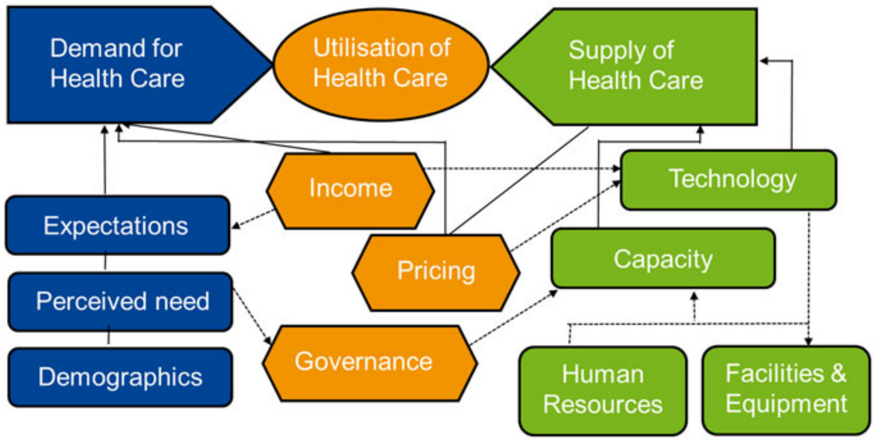
Planning assumes utilisation patterns are understood

An assessment of utilisation patterns is a necessary step to quantify current and future system pressure points. Advance warning is important, given the lead time that is required to adjust hospital capacity (construction of facilities, education of medical staff, etc.), modify service delivery systems or set out policies to influence demand or incentivize supply. There is a wide range of factors that impact the utilisation of hospital care, both demand-side factors (e.g. demographic, epidemiological or income changes, changes in expectations, etc.) and supply-side factors (e.g. technological advances, waiting lists, avoidable/inappropriate use of care, substitution to hospital care alternatives, etc.). These factors can have an opposite impact on the required capacity and whether hospitals need additional capacity depends on their combined effect. For example, older persons have the most hospital stays, and an ageing population could support the argument in favour of capacity increases. Conversely, a decreasing length of stay and initiatives keeping patients out of the hospital by treating them at home, may imply that existing capacity is (more than) sufficient. Therefore, planning of aggregate hospital capacity requires a careful modelling of the contribution of these factors.

Population needs as the driving force of hospital planning

The claim that healthcare ought to be determined and distributed according to 'need' is frequently encountered in both the academic literature and policy documents. It is also one of the main pillars of the reform plans of the minister in the redesign of the hospital landscape. The concept of need, however, has been defined in many ways, such as ill-health or capacity to benefit (from healthcare).[15] Need, as opposed to preferences, demand, access or use, has also been widely discussed in the literature.[16] This discussion is out of scope of this report. However, the concept of need should be clearly distinguished from demand for and use of healthcare.[17] Need is changed to a demand when an individual considers to have a need and is willing to spend resources such as money or time. Individuals may demand services but not receive care because they cannot afford the service, or because the service is not available. Hence, for demand to become use, also the supply side of the healthcare market has to be taken into consideration (see also 3.2).

Figure 1 – The complex drivers of healthcare utilisation



Source: Layte et al. (2009, p. 3)[18]

Modelling future hospital capacity need in Belgium

The aim of this part of the Short Report is twofold. The first aim is to develop a tool to support decision makers in forecasting future hospital capacity need. The techniques behind this tool, data requirements, and underlying assumptions are described in section 2.2. Second, the results of the analysis allow to give an answer to the central research question of this part of the Short Report: what is the required future hospital capacity? This future requirement will be defined at the national and regional (Flanders, Wallonia and Brussels Capital region) level.

Throughout this part, it should be kept in mind that the starting point of the analysis is current use, which is determined by needs, demand and supply factors. The implicit underlying assumption of such approach is that there is no unmet need and no inappropriate use of hospital services. Current use could be adjusted to better reflect demand/needs, for instance, by using information on incidence or prevalence of diseases and conditions, waiting lists, cancelled elective surgery and high occupancy rates (see part 3 of this Short Report). The choice of this approach was dictated primarily by lack of available data, for instance on incidence and prevalence, for the broad spectrum of diseases and conditions treated in hospital.

To assess the future hospital capacity need, changes in the age/sex composition of the Belgian population are taken into account. As far as age or sex can be seen as a proxy for healthcare need (they certainly are associated with need), the model takes account of the future need of the population. Of course, as current use is also driven by supply, this will be continued in the future. Therefore, the results of the model should be treated as a starting point only. It is recommended to **complement these results with more detailed analyses and in depth studies** in which current use can be more easily corrected for supply-side factors and other factors (in addition to need) determining demand. This is the topic of part 3 of this Short Report.

2.2. Design of a trend analysis model

The central question is 'How many hospital beds will be needed in 2025 in Belgium?' A previous study, conducted in 2005 by university teams from Leuven, Gent and Mons, tried to answer the same question with the end of the time horizon in 2015.[19] The approach taken in the 2005 report served as a starting point for the model that was developed for the current study. A detailed description and evaluation of the 2005 report can be found in Chapter 1 of the Scientific Report.

2.2.1. Trend analysis method

Trends teach us what happened in the past and what can be expected for the future

Statistical forecasting is a commonly used technique to plan into the future and guide decision making. The idea is to identify long-run statistical time patterns in currently available (historical) data that are assumed to continue into the future. Forecasting therefore starts by building a statistical model and estimating the parameters of the model using observed historical data. Once the dynamic pattern is mathematically described by a suitable forecast model, it can be extrapolated to project future outcomes.

This continuation of past trends should be interpreted broadly since it includes epidemiological trends (e.g. an increase in the prevalence of obesity, cancer or dementia), the steady improvement in expected healthy life-years at age 65, migration trends, the ongoing development in medical practice, the past substitution rate between hospital care and other care settings, the influence of financial incentives and other policy decisions, etc. To give a concrete example, if substitution rates of day surgery for inpatient care are lower for certain socioeconomic groups, this is incorporated in the past trends and continued in the future.

'What if' scenarios are needed to capture emerging trends and one-time changes

Trend analysis assumes that the effect of the extensive range of influential factors on the evolution of hospital services remains constant in the future. However, the future will never be a smooth continuation of past patterns. Moreover, emerging trends hardly visible or noticed at the present time may become critically important in the future. For example, telemedicine, eHealth and mHealth are considered to be the future of medicine with, certainly for older persons and persons with chronic conditions, a potential impact on admission rates and length of stay. However, at this moment this is not yet the case and hence, past and current data do not capture sufficiently emerging driving forces of hospital service use. Moreover, trend analysis is unable to predict disruptive changes in the health system or in social patterns that could significantly change patterns of utilization. Therefore, trend analysis should be complemented with input from literature and experts to deduce hypotheses on future evolutions that deviate from a trend.

2.2.2. *Selection of stays*

As the current reform plans of the minister focus on general hospitals, the analysis includes stays in acute care (including university) hospitals as well as stays in geriatric and categorical hospitals. All psychiatric stays (hospitals stays in psychiatric hospitals as well as full psychiatric stays recorded in non-psychiatric hospitals) are excluded from the analysis. Stays in categorical hospitals which fall under the competence of the communities are treated separately.

Inpatient as well as day-care stays are included. Ambulatory visits to the emergency department are excluded. Stays of newborns aged 29 days or less who are only registered in bed type M (maternity) are omitted to avoid double counting with the stay of the mother.

A more detailed description of the selection of included and excluded stays can be found in Chapter 1 of the Scientific Report.

2.2.3. *What data are used?*

Population data

Past demographic information is necessary to analyse hospital service use by sociodemographic group (see section 2.2.5) over time. The observed population size by age and sex at the level of the region of residence (Flanders, Wallonia and Brussels Capital) over the period 2003 to 2016 is provided by Statistics Belgium ('*Algemene Directie Statistiek*'/'*Direction générale Statistique*').

The future evolution of the population is projected in a joint effort by the Federal Planning Bureau ('*Federaal Planbureau*'/'*Bureau federal du Plan*') and Statistics Belgium. We use the latest available data that were released in March 2017.[20] The projections range from 2017 to 2061 and take into account international migration, domestic relocation, and the future evolution in fertility and mortality. The data are composed of yearly cross-sections indicating the projected size of the population residing on the Belgian territory on 1 January. The population can be further decomposed by age, by sex and by region of residence. The population projected on 1 January of year t+1 is used to predict care use in year t.

Minimal Hospital Data (MZG – RHM)

All general hospitals are required to submit twice a year a large set of data on all inpatient and day-care hospital stays and emergency room contacts: the Minimal Hospital Data (MZG – RHM) defined in a Royal Decree which are transferred to the Federal Public Service (FPS) for Health, Food Chain Safety and Environment. Day-care stays include all surgical stays and non-surgical day-care stays for which one of the following lump sums can be charged: maxi lump sum, mini lump sum (up to July 2014), lump sums

(3 groups) for chronic pain and one of the 7 groups of lump sums introduced in 2007; or are of a specific type (currently geriatric, paediatric, oncological). An APR-DRG is assigned to all inpatient stays and to all day-care stays (see Box 2).

At the time of this study, MZG – RHM data were available for 2003-2014 for inpatient stays and for 2006-2014 for day-care stays. A more elaborate discussion of the data and manipulations of the data can be found in Chapter 1 of the Scientific Report.

Box 2 – APR-DRG classification system

Belgium imported the 3M™ **APR-DRG** (All Patient Refined-Diagnosis Related Group) grouper to assign hospital stays to an APR-DRG. The basic APR-DRG structure is extended by adding two sets of subclasses to each APR-DRG, namely severity of illness (SOI) and risk of mortality (ROM).[8]

Patients are allocated to an APR-DRG-SOI group on the basis of principal diagnosis, secondary diagnoses and procedures, weight (for newborns), age and sex of the patient and, for some APR-DRGs (e.g. burns) type of discharge.

Severity of illness is defined as the extent of physiologic decompensation or organ system loss of function and introduces 4 categories for SOI: 1=minor, 2=moderate, 3=major, 4=extreme.

Risk of mortality is defined as the likelihood of dying during the hospital stay, also classified as minor, moderate, major and extreme.

Hospital stays are classified into one of 320 APR-DRGs (version 28), each with 4 SOI classes, and two 'residual' APR-DRGs grouping hospital stays whose medical record abstracts contain clinically atypical or invalid information, thus rendering SOI classification irrelevant (APR-DRG 955 – Invalid principal diagnosis and 956 – Ungroupable stay). Hence, the number of distinct groups amounts to 1 282.

Source: Devriese et al. (2016)[21]

2.2.4. The importance of sociodemographic characteristics and pathology groups in capacity planning

Age, sex and region

The relevant population for the projection model are all individuals residing in Belgium. The group of foreign patients, i.e. individuals who do not reside in Belgium, is treated separately.

Individuals belonging to different sociodemographic subgroups differ with respect to the type of hospital services they use, the severity of their disorders, their admission rates, their health status, the length of their hospital stay, etc. As the demographic composition of the population changes over time, it is important to translate demographic evolutions into future hospital use. The inclusion of sex allows to improve the forecasts for sex-specific types of care, e.g. pregnancy, treatments of the reproductive system.

The ageing of the population is not evenly spread across the Belgian territory. Therefore, sociodemographic groups are defined by sex, age, and region of residence. Age is subdivided in 7 age groups: 0, 1-19, 20-39, 40-59, 60-74, 75-84, 85+.

Adjustments to the APR-DRG-SOI classification

Admission rates and length of stay differ between pathology groups. In order to have a meaningful classification of hospital stays within the Belgian healthcare context and, from a statistical point of view, a grouping that contributes to the accuracy of the projections, the following choices were made:

- The APR-DRG-SOI level was the starting point.
- Adjustments were made for APR-DRG-SOI with fewer than 400 stays per year on average over the estimation period (see section 2.2.5) by combining them into a pathology group with related APR-DRG-SOI. This was done to improve the quality of the forecasts in terms of reliability and accuracy. The choice of 400 stays as target value is based on the volatility of the data and is discussed in detail in the data manual.

Long-term stays and chronic care

Two specific groups of inpatient care use a pathology classification unrelated to the APR-DRG-SOI system: long-term stays and chronic care.

- Long-term stays are defined as hospital stays that last more than 6 months. The idea is to single out inpatient stays that can be considered as outliers with respect to their length of stay. This reduces heterogeneity and improves the trend analysis.
- Chronic care is defined as all care provided in chronic care or S-beds and is categorized by type of bed (six types: S1 to S6). A separate group is created for chronic care that makes use of several types of S-beds. For ‘mixed’ stays, i.e. stays with an acute procedure alongside chronic follow-up care, the acute part is categorized according to the APR-DRG system, the chronic part is allocated to an S-bed.

Role in the model

We incorporate the effect of sociodemographic groups mainly by computing the hospital admission rates and average length of stay (ALOS) at the intersection of sociodemographic and pathology groups for the year 2014. Age plays an additional role as age groups are also used in the definition of admission rates over time. These serve as input for the projection model to forecast the future evolution of admission rates by pathology group and age group (see section 2.2.5).

2.2.5. Model specification

The results of the projection model are projections for the number of nursing days required in 2025. The projected number of nursing days is the result of multiplying the projected volume of stays (deduced from projected admission rates and the demographic evolution) and the projected ALOS.

Admission rates and length of stay: level of 2014, continuous or disruptive changes?

The future evolution is modelled for two variables that are an important determinant of hospital capacity: the ALOS and the admission rate. The future evolution can be operationalised by keeping the 2014 level fixed throughout he forecasting period (horizon 2025), by a continuous change or by a disruptive change.

For the majority of pathology groups (80% of all APR-DRGs), a decline in ALOS was observed over the period 2003 to 2014. Neglecting this past trend in ALOS would lead to untrustworthy estimates for the coming period. The same argument holds for admission rates, which is particularly important in the historic evolution of day care. Therefore, the baseline forecast results allow for a statistical trend analysis in ALOS and admission rates. This approach is preferred above a scenario analysis using predetermined values or growth paths. The main advantage of statistical trend analysis over scenario analysis for the baseline forecasts is that trend analysis is data driven and able to capture past changes: it incorporates indirectly many influential factors (see section 2.2.1). Moreover, since the evolution of ALOS and admission rates are examined by pathology group, the effect of influential factors is also pathology specific.

The baseline forecasts results are complemented with projection results that keep the future evolution in ALOS and/or in admission rates fixed at the 2014 level (demographic changes are always accounted for). This makes it possible to discern the impact of each variable on the future need for hospital capacity.

In addition, scenario analysis is used to evaluate the effects of more disruptive policy and demographic changes (see section 2.4 on accelerated substitution from inpatient to day care and 2.5 on accelerated population ageing). Scenario analysis is well suited to capture the potential effect of policy, technological and organisational reforms or demographic shocks, having the ability to disrupt the ongoing evolution. In this way, scenario forecast results serve as sensitivity analysis for the baseline forecast results.

Estimation, validation and forecasting period

Data are available for 2003-2014 for inpatients stays and for 2006-2014 for day-care stays. The forecast horizon is 2025.

Time trends in ALOS and admission rates were estimated using specifications from two broad families of statistical: deterministic trend regression models and auto-regressive integrated moving average (ARIMA) time series models. Deterministic trend regression models and ARIMA models were estimated on the entire data period. A first selection of models was based on how well a model fits the historical data and its level of complexity. For the final selection, forecast accuracy of all remaining forecast specifications was evaluated. To this end, the data were split in two periods: an estimation period and a validation period. The former ranges from 2003 to 2011 for inpatient care and from 2006 to 2012 for day care. The validation period goes from 2012 to 2014 for inpatient care and from 2013 to 2014 for day care.

The data used for estimation span a long time period during which health policy, and hospital and healthcare have changed. Hence it is important to account for trend changes in ALOS and admission rates that have set in recent years. Through the use of ARIMA models and a validation period, our methodology gives more weight to recent observations and enduring trend modification in the computation of the forecast outcomes.

2.3. How many hospital beds are needed in 2025? Baseline model

The projection model combines three evolutions to generate forecasts for future hospital capacity. First, it accounts for the future evolution in population size and composition. Second, the future evolution of ALOS is estimated by pathology group, and third, the evolution of the admission rate (AR) is computed by age group and pathology group. The effect of the three evolutions can be separately identified. Results are shown for inpatient and day-care activity.

The baseline model can be interpreted as a ‘no policy change scenario’ and therefore serves as a benchmark for comparisons of results without and with (new) policy actions. Of course, policy actions that were taken in the past, are reflected in current observations and their continued effect is projected into the future. In sections 2.4 and 2.5 two ‘what if’ scenarios are developed. First, an enhanced substitution between hospital inpatient care and day care on the global need for acute hospital services is evaluated. Second, since the real demographic peak in older persons will appear from 2030 onwards, a scenario of accelerated ageing is produced.

2.3.1. Almost 12% increase in inpatient stays with population growth and ageing as the main drivers

At the national level, the number of inpatient stays increased from 1.71 million in 2003 to 1.82 million stays in 2014, a 6.5% increase overall, or an average annual increase of 0.57%. This number is projected to increase by 215 000 stays from 2014 to 2025, which represents an overall increase of 11.8% or an average annual increase of 1.02%. The increase is sharper for medical (13.0%) than for surgical (8.1%) inpatient stays.

The largest share (45%) of this increase in inpatient stays can be explained by the population growth of 5.3% during this period. In addition, the number of inpatient stays increases with 4.3% (or 36% of the increase) due to changes in the composition of the population, i.e. the ageing of the population. As such, in the model which only accounts for demographic changes (number of inhabitants and ageing) and fixing admission rates at the 2014 level, the number of stays is expected to increase by 9.6%.

The difference between both forecasts (about 2.2% or 19% of the total increase) can be explained by the evolution in admission rates.

Increase in inpatient stays for majority of Major Diagnostic Categories

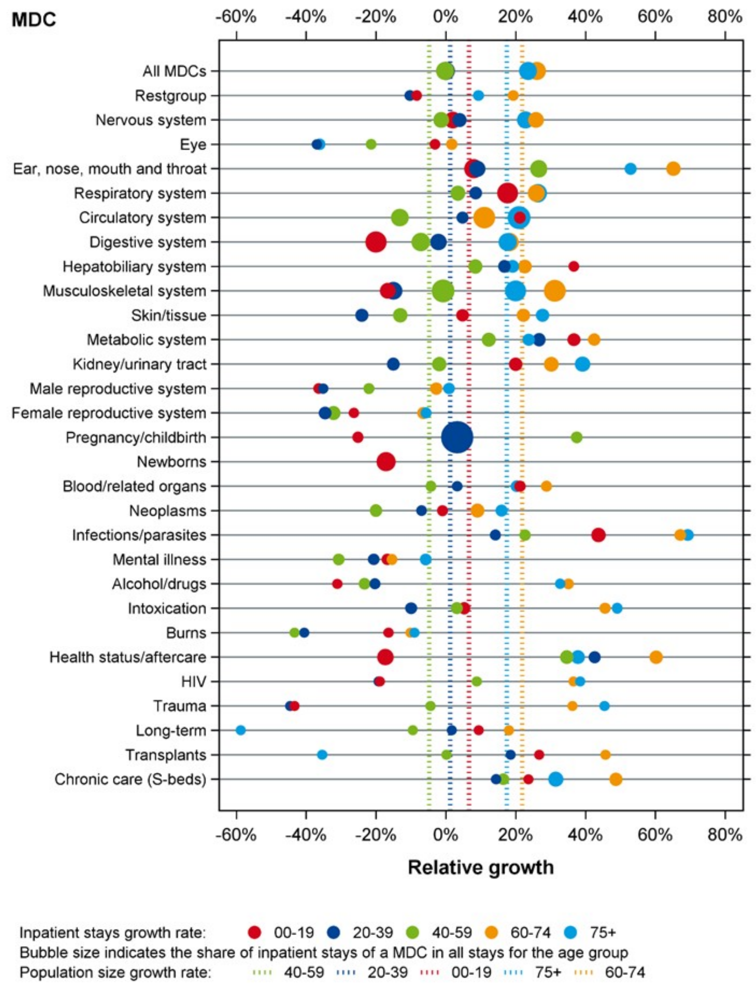
Although the number of inpatient stays is projected to increase for the majority of Major Diagnostic Categories (MDCs), the overall increase of 11.8% is driven by important expansions (over 20 000 stays) of some types of inpatient care, such as treatments of diseases and disorders of the ear, nose, mouth or throat (MDC 3), of the respiratory system (MDC 4), of the musculoskeletal system (MDC 8), of the circulatory system (MDC 5) and care related to health status and aftercare (MDC 23). An overview for all MDCs can be found in Chapter 1 of the Scientific Report.

Ageing is the major cause of upward pressure on hospital capacity

Figure 2 illustrates the relative growth in inpatient stays by MDC for five different age groups. Each circle specifies the growth rate for the MDC, the colour defines the age group. As a benchmark, the population growth of each of the age groups is indicated by vertical dotted lines in the colour of the age groups. Hence, circles at the right [left] of the benchmark line indicate an increase [decrease] in the admission rate for that age group. The size of the circles reflects the importance of each MDC for the particular age group. For example, stays related to diseases and disorders of the digestive system are projected to decrease by 20.0% between 2014 and 2025 for the age group between 0 and 19 years (indicated by the red circle). The decrease occurs despite an increase in size of that age group by 6.6% over the same period (indicated by the red line). The bubble size indicates that diseases and disorders of the digestive system represent an important share of all inpatient stays of individuals aged 19 or less.

The top line of Figure 2 summarizes the evolution of all MDCs combined: the admission rate is projected to increase for individuals aged 40 or more and to decrease for individuals under 40 years old. This can be seen by the green, orange and azure blue circles on the right side of the same-coloured dotted line. The opposite is true for the dark blue and red circles (hidden below the green circle). This overall trend holds for the majority of MDCs. An exception is, for example, the projected number of stays for diseases and disorders of the respiratory system for the age groups between 0 and 19 years and between 20 and 39 years: the growth of both age groups (6.6% and 1.2% respectively) is below the projected growth in inpatient stays (17.6% and 8.6% respectively). Remind that hospital stays in psychiatric hospitals and full psychiatric stays in general hospitals were not incorporated in the analyses. This is particularly important when interpreting the results for MDC 19 covering mental diseases and disorders.

Figure 2 – Relative growth in inpatient stays between 2014 and 2025, by MDC and age group



2.3.2. Average length of stay will continue to decrease in the next decade

Yearly reduction in average length of stay of 1.5%

Between 2003 and 2014, the average length of hospital inpatient stays has shortened from 8.26 days to 6.99 days, which represents a reduction of 1.27 days on average over the 11-year period (yearly reduction of 1.51% on average and 15.38% reduction over the 2003-2014 period). For acute care the average reduction in ALOS was 1.36 days, for chronic care it was 4.88 days.

The ALOS is projected to trend downwards in the next decade to 5.94 days in 2025, which represents a reduction of 1.05 days on average over the 11-year period (yearly reduction of 1.47% on average and 15.02% reduction over the 2014-2025 period; reduction of 1.09 days for acute care and 4.38 days for chronic care). Hence, taking account of all factors that resulted in a reduced ALOS in the last decade (because this is what a trend analysis model does) and of expected demographic evolutions (size and composition of the population), overall the ALOS is projected to follow the same trend for the next 10 years.

Reduced average length of stay for nearly all MDCs

Figure 3 shows the relative change in ALOS between 2014 and 2025 for a selection of MDCs (left panel; MDCs representing at least 2% of inpatient days in 2014) and APR-DRGs (right panel; APR-DRGs representing at least 1% of inpatient days in 2014). The vertical bars show the importance of the MDC/APR-DRG in percentage of inpatient days (left scale). The change in ALOS is indicated by the red markers and valued on the right scale. The dotted horizontal line marks the zero-change line where ALOS remains constant between 2014 and 2025.

The results per MDC clearly show a decrease in ALOS by 10% to 20%. MDC 8, diseases and disorder of the musculoskeletal system and connective tissue, representing the largest share of inpatient care in terms of stays as well as days, has an even more important decline in ALOS of about 30%.

The analysis at the level of APR-DRGs also shows a reduction in ALOS. However, the variability at the level of the APR-DRGs is larger compared to MDCs. For example, three APR-DRGs classified in MDC 8 have quite divergent reductions in ALOS: the ALOS for APR-DRG 347 ‘other back and neck disorders, fractures and injuries’, APR-DRG 302 ‘knee joint replacement’, and APR-DRG 301 ‘hip joint replacement’ the ALOS is projected to decrease by 12%, 45% and 58%, respectively.

Faster reduction in length of stay for stays with a lower severity level

The ALOS of inpatient stays with a severity of illness (SOI) level 1 or 2 decreased by about 25% between 2003 and 2014; for stays with SOI level 3 and level 4 the ALOS decreased by 19% and 5.8% respectively. The projection results predict similar reductions in ALOS between 2014 and 2025, of about 23% for SOI 1 and 2, 19% for SOI 3 and a slightly stronger reduction compared to the period 2003-2014 for SOI 4 of 9.5%. The divergent reduction in ALOS according to SOI-level is illustrated in Figure 4 for APR-DRG 302 ‘knee joint replacement’. While the overall reduction in ALOS for APR-DRG 302 equals 45%, the decrease in ALOS amounts to 46.2% for SOI 1, 51.9% for SOI 2, 18.9% for SOI 3 and 19.4% for SOI 4.

Detailed graphs and forecast results for the evolution of ALOS of all APR-DRGs at the APR-DRG-SOI level are available in the online appendix.

Predicted ALOS for 2025 is in line with current practice abroad

To assess the feasibility of reducing the ALOS per pathology group (APR-DRG-SOI or grouping) as predicted by the trend analysis model, the results were compared against current international practice. To enhance comparability, the projected results were compared with current practice in the United States (US) (known forerunners in reduced ALOS) because the same or very similar classification systems of hospital stays are used (see Chapter 1 in the Scientific Report for more details).

In general, the projections for ALOS in 2025 do not diverge inexplicably from the current situation in the US. For about 55% of the APR-DRG-SOI that could be compared, the projected ALOS in 2025 deviates less than 40% from current practice in the US (see Table 1 for an example).

Table 1 – Comparison of LOS predictions for 2025 with current LOS in the US: the example of APR-DRG 302 'Knee replacement'

Belgium			United States
Severity of Illness	**LOS in 2014**	**Estimated LOS in 2025**	**Current LOS***
1	6.1	3.3	2.9 - 3.6
2	8.0	3.9	2.9 – 4.1
3	16.3	13.2	6.9 – 7.2
4	39.1	31.3	18.8

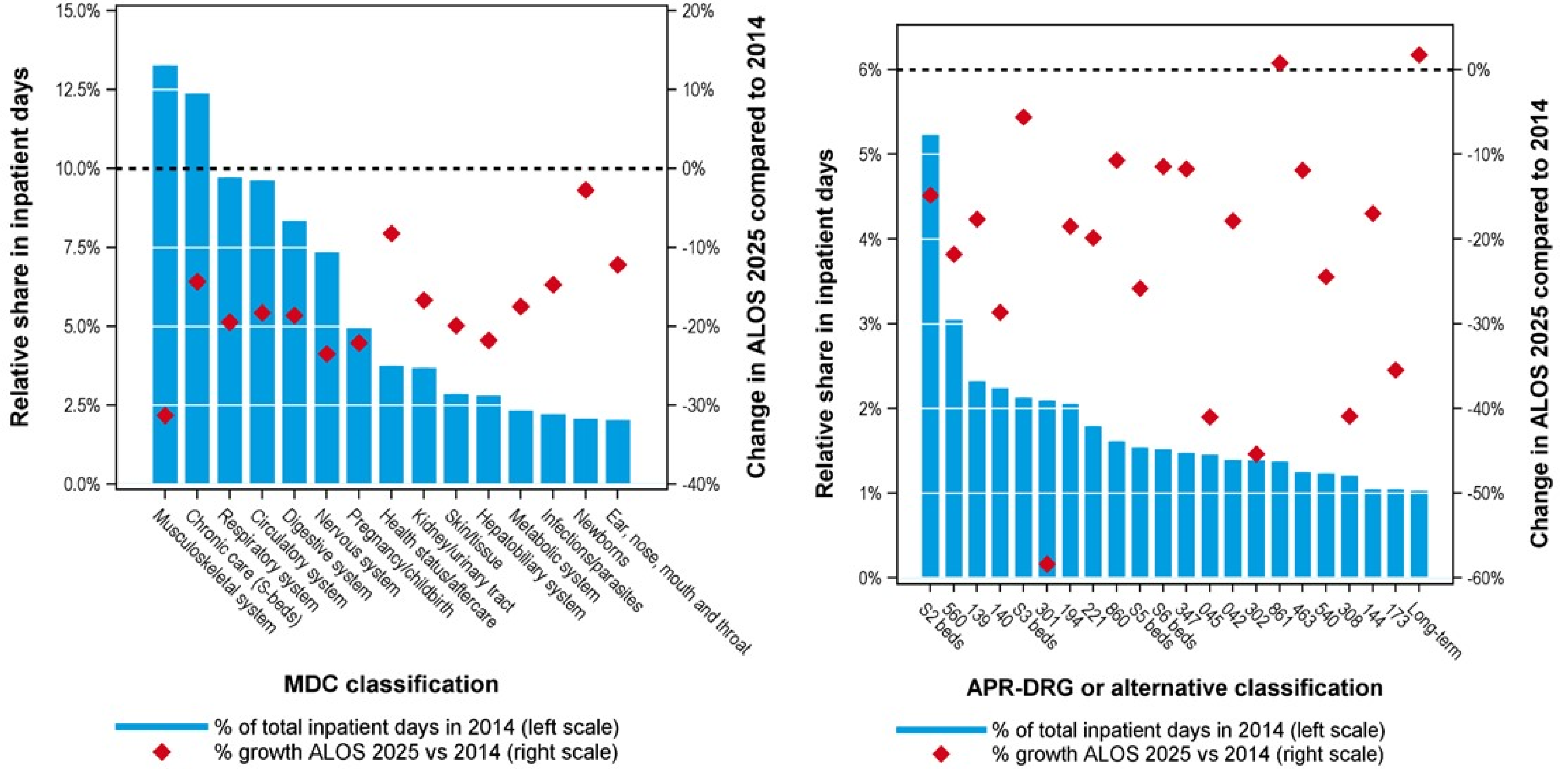
*LOS = length of stay; * Two different data sources were used (see Scientific report, Chapter 1)*

Hence, the rather drastic decrease in ALOS for SOI 1 and 2 seems a plausible projection for the coming decade. Yet the continued downward trend in ALOS should not be taken for granted. Besides the application of newer surgical and anaesthetic techniques that decrease recovery time, it has been shown that 'bundled' approaches that simultaneously focus on improved internal hospital flows, investments in alternative out-of-hospital services and patients have a larger impact on length of stay. These efforts will continue to be necessary in the future.[22]

A clear pattern is found in the APR-DRG-SOI for which the projections diverge more substantially. The APR-DRG-SOI for which the projected ALOS in 2025 is substantially shorter than is currently the case in the US are predominantly surgical DRGs (about 66%) and DRGs that have a low severity of illness (80% has SOI 1 or 2). This is probably due to the fact that in the US more of these medical and surgical procedures (e.g. laparoscopic cholecystectomy), are already performed in day care, resulting in a longer ALOS for the remaining inpatient stays.

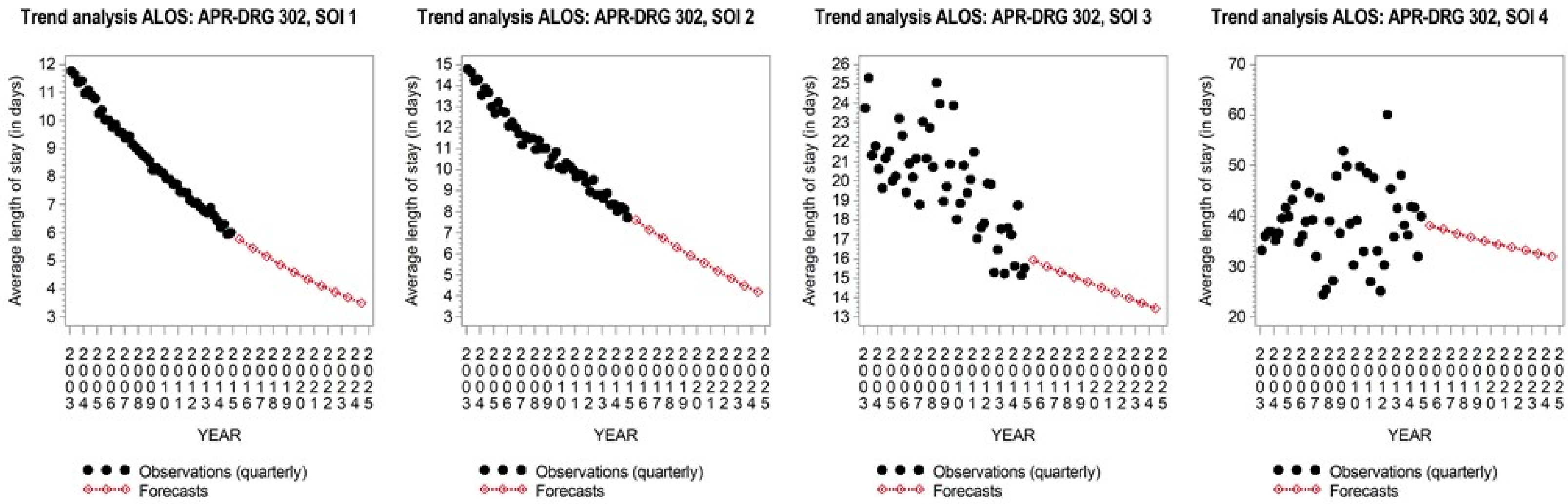
The APR-DRG-SOI for which the projected ALOS in 2025 is substantially longer than is currently the case in the US are predominantly medical DRGs (about 75%) and DRGS that have a high severity of illness (75% has SOI 3 or 4). At least part of the difference in length of stay can be explained by the older population in Belgium compared to the US. Another explanation is the difference in medical practice. For example, the ALOS for vaginal deliveries (APR-DRG 560) is projected to be 3 days for SOI 1 and 3.3 days for SOI 2 in 2025, coming from 3.8 and 4.2 days in 2014. This is well above the ALOS in the US and other countries (see Chapter 1 in the Scientific Report).

Figure 3 – Projected change in ALOS between 2014 and 2025 for selected MDCs (left panel) and APR-DRGs (right panel)



Note APR-DRGs (right panel): S2-beds: all care provided in bed type S2 (rehabilitation of the locomotor system); 560: Vaginal delivery; 139: Other pneumonia; 140: Chronic obstructive pulmonary disease; S3-beds: all care provided in bed type S3 (neurology); 301: Hip joint replacement; 194: Heart failure; 221: Major small and large bowel procedures; 860: Rehabilitation; S5-beds: all care provided in bed type S5 (chronic poly-pathology); S6-beds: all care provided in bed type S6 (psychogeriatric); 347: Other back and neck disorders, fractures and injuries; 045: Cerebral vascular accident and precerebral occlusion with infarct; 042: Degenerative nervous system disorders except multiple sclerosis; 302: Knee joint replacement; 861: Signs, symptoms and other factors influencing health status; 463: Kidney and urinary tract infections; 540: Caesarean delivery; 308: Hip and femur procedures for trauma, except joint replacement; 144: Respiratory signs, symptoms and minor diagnoses; 173: Other vascular procedures; Long-term: Hospital stays with LOS longer than 180 days.

Figure 4 – Projected change in ALOS for APR-DRG 302 'knee joint replacement', by SOI-level



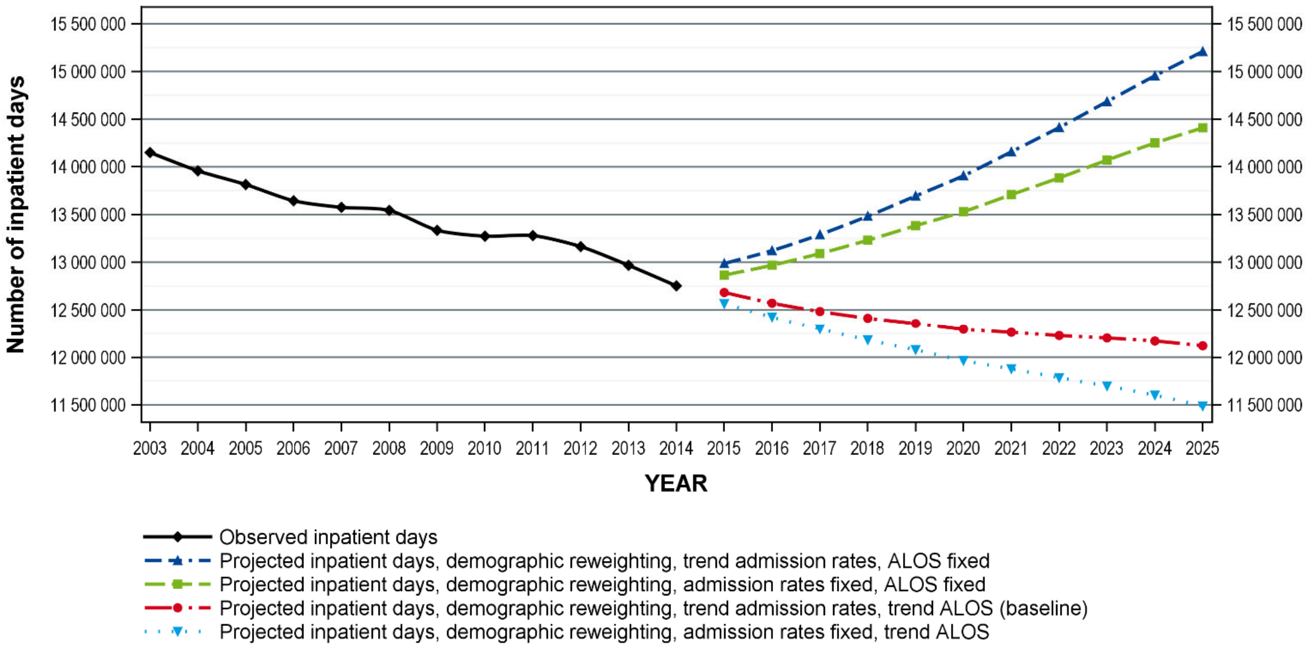
2.3.3. A 5% decrease in the number of nursing days with a shift from acute to chronic care

Shorter stays can free up capacity to absorb an increasing number of stays

Multiplying the projected number of inpatient stays by the projected ALOS for each pathology group gives the projected number of nursing days in 2025. The decrease in inpatient days between 2014 and 2025 is estimated at 633 000 days or 5.0% of the inpatient days in 2014 (-2.2% for medical stays; -19.3% for surgical stays; +17.4% for chronic care stays). This corresponds to about 2 170 beds at an occupancy rate of 80% or 4.3% of all licensed beds (excluding psychiatric bed-types) in 2014. The decrease in nursing days for inpatient stays between 2003 and 2014 amounted to about 1.4 million days. However, it should be clear that the 5% decrease in nursing days is the combined effect of demographic changes, a trend in admission rates and a trend in ALOS.

In a scenario only accounting for demographic changes and fixing ALOS and admission rates at the level of 2014, the number of nursing days is projected to increase by 13.0%. Forecasts accounting for demographic changes and a trend in admission rates, further increases the growth in the number of nursing days to 19.3%. The number of nursing days is projected to decrease (by 5%) only when the projection model also allows for a trend in ALOS, which is the more realistic assumption (see Figure 5). In the forecast results fixing the ALOS at the level in 2014, the projected increase in the number of nursing days can be explained by the projected increase in the number of stays. The decrease in days when allowing for a trend in the ALOS results from the projected efficiency effect of a continued decline in the length of inpatient hospital stays. Of course, this continued decline in the next decade can only be realised if comparable changes in medical technology, medical practice, care processes, availability of out-of-hospital services, or hospital payment schemes as in the past period will continue.

Figure 5 – Observed evolution and forecasts for hospital inpatient days



Reduction in nursing days for two out of three MDCs, with a shift from acute care to chronic care

A breakdown by MDC of the 5% projected decrease in the number of nursing days reveals that this number will decrease for two out of three MDCs (see Figure 6 showing MDCs representing at least 1% of all inpatient days in 2014).

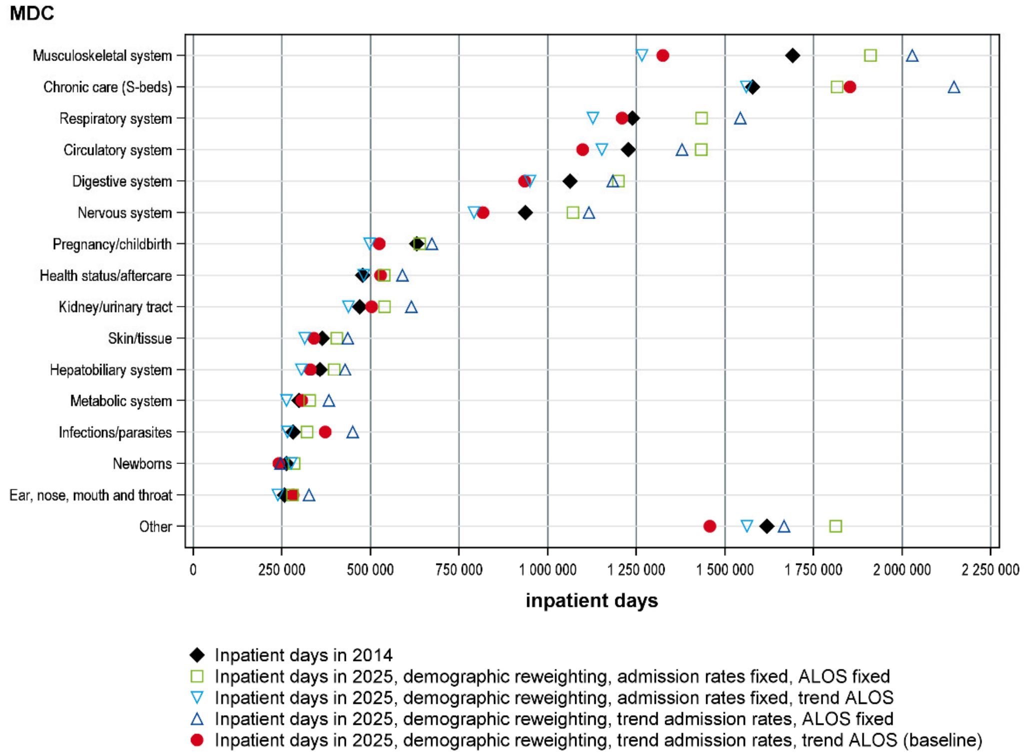
A major finding is that chronic care, i.e. all care provided in S-beds, will replace diseases and disorders of the musculoskeletal system as most important in terms of inpatient days. This is the result of an important increase in hospital stays and a relatively modest reduction in ALOS of about 13%. This shift already started in the 2003-2014 period: for the top five groups in terms of hospital inpatient days, chronic care is the only one which has experienced an increase in inpatient days between 2003 and 2014. Remark that care provided in isolated categorical hospitals is not included in these figures (see note to Table 5).

Figure 6 shows the separate and combined effects of demographic changes, ALOS and admission rates. The effect of demographic changes is visualized by the green square. For all care types, the demographic effects on their own lead to an upward pressure on the number of inpatient days, but there are substantial difference between pathologies. For example, the effect for newborns and neonates and pregnancy and childbirth is almost non-existent, whereas the upward effect is most pronounced for the top six MDCs: diseases and disorders of the musculoskeletal system, chronic care, diseases and disorders of the respiratory system, of the circulatory system, of the digestive system and of the nervous system.

The admission rate has an upward trend for MDCs where the upward pointing blue triangle is to the right of the green square. This effect is especially important for chronic care, infectious and parasitic diseases, and diseases and disorders of the musculoskeletal system, of the respiratory system, of the kidney and urinary tract. A decrease in the admission rate is revealed for diseases and disorders of the circulatory system, of the digestive system and care for newborns and neonates. The evolution of ALOS is captured by the position of the downward pointing azure blue triangle and the green square. If the triangle is to the left of the square, the estimates indicate that the ALOS will shorten. This is the case for all MDCs, but to a varying extent.

For the majority of MDCs in Figure 6, the trend in ALOS and the trend in admission rates exert an influence on inpatient days in opposite directions. For chronic care, after accounting for demographic changes, the effect of the admission rate and the ALOS on inpatient days is more or less equally important. This implies that after accommodating the increased need for chronic care, related to the growth and ageing of the population, any capacity gain related to shorter stays is directly taken up by an increase in the number of stays due to a higher admission rate. Visually, both triangles are equally distant from the green square at opposite sides. As a result the overall baseline forecast (the red circle) is very close to the forecast produced by demographic reweighting (the green square). In most cases, however, the effect of ALOS outweighs the effect of the admission rates.

Figure 6 – Observed number of inpatient nursing days in 2014 and forecasts for 2025, by MDC

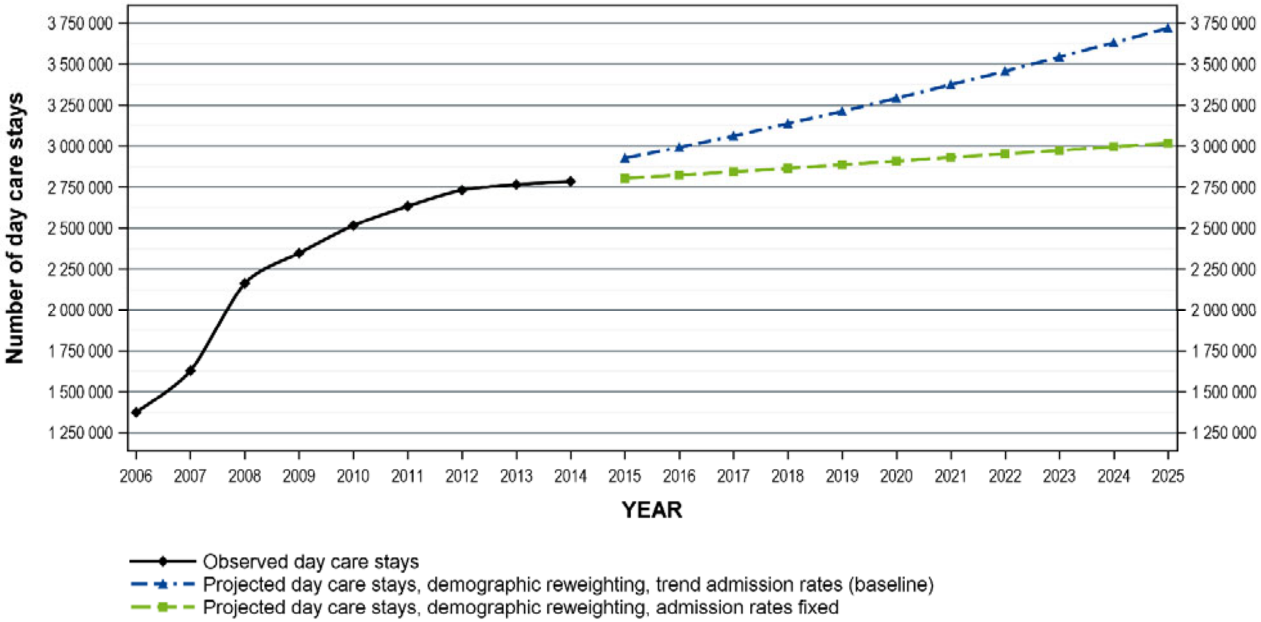


2.3.4. Shift towards day care continues in the years to come

Large increase in day-care activity but moderate impact of demographic changes

The projected increase in day-care activity crucially depends on whether admission rates are fixed at the level of 2014 or not (see Figure 7). With fixed admission rates, and hence only demographic changes that influence capacity need, an additional 232 000 day-care stays are projected for 2025 which represents an increase of 8.3% compared to 2014, i.e. an annual growth of 0.73%. For inpatient stays an increase of 9.6% was found over the same period. The difference can be explained by the younger patient population in day care. Allowing for a trend in admission rates results in an additional 702 000 inpatient stays. The total increase of 934 000 stays equals 33.5% of day-care activity in 2014. An increase by 33.5% over a period of 11 years, i.e. an annual growth rate of 2.66%, will require a significant expansion of the available capacity. The expansion appears challenging, but realistic given an increase of 1 400 000 stays observed between 2006 and 2014 (or 700 000 stays without including information on mini lump sums; see Chapter 1 of the Scientific Report for more details). The projected capacity expansion, driven by the growth in admission rates, comprehends substitution from inpatient and ambulatory care to day care as well as a net growth in medical practice.[23]

Figure 7 – Observed evolution and forecasts for hospital day-care stays



The expansion of day care will be most pronounced for medical day-care activities

Day-care activity is highly concentrated in a limited number of MDCs. For the majority of the MDCs the number of day-care stays is projected to increase.

Medical procedures account for 78% of the volume of stays in 2014 versus 22% for surgical stays. This discrepancy is further enlarged in the forecasts. Medical day care is projected to increase by 35.6% between 2014 and 2025, surgical day care by 26.1%. Of course, if the shift from day care to ambulatory care will become larger (for example, because of expanding use of oral chemotherapy), the above percentages will be lower.

2.3.5. Demographic differences between regions result in different resource needs

There are several potential causes of regional variation in healthcare use, such as differences in size and composition of the population, differences in prevalence of diseases, environmental and lifestyle factors or differences in medical practice. Table 2 provides some demographic and hospital use characteristics of the Belgian population by region of residence. The three regions differ substantially with respect to their population size and composition. In 2014, about 57.5% of the population resides in Flanders, 32% in Wallonia, and 10.5% in Brussels. The population shares hardly change between 2014 and 2025, with 57.4% of the population living in Flanders, 31.7% in Wallonia, and 10.9% in Brussels (not in Table 2).

The effects of population ageing are more pronounced in Flanders than in the other two regions, especially Brussels has a relatively younger population. In 2014, the share of over 75 year olds equals 9.7%, 8.5% and 6.8% in Flanders, Wallonia and Brussels, respectively. In 2025, these shares amount to 11%, 9.6% and 6.4% in Flanders, Wallonia and Brussels, respectively. Ageing is generally associated with increased hospital use. Hence, in comparison to the population share, we expect a more important share in required hospital capacity in Flanders and Wallonia compared to Brussels.

Table 2 – Demographic and hospital use characteristics in 2014, by region

	Flanders	Wallonia	Brussels
Share in total population	57.5%	32.0%	10.5%
Share +75 (2025)	9.7 (11) %	8.5 (9.6)%	6.8 (6.4)%
Share in day-care stays	65.1%	27.3%	7.6%
Share in inpatient stays	57.9%	33.1%	9.0%
Average length of stay	6.64 days	7.27 days	8.23 days
Share of inpatient days	55.0%	34.4%	10.6%

Table 3 summarizes the results of the trend analyses for 2025 and compares them with the starting point in 2014 for Belgium as well as for the three regions, where region is based on the place of residence of the patient. Only results for the baseline model are shown, which takes account of demographic changes as well as of a trend in admission rates and ALOS. Since the results at national level have been discussed in the above sections, we focus here on differences and similarities between regions.

The following conclusions can be drawn from Table 2 and Table 3 (in Table 3 hospital activity of patients living abroad is included which explains the (small) difference in the number of stays and days for Belgium with the numbers in the previous sections). Day-care activity is significantly more developed in Flanders than in the other regions and given the continuation of historic trends, the gap with the other regions will further increase if no policy action is undertaken to level out these regional differences. The share in day-care volume of patients living in Flanders amounts to 65.1% in 2014 and will further increase to 65.4% in 2025, which is almost 8 percentage points above the population share.

The distribution of inpatient stays across regions more closely resembles the population share. The projected increase in inpatient stays between 2014 and 2025 is more or less the same for the three regions. The comparable increase in Brussels and Flanders, which has a much faster pace of population ageing, can be explained by the larger increase in population size in Brussels.

The ALOS differs importantly in the three regions. Hence, despite the relatively older population, the number of inpatient days is relatively smaller in Flanders with a share of 55.0%, compared to 34.4% in Wallonia and 10.6% in Brussels. The trend projections for the ALOS show a stronger decline in Brussel and Wallonia, so that their respective shares in inpatient days will decline slightly over time.

An analysis of the factors contributing to the regional variation in hospital care use was beyond the scope of this study. It should, however, be kept in mind that in case variations are not fully explained by differences in patient need, either too much hospital care is being delivered or patients are missing out on treatment they need, whether inside or outside the hospital. These variations are also projected into the future.

Table 3 – Hospital activity in 2014 and summary of projected activity in 2025, by region

	Belgium				Brussels			
	2014	2025	Abs. difference 2014-2025	Rel. difference 2014-2025	2014	2025	Abs. difference 2014-2025	Rel. difference 2014-2025
Day care stays	2 820 031	3 754 995	934 964	33.2%	218 140	289 530	71 390	32.7%
Medical	2 196 025	2 970 810	774 785	35.3%	167 425	225 051	57 626	34.4%
Surgical	624 006	784 185	160 179	25.7%	50 715	64 479	13 764	27.1%
Inpatient stays	1 851 612	2 072 756	221 144	11.9%	167 232	187 402	20 170	12.1%
Inpatient days	12 906 895	12 268 831	-638 064	-4.9%	1 372 297	1 275 053	-97 244	-7.1%
	Flanders				**Wallonia**			
	2014	2025	Abs. difference 2014-2025	Rel. difference 2014-2025	2014	2025	Abs. difference 2014-2025	Rel. difference 2014-2025
Day care stays	1 833 791	2 454 027	620 236	33.8%	768 100	1 011 438	243 338	31.7%
Medical	1 429 941	1 944 265	514 324	36.0%	598 659	801 494	202 835	33.9%
Surgical	403 850	509 762	105 912	26.2%	169 441	209 944	40 503	23.9%
Inpatient stays	1 073 408	1 206 639	133 231	12.4%	610 972	678 715	67 743	11.1%
Inpatient days	7 105 269	6 790 007	-315 262	-4.4%	4 429 329	4 203 771	-225 558	-5.1%

Note: including stays and days of foreign patients (i.e. patients living abroad) with the regional subdivision based on the region of the treatment hospital

2.3.6. *Required bed capacity in 2025*

The concept of normative need for bed capacity

The final step consists of translating the projected number of nursing days in a required number of beds in 2025. For inpatient care, a distinction is made between the following bed indices (see Table 4): C, D, E, M (grouping M and MI - see section 3.5.1), N (grouping N* and NIC - see section 3.5.1), G, I (grouping EI, CI, DI and HI), S (grouping S1, S2, S3, S4, S5 and S6), BR and L.

To translate nursing days in bed numbers, the normative occupancy rate as applied in the calculation of the number of justified beds or staffing standards was used (see also Table 4). Justified beds are a central concept in the calculation of the hospital budget for Belgian hospitals (see KCE Report 229[1] for more information). For N* and S-beds[a], no justified beds are calculated and hence no normative occupancy rate is available. We apply a rate of 75% for N*-beds, in line with NIC (neonatal intensive care) beds, and a 90% rate for S-beds, in line with G-beds. For day care we assumed that a stay equals 1 day and that the day-care centre is open for 250 days a year with an occupancy rate of 100%.

We call the resulting number of beds the *normative need for bed capacity*. The current (2014) and projected (2025) normative need as well as the number of licensed beds in 2014 are given in Table 5, per bed index. In real practice, the number of licensed beds does not necessarily coincide with the number of operational beds, for example because of summer closures or a temporary closure due to renovation.

[a] For S1, S2, S3 and S5 an occupancy rate of 80% (per 30 beds) is used to determine staffing standards.

Overall reduction in need for hospital inpatient beds but increase in day-care places

The baseline projections indicate a reduced need for hospital inpatient beds. Based on the normative bed need, the decrease amounts to about 2 300 beds by 2025 or 5.4%. For day care about 3 700 additional places are needed. If we use the number of licensed beds as point of comparison the downward potential rises to almost 10 000 inpatient beds or about 20% of current capacity.

Table 4 – Normative occupancy rate by bed index

Normative occupancy rate	Bed index
70%	E (paediatric services); M (maternity services)
75%	N (neonatal services)
80%	C (surgery); D (internal medicine); I (intensive care); L (contagious diseases); BR (burns)
90%	G (geriatrics); S (chronic care)
100%	Day care (assuming 250 working days)

Note: M (grouping M and MI), N (grouping N and NIC), I (grouping EI, CI, DI and HI), S (grouping S1, S2, S3, S4, S5 and S6) with S1=cardiopulmonary rehabilitation, S2=rehabilitation of the locomotor system, S3=neurologic rehabilitation, S4=palliative care, S5=poly-pathologies and S6=psycho-geriatrics*

Shift from acute to chronic beds

The results in Table 5 show an increase in the normative need for G and S-beds. For both bed types the number of licensed beds in 2014 is not sufficient to absorb this growth.

Both for G and S-beds, the number of licensed beds in 2014 more or less matches use in 2014. The projections indicate an increased need for G (+269) and S-beds (+811). However, the projected increase for S-beds should be differentiated according to the type of S-bed. The increase is concentrated in S2-beds (+24%), S3 (+25.4%) and S6 (+28.4%). The number of S5-beds can be reduced (-27.6%).

It should be kept in mind that D-beds and C-beds are sometimes used as an alternative for G-beds when the latter would actually be more appropriate but are unavailable due to capacity restrictions.

The projection results suggest a levelling out of I-beds, and a reduction in the future needs of the remaining bed types. Remark that the future need for I-beds may be underestimated as a consequence of the followed projection methodology. The majority of hospital inpatient stays (85%) occurs in one bed index. The opposite is true for hospital inpatient stays taking place (partly) in an I-bed. In this case, 90% of the inpatient stays register at least one additional bed type, predominantly C-beds or D-beds. As inpatient days are projected and attributed to bed types, the change in ALOS plays a key role. Its projected evolution is pathology specific, but does not differ by bed type. As it is a likely hypothesis that reductions in ALOS are more difficult to attain in more intensive bed types, it is possible that the baseline forecast underestimates the number of inpatient days spent in I-beds and hence the number of beds. Alternatively, if important reductions in ALOS are equally achieved in I-beds, the counterpart might be an intensification in care needs in C-beds and D-beds. A further exploration of this hypothesis demands a more detailed analysis of intensive care beds utilisation patterns together with a review of the literature.

Oversupply concentrated in maternity and surgical beds

The forecasts demonstrate a particularly important drop for M-beds and C-beds. The former is related to a significant projected shortening of 20% to 25% of hospital time for pregnancies and childbirth in combination with a minor increase in hospital stays. The admission rate for pregnancies and childbirth is not expected to increase in an important way and demographic changes are small (see also section 3.5.4). The phase-down of C-beds is the result of important reductions in ALOS for surgical treatments and the substitution to day-care activity. The projected scaling down of M-beds and C-beds is even more pronounced when comparing with the number of licensed beds.

Table 5 – Number of licensed beds (2014) and current (2014) and projected (2025) normative bed need, by bed index

	Licensed beds 2014	2014	2025	Abs. Δ 2025-2014	Abs. Δ 2025-licensed
Day care					
Medical places		8 784	11 883	3 099	
Surgical places		2 496	3 137	641	
Inpatient					
Total	50 973	42 704	40 413	-2 291	-10 560
D	14 638	13 026	12 533	-493	-2 105
C	14 310	10 114	7 897	-2 217	-6 413
G	7 340	7 246	7 515	269	175
S (S1 to S6)	5 439	5 080	5 891	811	452
M	3 176	2 545	2 113	-432	-1 063
E	2 651	1 951	1 763	-188	- 888
I	2 026	1 784	1 781	-3	-245
N (=NIC, N*)	1 311	895	864	-31	-447
L	38	33	30	-3	- 8
BR	44	30	26	-4	- 18

Source licensed beds: FPS Health
Note: Including bed capacity for foreign patients. Bed capacity in isolated categorical hospitals is excluded: normative need in 2014 = 931 S-beds and 56 G-beds; licensed beds in 2014 = 971 S-beds and 52-G-beds and normative need in 2025 = 1 076 S-beds and 46 G-beds. Licensed CD-beds are attributed for 50% to C-beds and for 50% to D-beds

Impact of reconversion of licensed beds between 2014 and 2017

Throughout the Short and Scientific Report licensed beds in 2014 are used because this was the most recent year available in the MZG – RHM database to calculate the actual use of hospital services. However, between 2014 and 2017 the number of licensed beds has changed substantially for some bed types because of reconversions, mainly to G and S-beds. Hence, the largest difference between 2014 and 2017 is found for G-beds and S-beds.

Table 6 shows the total number of licensed beds, as well as the number of licensed G-beds and S-beds on 12/2014 and 02/2017. Excess capacity, comparing the number of licensed beds in 2017 and the projected bed need in 2025, amounts to about 9 300 beds. Current capacity in terms of licensed beds is sufficient for G-beds and S1, S4 and S5-beds. For S2, S3 and S6-beds additional capacity is needed.

As was mentioned before, we know that currently C and D-beds are sometimes used as an alternative for G-beds which qualifies the results somewhat. In addition, when taking into account the ageing peak from 2030 onwards additional G- and S-capacity might be needed (see section 2.5).

The number of licensed beds in 2017 in categorical hospitals amounts to 52 G-beds and 1 009 S-beds which is comparable to the number in 2014 (52 and 971 respectively). For G-beds this is slightly (i.e. 6 beds) higher than the normative bed need in 2025, while for S-beds this is 119 beds below the normative need in 2025. When the number of licensed S-beds in 2017 is compared with the normative bed need in 2025 per type of S-bed, it can be observed that there is an overcapacity for S1 (7 beds); S4 (2 beds) and S5 (13 beds), an undercapacity for S2 (109 beds), S3 (31 beds) and a match for S6-beds.

In any case, recommendations concerning future capacity need by bed type should be based on the recent numbers for 2017.

Table 6 – Number of licensed beds (2014 and 2017) and projected (2025) normative bed need: total, G-beds and S-beds

Bed type	Licensed beds 12/2014 (A)	Licensed beds 02/2017 (B)	(B) - (A)	Projected bed need 2025	Abs. ∆ 2025-Licensed beds 2017
Total*	50 973	49 721	-1 252	40 413	-9 308
G (geriatrics)	7 340	7 772	432	7 515	-257
S (chronic care)	5 439	5 802	363	5 891	89
S1	412	449	37	376	-73
S2	2 291	2 497	206	2 646	149
S3	1 014	1 053	39	1 199	146
S4	373	373	0	351	-22
S5	662	671	9	460	-211
S6	687	759	72	858	99

**Total refers to all bed types, not only G-beds and S-beds; S1=cardiopulmonary rehabilitation, S2=rehabilitation of the locomotor system, S3=neurologic rehabilitation, S4=palliative care, S5=poly-pathologies and S6=psycho-geriatrics*

Importance of demographics and mobility trends of patients across regions in planning hospital capacity

A regional division of licensed and normative bed need shows the importance of the size and composition of the population in the three regions and of mobility trends of patients between regions. In Flanders the high and increasing need for S and G-beds dominates the picture. The population in Brussels has a stronger need for M and E-beds. Given the decrease in ALOS, the normative need for M and E-beds reduces in all regions, but the projected decrease in M-beds will be much smaller in Brussels and forecasts indicate a status quo in the need for E-beds. Moreover, in Brussels the projections indicate a rise in the need for chronic (S-)beds and at the same time a decline in the number of G-beds. This indicates that the increase in chronic beds is not solely related to population ageing, but also to a shift from acute care beds to chronic care beds. Detailed results can be found in Chapter 1 in the Scientific Report.

In comparing the normative bed needs with the number of licensed beds in 2014, it should be kept in mind that the first is based on the place of residence of the patient and the second on the location of the hospital. Especially for Brussels this difference is important, since a substantial part of patients treated in hospitals located in Brussels lives in Flanders or Wallonia (for example, for 62.3% of all inpatient stays in Brussels hospitals the patient's residence is Brussels; for Flanders (96.5%) and Wallonia (97.5%) this percentage is much higher). The number of licensed (inpatient) beds is well-above the current and projected bed need in Brussels: 7 137 licensed beds versus 4 521 normative bed need in 2014 and 4 197 projected for 2025. In the other regions the gap (in %) is much smaller.

When allocating bed capacity to the regions, several factors should be taken account of, such as patient flows between regions, but also the location of supraregional care assignments (because this will bring about other patient flows) and the treatment of foreign patients.

2.4. Accelerated substitution from inpatient to day care

The steady growth in day-care activity between 2014 and 2025 in the baseline model is a continuation of past trends in substitution from inpatient to day care (2006-2014), which are partly the result of policy actions that were taken in that period. An example is the introduction of some lump sum payments for day care and chronic pain in 2007.[23] In KCE Report 282 it has been shown that a number of factors such as new payment rules, developing clear clinical guidelines and pathways or expanding the availability and expertise of community care could substantially increase day-surgery rates.[2]

The baseline forecast results project an important increase in day-care activity that, at least partially, stems from substitution from inpatient and ambulatory care to day care in continuation of historic evolutions. The realisation of the substitution effects incorporated in the baseline hinges upon the continuation of past and current policies. In this section the impact of an enhanced substitution between hospital inpatient care and day surgery on the global need for acute hospital services is evaluated, on top of the substitution included in the baseline. Remark that the proposed policy change is limited in scope, since surgical day care covers about 22% of total day-care activity in Belgium. The results of this scenario-analysis have to be compared with the baseline forecast results.

Gradual shift from inpatient to day surgery for a selection of 134 surgical procedures

Surgical procedures that meet the following criteria were selected:

- Substitution from inpatient to day care should have a noticeable effect on the number of nursing days and beds: the surgical procedure was performed on average 400 times per year in the 2011-2013 period either in an inpatient or day care setting and at most 90% of the cases were performed in day care;
- The surgical procedure can safely be performed in a day-care setting: at least 5% of cases in 2011-2013 was performed in day care and experts have not qualified the procedure impossible to perform in day care.

For the 134 selected surgical procedures, the day-surgery rate in 2014 was stepped up to a predetermined threshold. In a first scenario, the threshold equals the national proportion of the surgical procedure performed in day care over the period 2011 to 2013 by hospitals that performed at least 10 of these procedures in that period. The second scenario has a more ambitious substitution objective with the threshold set at the P75 value. The substitution effects are gradually superadded to the baseline results over the period 2018 to 2022 (at a cumulative rate of 20% per year). From that point onwards the policy will have reached its full potential.

The 'accelerated' substitution from inpatient care to day surgery was limited to stays with an SOI of 1 or 2 and preference was given to inpatient stays with a low ALOS. Hospitals with a proportion of day surgery above the scenario-specific policy threshold (national proportion or P75) are considered not affected by the policy incentives. No additional substitution on top of the baseline trends was modelled for these hospitals. For hospitals below the threshold for a specific procedure, the substitution potential, i.e. the number of inpatient stays to be shifted to day surgery in order to surpass the scenario-specific policy threshold, was quantified. More details on the selection procedure can be found in Chapter 1 in of the Scientific Report.

Potential impact on normative need for bed capacity is very limited

Depending on the scenario (scenario 1: national proportion; scenario 2: P75), 16 000 or 27 000 inpatient stays are expected to shift to day care by 2020. By 2025, this substitution will be 24 500 or 40 000 stays which corresponds to 1.3% or 2.2% of inpatient stays in 2014. Expressed in terms of day-surgery stays, this policy scenario contributes to a non-negligible increase of 3.9% or 6.4% stays on top of the important increase projected in the baseline results.

The reduction in the number of inpatient days is of the same magnitude as the number of substituted inpatient stays.

The reduction in the number of inpatient C-beds (surgical beds) is very limited: 84 beds in scenario 1 and 140 beds in scenario 2. Other bed types are hardly affected.

2.5. Accelerated ageing from 2030 onwards

Already today the ageing population has an important influence on the required hospital capacity. Yet, to anticipate on the real demographic peak in elderly that will appear from 2030 onwards, a scenario of accelerated ageing is described in this section. After all, it makes no sense to reduce hospital capacity based on trend analysis with a horizon 2025 when, for instance, it five years later it would turn out that more capacity is needed. The objective of the scenario analysis of accelerated ageing is to uncover and emphasize potential pressure points in the long(er) term.

An ageing (hospital) population

The number of elderly (75 years or older) in Belgium is increasing rapidly (8.9% of the Belgian population in 2016, expected to be 10% in 2025, 12,5% in 2035 and 14,4% in 2045).[24] Although about 60% of people in the age group of 75 years and older rate their health status as good, there is a growing burden of multiple conditions.[25] This evolution will challenge our healthcare system because there will be a rising demand for services, services that will also have to be redesigned to meet the changing needs of persons with often multiple chronic conditions.[26] With the ageing population, also the hospital population is ageing. Older patients (75 years or older) now account for 25% of total inpatient stays (anno 2014), which is expected to increase to 28% in 2025. The capacity use is even more pronounced when expressed in inpatient nursing days: from 43% in 2014, to 46% in 2025. The proportion of hospitalised patients in this age group with a geriatric profile is high (estimates in the order of magnitude of 30% to 60%).[26]

The real challenge of ageing is expected from 2030 onwards

To incorporate the ageing peak from 2030 onwards two scenarios (each with a different acceleration speed) of accelerated ageing were developed. In both scenarios adjustments are made in the makeup of the population (from 2017 onwards):

- For scenario 1 the pace of ageing from 2017 onwards is doubled to be (for the 2025 estimates) in line with the projected demographic evolution up to 2034.

- In scenario 2 the pace of ageing from is tripled to be (for the 2025 estimates) in line with the projected demographic evolution up to 2043 (see Chapter 1 of the Scientific Report).

Only adjustments are made for the makeup of the population, not for population size. This allows the evaluation of the effects of population ageing on hospital care use, independent from the effect of the change in population size on care use. The trend projections for ALOS and admission rates remain the same and correspond to the matching baseline projection year.

In both scenarios, an increase in the population share of individuals aged 75 or more is observed, compensated by a decrease in the population share primarily of individuals aged between 40 and 60. Moreover, at the end of the planning horizon it is also compensated by a decrease in the population share of individuals aged between 60 and 75.

Hospital activity increases sharply

The number of inpatient and day-care stays both increase in case of accelerated population ageing, but the impact on inpatient stays is more pronounced. The different impact is most noticeable when comparing the results for both scenarios in baseline projection year 2025. In 2025, both scenarios differ significantly on the number of oldest elderly, i.e. the above 85 year olds. This is associated with a clear difference in the projected number of inpatient stays in both scenarios: an additional 93 000 inpatient stays are projected in scenario 1 above the baseline, whereas in scenario 2 the difference rises to 168 000. For day-care activity on the other hand, the evolution in scenario 1 and 2 is more similar: 91 000 and 110 000 stays for scenario 1 and 2, respectively.

Hospital inpatient days show a deviation from the trend once the accelerated ageing is introduced. Where the baseline results projected a decline in inpatient days (638 000 days or 4.9 % of 2014 days when including foreigners, see Table 3), both ageing scenarios show an increase in days (447 522 days or 3.5% in scenario 1, 1 445 169 days or 11.2% in scenario 2). This emphasizes the power of the leverage effect of an increased number of elderly on the Belgian hospital system.

Population ageing has a stronger impact on inpatient stays with long duration and need for G- and S-beds

The growth in inpatient stays related to population ageing is most pronounced for inpatient stays with a long duration. Again this is not surprising given that older patients are more likely to have more co-morbidities, a higher severity of illness and hence longer hospital stays. The ALOS of all inpatient stays can be computed as the ratio of inpatient days to inpatient stays. For the baseline forecast results, the ALOS in 2025 is 5.9 days, the additional stays due to population ageing have an ALOS of 11.7 days in scenario 1 and 12.4 days in scenario 2.

In line with the baseline forecasts, but much more pronounced, the normative need for S-beds and G-beds is projected to increase: 25% up to 51% for G-beds, i.e. 22 and 47 percentage points above the baseline forecasts and 27% up to 36% for S-beds or 11 and 20 percentage points above the baseline forecasts.

For both bed types, normative need in 2025 in acute hospitals is much higher than the number of licenced beds in 2017 (scenario 1): for G-beds there is a difference of 1 308 beds; for S-beds the difference amounts to 669 beds. Also in categorical hospitals the expected need in 2025 is higher than the licensed beds (2017): 4 G-beds and 196 S-beds.

Population ageing additionally leads to an increased need for D-beds, C-beds and I-beds (potentially representing a latent additional need for G-beds). Yet, even when the ageing scenario is taken into account, an overall overcapacity is expected of 5 832 beds (all bed types, scenario 1).

2.6. The capacity of geriatric hospital beds: the case of dementia

2.6.1. Capacity needs will intensify in the future

Capacity problems in geriatrics are a known and long-standing issue with some improvements during recent years

Acute geriatric wards (G-wards) are discrete wards with a coordinated specialist multidisciplinary team and are considered as the gold standard[27, 28] to deal with hospitalised patients with a geriatric profile. The programming standard for geriatric care beds (i.e. 6 G-beds per 1 000 inhabitants of ≥65 years) results in 12 775 beds (anno 2017). In Belgium there are (anno 2017) 101 acute hospitals with 7 772 licensed geriatric beds and 1 isolated geriatric/chronic hospital with 52 licensed geriatric beds. The total of 7 824 geriatric care beds is thus 38.8% below the programmed number of G-beds. Although this programming standard might be outdated (e.g. people stay longer in good health which may be an argument to increase the age of the target population) it is an indication of capacity problems. Another indication of a too low capacity of G-beds results from the comparison between 'justified G-beds' (i.e. the beds for which the hospital budget allocates money to the hospital based on its activity profile) and the licensed G-beds. It was indicated before that there are more justified than licensed G-beds.

Moreover, based on the trend analysis it is expected that the need for G-beds will continue to increase. The hospital sector transformed during recent years other bed types in G-beds. As a result, between 2014 and 2017 the capacity of G-wards in acute hospitals rose with 432 G-beds. Compared with the normative need in 2025, this even results in an estimated overcapacity of 257 G-beds. Yet, it is important to note that the number of G-beds estimated based on the trend analysis is based on the current use of G-beds. In other words, if many patients with a geriatric profile are currently not treated on G-wards, as was clearly demonstrated before, this relative underuse of G-beds will be sustained in the projected number of required G-beds.[26]

Hospital capacity use of patients with dementia: a case to identify 'lessons learned' for this growing patient group

In this part of the Short Report, we will further explore the hospital capacity use of people with dementia. This sub-group of older patients was chosen because it represents a large and growing group of people. Indeed, although exact figures are not available it is estimated that, in Belgium, about 200 000 persons have dementia.[29] Important note is that all prevalence numbers (i.e. dementia in society and hospitals) are underestimates since many people with dementia are often not diagnosed as such.[30]

In addition, it is known to be a patient population with high care needs often resulting in a high use of hospital capacity services.[31] In this report we looked in particular at the prevalence of patients with dementia in acute care hospitals and their hospital use (based on a literature review and an analysis of Belgian administrative databases) and the effectiveness of interventions to avoid or reduce hospital use by patients with dementia (based on a literature review). Although patients with dementia are not covering the entire 'geriatric population' many of the observations also might apply on frail older patients, in general.

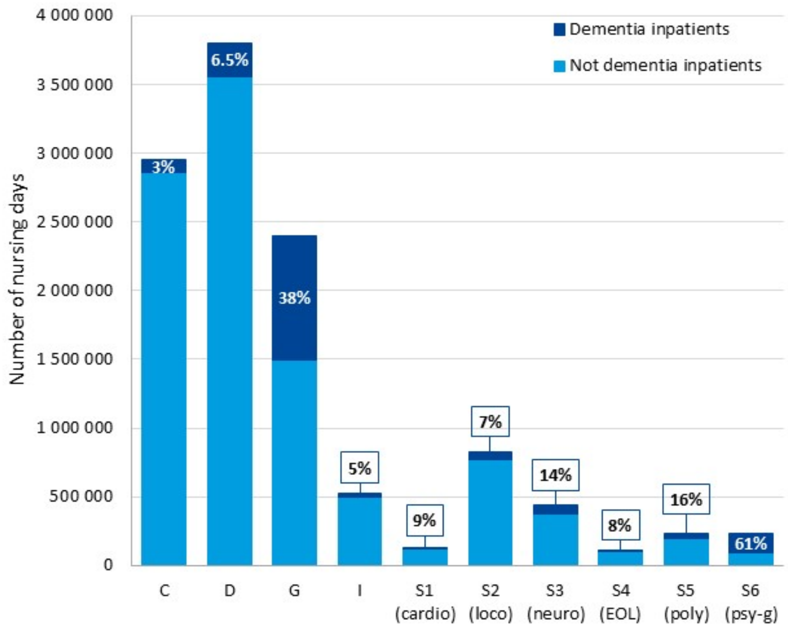
Dementia patients are more frequently hospitalised

It is well documented in the literature that patients with dementia have a higher risk of hospitalisation (about 1.4 to 3.6 times higher) compared to patients of a similar age without dementia.[32] Also in Belgium we see a yearly increase (about 3%) in the number of hospitalisations for people with dementia amounting to 97 208 patient stays in 2014: 83 017 inpatient stays and 14 191 day-care stays. These stays correspond to a total of 1 612 456 nursing days (12.3% of the total number of days for people aged 40 or above). Most patients are female (64%) and patients with dementia have an average age of 82 years.

Dementia patients are often admitted via the emergency department and frequently stay on a geriatric ward

If we look at the capacity use of the inpatient stays, we observe that 80% of patients with dementia is admitted via the emergency department and that in 60% of the inpatient stays at least a part of the stay takes place on a G-ward. But in 37% and 16% of the inpatient stays at least a part of the stay takes place on an internal medicine (D-beds) or surgery ward (C-beds), respectively. In Figure 8 it is shown that patients with dementia account for 61% and 38% of the nursing days on psychogeriatric and acute geriatric wards, respectively. But also on other wards (e.g. 6.5% of nursing days on internal medicine) a portion of the nursing days concern patients with dementia.

Figure 8 – Number of nursing days per bed type for patients with and without dementia



EOL (end of life): palliative care

The non-negligible number of patient stays on non-geriatric wards is not a surprise given that in 78% of the stays, dementia is not the primary reason for the hospital admission. Patients with dementia are often admitted for other reasons than dementia itself such as ‘femur fracture’; ‘heart failure’; ‘pneumonia’; ‘functional decline’, ‘urinary tract infection’ and treated on other types of nursing wards. Although a substantial share of these patients would benefit from a stay on a G-ward (for example, a multidisciplinary geriatric approach for a faster functional rehabilitation), the capacity problems prevent this. To deal with this growing problem, the Belgian authorities supported the development of inpatient geriatric consultation teams which have as main objective to share the core geriatric principles and multidisciplinary expertise to all medical staff and care teams of non-geriatric wards. An evaluation of these inpatient geriatric liaison teams demonstrated their potential but also showed many weaknesses. The most prominent limitation is the underuse (i.e. the demand for geriatric expertise clearly outweighs the supply of available resources) which is partly related to the budgets mobilised but certainly to the shortage of geriatricians and nurses with a special expertise in geriatric care.[26] This problem of underuse is also documented in the current report. Only 13% of the patients with dementia that are hospitalised on non-G wards (n=33 829 in 2014) receive a geriatric consultation.

When dementia patients are hospitalised they stay for a long period

Although the average length of stay for patients with dementia has decreased from 21.4 to 19.1 days between 2010 and 2014 (possible indication for improved efficiency) the overall number of nursing days still increased by 0.13% from 1 610 379 to 1 612 456 days. In other words, without major change, these recent trends indicate that the more people with dementia there are, the more pressure there will be on hospitals. Furthermore, the overall length of stay for patients with dementia is consistently higher across APR-DRGs compared to patients of a similar age but without dementia (e.g. APR-DRG 301 ‘Hip joint replacement’ severity of illness 1 or 2: 18 days for older (≥75 years) patients with dementia compared to 14 days for older patients without dementia). This observation is in line with the international literature. One explanation is that patients with dementia are more prone to complications (e.g. falls, delirium, urinary tract infections.[33] Another explanation is that, although there are no medical reasons to keep the patient with dementia in the hospital, a discharge is delayed because of difficult discharge arrangements.[31]

Long length of stays were particular seen in patients that are discharged to a residential care setting. Although several issues (e.g. worse medical condition) might explain these large (but slightly decreasing) differences, it is suspected that difficult discharge arrangements are an important explanation for a difference of 11.4 days in 2014 (27.2 days compared to 16.8 days). When comparing the patients' region the difference is the largest in Flanders: 15.5 versus 28.2 days in Flanders; 15.8 versus 25.6 days in Wallonia; 17.3 versus 24.9 days in Brussels.

Are there areas where the use of hospital capacity can be improved?

Based on the literature review as well as on the Belgian data analyses there are some indications of inappropriate use of hospital capacity. First, persons with dementia are considered as frequent emergency department (ED) users. The ambulatory ED visits are out of scope of the current study but it is discussed in extenso elsewhere that an important portion of these ED contacts do not require emergency care and could be avoided.[34] As described above, 80% of patients with dementia that are hospitalised enter the hospital via the emergency department of which 40% is referred by his GP. The admission policy for this patient groups (for example walk-in geriatric consultation, geriatric assessment unit, a hospital admission from home or nursing home without emergency contact) needs to be scrutinised to investigate whether the pressure on the already strained emergency department could be reduced.

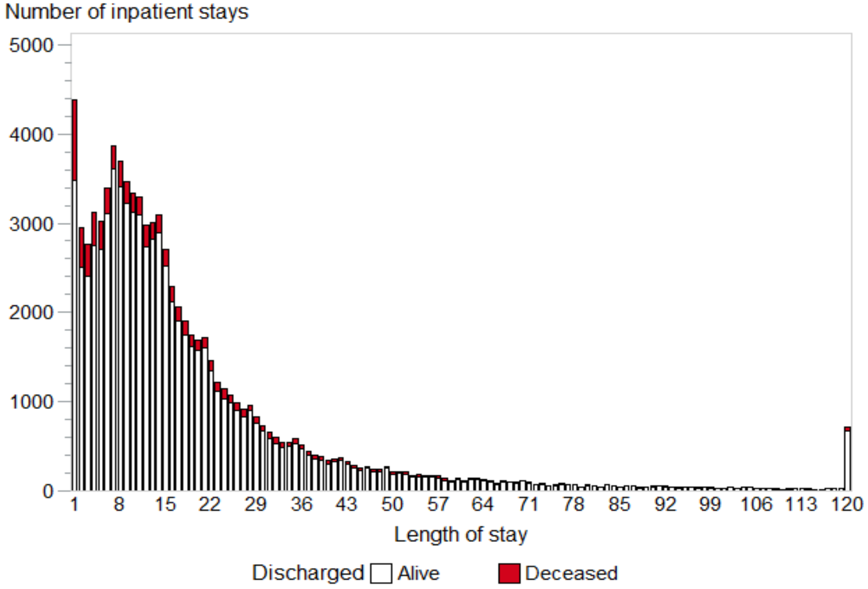
Secondly, in the literature a substantial part of hospital admissions is called 'ambulatory care sensitive conditions' and seen as, in theory, avoidable. This concerns admissions for conditions that can, if appropriate care services are available, be dealt with outside the hospital, for example diabetes mellitus, pneumonia, urinary tract infection, dehydratation, pressure ulcers, COPD. Yet, an international consensus on which conditions can be considered as ambulatory sensitive conditions and how they should be measured is lacking.[35] In addition, the assessment if a hospitalisation can be avoided cannot be restricted to a medical assessment, which is often the case in the available literature; also an assessment of the social circumstances are of utmost importance. If a patient has, for instance, no informal caregiver then a 'minor' fall, or other 'minor' event can be an understandable reason to go the hospital ED and it is also understandable that hospital professional caregivers decide in such circumstances to admit the patients in case of lack of suitable available alternatives (e.g. rapid access to a nursing home for a temporary stay). Nevertheless, it is clear that this is an area with large potential gains that should be further investigated.

Third, the end-of-life hospital use is considerable among patients with dementia.[36] A Belgian study[37] showed that 19.5% of nursing home residents with dementia were hospitalised in the last month of their life. From the current study it is clear that in-hospital mortality for patients with dementia often occurs in the first day(s) after admission (see Figure 9).

Fourth, hospitalisations for patients with dementia frequently concern (unplanned) readmissions. Reviews consistently report higher readmission rates within 30 days for people with dementia (readmission rates are between 1.5 to 2 times higher).[38, 39]

There are no indications that these observations are different for frail elderly in general.

Figure 9 – Length of stay for patients with dementia: deceased and alive



2.6.2. A plethora of interventions to reduce hospital use are described and tested: but do they work?

There is plethora of interventions believed to have an impact on hospital use by patients with dementia, varying from improvements in home care, primary care and residential care to improvements at the front door of the hospital, interventions during the hospital stay, at the back door and after hospital discharge to whole healthcare system changes. Making sure older patients with dementia are not hospitalised or stay in hospital no longer than necessary is a complex issue that requires a coordinated response from hospitals, organisations for elderly, primary and social care. Yet, for practical reasons we structure the evidence in this section as follows: interventions aimed at avoiding hospitalisations and interventions aimed at shortening hospital stays.

An important restriction of the evidence review is that we only evaluated the effectiveness on hospital use. Therefore, if we state that there is no or inconclusive evidence for an intervention it only applies to hospital use and not to other outcomes (e.g. mortality, patient satisfaction, quality of life). Although in many cases direct proof of evidence is lacking, it may never be the case that interventions should not be given, because of a lack of demonstrated effect on hospital use, when these interventions are recommended and regarded as good clinical practice given their proven positive effects on other outcomes, such as mobility, patient satisfaction, delay of institutionalization or quality of life.

Keep dementia patients (and by extension frail elderly) out of the hospital if possible

While there is a clear awareness of the need to discharge patients with dementia from hospital sooner, there are currently far too many patients with dementia in hospitals who do not need to be there. Although in many cases direct proof of evidence is lacking, most promising interventions to reduce hospital admissions of dementia patients seem to be to improve care for dementia patients in primary (e.g. enabling GPs to access specialist opinion to help them manage patients in the community and avoid unnecessary referral)[40] and residential care settings by more specialised nursing and medical staff and by more support and liaison services for them and for informal caregivers.[41] The interventions for which there is better evidence are community-based palliative care[42] and advanced care planning in nursing homes[43] and specialised dementia care units in residential care settings.[44] When designing interventions that aim to reduce avoidable hospital admissions it seems to be important that gaps in services are addressed rather than that services are duplicated.[40]

In case of hospital admission mobilise geriatric expertise

Keeping patients with dementia in hospital longer than necessary can result in worse outcomes (e.g. functional outcomes such as bathing and dressing) and even increase their long-term care needs.[45] In addition, it also puts an additional pressure on the financial sustainability of the Belgian hospital sector. With the increase in the number of patients with dementia (and older patients in general) it is critical to minimise the length of time spent in the hospital. This can be achieved by minimising delays for those who are admitted. Of course premature discharges (discharge before the patient is clinically ready) should be prevented: patients are not discharged from hospital before they are clinically ready. Nevertheless, the review of in-hospital interventions targeting the reduction of hospital stays specifically in the group of patients with dementia, showed that there is in general no or weak evidence of an effect. However, indirect evidence (interventions targeting frail older patients in general) exists for interventions were specific geriatric expertise is mobilised such as geriatric assessment wards (as an alternative for ED admissions)[46, 47] and ortho-geriatric wards (a co-management model between a geriatrician and a surgeon)[48, 49] As such, there seem to be indications to, besides an investment in increased acute geriatric ward capacity (the gold standard), further develop and evaluate alternative care models where the geriatric expertise is mobilised.

2.7. Discussion

2.7.1. Future capacity needs dominated by ageing population and chronic conditions

Close down redundant hospital capacity and partly turn it into beds and types of care for old and chronically ill people

The analyses have shown that population ageing, especially from 2030 onwards, will pose challenges in terms of hospital capacity. However, a comparison of the number of licensed beds in 2014 and the projected normative need for bed capacity reveals that, even in the scenario of accelerated ageing, current capacity will be sufficient or even exceeding demand, except for chronic care (S) and geriatric care (G) beds. Inpatient hospital admissions of elderly are an important current and future pressure point. Moreover, the current mismatch is probably an underestimate because D and C-beds are sometimes used as an alternative for G-beds. In addition, the normative bed occupancy of 90% for G-beds is rather high, given that also on G-beds the length of stay shortens and patient turnover increases. For all other bed types a reduction in the licensed number of beds can be realised. Hence, in the short to medium term a reconversion[b] of (part of) maternity, paediatric, surgical or internal medicine beds to G and S-beds could set off the under-capacity of S and G-beds. This can, of course, only be achieved when there are parallel policy interventions to ensure that a sufficient geriatric workforce (e.g. geriatricians, nurses specialised in geriatric care) is available to staff these additional capacity. The remaining oversupply of hospital beds can be cut down. Of course, the baseline forecasting results assume that the effect of epidemiological trends, the steady improvement in expected healthy life-years at age 65, migration trends, the ongoing development in medical practice, the past substitution rate between hospital care and other care settings, the influence of financial incentives and other policy decisions on admission rates and ALOS remains

[b] The term reconversion does not refer to current legal possibilities for the reconversion of bed types.

constant in the future. This will require a continuous effort from policymakers.

Based on a recent survey it was estimated that about 5% of hospital beds was occupied by patients for whom the medical decision for discharge was taken at least 24 hours before.[50] The majority of these unnecessary occupied hospital beds were G- (28.8%) and S-beds (27.8%) with the unavailability of another appropriate care setting (50%) as main reason. Hence, part of the under-capacity of G- or S-beds could be solved by the provision of more alternative care settings.

Hence, policy should follow two parallel tracks: the closure of excess capacity and investing in geriatric and chronic care beds; and further develop and evaluate alternative care models in (e.g. ortho-geriatric wards) and outside (e.g. community-based palliative care; specialised units within nursing homes; hospital at home) the hospital setting such as or ortho-geriatric wards. This policy should take account of regional needs and capacity.

Day care has the potential to free bed capacity but only with accompanying measures

The baseline forecast results show a substantial increase in day-care activity between 2014 and 2025. The number of day-care stays is projected to increase by more than 33%. Also in the past period 2006-2014 the number of day-care stays grew very fast. Part of this increase can be explained by a substitution from inpatient care. The increase is mainly observed for the medical day-care activity. The projected increase for surgical activity is more modest. Day-care capacity will have to be expanded to accommodate the extra demand. This additional capacity can be provided as a standard day-care activity in a general hospital as well as via more innovative care models such as specialised day-care hospitals focusing on specific service lines (e.g. eye surgery, elective orthopaedic procedures). In addition a shift from day-care to ambulatory care is observed in most western countries. This results in the emergence of additional outpatient clinics, often strategically located to attract patients from neighbouring hospital areas to the own hospital.

Only a limited potential impact was found when current trends in substitution between hospital inpatient care and day surgery were replaced by an enhanced substitution for 134 surgical procedures. If substitution is desirable from a policy perspective, one should consider increasing incentives for surgical procedures that are currently not performed (or very limited) in day care in Belgium, but have good prospects to be performed in day care in the future. For this, one can look at medical practice and experience in other countries (see section 2.3.2).

2.7.2. *Some lessons learned from international experience*

The difficult balance between increasing admission rates and reductions in hospital capacity

In England, France and the Netherlands[c] the number of hospitals and the number of beds in acute structures have steadily decreased during the last decades. These evolutions are the result of political willingness (often stimulated by economic motives) to reduce the excess capacity and to reorganise the supply of care towards more alternatives to inpatient stays. At the same time the number of hospital admissions grew at a faster pace than population changes. Reducing the hospital bed capacity was, therefore, only possible by an increased productivity. Indeed, there was an important shift from inpatient care towards day care and a substantial decrease in hospital length of stay.

Nevertheless, the required and available bed capacity should be closely monitored. The English case clearly indicates that a reduction in bed capacity is not without risks. While a bed occupancy of around 85% is considered to be optimal in the management literature the occupancy rates in English hospitals increased from 85% in 2006 to around 95% in 2016. These high occupancy rates together with higher turnover rates (increased portion of shorter stays) cause capacity problems which escalate during

[c] An extensive description and evaluation of the hospital landscape in these countries can be found in Part III of the Scientific Report.

periods of higher demand – such as winter months. Patient safety and quality problems have emerged.

A real shift from hospital to out-of-hospital care seems necessary but estimated benefits should be kept within realistic proportions

The need to invest more in care models outside the hospital is internationally recognised. However, foreign examples show that estimated savings of new care models are often overestimated by policy makers. While some isolated best-practice examples exist there is no sound evidence for systematic, sustainable reductions of care arising from integration of care. In England, for instance, the high ambitions of the reform plans that aimed to shift the balance from hospital to community care does not translate in better performance measures (e.g. delayed hospital discharges increased with 37% due to capacity problems in nursing homes and community care).[40] One of the reasons is that healthcare providers have large fixed costs. Unless whole wards or departments are closed, shifting some of the activities towards another care setting is insufficient to book large cost savings.

Moreover, avoiding hospital admissions are only possible when sufficient capacity and funding of alternative forms of care in the community are provided. Some lessons can be drawn from an evaluation of the evidence: targeting particular patient populations, appropriately supported and trained staff, addressing gaps in services rather than duplicating services.

Shifting the balance of care from hospitals towards the community has many advantages for patients but it is unlikely that this will save money in the short to medium term. Avoiding hospital admissions and accelerated discharges are, for instance, only possible when sufficient capacity and funding of alternative forms of care in the community is provided.

2.7.3. The importance of good quality data and regular updates of the forecasting model

Planning of hospital capacity or of healthcare capacity in general is challenging for many reasons. In an ideal world the starting point of a projection model is current need for hospital services and the future need is based on demographic projections, expected prevalence of diseases, changing lifestyles and all other factors that impact on this future need. Also technological breakthroughs in medicine will change the future need for hospital inpatient and day care and for other types of care. However, assessing current as well as future need for hospital services requires data and insights that are not (all) available.

The risk of basing the future on past data

Although heavily criticized, planning hospital capacity on the basis of historical and current levels of service provision as opposed to the needs of the population is still the dominant practice in many countries. This approach is mainly driven by the lack of available data on population needs. This way of planning perpetuates existing inefficiencies (over-provision) and unmet need in how healthcare is delivered.

Available data are focused on the actual use of hospital services, in Belgium collected through the MZG – RHM database. These administrative data are then linked to population data to arrive at projections for the future need for hospital services. Even if projections capture evolutions in the size and composition of the population or in disease prevalence relatively well, current overcapacity or unmet need are forecasted into the future.

Population-based needs assessment, including societal changes (e.g. increase in single households), is necessary to estimate whether current use is sufficient to meet current and future healthcare requirements, which can be deduced from estimates of prevalence or incidence of key conditions or from consultation of relevant stakeholders. Although this approach is very demanding at a macro-level, it is feasible in case of specific services (see Part 3 of the Short Report).

The importance of regular updates of the forecasting model

The projection model developed in this study builds upon the model in the 2005 study, in which hospital bed need was estimated for 2015. We compared the population projections in the 2005 model with the official population figures for the forecasting period (2005-2015). The projections substantially underestimated actual population growth. The difference amounts to a discrepancy of about 420 000 individuals or 4% in 2010 and 640 000 individuals or 6.1% in 2015. The deviation between the projections and the actual population size is most pronounced for newborns and children below 10 years of age, with an underestimation of 16% for these age groups in 2015. In fact, Statistics Belgium forecasted a decrease over time in the number of children aged below 10 years of age while an increase is observed.

Although only illustrative, the mismatch between the population projections and real population growth emphasizes the importance of regular updates of the forecasting model. The baseline forecasts assume a continuation of past trends in demographics, policy, innovation, population preferences, etc. Disruptive changes in one or more of these factors should be incorporated in the forecasting model. Continuous monitoring and evaluation is needed to make the forecasting model/tool an effective instrument for planning hospital capacity.

3. THE ROLE OF EVIDENCE-INFORMED PROGRAMMING

As was mentioned in the introduction, some large-scale trends in health services design are emerging, that respond to demand (demographic pressures, expectations, multi-morbidity, etc.) and supply (workforce shortages, new technologies, increasing costs, etc.) pressures. The new landscape is mainly characterised by the following trends: care is moving closer to home, but is also becoming more specialised and concentrated, services are increasingly integrated, and hospital are part of larger collaborations such as clinical networks.

3.1. Typology of hospital services

Underlying these trends is a new typology of hospitals and hospital services. There is a move away from a 'one-size-fits-all' approach with hospitals operating as stand-alone organisations providing the full range of services towards more concentration and task distribution. An important question is which criteria should be used to differentiate between types of hospitals/hospital services, with an important implication for the location and spread of hospitals and hospital services. To put it in concrete terms (and referring to the terminology of the reform plans of the minister – see Box 1): how to classify the care assignments in general, specialised, reference and university assignments?

The triple goal of lower cost, better access, and higher quality

There is no ‘optimal’ spread or mix of hospital services. The classification of care assignments will always illustrate an inevitable trade-off between the societal goals of quality, efficiency and accessibility. However, such classification should ideally be supported as much as possible by evidence from different sources such as data analysis, literature or good practice abroad (see section 3.2).

There is no exhaustive or commonly accepted list of criteria (or weights for these criteria) to classify hospital services in terms of where they should be provided: close to the patient or centralised at a limited number of places.

However, the following criteria emerge from the literature and practice abroad:

- Interventions for time-critical conditions
- Capital intensity (expensive equipment or infrastructure)
- Size and composition of the target population
- Degree of specialisation/complexity
- Available workforce
- Frequency of the intervention (per patient).

The more care assignments are capital intensive, concern non time-critical conditions, demand specialised skills and are provided for a small number of patients or at a low frequency, the more the care assignment could be centralised.

Weight of criteria determines classification into four groups of care assignments

Some care assignments can be clearly allocated to one of the four groups (general, specialised, reference and university), for other care assignments this will require a balancing of lower cost, better access and higher quality. For example, for geriatric patients, proximity to geriatric hospital services is essential. Geriatric patients do, in general, not require expensive infrastructure or equipment and the target group is substantial (and growing). Therefore, geriatric services could be considered a general care assignment, which means that they *can* be provided in each hospital of the loco-regional network, without jeopardizing quality or cost. But shortages in the available workforce may hinder to implement this in all hospitals. For emergency services also access (travel time and distance) is the dominant criterion. However, current low caseloads and small distances between emergency departments raise doubts about the efficient allocation of available resources. There are strong indications that high accessibility to emergency care services can be maintained with less hospital sites having an emergency department.[34] Therefore, basic emergency services (as opposed to specialised trauma care) could be considered a specialised care assignment, and hence be provided in a (more) limited number of hospitals of the loco-regional network.

At the other end of the spectrum, for some rare or complex services (see section 3.3), often requiring highly specialised skills of a multidisciplinary team, or for very costly services, care should be concentrated in a limited number of hospitals. Quality and/or cost are the dominant criteria as well as the availability of expertise (e.g. limited number of physicians of a particular medical sub-specialisation). Distance is of a lesser importance, but patients may ask that transport costs are covered.[51, 52]

However, for some care assignments the allocation to one of the four types is not so straightforward because the choice for one criterion and hence for one of the goals to achieve (cost, quality, access) conflicts with other criteria and goals. For example, in the case of stroke patients there is a clear need to balance concentration of care (i.e. proven effect of acute stroke units on mortality) with transport times given the time-critical nature of the condition. Moreover, after the acute phase specialist multidisciplinary care and rehabilitation is preferably provided within the proximity of the patient.[53]

Even if the allocation to one of the four groups of care assignments is clear, in a second step the number and geographical spread of centres has to be decided. Moreover, the allocation to one of the four groups should be evaluated periodically taking account of new scientific and technological knowledge, expertise and number of patients.

3.2. The concept of evidence-informed programming

Programming and the hospital payment system are federal competencies for hospital capacity planning, defining licensing standards is a federated competency. The focus of this section is on evidence-*informed* programming, but it should be kept in mind that the three instruments should be geared to one another.

Programming is not new in the Belgian hospital context. However, the current mechanism of programming and planning has been criticised because it mainly consolidates historical developments instead of aligning the service offer to the population needs.[1] Given the complexity of the issues involved in hospital redesign it is essential that policy makers know which aspects are supported by evidence. Therefore, a central pillar of the reforms of the hospital landscape is programming based on evidence.

3.2.1. Information used to build policy decisions: evidence on a par with expert opinion?

Use evidence where possible

An analysis of the role of evidence in the Netherlands, France and England revealed that evidence gains importance in the policy process. Although a policy problem (e.g. waiting times, fragmentation of specialised care, poor survival rates) is often raised by front-runners of scientific or professional bodies, it is in many cases a data-driven report that creates a sense of urgency for a policy reform. Examples are cancer survival below international standards resulting in the investment in national cancer plans or drastic epidemiologic (e.g. diabetes and other chronic conditions) and demographic changes (e.g. ageing population) changing policy priorities.

Furthermore, evidence is increasingly used to guide the direction of service reconfigurations (e.g. concentration of care, investing in workforce innovations and new service delivery models, introduction of new technologies). Yet, it should be noted that evidence has its limitations. Evidence is often insufficient to take decisions on service reconfigurations. A good example of this are the volume thresholds that are used to concentrate specialised services. Although the volume-outcome relationship is often clearly demonstrated (e.g. surgery for pancreatic cancer) the optimal volume threshold cannot be determined on the basis of available studies (e.g. because of limitations in the study designs). Therefore, in many of the reforms the evidence is complemented with expert input (e.g. established professional organisations and institutes) to define rules of thumb.

Consulting experts is not the same as expert driven

In the studied countries experts have an important role in the policy process but this does not mean that policy changes are expert driven. The analysis made clear that experts are consulted within a pre-defined framework. They are asked to advice, for instance, on how to fine-tune policy actions where knowledge stops (e.g. which volume threshold for pancreatic cancer surgery). Experts rarely have the lead. Moreover, their advice is often complemented with other more qualitative forms of evidence (e.g. patient expectations, international comparisons). In England, for instance, advisory groups are consulted to define the ‘products’ that are commissioned. These groups have to follow a clear methodology (e.g. topic identification, public consultation, evidence review) which is described in a manual.[54] Another example is the important influence of Dutch scientific medical associations on hospital treatment profiles. For example, they advised the Health Inspectorate to set quality and volume norms for some treatments of complex diseases (i.e. breast cancer, bladder cancer and prostate cancer).[55] These norms are now clearly stated and set in the contracts between providers and health insurers.[56]

Resistance to change emphasizes the importance of using evidence in a transparent and comprehensible way

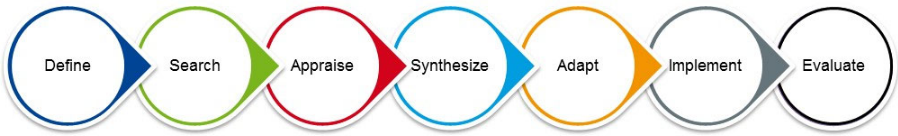
Even the successfully implemented reconfigurations, which were based on a solid evidence base, faced public and political opposition, including use of social media, petitions and public meetings. Since hospitals are a strong symbol of the welfare state, proposed changes to hospital services therefore often create high profile, contentious debates locally, and sometimes nationally.[57] Despite a clear national policy focus to further concentrate surgical and specialised services in England, for instance, there is a strong pressure from local populations to maintain a sufficient wide range of services, even when they are loss-making (services operating below capacity).[58] Nevertheless, where evidence does exist, it should be taken into account, with the knowledge that the relevance of the research evidence is likely to be contested by stakeholders with different perspectives and values.[53] It is therefore crucial to pay close attention to the transparency, and comprehensiveness of the evidence and to align the topics which are studied with the policy priorities of decision makers.[59]

3.2.2. The process of evidence-informed decision making

The aim of evidence-informed decision making is to facilitate policy development and implementation through the use of the best scientific evidence available.[60] The process of evidence-informed decision making can be summarized in seven steps (see Figure 10):

1. Define: clearly define the health problem or issue
2. Search: efficiently search for research evidence
3. Appraise: critically and efficiently appraise the research sources
4. Synthesize: interpret/form options or recommendations for practice or policy based on the literature found
5. Adapt: adapt the information to a local context
6. Implement: decide whether to use the adapted evidence in practice or policy
7. Evaluate: evaluate the effectiveness of implementation efforts.

Figure 10 – Process of evidence-informed decision making



The process presented in Figure 10 can be applied to the new programming plans of the minister. It provides an overarching strategy, ranging from the definition of a hospital service to be programmed (for example, centres for complex surgery for pancreatic cancer) to the evaluation of, for example, quality indicators for selected centres.

Steps 1 to 5, from defining the 'problem' to adapting the available information to the local context, concerns the uptake of research evidence in the policy-making process. These steps are included in sections 3.3 to 3.5 (for complex surgery for pancreatic, oesophageal and lung cancer, radiotherapy and maternity services). We return to steps 6 (implement) and 7 (evaluate) in the final section of the Short Report.

The role of needs assessment in evidence-informed programming

In steps 1 to 5, needs assessment should play an important role in current and future programming. Stevens and Raftery (1994)[61] outlined epidemiological, comparative and corporate methods as three approaches to population-based needs assessment. In the epidemiological approach, estimates of prevalence and incidence of key conditions allow to assess how many people need a specific service or intervention. Although this information is rarely available for all conditions (therefore overall hospital capacity planning is often based on current use), for those conditions where incidence or prevalence information is available, this should be the primary source for current or future capacity planning.

The comparative approach to needs assessment contrasts the services received by the population in one area with those elsewhere. International or interregional comparison of, for example, variations in service use, can contribute to an understanding of population needs. Corporate methods are based on the perspectives of interested parties, including professional, political and public views.

Principal activities involved in healthcare needs assessment are the assessment of incidence and prevalence; the effectiveness and cost-effectiveness of services and knowledge of existing services.[61] Objectives of needs assessment include specifying services and other activities which impinge on healthcare, improving the spatial allocation of resources and the accurate targeting of resources to those in need.

3.3. Complex surgery for cancer of the pancreas, oesophagus and lung

Centralising rare and complex care in reference centres is an internationally accepted best practice

Concentration of care for rare or complex conditions has become a widespread policy in many western countries with quality of care as the most important argument. The idea is that for patients suffering from rare conditions or requiring complex treatments the concentration of care is required to assure that specialist multidisciplinary teams see a sufficient number of patients to be able to develop and maintain expertise and to deliver best outcomes.[53, 62, 63] Typical examples in which concentration of care has proven to be succesful are stroke care services (hyper-acute stroke units)[53] and complex cancer surgery.[64] Yet, the number of specialised services for which concentration takes place is much larger. Some specialised services cover the majority of care for patients with these conditions while for most conditions the specialised services only concern a part of the entire care pathway.

The subject of this section is the concentration of complex surgical treatment of cancers for which a high level of expertise is required. There is a sound evidence base that endorses the need to concentrate complex surgical procedures in reference centres. Indeed, ‘volume-outcome relationships’ have been demonstrated for numerous types of complex surgical procedures for cancers such as oesophageal or pancreatic cancer resections. Both cancers are not so infrequent (around 1 500 new oesophageal and 1 800 new pancreatic cancer cases per year), but only about one quarter of those patients will undergo a surgery. Therefore, oesophagectomy and pancreatectomy can be considered as rare surgical interventions in addition to being complex interventions.

Providing highly specialised and complex healthcare of quality is a challenge which requires careful resource planning. Especially in the case of rare and/or complex cancers, there is a compelling pressure, both from the side of patient organisations and from European authorities to concentrate their management in reference centres, embedded in a ‘shared care’ network model.[16] Stakeholders admit that the well-documented extremely low caseloads for many specialised services in Belgium put too many patients at risk of not getting access to high-quality state-of-the-art care.[1] Whenever it has been studied in Belgium, the relationship between volume and outcomes has been confirmed.[65-67] Concentration is, however, not only a means to get skilled and experienced physicians but it is also required to get expertise and specialist input from the entire multidisciplinary team throughout the whole care continuum.[1] Reforms aiming at concentration are based on the ‘practice makes perfect’ principle: physicians and multidisciplinary teams with more of these patients develop greater skills which contributes to better outcomes.

Necessary preparatory work is done

The Belgian legislator provided a law regulating care for oncology patients via ‘the care programme for oncology care’. Hospitals can be licensed as having a:

- ‘Care programme for basic oncology care’ that focuses mainly on diagnosis and less complex treatment. In January 2017, 83 out of 204 acute hospitals sites had a care programme for basic oncology care.
- ‘Oncology care programme’ that has to offer more advanced diagnostic options as well as various therapeutic possibilities. The number of care programmes that can be installed at that organisational level is not limited. In January 2017, 76 out of 204 acute hospital sites had such programme.
- In addition, the law allows the development of ‘specialised care programmes’ for patients with cancers that need a complex multidisciplinary approach and/or extremely specialised expertise and/or that are very rare. The current study fits in this context.

Preparatory work to enable the implementation of reference centres in Belgium was done in KCE report 219.[16] For fourteen different groups of rare and/or complex cancers, multidisciplinary working groups convened to specify and detail the preferred model of reference centre for their discipline.

The working groups detailed the list of specific criteria that have to be fulfilled by a hospital that would like to become a reference centre, including human resources and team requirements, multidisciplinary management, required facilities and equipment, patient-centred care, quality assurance research and other scientific activities, teaching and dissemination, and minimal volume of patients.

3.3.1. Scope and research objective

The objective is to formulate recommendations on the required number of reference centres for complex surgery for pancreas, oesophageal and lung cancer, now and in the future (horizon 2025), on the basis of volume thresholds. In the Scientific Report also other criteria that should be met by reference centres are described. In the reform plans of the minister, it is mentioned that care assignments that are not provided in each loco-regional network will be provided at the super-regional level by 'reference points'. To be in line with the international literature, we use the term 'reference centres' instead of reference points throughout this section, as this term is more commonly used.

3.3.2. Research evidence

The research evidence consists of previous KCE reports, analysis of international practice and Belgian data:

- For the analysis of the international practice, a grey literature search was performed by looking at official/national websites of the selected countries (i.e. France, England, the Netherlands and Denmark) in order to update KCE Report 219.[16] The analysis focuses on the approach taken in the selected countries for determining volume thresholds and on implementation characteristics.
- The Belgian Cancer Registry (BCR) made incidence data (2005-2014) for the three cancers available. Incidences are reported for all patients with a known incidence date and having a Belgian residence at time of diagnosis.
- To select cancer patients undergoing a resection, the BCR database was linked to the IMA – AIM (Intermutualistic Agency) database containing reimbursed procedures, gathered from all seven Belgian health insurance companies. The following inclusion criteria were applied to the linked database:
    - ICD-10 definition for (peri)-pancreatic cancer (C25 + C17.0 + C24.0 + C24.1)[d], oesophageal cancer (C15 + C16.0[e]), and lung cancer (C34);
    - Within a given tumour type, only the first primary tumour diagnosed was kept for analysis.
    - Only surgeries performed within 2009-2013 (2014 for pancreas) were retained.
- IMA – AIM made available the number of resections for all causes without making a distinction between oncologic or non-oncologic indications for these surgical procedures (2006-2015).

3.3.3. Pancreatic cancer

Burden of pancreatic cancer in Belgium

For the 2009-2014 period, pancreatic cancer (ICD-10 code C25) was newly diagnosed in 9 389 new patients; extending the selection to peri-pancreatic cancer (ICD-10 codes C25 + C17.0 + C24.0 + C24.1) gives 11 474 newly diagnosed patients in the same period.

Twenty four percent of patients with a (peri-)pancreatic cancer underwent a surgical resection in 2014.

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[d] Other tumour sites around the pancreas (i.e. C25) were also taken into account to describe 'peri-pancreatic cancer' (i.e. C17.0: Malignant neoplasm of duodenum; C24.0: Malignant neoplasm of extrahepatic bile duct; C24.1: Malignant neoplasm of ampulla of Vater) because if resection is considered, similar surgical intervention techniques as for pancreatic tumours are used. We labelled all these cancers together as '(peri-)pancreatic cancers'.

[e] For oesophageal cancer, the gastro-oesophageal junction (C16.0) was also taken into account for similar reasons as explained in footnote d.

Current practice of pancreatic resections

Table 7 presents the number of pancreatic resections for all causes for the years 2009-2015 and for (peri)-pancreatic cancer patients for the years 2009-2014. In 2014, 58.5% of all resections were for cancer patients. The average number of interventions per hospital slightly increased in recent years and ranged from 8.5 to 10.9 for all causes and from 5.8 to 7.2 for cancer patients. The increase can be explained by the rising number of interventions as well as by the steadily decreasing number of hospitals performing this type of surgery.

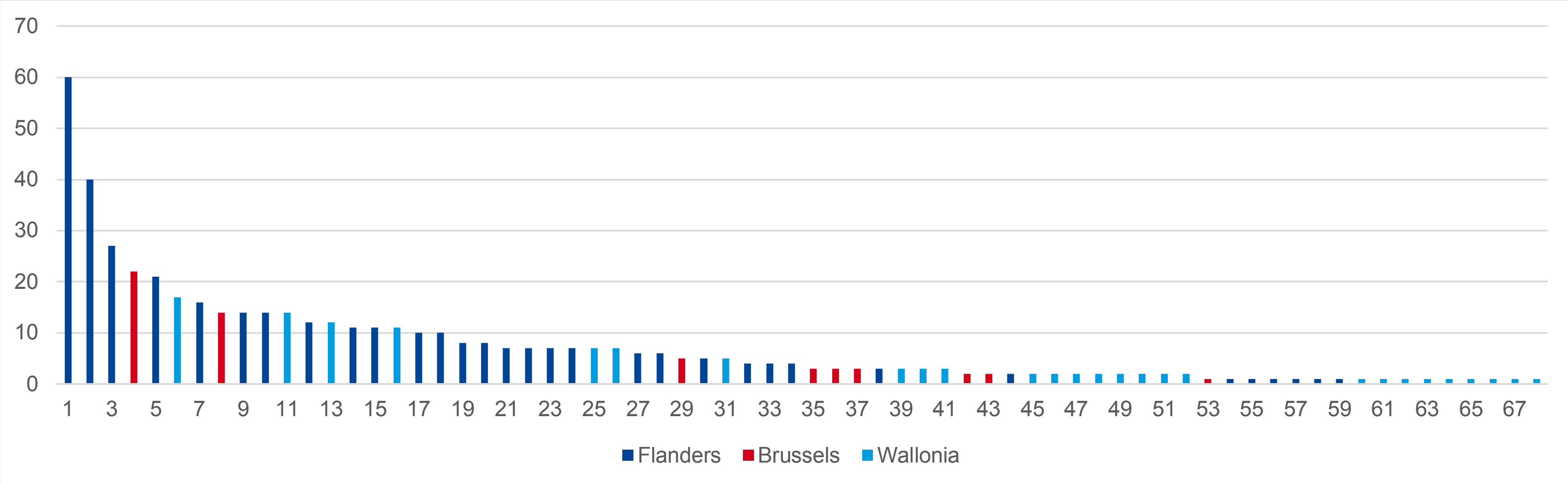
The scattered landscape is illustrated in Figure 11 showing the number of pancreatic resections for (peri-)pancreatic cancer performed in 2014 (492 in total) in 68 hospitals (see also Table 7). Half of the number of interventions was carried out in 11 hospitals.

Table 7 – Overview of pancreatic resections, all causes (2009-2015) and for (peri)-pancreatic cancer (2009-2014)

	2009		2010		2011		2012		2013		2014		2015
	All	Cancer	All	Cancer	All	Cancer	All	Cancer	All	Cancer	All	Cancer	All
Number of interventions	769	447	745	416	810	506	756	453	793	455	841	492	870
Number of hospitals*	90	77	89	73	88	78	86	74	85	72	81	68	80
Average per hospital	8.5	5.8	8.4	5.7	9.2	6.5	8.8	6.1	9.3	6.3	10.4	7.2	10.9
Median	5	4	4	3	4	3	4.5	3.5	5	4	4	3.5	5

**Some hospitals underwent a merger during the study period. The number of hospitals per year is based on the hospitals that were active at the end of the observation period, i.e. in 2014 or 2015.*
Source: All causes: Atlas IMA – AIM[68]; Peri-pancreatic cancer: Belgian Cancer Registry[69]

Figure 11 – Number of pancreatic resections for cancer, per hospital and per region in 2014



Source: Belgian Cancer Registry[69]

Scenarios for the required number of reference centres

In KCE Report 219, the expert group for pancreatic cancer identified minimum volume criteria for reference centres for complex surgery for pancreatic cancer:

- 40 patients/centre/year for onco-surgical approach (including metastatic)
- At least 10 pancreatic resections for cancer per year for a team of 2 surgeons at one hospital site

In the current report, a number of scenarios were developed to identify the required number of reference centres. These scenarios are based on a minimum volume of patients for pancreatic resections and on the period in which this minimum volume has to be achieved. First, scenarios were developed for pancreatic resections performed in cancer patients. Second, scenarios were developed for patients who received a Whipple procedure. A Whipple procedure is a surgical procedure to remove the head of the pancreas. Experts emphasize this is the most complex procedure. Also in the Netherlands the minimum caseload is determined on the basis of Whipple procedures (all causes). Therefore, two scenarios were included for Whipple procedures: for cancer patients and for all patients.

For the patient selection scenarios, the minimum volume was to be achieved in the most recent year for which data are available (to capture the increasing trend in cancer incidence) or on average for the last three years (to select centres that have a more stable caseload).

The number of new diagnoses of (peri-)pancreatic cancer and of the number of resections for the different scenarios are shown in Table 8.

Table 8 – Incidence of (peri-)pancreatic cancer and number of pancreatic resections, by period

	2012-2014	2013-2015	2014	2015
Number of new diagnoses of (peri-)pancreatic cancer	yearly average: 2 003	-	2 105	-
Number of pancreatic resections for cancer patients	yearly average: 467	-	492	-
Number of Whipple procedures for cancer patients	yearly average: 357	-	388	-
Number of pancreatic resections (all patients)	yearly average: 797	yearly average: 835	841	870
Number of Whipple procedures (all patients)	yearly average: 467	yearly average: 481	513	492

(-) = not available. Source: BCR data[69] *and* Atlas IMA – AIM[68].

In Table 9 the number of hospitals that respect the minimum volume threshold for the respective scenarios (different patient selection and period) is given for Belgium and for the three regions. The results should, however, be interpreted with caution. The BCR and IMA – AIM data are available at the level of a hospital and not at the level of a hospital site which is the relevant unit of analysis following the recommendations of KCE Report 219. Hence, when centralising complex surgery for pancreatic cancer into high-volume centres, the caseload should be determined at the level of the hospital site.

The number of hospitals that meet the minimum caseload requirement for complex pancreatic surgery ranges from 2 for Whipple procedures (20 procedures for cancer patients in scenario 6) to 18 for pancreatic resections for cancer patients (2014 in, scenario 2). In scenario 6 there will be no reference centre in Brussels or Wallonia. It can, however, be decided to allow such centre in both regions because of language issues.

Table 9 – Required number of reference centres for pancreatic resections for different scenarios, by region

	Number of reference centres			
	Flanders	Brussels	Wallonia	Total
Scenario 1: minimum of 10 pancreatic resections for cancer patients (2012-2014)	8	2	3	**13**
Scenario 2: minimum of 10 pancreatic resections for cancer patients (2014)	12	2	4	**18**
Scenario 3: minimum of 10 Whipple procedures for cancer patients (2012-2014)	6	2	2	**10**
Scenario 4: minimum of 10 Whipple procedures for cancer patients (2014)	8	2	3	**13**
Scenario 5: minimum of 20 Whipple procedures for all patients (2015; and 2013-2015) (the Netherlands)	3	1	1	**5**
Scenario 6: minimum of 20 Whipple procedures for cancer patients (2014; and 2012-2014)	2	1*	1*	**2 (4)***
Extrapolation from England				**5**
Extrapolation from Denmark				**7**

**Added to have at least one hospital per region (no hospital respected the threshold of 20 Whipple procedures in these regions).*

Volume numbers are low compared to international standards

In *France*, pancreatic resections for cancer must be performed in hospitals that obtained an authorization to perform digestive surgery for cancer (with a minimal threshold of 30 digestive surgery interventions per centre per year). Digestive surgery encompasses surgery of the stomach, oesophagus, liver, pancreas, and colorectal surgery which is a much broader scope than pancreatic cancer only. Therefore, no extrapolations for the Belgian situation were made.

Each person diagnosed with a pancreatic cancer in *England* should be reviewed by a specialised cancer centre. Tests, chemotherapy and radiotherapy treatments can be done at local hospitals, with a review from a specialist centre. Surgery (curative or palliative) should only be done in a specialist centre.[70] According to the contracts of the NHS England, specialist pancreatic cancer centres should serve a population of at least 2 million people or more and there should be at least four to six pancreatic or hepatobiliary surgeons within the team.[71] It should also be noted that at the request of the Department of Health in England (to define the minimum population that should be covered), the association of upper gastrointestinal surgeons of Great Britain and Ireland (AUGIS) made recommendations on a minimum surgeon volume for pancreatic surgery i.e. at least 80-100 pancreatic resections per centre annually. For a team of 6 surgeons, this mean that they should carry out 12-16 pancreatic resections per year per surgeon.[72] Currently, no Belgian hospital performs 80-100 resections. However, when we look at current practice in England, in 2014 there were 24 specialised centres for a total of 8 080 newly diagnosed patients. Applying these figures (8 080/24) to the Belgian context with 1 715 newly diagnosed patients (C25 only) in 2014, gives a total of 5 centres.

According to the 2017 SONCOS standards in *the Netherlands*, pancreatic cancer surgery should be performed by at least two certified surgeons with demonstrable specific expertise in pancreatic cancer surgery. At least 20 pancreatoduodectomy procedures (classic Whipple or pylorus preserving pancreatoduodectomy; all causes) should be performed per centre annually.[73]

In *Denmark*, pancreatic resections for benign and malignant pancreatic tumours (including ampullary and duodenal cancers) must be performed in highly specialised centres. In the new 2017 plan, 4 hospitals obtained such an authorization for a population of 5 707 251 people (January 2016), i.e. an average population of 1 426 813 per centre.[74, 75] To extrapolate this number to the Belgian situation, we used the number of new diagnoses of pancreatic cancer (C25) in both countries in 2014. With 1 715 and 973 new diagnoses in Belgium and Denmark respectively,[69, 76] this would give 7 centres in Belgium.

Defining the minimum hospital caseload

Since the volume-outcome relationship has been most studied and demonstrated for cancer patients, the minimum hospital caseload is preferably applied to cancer patients only. Moreover, a minimum caseload is only one criterion to be fulfilled by reference centres. A multidisciplinary team of recognised clinical and technical expertise in complex cancers should be established. If the minimum caseload is defined on the basis of the number of procedures for all causes, this multidisciplinary team might see insufficient cancer patients to maintain its level of expertise.

Another consideration to take into account when defining minimum caseloads is the fact that experts consider the Whipple procedure to be the most complex procedure. As such, reaching a minimum threshold for the most complex procedure seems important in order to be authorised as a reference centre. Otherwise the data on which minimal thresholds are based may be diluted with less complex procedures. Finally, concerning the period in which this minimum volume has to be achieved, it could be argued that basing the minimum caseload on the number of procedures performed in the most recent year (for which data are available), is not sufficient to guarantee a stable experience, certainly if this number fluctuates substantially from one year to another. Taking account of these arguments reduces the range of the number of centres from 2-18 to 2-13. If it is decided to have at least one centre in each region, the range can be further reduced to 4-13.

Volume matters, also for surgeons

A volume-outcome association for pancreatic cancer surgery has been found not only at the centre level, but also for surgeon volume and outcome indicators, for example mortality.[67] No minimum threshold for surgeon volume for pancreatic resections or Whipple procedures was found in literature. However, in KCE Report 113 on the 'volume-outcome for surgical interventions', a statistically significant inverse association between the volume of surgeons and the 2-year mortality for pancreatic cancer was found: 58% for surgeons performing less than 6 interventions per year and 43% for surgeons performing at least 6 interventions per year. Although the 'practice makes perfect' argument presumes an impact of surgeon volume on outcomes, this has to be further investigated.

Increase in scale of high-volume centres

Concentrating complex surgery also means that current high-volume centres will have to be able to cope with an increase in scale. For illustration, suppose an average of 10 Whipple procedures for cancer patients during the 2012-2014 period is the minimum volume threshold (and all other criteria, besides volume, are met), 10 hospitals will meet the threshold. On average, 175 patients per year underwent a pancreatic resection for cancer in the 10 selected hospitals (reference centres); an average of 182 patients per year were treated in low(er)-volume hospitals. Hence, these patients will be referred to the selected hospitals, which gives an average of 36 patients per centre per year. Of course, in reality there will be no equal spread of patients among the reference centres, but patient management issues should be taken into account in a process of concentration.

Although there are good arguments to base minimum caseloads on cancer patients only (for example, to safeguard the expertise of the multidisciplinary team), there are also good arguments to refer all patients, whether cancer patients or not, to a reference centre for a pancreatic resection. This certainly is the case for non-cancer patients undergoing a Whipple procedure, given its complexity. Therefore, an increase in scale and subsequent patient management become even more important.

Horizon 2025: more reference centres or more patients per centre?

According to the Belgian Cancer registry, the number of patients diagnosed with pancreatic cancer is expected to rise from 1 715 in 2014 to more than 2 600 by 2025, due to a combination of ageing and growth of the population and an increase in cancer risk over time in males and females.[77] Applying the current percentage difference in new diagnoses of pancreatic cancer and peri-pancreatic cancers for the 2012-2014 period (i.e. +21.5%), gives an estimated number of 3 267 patients diagnosed with a peri-pancreatic cancer in 2025.

It is nevertheless difficult to predict how many pancreatic cancer patients will be eligible for surgery in 2025. Assuming the same percentage as in 2012-2014 (about 24%) gives 783 resections in 2025, as compared to 492 in 2014. Using the same illustration as above, this means that for the 10 reference centres the number of patients will (on average) increase from 36 to 39 patients per centre per year.

3.3.4. Oesophageal cancer

Burden of oesophageal cancer in Belgium

For the 2009-2013 period, oesophageal cancer (ICD-10 code C15 and C16.0) was diagnosed in 6 906 new patients.

In 2013 a resection was performed in 26% of patients with an oesophageal cancer.

Current practice of oesophageal resections

Table 10 presents the number of resections for all causes for the years 2009-2015 and for oesophageal cancer patients for the years 2009-2013. In 2013, 79.1% of all resections were performed in cancer patients. The average number of interventions per hospital slightly increased in recent years and ranged from 6.8 to 9.1 for all causes and from 5.8 to 6.1 for cancer patients.

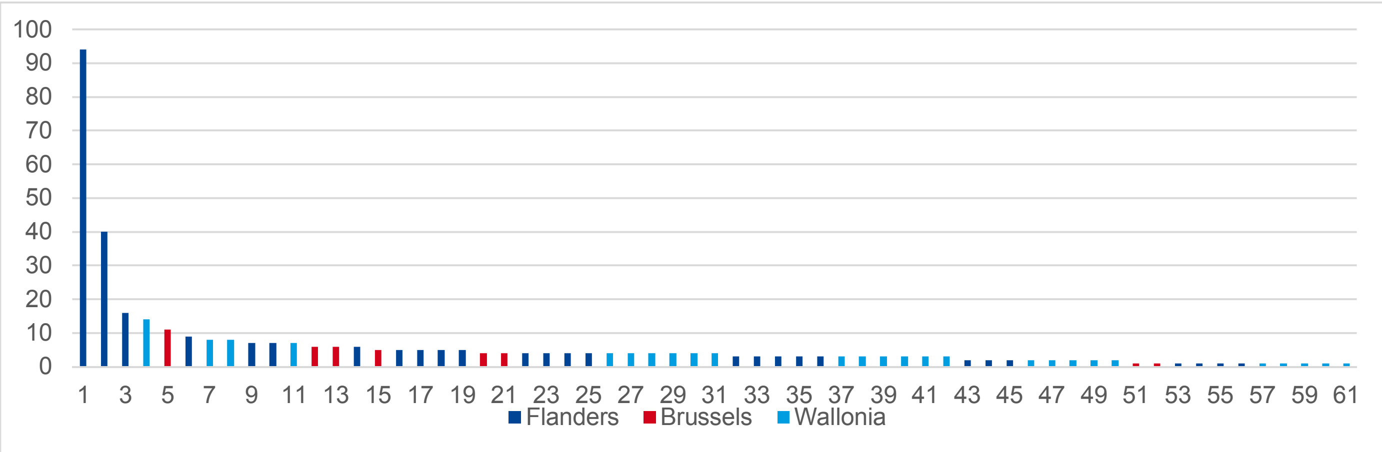
The scattered landscape is illustrated in Figure 12 showing the number of resections for oesophageal cancer performed in 2013 (372 in total) in 61 hospitals (see also Table 10). Half of the number of interventions was carried out in 7 hospitals.

Table 10 – Overview of oesophageal resections, all causes (2009-2015) and for oesophageal cancer (2009-2013)

	2009		2010		2011		2012		2013		2014	2015
	All	Cancer	All	Cancer	All	Cancer	All	Cancer	All	Cancer	All	All
Number of interventions	405	314	438	357	458	376	499	398	470	372	500	492
Number of hospitals*	60	54	62	61	66	62	67	62	63	61	55	54
Average per hospital	6.8	5.8	7.1	5.9	6.9	6.1	7.5	6.4	7.5	6.1	9.1	9.1
Median	4	3	4	3	3	3	4	3.5	4	4	4	4

**Some hospitals underwent a merger during the study period. The number of hospitals per year is based on the hospitals that were active at the end of the observation period, i.e. in 2013 or 2015.*
Source: All causes: Atlas IMA – AIM[68]; Oesophageal cancer: Belgian Cancer Registry[69]

Figure 12 – Number of oesophageal resections for cancer, per hospital and per region in 2013



Source: Belgian Cancer Registry[69]

Scenarios for the required number of reference centres

In KCE Report 219, the expert group for oesophageal cancer identified minimum volume criteria for reference centres for complex surgery for oesophageal cancer:

- 50 new patients/year as registered in the multidisciplinary team meeting (MOC – COM);
- At least 12 oesophageal resections for oesophageal cancer per year.

In the current report, a number of scenarios were developed to identify the required number of reference centres. As for pancreatic surgery, these scenarios are based on a minimum volume of patients for oesophageal resections and on the period in which this minimum volume has to be achieved. The minimum volume was applied to cancer patients only, for the most recent year for which data are available and for the average in the last three years.

The number of new diagnoses of oesophageal cancer and the number of resections are shown in Table 11.

Table 11 – Incidence of oesophageal cancer and number of resections, by period

	2011-2013	2013-2015	2013	2015
Number of new diagnoses of oesophageal cancer	yearly average: 1 431	-	1 443	-
Number of oesophageal resections for cancer patients	yearly average: 382	-	372	-
Number of oesophageal resections (all patients)	yearly average: 475.7	yearly average: 487.3	470	492

(-) = not available. Source: BCR data[69] *and* Atlas IMA – AIM[68]

In Table 12 the number of hospitals that respect the minimum volume threshold for two periods is given, for Belgium and for the three regions. As for pancreatic cancer, the results should be interpreted with caution because data are available at the level of a hospital and not at the level of a hospital site.

Table 12 – Required number of reference centres for oesophageal resections for different scenarios, by region

	Number of reference centres			
	Flanders	Brussels	Wallonia	Total
Scenario 1: minimum of 12 oesophageal resections for cancer patients (2011-2013)	4	1	1*	**5 (6)***
Scenario 2: minimum of 12 oesophageal resections for cancer patients (2013)	3	1*	1	**4 (5)***
Extrapolation from England				**5**
Extrapolation from the Netherlands (20 resections for cancer patients in 2013)				**2**
Extrapolation from Denmark				**4**

**Added to have at least one hospital per region (no hospital respected the threshold of 12 procedures in this region).*

Volume numbers are in line with international standards

In *France*, oesophageal resections for cancer must be performed in hospitals that obtained an authorization to perform digestive surgery for cancer (with a minimal threshold of 30 digestive surgery interventions per centre per year). Again, as digestive surgery encompasses surgery of the stomach, oesophagus, liver, pancreas, and colorectal surgery which is a much broader scope than oesophageal cancer only, no extrapolations for the Belgian situation were made.

Each person diagnosed with a gastro-oesophageal cancer in *England* should be reviewed by a specialised cancer centre. Palliative and supportive care can usually be performed at local hospitals, if agreed with the specialist centre. Endoscopic therapies and resection surgery can only be done in a specialist centre.[78] The professional association of Upper Gastrointestinal Surgeons (AUGIS) has recommended a minimum of 15 to 20 resections per year for an individual specialist surgeon and at least 4-6 surgeons within the team.[78] The resulting minimum number of 60 resections per centre, corresponds to a population of about 1.3 million people each centre should serve. However, according to the contracts of the NHS England, specialist oesophageal and gastric cancer centres should serve a population of at least 1 million people or more and there should be at least four to six surgeons within the team. Currently, only one Belgian hospital performs at least 60 resections. However, when we look at current practice in England, there were 41 specialised centres for a total of 12 656 patients newly diagnosed with an oesophageal (C15) or a gastric cancer (C16). Applying these figures (12 656/41) to the Belgian context with 2 470 newly diagnosed patients (C15 and C16) in 2014, gives a total of 8 centres. Since only C15 and C16.0 are the scope of this report, for 1 451 newly diagnosed patients in 2014, 5 centres are needed.

According to the 2017 SONCOS standards in *the Netherlands*, oesophageal cancer surgery should be performed by at least two certified surgeons with demonstrable specific expertise in oesophageal cancer surgery. Moreover, at least 20 oesophageal resection procedures for cancer should be performed per centre annually.[73]

In *Denmark*, resections for oesophageal and gastric cancers (C15-C16) must be performed in highly specialised services. In the new 2017 plan, 3 hospitals obtained such an authorization for a population of 5 707 251 people (January 2016), i.e. an average population of 1 902 417 per centre.[74, 75] Extrapolations to the Belgian situation on the basis of the number of new diagnoses of oesophageal and gastric cancer (C15-C16) in both countries in 2014 (2 470 in Belgium and 1 113 in Denmark[69, 76] gives 7 centres in Belgium. Since only C15 and C16.0 are the scope of this report, for 1 451 newly diagnosed patients in 2014, 4 centres are needed.

Defining the minimum hospital caseload

The same arguments as for pancreatic cancer hold: the minimum hospital caseload is preferably applied to cancer patients only because the volume-outcome relationship is mainly demonstrated for cancer patients and because of expertise requirements for the multidisciplinary team involved for cancer patients.

For the period in which this minimum volume has to be achieved, also here a stable experience is important.

Volume matters, also for surgeons

A volume-outcome association for oesophageal cancer surgery has been found not only at the centre level, but also for surgeon volume and outcome indicators, for example mortality.[67] No minimum threshold for surgeon volume for oesophageal resections was found in literature. In KCE Report 113 on the 'volume-outcome for surgical interventions' a (not) statistically significant inverse association between the volume of surgeons performing oesophageal resections and the 3-months mortality was found: 13.5% for surgeons performing less than 6 interventions per year and 6.4% for surgeons performing at least 6 interventions per year. Results at 2 years were consistent.

Increase in scale of high-volume centres

Concentrating complex surgery also means that current high-volume centres will have to be able to cope with an increase in scale. For illustration, suppose an average of 12 oesophageal resections for cancer patients during the 2011-2013 period is the minimum volume threshold (and all other criteria, besides volume, are met), 5 hospitals will meet the threshold (or 6 if it is decided to have at least one centre per region). On average, 188 patients per year underwent an oesophageal resection for cancer in the 6 selected hospitals; an average of 199 patients per year were treated in low(er)-volume hospitals. Hence, these patients will be referred to the selected hospitals, which gives an average of 64 patients per centre per year. Of course, in reality there will be no equal spread of patients among the reference centres, but patient management issues should be taken into account in a process of concentration.

Although there are good arguments to base minimum caseloads on cancer patients only (for example, to safeguard the expertise of the multidisciplinary team), there are also good arguments to refer all patients, whether cancer patients or not, to a reference centre for an oesophageal resection. Therefore, an increase in scale and subsequent patient management become even more important.

Horizon 2025: more reference centres or more patients per centre?

According to the Belgian Cancer registry, the number of patients diagnosed with oesophageal cancer is expected to rise from 1 443 in 2013 to more than 1 800 by 2025, mainly due to a combination of the ageing and growth of the population.[77]

It is nevertheless difficult to predict how many oesophageal cancer patients will be eligible for surgery in 2025. Assuming the same percentage as in 2011-2013 (about 27%) gives 493 resections in 2025, as compared to 372 in 2013. Using the same illustration as above, this means that for the 6 reference centres the number of patients will (on average) increase from 64 to 82 patients.

3.3.5. Lung cancer

Burden of lung cancer in Belgium

For the 2009-2013 period, lung cancer (ICD-10 code C34) was diagnosed in 39 908 new patients.

In 2013, about 19% of lung cancer patients underwent a surgical resection. A major limitation concerns administrative data that hamper to differentiate between types of surgery because they are not sufficiently discriminatory for the complexity of the procedure (lobectomy from pneumonectomy, the latter having much higher mortality than other surgeries).

Current practice of lung resections

Table 13 presents the number of lung resections for all causes for the years 2009-2015 and for lung cancer patients for the years 2009-2013. In 2013, 58% of all resections were for cancer patients. The average number of interventions per hospital slightly increased in recent years and ranged from 24.9 to 30.3 for all causes and from 15.6 to 17.5 for cancer patients.

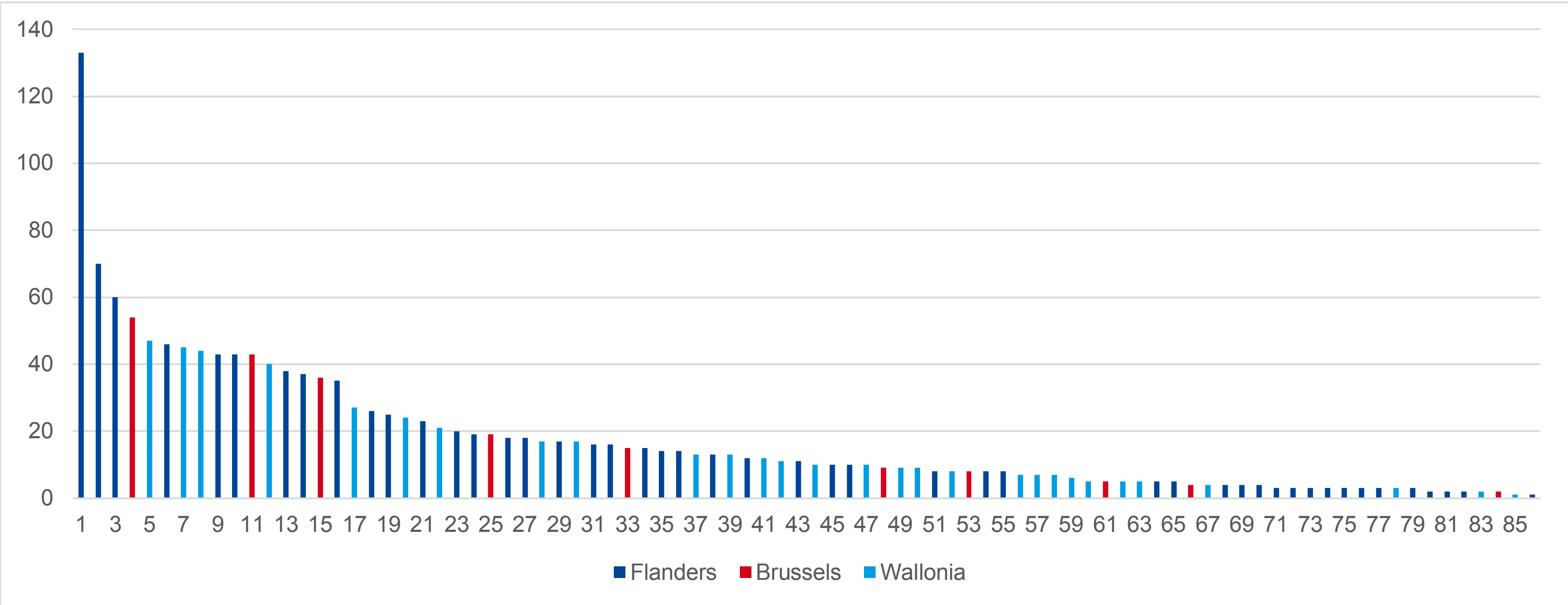
The scattered landscape is illustrated in Figure 13 showing the number of resections for lung cancer performed in 2013 (1 503 in total) in 86 hospitals (see also Table 13). Half of the number of interventions was carried out in 15 hospitals.

Table 13 – Overview of lung resections, all causes (2009-2015) and for lung cancer (2009-2013)

	2009		2010		2011		2012		2013		2014	2015
	All	Cancer	All	Cancer	All	Cancer	All	Cancer	All	Cancer	All	All
Number of interventions	2 307	1 353	2 311	1 410	2 391	1 377	2 579	1 432	2 607	1 503	2 787	2 954
Number of hospitals*	92	86	93	89	93	88	95	88	95	86	92	92
Average per hospital	25.1	15.7	24.9	15.8	25.7	15.6	27.2	16.3	27.4	17.5	30.3	32.1
Median	13.5	8	15	10	15	9.5	15	10.5	15	10.5	17.5	20

**Some hospitals underwent a merger during the study period. The number of hospitals per year is based on the hospitals that were active at the end of the observation period, i.e. in 2013 or 2015.*
Source: All causes: Atlas IMA – AIM[68]; Lung cancer: Belgian Cancer Registry[69]

Figure 13 – Number of lung resections for cancer, per hospital and per region in 2013



Source: Belgian Cancer Registry[69]

Scenarios for the required number of reference centres

Lung cancer was not taken into account in KCE Report 219 on the organisation of care for rare and complex cancers.[16] However, in KCE Report 266 on 'quality indicators on the management of lung cancer', the relationship between surgical volume and outcomes (1-year and 3-year survival and post-operative mortality) for operated lung cancer patients was analysed at the hospital level. For this analysis, only non-small-cell lung cancer (NSCLC) patients with unique tumours who underwent thoracic surgery with curative intent were included.[79]

Centres were categorised as:

- Very low-volume centres: less than 10 patients per year
- Low-volume centres: between 10 and 19 patients per year
- Medium-volume centres: between 20 and 39 patients per year
- High-volume centres: at least 40 patients per year

The conclusion of KCE Report 266 was that 'There is some evidence that centres treating more than 20 patients a year have better survival at 1 year than centres with lower surgical volumes. Results also show a trend towards a better survival at 3 years but this effect is no longer statistically significant. For short term postoperative mortality (60 days) evidence is less clear, except for very low-volume centres (<10).[79]

In the current report, a number of scenarios were developed to identify the required number of reference centres. These scenarios are again based on a minimum volume of patients for lung resections and on the period in which this minimum volume has to be achieved. The minimum volume was applied to cancer patients only, for the most recent year for which data are available and for the average in the last three years.

The number of new diagnoses of lung cancer and the number of resections are shown in Table 14.

Table 14 – Incidence of lung cancer and number of resections, by period

	2011-2013	2013-2015	2013	2015
Number of new diagnoses of lung cancer	yearly average: 8 135	-	8 227	-
Number of lung resections for cancer patients	yearly average: 1 437	-	1 503	-
Number of lung resections (all patients)	yearly average: 2 526	yearly average: 2 783	2 607	2 954

(-) = not available. Source: BCR data[69] and Atlas IMA – AIM[68].

In Table 15 the number of hospitals that respect the minimum volume threshold for two periods is given for Belgium and for the three regions. As for pancreatic and oesophageal cancer, the results should be interpreted with caution because data are available at the level of a hospital and not at the level of a hospital site.

Table 15 – Required number of reference centres for lung resections for different scenarios, by region

	Number of reference centres			
	Flanders	Brussels	Wallonia	Total
Scenario 1: minimum of 20 lung resections for cancer patients (2011-2013)	13	3	7	**23**
Scenario 2: minimum of 20 lung resections for cancer patients (2013)	13	3	7	**23**
Extrapolation from England				**7**
Extrapolation from the Netherlands (20 resections for cancer patients in 2013)				**23**
Extrapolation from Denmark				**7**

Volume numbers are low compared to some international standards

In *France*, lung resections for cancer must be performed in hospitals that obtained the authorization to perform thoracic surgery for cancer (with a minimal threshold of 30 thoracic surgery interventions for cancer per centre per year). Since thoracic surgery is much broader in scope than lung surgery, no extrapolations to the Belgian context were done.

The NHS *England* aims to have all thoracic units performing at least 150 lung cancer resections per year for 2018/19. Moreover, no units should provide a lung cancer surgical service where less than 70 patients are treated per year and the minimum population served by thoracic surgical units should be in the order of 1.5 million.[80] There are 29 surgical resection units for the treatment of lung cancer in England for a total number of 37 453 new cases of lung cancer in 2014.[81-83] An extrapolation to the Belgian context, with 8 452 new diagnosis in 2014[69] corresponds to 7 centres.

According to the 2017 SONCOS standards in *the Netherlands*, lung cancer surgery should be performed by at least two certified surgeons with demonstrable specific expertise in lung cancer surgery. At least 20 lung resections for cancer patients (segmental resection, lobectomy and pneumonectomy) per year per centre should be performed by a certified lung surgeon or thoracic surgeon.[73]

In *Denmark*, resections for lung cancers (T4) must be performed in highly specialised services. In the new 2017 plan, 4 hospitals obtained such an authorization for a population of 5 707 251 people (January 2016), i.e. an average population of 1 426 813 per service.[74, 75] To extrapolate this number to the Belgian situation, we used the number of new diagnoses of lung cancer (C34) in both countries in 2014. With 8 452 and 4 689 new diagnoses of lung cancers (C34) in Belgium and in Denmark respectively, this would give 7 centres in Belgium.[69, 76]

Defining the minimum hospital caseload

The same arguments as for pancreatic and oesophageal cancer hold: the minimum hospital caseload is preferably applied to cancer patients only because the volume-outcome relationship is mainly demonstrated for cancer patients and because of expertise requirements for the multidisciplinary team involved for cancer patients.

For the period in which this minimum volume has to be achieved, also here a stable experience is important.

Volume matters, also for surgeons

A volume-outcome association for lung cancer surgery has been found not only at the centre level, but also for surgeon volume and outcome indicators, for example mortality.[67] No minimum threshold for surgeon volume for lung resections was found in literature. In KCE Report 113 on the 'volume-outcome for surgical interventions' a statistically significant inverse relationship between the volume per surgeon and 2-year mortality was found. However, this association was mainly driven by one surgeon with a very high volume and a good outcome (>100/year).

Increase in scale of high-volume centres

Concentrating complex surgery also means that current high-volume centres will have to be able to cope with an increase in scale. For illustration, suppose an average of 20 lung resections for cancer patients during the 2011-2013 period is the minimum volume threshold (and all other criteria, besides volume, are met), 23 hospitals will meet the threshold. On average, 923 patients per year underwent a lung resection for cancer in the 23 selected hospitals; an average of 514 patients per year were treated in low(er)-volume hospitals. Hence, these patients will be referred to the selected hospitals, which gives an average of 62 patients per centre per year. Of course, in reality there will be no equal spread of patients among the reference centres, but patient management issues should be taken into account in a process of concentration.

Although there are good arguments to base minimum caseloads on cancer patients only (for example, to safeguard the expertise of the multidisciplinary team), there are also good arguments to refer all patients, whether cancer patients or not, to a reference centre for a lung resection. Therefore, an increase in scale and subsequent patient management become even more important.

Horizon 2025: more reference centres or more patients per centre?

According to the Belgian Cancer registry, the number of patients diagnosed with lung cancer is expected to rise from 8 452 in 2014 to 10 693 by 2025, mainly due to a combination of the ageing and growth of the population and an increase in risk for females.[77]

It is nevertheless difficult to predict how many lung cancer patients will be eligible for surgery in 2025. Assuming the same percentage as in 2011-2013 (about 18%) gives 1 943 resections in 2025, as compared to 1 503 in 2013. Using the same illustration as above, this means that for the 23 reference centres the number of patients will (on average) increase from 62 to 84 patients.

3.3.6. Quality demands concentration, but concentration must not lead to waiting lists

Quality is the main reason for concentrating complex cancer surgery in a limited number of centres. An important argument to have a sufficient number of patients is statistical in nature. For example, to evaluate the performance of the selected centres, large volumes allow to produce meaningful and reliable results.

On the other hand, the selected centres must have the necessary capacity (for example skilled staff, intensive care unit, operating theatre) to accommodate the increase in patients. Waiting lists have to be avoided for these kind of interventions. A solution could be to ask centres that fulfil all other criteria (volume, personnel, equipment, infrastructure) to be a reference centre, to demonstrate that the required additional capacity can be provided.

It is not possible to estimate the distribution of the number of patients across centres when the number of centres will be reduced. An equal distribution only gives a very rough picture of possible numbers. Even now, there are large differences in the number of patients between the centres that meet the minimum volume criteria (for example, 10 Whipple procedures in 2012-2014). A more realistic scenario is that the current major centres will maintain or even expand their patient numbers.

3.4. Radiotherapy

Radiotherapy is a key therapeutic approach in the multimodality treatment of cancer.[84] Ionising radiation is used to kill cancer cells with the aim of cure or effective palliation. Radiotherapy is an example of a high-cost medical service requiring large investments and input from specialised staff.

3.4.1. The legal framework is outdated

The legal structure determining the Belgian radiotherapy landscape is complex: whereas the formal legislation goes back to 1991, several changes and additions have been made, that make the current situation less transparent. Originally, only 25 centres were allowed to possess a licensing number, yet, satellite sites existed as of the start and were further endorsed by the Royal Decree (RD) of 17 September 2005.[85] The result is that the landscape has grown in an often-haphazard way (see Figure 14).

Moreover, infrastructural and functional requirements that current radiotherapy departments have to fulfil go back to 1991 as well. It is not surprising, then, that the licensing requirements have partly become obsolete (e.g. the requirement of having a kilo-voltage (KV), brachytherapy or cobalt machine) and that they do not reflect the current state-of-the-art of radiotherapy equipment (e.g. Record and verify systems (R&V), image guidance). The same goes for the personnel standards, which are a mere reflection of the then accepted patient or treatment throughput per professional type, without any consideration for the complexity of the treatments delivered.

Box 3 – Legal context of radiotherapy services

Major medical equipment operated in medical and medico-technical services. Radiotherapy equipment that uses (the emission of) photons, proton beams or carbon ions is included in the list of major (heavy) medical equipment.[86] The RD of 5 April 1991 lays down the standards to be met by a radiotherapy department in order to be licensed as a (major) medico-technical service:[87]

- **Infrastructural requirements.** The radiotherapy department is located within a general hospital with the obligation to have an irradiation unit equipped with external beam radiotherapy devices (EBRT), a mould room, areas for clinical examination adjacent to the treatment machines, simulation and treatment planning rooms.
- **Functional requirements.** The radiotherapy department should have a minimum of two EBRT machines (linear accelerators (LINACs) and/or a cobalt unit) and a device for surface and contact therapy. Minimal personnel standards concern the specialised medical staff (accredited specialists in radiotherapy) including the head of department, the physicists and/or engineers specialised in medical physics, the technical staff and the nursing and administrative staff.

Radiotherapy departments are allowed to operate a **satellite radiotherapy centre**, based in another hospital that does not hold the radiotherapy license.[87] This is possible only under strict conditions: an official collaboration agreement between the two involved hospitals; a common head of department; the satellite should have at least two LINACs (amended by the RD of 17 September 2005) and in one of the involved centres (satellite or not), there should be a minimum of 500 new patients per year.

Programming. The number of radiotherapy departments is limited to the number of departments licensed at the date the Royal Decree came into effect (30 August 2000). There is, however, one exception: if no other radiotherapy department is located in the same province and the distance between the concerned location and any other radiotherapy department is at least 50 km (amended by the RD of 12 February 2001). This exception relates only to satellite centres. A hospital association with several radiotherapy sites is considered as one radiotherapy department (RD of 1 August 2006).

3.4.2. Scope and methods

It is clear from the above that the organisational and legal system of Belgian radiotherapy has become obsolete, urging for an update. The current 'radiotherapy in-depth study' focuses on the revision of the Belgian radiotherapy infrastructure, in view of its embedding in the Belgian hospital landscape of 2025, with the purpose of providing an environment that allows for safe, high-quality, evidence-based and cost-effective radiotherapy. The study has the following objectives:

- to document the current infrastructure situation of radiotherapy departments and equipment in Belgium (availability);
- to assess the current and future radiotherapy treatment and resource needs as a function of current and future cancer incidence data and (optimal) radiotherapy utilisation rates;
- to assess the required evolution in the number of radiotherapy centres.

Several data sources were used:

- The description of the current availability and distribution of radiotherapy departments and equipment is primarily based on the 2016 data collected through the Quality Indicator Project (QI Project) of the Belgian Federal College for Physicians in Radiation-Oncology. This survey yielded also information on the activity profile of radiotherapy departments.
- The description of the activity profile (reimbursed treatments) is based on the billing data of RIZIV – INAMI (2005-2015).
- Incidence data are based on the Belgian Cancer Registry (BCR), a population-based registry covering incidences in Belgium (2004 to 2014).
- To calculate the proportion of cancer patients treated with radiotherapy the BCR data were linked with the billing data from the Intermutualistic Agency (IMA – AIM). Patients with a unique cancer diagnosed in 2009-2010 were identified from the BCR and linked with the IMA – AIM data. Reimbursement data were available for a period ranging from one year before up till five years following the incidence year, limited to the end of 2014. 110 367 out of 113 153 (97.5%) cancer patients were linked. Analyses were performed by cancer type, and where applicable, by stage at the national level and per radiotherapy centre (n=25). In case radiotherapy was performed in a satellite centre, the case was assigned to the corresponding primary radiotherapy department. In case a patient was treated twice in the same centre, this only counts as one case.

3.4.3. Availability of radiotherapy infrastructure in Belgium

Number of hospitals with a radiotherapy department: 24 departments on 37 locations

The current (January 2017) Belgian radiotherapy landscape consists of 24 primary radiotherapy departments (7 in Brussels; 13 in Wallonia; 17 in Flanders) that operate a total of 72 external beam radiotherapy (EBRT) devices. In addition, there are 13 satellite centres with in total 18 EBRT devices. This results in a total of 90 EBRT devices allocated to 37 different locations. Of this total number of EBRT devices, 87 are LINACs and three are dedicated stereotactic devices. This corresponds with 0.80 EBRT devices per 100 000 Belgian inhabitants, which is equivalent to 1 device per 125 000 inhabitants. The number of EBRT devices per 100 000 inhabitants available in Brussels is double the number of EBRT devices available in Flanders and Wallonia (1.68 versus 0.77 and 0.72 respectively). Some hospitals have concluded a hospital association for their radiotherapy departments. The geographical spread of these primary radiotherapy departments and satellites, along with their size and the association between the primary department and their satellites, is visualized in Figure 14.

In addition to EBRT devices, six hospitals have also invested in the acquisition of intraoperative radiation therapy devices (IORT), which allow the delivery of a high dose of radiation to the tumour bed during operative procedures. Currently, the most typical indication for these IORT devices is radiotherapy in case of breast-conserving surgery for early-stage breast cancer. Finally, 17 primary radiotherapy departments are delivering brachytherapy (BT) treatments and seven departments have orthovoltage devices (two of them are not clinically used).

Box 4 – Radiotherapy: some definitions

EBRT: External Beam Radiotherapy. Use of high energy X-ray beams such as photon and electron beams delivered through equipment located outside of the patient.

IORT: Intraoperative Radiation Therapy. Treatment modality delivering high dose radiotherapy to the tumour bed during surgery.

BR: Brachytherapy. Internal radiation where one or more radioactive sources are placed in or close to target volume, limiting the dose to the healthy tissues.

Orthovoltage radiotherapy. X-rays with low energy, used to irradiate the skin or superficial tumours.

SBRT: Stereotactic Body Radiation Therapy. SBRT uses X-rays for stereotactic positioning and sometimes implanted markers to give a very high irradiation dose to a very precise target, maximally sparing health tissue.

IGRT: Image-guided radiotherapy. The use of two and/or three dimensional imaging, during the course of a radiation therapy treatment, in order to verify and correct for patient setup and to precisely deliver the radiation therapy treatment.

3D-CRT: 3D conformal radiotherapy. External radiotherapy technique that uses three-dimensional image information (e.g. CT scan) to optimise the size, shape and energy of the radiation beams as best as possible to the location and shape of the target volume, and to maximize the saving of the healthy tissues.

IMRT: Intensity Modulated Radiation Therapy. Further refinement of 3D-CRT, with the radiation intensity of the radiation beams being modulated to the density of the irradiated tissues, in order to better conform the irradiation to the irradiated target volume with maximum dose savings on the healthy tissues.

Figure 14 – Geographical spread of radiotherapy departments across Belgium

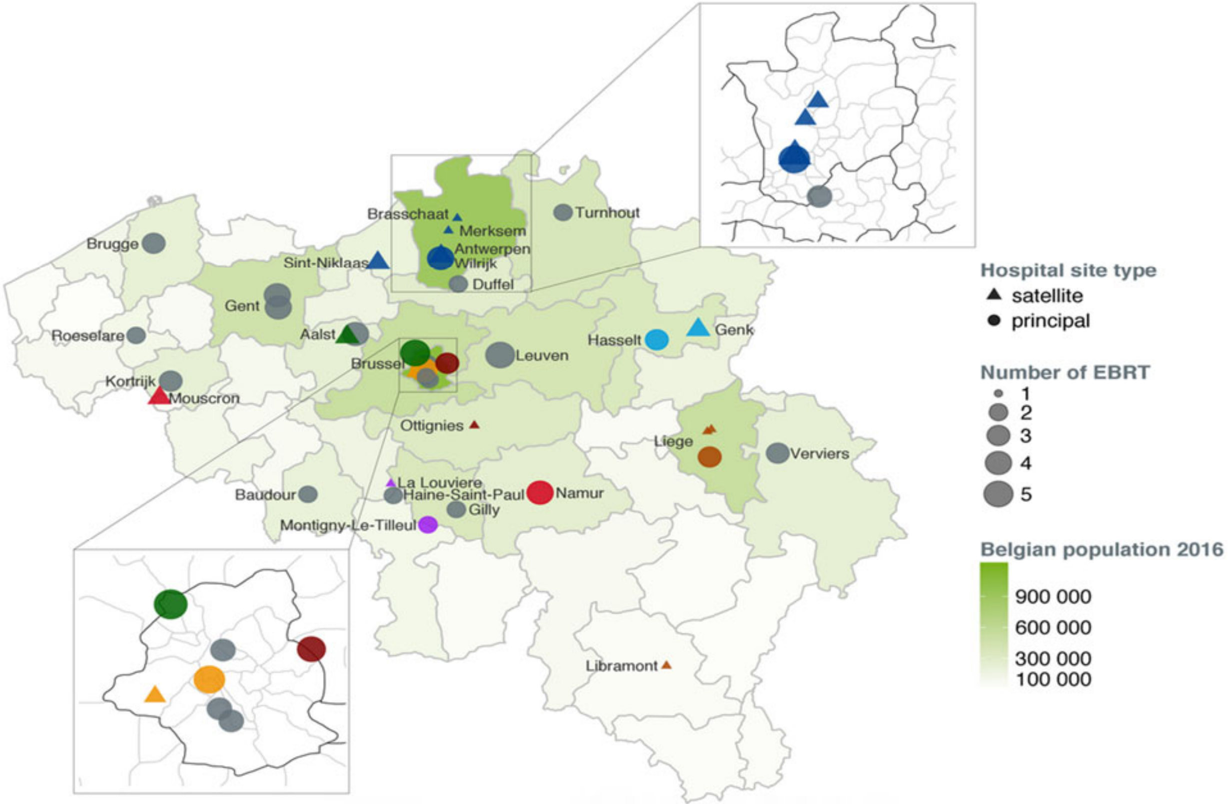


Figure illustrating the geographical spread of radiotherapy departments taking into account the population density, the size of the radiotherapy department (number of external beam radiotherapy (EBRT) devices/department) and the association between the primary department and their satellites (colour coding).

Number and technical capabilities of EBRT devices per radiotherapy department

The mean number of EBRT devices per primary radiotherapy department is 4.0, 3.4, and 3.7 EBRT devices per department in Flanders, Wallonia and Brussels respectively and 3.8 EBRT devices in Belgium (see Table 16).

When analysing the number of EBRT devices per individual radiotherapy site, the mean decreases to 2.4 EBRT devices per hospital site. The mean number of EBRT devices per satellite centre is 1.4. Moreover, 5 of the 13 satellite centres only possess one EBRT device.

Table 16 – Number of EBRT devices per radiotherapy department

	Total	Flanders	Wallonia	Brussels
Mean number of EBRT devices/primary hospital*	3.8 (4.0)	4.0 (4.4)	3.4 (3.6)	3.7 (3.8)
Mean number of EBRT devices/hospital site	2.4 (2.5)	2.6 (2.8)	1.9 (2.0)	2.7 (2.9)
Mean number of EBRT devices/satellite	1.4 (1.5)	1.7 (1.7)	1.2 (1.3)	1 (1)

*Numbers between brackets: number of EBRT devices including IORT devices; * the EBRT devices of the two satellites in another regions than the region of the primary hospital are included in the number of devices of the region of the primary hospital (=Brussels).*

Important evolution in technical capabilities radiotherapy equipment but with important regional differences

Image guided radiotherapy (IGRT) and intensity modulated radiotherapy (IMTR) are important in the delivery of state-of-the-art radiotherapy. In Belgium, 96.6% of the devices is capable of MV (megavoltage) imaging and 64.4% capable of kV (kilovoltage) imaging. About two thirds (71.3%) of the equipment is also capable of performing volumetric IGRT which allows for the acquisition of 3D imaging for patient positioning verification. These figures however vary by region. About 92% of Belgian EBRT devices have, for instance, the capability to deliver static as well as rotational IMRT. Brussels knows a different situation with only 76.5% of the devices allowing static (and 64.7% rotational) IMRT. An important evolution over the last decade in IGRT and IMRT capabilities of EBRT devices was observed.

3.4.4. Cancer incidence and radiotherapy treatment

Cancer incidence

Incidences were calculated for a selection of tumour types for which radiotherapy might be a treatment option.[88] This resulted in 65 144 new diagnoses for the incidence year 2014, of which 34 362 in males and 30 782 in females. Prostate cancer is the most frequent cancer in males in Belgium (23.1%), followed by lung (16.9%) and colon (without recto sigmoid junction, 11.1%). In women, breast cancer is responsible for one third of all tumours (34.0%) followed by colon cancer (10.0%) and lung cancer (8.6%). Together, these four tumour types represent 52% of all new cancer diagnoses in males and females together. Most of the cancers that occur in both sexes, have higher incidences in males compared to females. When studying incidence trends over time (2004-2014), incidence rates are decreasing in males (0.6% annually), while the risk for females increased with 0.8% annually.

Number of (re)treatments and sessions

Almost 35 000 radiotherapy treatments have been delivered in Belgium in 2015, with a heterogeneous distribution across departments and sites. Some departments have less than 500 treatments per year while several departments have an activity close to 3 000 treatments per year. In 2016, one department consisting of one primary site and 4 satellites even delivered over 5 000 treatments. The variability in machine availability and in patient throughput translates into number of treatments delivered on annual basis per MV machine to range between 216 and 576. Similarly, there is a one out of two variation of average fractions per treatment, varying from 12 to 25 across departments in Belgium (see Table 17).

Treatments become more complex

The analysis of the reimbursement categories (reflecting different levels of complexity of treatments) clearly illustrates that treatments have progressively become more complex. The most complex treatments (reimbursement category IV), for instance, including IMRT, TBI, SRS and SBRT have risen from 1 531 in 2005 to 12 476 treatments in 2015 (800% increase). The gradual acquisition of more modern EBRT devices, capable of IMRT and IGRT, has allowed for a further evolution from 3D conformal treatments into IMRT techniques. As a result, the number of IMRT treatments are in 2015 for the first time exceeding the number of conformal 3D treatments. Conversely, it is reassuring to observe that the proportion of treatments with purely palliative intent for symptom control, have remained stable over time – accounting for 25% of all EBRT treatments.

Table 17 – EBRT treatments in Belgian radiotherapy departments (2015)

Activity	Total	Minimum	Maximum	Mean
Total number of treatments QI Project*	35 087*			
RIZIV – INAMI**	34 547**			
Number of treatments per EBRT device		216	576	399
Number of sessions per EBRT device		4 281	10 781	6 989
Number of sessions per treatment		12	25	17.3

** Missing data for two satellite centres; ** Maximum of 3 series reimbursed per year*

Nearly forty percent of cancer patients are treated with radiotherapy with important variations between cancer types and stages

A total of 42 742 (38.7%) out of 110 367 patients were irradiated (39 180 with EBRT or 35.5%). As expected, large differences in these percentages were observed across tumour types. Some tumour types appeared frequently irradiated (e.g. breast: 76.8%, head and neck: 71.9%), some infrequently (e.g. colon: 6.2%, ovary: 6.6%, stomach: 8.2%), and others in between (e.g. lung: 46.2%, oesophagus: 42.2%, prostate: 38.0%, rectum: 57.3%). The use of brachytherapy only was mainly observed in cancers of the prostate (9.8%), uterus (8.5%) and vagina (7.2%).

The use of radiotherapy also varies between cancer stages. Since adjuvant radiotherapy is often not required after a surgical treatment of a stage I tumour, the patients with a stage I cancer treated with radiotherapy is rather low. Patients with stage II and III cancer are more frequently treated with radiotherapy, either in addition to surgery (e.g. adjuvantly in breast cancer, corpus uteri, pancreas or neo-adjuvantly in rectal cancer), either without surgery (with or without chemotherapy, e.g. head and neck cancer, lung cancer). The main indication for radiotherapy treatment of patients with stage IV cancers is the radiation of a distant metastatic site. This highly depends on the cancer type ranging from 5.4% (gallbladder cancer) to 83% (head and neck cancer).

3.4.5. *Calculation of required number of devices based on available guidelines: the importance to account for underuse, retreatments and complexity*

The number of cancer patients that receive radiotherapy is lower than guidelines recommend

The 'Australian Collaboration for Cancer Outcomes Research and Evaluation' (CCORE) defined per cancer type the proportion of patients that require radiotherapy at least once in the course of their disease. This is called the 'optimal utilisation proportion (OUP)'.[88] This methodology has been applied in different regions around the globe, and has consistently shown that about one out of two cancer patients needs at least one radiotherapy treatment in the course of his/her disease.[89, 90] For Belgium the optimum evidence-based utilisation (EBRT treatment) has been calculated to be 53.3% while the linked database (BCR with IMA – AIM) showed that only 35.5% of cancer patients received radiotherapy. The latter is probably an underestimation. A previous study by Borras et al. (2016)[91] demonstrated that in Belgium about 80% of the estimated optimal treatments was actually delivered. Several methodological differences might have contributed to these different results. Whereas Borras et al. (2015)[89] used the actual number of treatments delivered, the BCR followed a cohort of individual cancer patients over time. Apart from relating to a different cohort of patients, the follow-up is limited to a maximum of 5 years (thus excluding treatments potentially occurring later in time) and excludes non-cancerous patients that require radiotherapy (e.g. Ductal Carcinoma in Situ and meningioma).

The number of devices required for radiotherapy treatments (current versus optimal): several guidelines result in divergent outcomes

Several publications or national guidelines include recommendations on the required number of EBRT devices. The IAEA (International Atomic Energy Agency)[92], QUARTS (guideline to estimate infrastructure and staffing needs in Europe)[93] and Dutch guidelines[94] calculate the number of devices by using a recommended number of treatments per device accounting for the complexity of the treatments. In the current study, the complexity categories as applied in the reimbursement system (RIZIV – INAMI data) are used: category I and II are considered as being 'simpler techniques' while those billed as category IV are the most complex techniques. The English[95] and French guidelines[96] estimate the need of EBRT equipment as a function of the number of inhabitants.

A distinction should be made between the number of cancer patients requiring radiotherapy and the number of treatments that are required. Indeed, one cancer patient may need a number of EBRT treatments in the course of his/her disease: e.g. a first one during the curative episode of care and later on when metastases occur, or for the simultaneous treatment of multiple metastases. These episodes of treatment have been defined as the retreatment rate, which on the basis of the available evidence is estimated to be around 25%.[97] Therefore, the number of patients with radiotherapy (current situation or optimal) was increased with 25% to calculate the required number of devices.

From Table 18 it is clear that the results differ substantially according to the method used (whether and how complexity was taken into account). Based on the actual utilisation patterns, the QUARTS guideline results, for instance, in 80 devices while the IAEA guideline results in 107 devices. In a scenario where optimal utilisation patterns are used as total number of treatments, the required number of devices amounts to 101 and 134 according to the QUARTS calculation and the IAEA calculation respectively. In the Scientific Report similar results for 2025 are included (based on estimated incidence rates and population growth).

Table 18 – Number of radiotherapy devices for the country: calculation based on different guidelines including current and optimal utilisation rates

Guideline		Current utilisation patterns	Optimal utilisation pattern	Required number in 2025 based on current use	Required number in 2025 based on optimal use
Source	**Rule**	**Number of devices (Min-Max)**			
QUARTS	1MV*/450 patients**/year; increasing complexity: 1/400-450 patients**/year	80[¥] (77-86)	101[¥] (97-109)	99[¥] (95-107)	121[¥] (116-131)
IAEA	1 MV*/200-500 patients**/year depending on complexity	107[¥] (69-173)	134[¥] (87-217)	132[¥] (86-214)	161[¥] (104-261)
Denmark	1 MV* per 200 new patients	138	174	171	209
The Netherlands	1 MV*/500 teletherapy treatments (based upon T2 equivalent treatments)	119	150	148	181
England* **	1 MV*/250 000 inhabitants	45	45	47	47
France	1 MV*/140 000 inhabitants	80	80	84	84

[¥] *Complexity corrected; * MV unit = EBRT device, LINAC; ** Guidelines often refer to the number of patients thus excluding the notion of retreatment – we therefore considered 'total number of treatments' when the models refer to number of patients;* *** England recommendations correspond to UK recommendations

A Time-Driven Activity-Based Costing approach is a promising alternative method but Belgian data (time measurements) are lacking

The above methods insufficiently take into account recent evolutions in radiotherapy such as increased use of shorter fractionation schedules as well as the increased complexity in treatment. Therefore, a Time-Driven Activity-Based Costing approach was used as an alternative method. This costing model allocates the total available resource time to the treatments delivered on the basis of the time required for each step in the treatment process. It is important to note that the time estimates are based on a literature review and thus potentially different from Belgian reality. Different scenarios were used to simulate the impact of complexity features (e.g. IGRT versus IMTR; use of motion management techniques), fractionation schedules (e.g. hypo-fractionation schedules for specific tumours such as lung, prostate and breast cancer) and opening hours of the radiotherapy department (from 8 to 12 hours).

Based on this method and depending on the scenario the number of devices required in 2015 (actual use) varied between 66 and 106. Yet, it should be noted that the lower limit (i.e. 66) is probably a suboptimal result as these calculations insufficiently take into account the current state-of-the-art recommendations to use image-guidance in curative intent treatments. When complexity features are combined by pairs or jointly, the need of EBRT devices rises to between 95 and 106 EBRT devices. Shorter fractionation schedules compensate for the increased EBRT device needs related to complexity (e.g. a reduction of 23%, 1% and 5% based on lower fractionation schedules for breast, lung and prostate EBRT treatments, respectively). When pushing this modelling exercise to the extreme, and the cumulated effect of complexity features and all fractionation schedule changes are combined, it is estimated that 74 EBRT devices are required. This example with extremely hypofractionated EBRT schedules for breast cancer might be too extreme given the combined effect of large patient numbers and the important decrease in fractions. A more moderate estimate, only combining the complexity changes with hypo-fractionation in lung and prostate results in 101 EBRT devices needed now. It should be stressed that these results are only an indication that changing practice patterns have a serious impact on capacity needs (e.g. hypo-fractionation compensates for increased complexity). The estimated number of devices are to be interpreted with caution given that various model components (e.g. time estimates used for the different treatments) are not yet validated in the Belgian context.

3.4.6. Reforming radiotherapy capacity: lessons learned

A call for more centralisation

By chance, the 25 loco-regional clinical networks envisaged by the reform (see Box 1), coincide with the maximum number of 25 radiotherapy departments that can be licensed, of which to date 24 primary departments are operational. But obviously, these departments are not evenly distributed across the country, resulting in some hospital networks that would have no radiotherapy department, whereas others would have more than one. In addition, there are also 13 satellite sites, depending of the primary hospitals (see Figure 14). This all results in a very heterogeneous geographical spread, which has been determined historically, mainly driven by management and/or political decisions, without really taking into account the real resource needs based on cancer incidence and radiotherapy indications. The same conclusion can be drawn for the spread of actual radiotherapy devices across the country. There are important regional differences within Belgium, with the Brussels region being more densely covered with EBRT machines, resulting in much smaller departments.

Based on the average number of machines per department (3.8) and per site (2.4), it is clear that the radiotherapy landscape in Belgium is rather scattered, much in line with countries as France (2.6) and Ireland (2.7), and in contrast to countries that have adopted a more centralised approach, such as the UK (4.3), the Netherlands (6.3) and especially Denmark (7.6). It should be mentioned that the average number of machines in the satellites only reaches 1.4, whereas the legal recommendation states that each satellite should have 2 (operating) EBRT devices.

There are strong arguments in favour of adopting a more centralised approach, as well from a clinical and quality perspective as from an economic point of view. Oncological care requires a close collaboration amongst different cancer care professionals. In this context, subspecialisation of the radiation oncologists is key to safeguard evidence-based expertise, as is the case in countries such as the Netherlands and Denmark, where radiation oncologists are dedicated to only a few pathologies.[73] Moreover, a higher number of treatment machines per department is more flexible in handling machine downtime and allows for a combination of standard and more dedicated machines, as the latter require higher patient numbers to have an adequate - cost-effective - utilisation. Finally, centralisation translates into lower costs per treatment due to the economies of scale. For Belgium, available data demonstrate that in departments treating less than 1 000 patients annually, treatment costs rise considerably[98, 99], that is, departments that operate less than 3 machines are economically less sustainable.

A reasonable global coverage, but with inconsistent variation across the country

With 8 MV machines per million inhabitants, Belgium has a good global coverage in radiation oncology equipment, in comparison to other European countries: it is only slightly lower than the number observed in Denmark (9.5), close to the figure of the Netherlands (7.9), but clearly higher than in France and Ireland (6.9 resp. 7) and especially in England, where only 5 MV machines are available per million inhabitants. The latter is close to the European average of 5.3 observed in the ESTRO-HERO project.[100] The equipment is of high standards and even evolved importantly during the last decade.[100] Yet an important difference between the regions exists.

Of course, in addition to mere population data, cancer incidence and radiotherapy indications should be accounted for when defining the radiotherapy resources needs. Based on cancer incidence data and the then accepted machine throughput in 2005, the ESTRO-QUARTS project determined an average need of 5.9 MV units per million inhabitants for Europe, but a number as high as 7.5 for Belgium.[93]

Applying the recommendations of QUARTS on the actual number of treatments delivered to date shows that we would need between 77 and 86 EBRT devices. Additionally applying other recommendations, of the IAEA and of selected European countries, to the actual number of treatments delivered, a large variability in required number of machines is obtained. This points to the weakness of the available recommendations, which are very much determined by the actual state-of-the-art at a certain point in time in a certain organisation or country, hence mostly represent a consensus, without trying to make formal evaluations based on real needs and radiotherapy indications in a certain cancer population. Better would be to base these decisions on a consensus developed template, using consistent terminology and metrics, for the planning of radiotherapy resources.[96]

Taking these uncertainties and variability into account, the current number of MV machines seems sufficient for the actually treated patient population. But even if there may seem to be some idle capacity to date, delivering the optimal number of evidence-based treatments (see below) may require additional investments of about 20%, in line with the currently estimated underuse.

Machine under- and overutilization

The same variability is observed when looking at the current treatment activity per department and machine. When comparing the variability in treatment activity per machine, it becomes clear that some machines are underutilised, whereas others tend to operate above throughputs that are generally accepted in international standards. Hence, again, although the average machine throughput of 399 treatments annually aligns to the international recommendations of 400-450 patients per year[101], and has increased compared to the ESTRO-HERO survey of some years ago[100], the variability across departments demand a better infrastructural planning. In addition, the large variation in average fractions delivered per treatment can hardly be related to variations in patient population mix, but denote a variation in uptake of evidence-based treatment schedules.

Variation in treatment complexity and fractionation: in the country, and over time

Treatments are not all the same: depending on the specific patient population mix and the technical capability of the specific machines, the complexity of the treatments delivered varies and a continuous evolution towards more complex treatments has been observed. All in all, about half of the treatments are delivered with 3D-CRT, one third with IMRT and a small amount with stereotactic treatments, cranial or body. Yet, of interest is that the so-called palliative indication has remained stable over the years.

In parallel with the evolving technological capability of the equipment and with the increased technical accuracy of the delivered treatments, there is a general tendency to deliver shorter fractionated regimes: the typical 6-7 week schedules have decreased to 3-4 weeks in many breast cancer patients, for example, and have found the extreme in the so-called SBRT treatments, where high doses are delivered in just a few fractions. This evolution not only brings equal or better disease control, but is also beneficial for the patient and society, as less cumbersome travels to and from the hospital are required. Yet, such evolution should go hand in hand with better technology and techniques, and rigorous quality assurance. As alluded to previously, it is clear that this evolution is not homogeneous across the country. The average number of fractions may in part be related to the specific patient population mix, that as shown in this report is quite variable, but it is clear that the uptake of newer technologies and evidence-based treatment schedules lags more behind in some departments than in others. Again smaller departments will encounter more difficulties to implement novel treatment approaches due to the specific expertise that this requires.

The impact of various combinations of treatment complexity and fractionation schedules has been modelled in a time-driven approach. This shows clearly how shorter fractionation schedules compensate for higher complexity in terms of machine resource needs, and how in addition, operational models using longer working hours may – as expected – decrease the machine needs. It should however be acknowledged that longer operating hours translate into less favourable working conditions of the highly specialised staff, e.g. working outside standard hours or in unacceptable shifts.

Current and future treatment coverage and needs

The above simulations have been performed on the basis of the current number of treatments delivered. Yet we do know if about 20 to 30% of the patients that require radiotherapy on the basis of the evidence, actually receive it or not. Treating all evidence-based indications would require about 20% extra equipment. Of course, solely adding radiotherapy devices will not be sufficient to eliminate this underuse.

In addition, new indications arise. One typical example is the use of local therapy, be it SBRT, surgery or radio-frequency ablation, in the treatment of oligometastatic disease. In the project on Innovative Radiotherapy, a collaborative effort of the KCE, the RIZIV – INAMI, the Belgian College for Physicians in Radiotherapy-Oncology and the radiotherapy professionals, a total of 943 oligometastases have been treated over 3 years, the majority of which would only have received systemic therapy before.[102] In addition, 1 210 early-stage lung cancers have been treated with SBRT. Based on population-based data, a.o. from the Netherlands[103], it is known that part of these patients were not treated previously. Hence, novel radiotherapy technology, delivering more accurate treatments with better outcome and less side-effects, attract a new type of patients to radiotherapy, especially the elderly, who would previously not have been referred for a treatment deemed too aggressive. In addition, the parallel improvement of diagnostics and of systemic treatments induces a shift in the natural history of our cancer patients, which also induce new indications for radiotherapy, as is the case for oligometastatic disease.

Whereas it is difficult to accurately estimate the impact of these shifts in indications, there are more accurate data that predict the increase in radiotherapy indications ensuing from demographic changes. The approach of the Belgian Cancer Registry has been discussed previously. In addition, the ESTRO-HERO project estimated a growth in optimal radiotherapy indications of roughly 20% for Belgium between 2012 and 2025.[91]

Applying the recommendations from the various organisations and countries to these figures shows that we have to be prepared for extra capacity needs in a decade from now, similar to the estimated growth in treatment needs. But from the above discussion it yet again becomes clear that just applying simple recommendations will not give us sufficient tools to monitor the changes and predict the needs in an accurate way. In order to best align the resources to the actual needs, at national level, but also at the regional and network level, flexible models will have to be used. Only in this way will we be able to evaluate the complex interplay of changing cancer incidence, population mix, indications, techniques and fractionation schedules, and its impact on the required equipment in the future. A long-term vision ask for investing in services and equipment; the training of the dedicated radiotherapy personnel cannot be deferred much longer so that they can operate new state-of-the-art material.

To conclude

Although the Belgian radiotherapy equipment coverage seems adequate at the national level, there is an enormous variability in geographical spread of services and machines, in size of the radiotherapy departments, and in the way centres respond to the evolving radiotherapy indications and technologies. This situation has resulted from a 'bottom-up' development over the years, which was not based on actual needs at national or regional level.

The disparities that have been demonstrated call for a - gradual - reorganisation, homogenisation and centralisation of the radiotherapy system in Belgium. This should be based on the actual treatment needs, performed in close collaboration with other oncological disciplines and taking into account the evolution towards loco-regional and supraregional networks. It is clear that additional radiotherapy departments should be avoided at every cost. On the contrary, the closure of smaller departments should be considered. The loco-regional networks can be a vehicle for this rationalisation process. Indeed, when other options are available within the loco-regional network, there are no cost, quality or accessibility arguments to keep the small radiotherapy centres open. For loco-regional networks without a radiotherapy department, agreements with radiotherapy departments from outside the network have to be made. In the longer run, and after a first rationalisation process, it should be reviewed whether the remaining radiotherapy departments are well spread over the territory (and the loco-regional networks) when looking at cancer incidence.

Expansion of existing departments instead of increasing the number allows for more subspecialisation of the staff. However, subspecialisation emphasizes the need to concentrate activities in a limited number of centres and make arrangements at the supraregional level. The different areas of subspecialisation (techniques and indications) and the location of selected centres have to be defined after an extensive consultation of experts in the field, taking transport issues for patients into account.

To reform the radiotherapy landscape, a close monitoring of the clinical and technological evolution of radiotherapy is necessary, with generation of evidence at different geographical levels. These data should aliment models to help estimating the needs and reshape the radiotherapy landscape, the legal structure, the recommendations and the reimbursement system, with the final aim to better align the actual capacity to the patients who need radiotherapy and to develop a high-quality and cost-effective radiotherapy system, now and for the future.

3.5. Maternity services

Maternity services in Belgium are in the spotlight given their importance and the vital role they play in a crucial period in the life of most Belgian people (98.8% of births in Belgium takes place in the hospital).[104] Maternity services can be seen as an example of a care assignment that is best delivered in the proximity of the patient: a high patient volume combined with accessibility requirements. On the other hand, there are also regular reports about an overcapacity of maternity services (beds and services) in Belgium. Also in the reform plans of the minister, maternity services are the prime example to rationalise hospital supply. Therefore, the following objectives were formulated for the study:

- to document the current capacity and activity of Belgian maternity services;
- to assess the current and future (2025) need for maternity services capacity as a function of current and future number of births and utilisation rates of maternity services;
- to define programming standards for maternity services capacity adapted to the current and future needs.

3.5.1. *Scope and methods*

In Belgium there are two levels of maternity services: the general maternity services (M-beds) and the 'maternal intensive care' services (MIC-beds) (see Box 5 for a description of the legal context of maternity services). In this report the focus is on maternity services in general, a detailed evaluation of MIC-beds is out of scope. Where relevant, results are presented for maternity services with and without MIC-beds separately. Also the delivery/labour room, and the neonatal function are out of scope.

To explore the available capacity of and the activity patterns on maternity services, a detailed analysis of Belgian administrative databases was performed: i.e. the hospital characteristics data (FOD – SPF) and the Belgian Hospital Discharge Dataset (MZG — RHM). Unless mentioned otherwise data of the year 2014 were used. The preferred unit of analysis for maternity services was the hospital site level. When analyses were performed at the hospital level this is explicitly mentioned. In addition, the organisation of maternity services in a selection of countries (i.e. England, France, Sweden) with a high rate of hospital-based deliveries but different utilisation patterns (e.g. shorter length of stay) was studied.

Box 5 – Legal context of maternity services

Maternity services (M) cannot exist as isolated entities since they must belong to a hospital with surgery and internal medicine (services C and D),[105] a licensed neonatal care function (function N*)[106, 107] and a licensed care programme for children.[107] In order to have the latter, a hospital is required to have an emergency department. Therefore, there is an indirect link in the licensing criteria between emergency departments and maternity services. The Royal Decree regulating the care programme for children was, however, recently suspended.

The minimum size of a maternity service is at least 10 licensed M-beds and 400 deliveries per year (average over the last three years).[108] Yet, for the latter some exceptions exist based on the geographical location of the maternity service: the closest maternity service is located at a distance of at least 25 km; the maternity service is established in a municipality with at least 20 000 inhabitants where the closest maternity service is located at a distance of at least 15 km; the closest maternity service located in the same Community ('Communauté'/'Gemeenschap') is located at a distance of at least 50 km.

There is a **programming standard** to determine the number of M-beds for the Belgian territory: 32 M-beds for 1 000 births.[109]

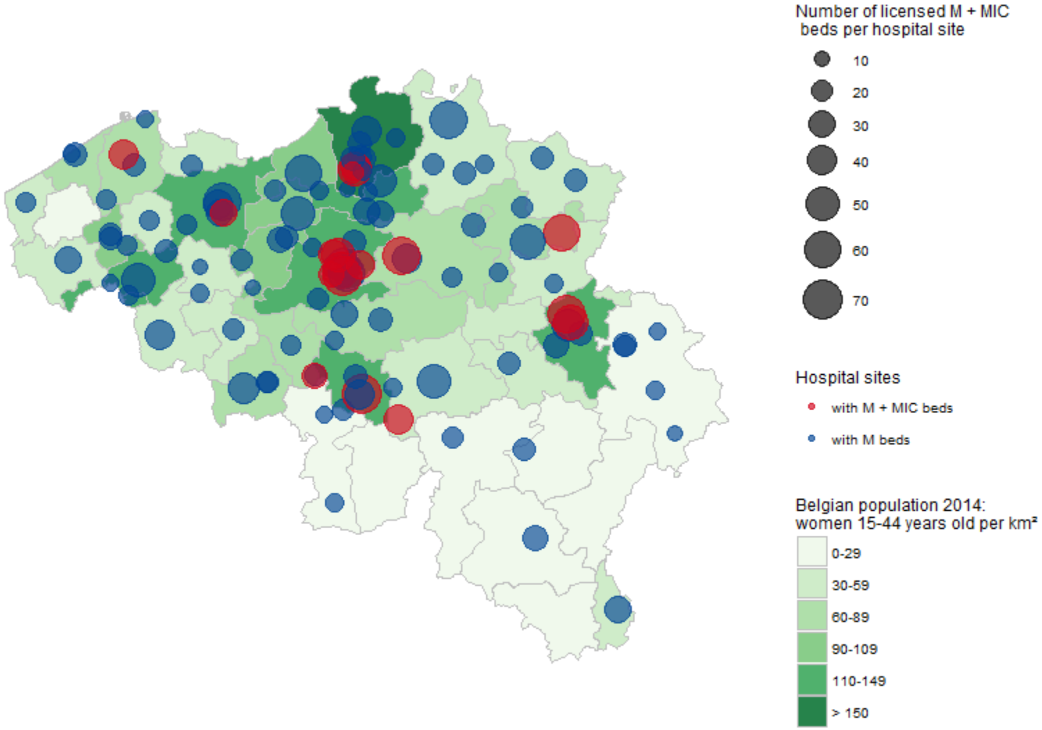
There are two levels of maternity services: general maternity services (M-beds) and maternity services with 'maternal intensive care' beds (MIC-beds). Maternity services with MIC-beds are meant to act as a reference centre for high-risk pregnancies. While additional funding is provided for these MIC-beds, the law does not describe (apart from the minimal number of 8 beds per service) additional licensing requirements nor the precise objective of these services in detail.[110] MIC-services are part of reference centres for regional perinatal care (P*-function) which also requires a licensed service of neonatal intensive care (NIC) on the same hospital site. These reference centres are supposed to cover an area with 5 000 deliveries per year.

3.5.2. Availability of maternity services in Belgium

A high density of maternity services

Nearly all Belgian acute hospitals have a maternity service. In Figure 15 and Table 19 it is shown how the 3 176 licensed M-beds (of which 168 are MIC-beds) are divided among 111 different hospital sites: 64 in Flanders, 36 in Wallonia and 11 in Brussels. Among them, 18 also have a MIC department: 7 in Flanders, 5 in Wallonia and 6 in Brussels (indicated by red colour).

Figure 15 – Geographic distribution of M-beds among hospital sites in Belgium, December 2014



Regional differences in size of maternity services

From Table 19 it is clear that maternity services in Brussels have a higher median number of licensed beds per hospital site (40 beds) compared to Flanders (22.5 beds) and Wallonia (23.5 beds). In addition, Flanders has the highest proportion of small-sized maternity services. In Flanders there are 15 out of 64 (23.4%) maternity services with 15 or less licensed beds while this is 19.4% (7 out of 36 M-services) in Wallonia and only 9% (1 out of 11 M-services) in Brussels. Only three maternity services (two in Flanders and one in Wallonia) have the legal minimum of 10 beds (RD of 12 October 1993, art. 5).[111]

The share (and importance) of maternity services in the total hospital capacity varies between hospitals

At the national level, M-beds represent 6.2% of total hospital capacity (i.e. 3 176 licensed M-beds on a total of 50 973 total licences beds as included in Table 5. However, the relative importance of maternity services differs between hospitals. While the median share of M-beds in the total hospital bed capacity is 6.8%, it ranges from 2.8% to 16.7%. It is clear that the smaller the hospital, the larger the share of M-beds (e.g. median share of M-beds in hospitals with less than 200 beds is 9.5% compared to 3.5% in university hospitals). This indicates the importance of maternity services (especially for smaller hospitals) in negotiations about task distribution within loco-regional networks. Of course, other elements (e.g. attracting a young patient population to the hospital, reputation) are also important.

Table 19 – Hospitals and sites with M-beds in Belgium, December 2014

	Brussels	Flanders	Wallonia	Belgium
Hospitals with M-beds (total number of acute hospitals[f])	10 (12)	55 (55)	33 (37)	98 (103)
Hospital sites with M-beds (total number of acute hospital sites[g])	11 (18)	64 (81)	36 (55)	111 (154)
Number of M-beds (number of M-beds that are licensed as MIC[h])	453 (50)	1 728 (70)	995 (48)	3 176 (168)
Number of M-beds (total: M+ MIC) per 1 000 births	24.5	25.7	25.7	25.5
Median number of maternity beds per acute hospital site	40	22.5	23.5	24

Source: FOD VVVL - SPF SPSCAE (2014)

[f] Hospitals with at least one C, D, H, E or M-bed

[g] Hospital sites with at least one C, D, H, E or M-bed

[h] For MIC-beds, data are from 2016 (source: FOD VVVL - SPF SPSCAE)

3.5.3. *Capacity problems for maternity services: national overcapacity — regional imbalances — fragmentation of available resources*

M-bed capacity is mainly used for delivery-related stays

In 2014, there were 143 829 hospital stays (with at least a part of their stay) in an M-bed. The majority of these stays (n=141 348 or 98.3%) relate to Major Diagnostic Category (MDC) 14 'Pregnancy, Childbirth and Puerperium'. These stays can be further divided between deliveries[i] (n=122 380) and other related diagnostic groups (n=18 968). While the number of stays for deliveries outside M-beds is negligible (n=879 or 0.7%), the majority of non-delivery related stays of MDC 14 (26 468 stays; 58.3%) does not use M-bed capacity. It mostly (72%) concerns day-care admissions.

While the number of births remains stable, length of stay continues to decrease

The number of hospital stays for deliveries remained relatively stable over time and amounted to 123 259 hospital stays in 2014: 97 054 for vaginal deliveries and 26 205 for C-sections. The proportion of stays for C-sections is slightly higher in Wallonia (22.5%) compared to Flanders (20.8%) and Brussels (20.6%).

The Belgian hospital payment system gives, via the system of justified activities, a strong incentive to shorten the length of stay. The average length of stay for vaginal deliveries and C-sections decreased between 2003 and 2014 from 5.0 to 4.1 days and from 7.8 to 6.1 days, respectively. This decreasing trend is consistent with what is observed in other countries even if the average length of stay in Belgium is still above the EU average.[112]

Variability between Belgian maternity services: large differences in caseload, low variability in length of stay

The median number of deliveries per site is 897 which is roughly corresponds to 2.5 deliveries per day. This situation is comparable to type I maternity services (obstetrics without neonatology) in France which perform 816 deliveries per year, on average. In England, and even more in Sweden, volumes are higher. Yet large variability in caseloads is observed: from 212 (or 0.6 deliveries/day) to a maximum of 3 333 per hospital site (9.1 deliveries/day). In general, maternity services with a higher number of licensed beds have a higher number of deliveries per year. From the 8 maternity services with less than the legally required 400 deliveries per year[j], two do not qualify for one of the exceptions and thus, in principle, should lose their license. Moreover, there are clear regional differences. The caseload of maternity services in Brussels is much higher (median of 2 236 deliveries) than the caseload in Walloon (median of 864.5 deliveries) and Flemish (median of 800 deliveries) hospitals.

In contrast with the high variability in caseload the average length of stay for deliveries does not vary much between Belgian hospitals. An exception are maternity services with MIC-beds and/or university hospitals with a slightly higher average length of stay. This is not unexpected given their reference centre role.

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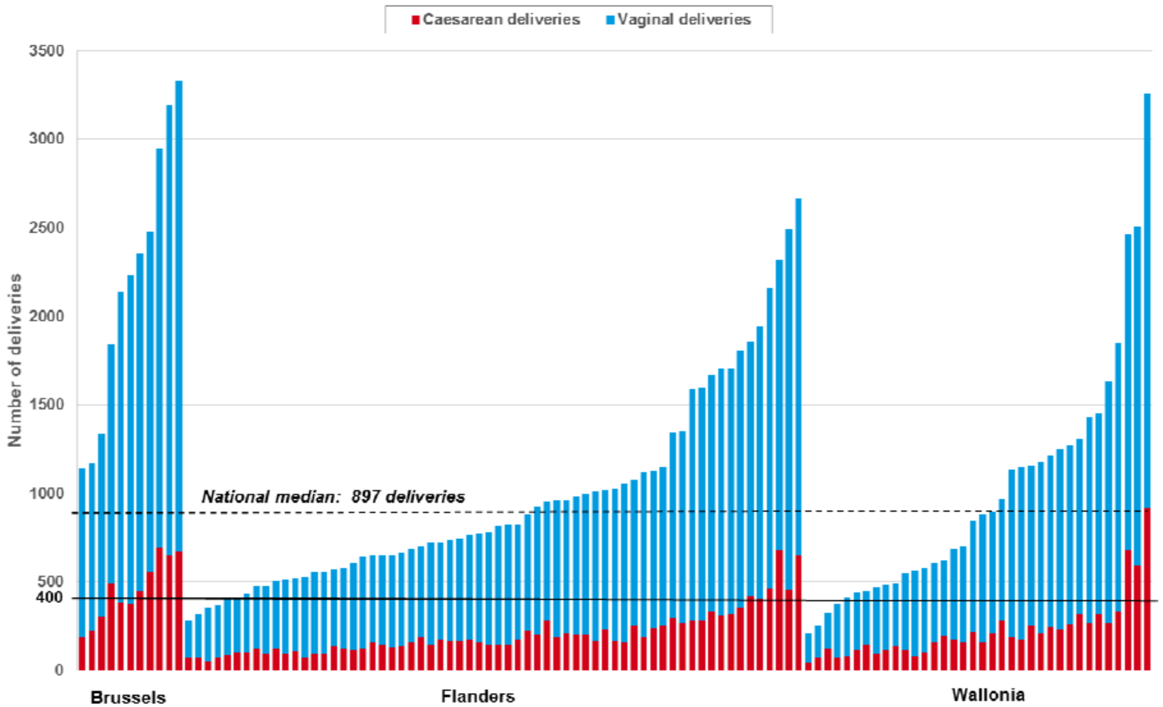
[i] APR-DRG 540 "Caesarean Delivery", 541 "Vaginal Delivery with Sterilization and/or Dilatation and Curettage", 542 "Vaginal Delivery with Complicating Procedure except Sterilisation and/or Dilatation and Curettage" and 560 "Vaginal Delivery"

[j] Calculated on one year while for the legal minimum requirement the calculation is based on an average of three years.

Figure 16 – Number of deliveries per site in Belgium, 2014



Maternity services have very low occupancy rates, except in Brussels

In this section the occupancy rates of maternity services are evaluated. The licensed number of M-beds was used as denominator. It should be noted that this results in a potential underestimation of the occupancy rates as they are perceived in reality. After all, not all licensed M-beds are operational. Indeed, some hospitals have decided to close some M-beds themselves, because they were loss-making due to a structural overcapacity. Yet, they keep these licensed M-beds in their portfolio. Consequently, when the current moratorium rules that prevent hospitals to transform M-beds in other bed types are abandoned, hospitals with a surplus of M-beds are in a preferential position.

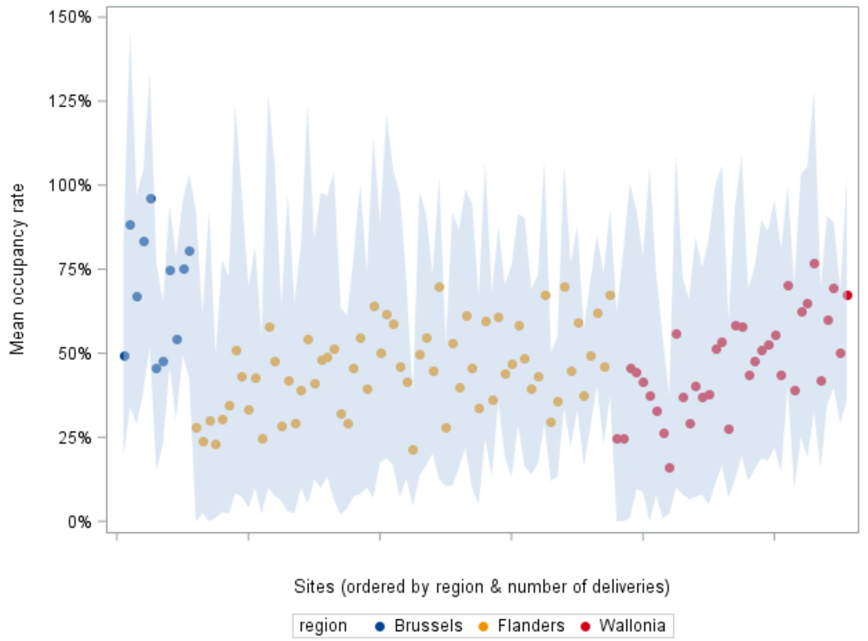
On a national level the yearly average occupancy level of the available capacity of licensed M-beds is below 50%. Variations exist over the period of a year but occupancy rates stay far below the normative occupancy rate of 70% since they fluctuate, over the course of a year, between 39.9% and 58.3%. This is a clear indication that there are too many licensed maternity beds in Belgium. The average occupancy rates for maternity services in France and England are 70% and 60%, respectively. The available capacity is (insufficiently) adapted to changing utilisation patterns, the shortening length of stay in particular.

In Figure 17 it is shown that this surplus in M-bed capacity exists for most maternity services. The annual average occupancy rate of maternity services in Brussels (69.33%) is much higher compared to Flanders (45.1%) and Wallonia (48.0%). In Brussels the annual average occupancy rate varies between maternity services from 45.8% to 96.4% (median: 74.9%). This deviates clearly from the two other regions which have similar occupancy rates: Wallonia (from 15.9% to 76.8%, median 45.0%); Flanders (from 21.4% to 70.0%, median 45.2%). The variation in occupancy rate seems not to be related to the number of licensed beds per maternity service nor to the proportion of nursing days for patients with non-delivery related diagnosis (on average 10.4% of the nursing days on M-beds). However, maternity services with a MIC-department seem to have higher occupancy rates.

Average occupancy rate is, of course, not the best metric to assess the capacity in a domain that is subject to activity peaks (high number of deliveries on the same day). Therefore, also the higher and lower peaks are depicted (i.e. the blue band) in Figure 17. It can be observed that this fluctuates between nearly 0% and 150%. Yet, for most maternity services, the number of days with occupancy rates above 95% is limited (i.e. for 92% of the maternity services in Flanders and Wallonia, this happens less than 10 days a year). In Brussels, the situation is different. While most sites (i.e. 7 out of 11) have less than 10 peak days a year, there are also 4 maternity services with more than 30 peak days a year. In the site with the highest number of peak days this amounts to almost 200 days per year.

In addition, we looked at the number of maternity services that face peak moments (lower threshold set at <30%; higher threshold at >95%) at the same day. On a typical day of the year, there are much more maternity services with thresholds below the minimum threshold than above the maximum threshold. Even on the busiest day of the year (21 December 2013) only 9 maternity services had an occupancy rate above 95% while at the same day 14 hospital sites had an occupancy rate below 30%.

Figure 17 – Average occupancy rate per maternity service in Belgium, 1 November 2013 - 31 October 2014



3.5.4. *Overcapacity will intensify in the future when length of stay further decreases*

As it is clearly illustrated in section 3.5.3 the combination of a relatively stable number of deliveries with a decreasing length of stay resulted in an overcapacity of maternity beds. Based on a normative bed occupancy rate of 70%, the overcapacity is estimated to be 631 beds (or 19.87% of the 3 176 M-beds). In this section we describe the estimations when current policy is continued; estimations when policy actions accelerate the reduction in length of stay; an update of obsolete programming standards; and ways to allocate beds to maternity services.

While admission rates will rise, the length of stay will continue to decrease

The number of births is expected to increase in the coming years due to an increasing population trend.[24] Yet, based on a different composition of the population and different birth rates, this increase will be most pronounced in Brussels (11.6%) compared to Flanders (7.2%) and Wallonia (8%).[24]

It should be noted that the 4.3% (baseline scenario: 2025 compared with 2014) increase in the estimated number of inpatient stays for MDC 14 is lower than the overall increase of 11.9% in inpatient stays. The increase in admission rates for C-sections (i.e. 15.2%) is expected, when no specific policy interventions are undertaken, to be more pronounced than for vaginal deliveries (1.5%). The length of stay is expected to further decrease for both vaginal and C-section deliveries (for example APR-DRG 560 for severity of illness 1: from 3.8 days in 2014 to 3 days in 2025).

Based on these evolutions it is estimated that the number of nursing days will further decrease by 16.7% in 2025 (MDC 14). When looking at the deliveries, this decrease will be more pronounced for vaginal deliveries (19.2% decrease for APR-DRG 560) than for C-sections (12.5%).

The required number of M-beds for the year 2025 is expected to amount to 2 113 beds which is 1 063 less beds than the number of licensed M-beds in 2014 (a reduction of 17% is possible).

Investing in an accelerated reduction in length of stay

The estimated length of stay in 2025 (e.g. 3 days for APR-DRG 560) is still much longer than today's length of stay for normal deliveries in countries such as Sweden (2.3 days) and the United Kingdom (1.5 days). Therefore, it is not unlikely that the reduction will be accelerated by policy interventions. Indeed, this is already included in the Action Plan of the minister where it is stated that: *"International figures show that the length of stay after a normal delivery or C-section remains quite high in Belgian. (…) The resources released by shortening the length of maternity stay (fewer beds) can be used to organise pre- and post-natal ambulatory care (medical and nursing) differently."*[5] On this basis seven pilot projects, with a duration of two years, have been selected at the end of February 2016 to optimise the organisation of care before, during and after the hospital stay. According to the minister, the main objective of the pilot projects is to maximise women's satisfaction with respect to the quality of care in hospitals and at home. A second objective is to allocate the hospitals budgets more efficiently.[113]

Therefore, we estimated the required capacity for a scenario with a shorter length of stay which differs between SOI 1 and 2 and between vaginal and caesarean deliveries. For ease of comparison (i.e. the same classification system) we took the current length of stay in the US as benchmark which was gradually introduced in our projections between 2018 and 2025. Based on this scenario the number of nursing days will be 109 253 days beneath the baseline scenario. The required number of beds will thus further decrease to 1 688 M-beds (or 425 fewer M-beds than the baseline).

3.5.5. *Policy actions to better match demand and supply*

Update programming standards to better reflect the current and future reality

Anno 2014 there are 25.5 licensed beds per 1 000 births which is far below the programming norm of 32 M-beds per 1 000 births. The lower number of licenced M-beds than those based on the programming standards are in contrast with the overcapacity of M-beds (see above). It can be concluded that the programming standards for M-beds are outdated. In fact they date back to the 1970s[114] when the length of stay (and thus the required capacity) was much longer than it is today and will be in the future.

In Table 20 some suggestions are made for alternative programming criteria on which the required M-beds for the territory can be based. The first scenario is based on the distribution of the number of nursing days and births per APR-DRG-SOI (540/541/542/560) which results in 4 510 nursing days per 1 000 births. With a normative bed occupancy rate of 70% (equivalent of 255.5 available days per bed) this results in a programming standard of 17.7 M-beds per 1 000 births. If the current policy to use M-beds for non-delivery hospital stays (about 10% of the nursing days in 2014) is continued, this programming standard is best increased to 19.5 M-beds per 1 000 births.

Table 20 – Scenarios for alternative programming standards to determine the number of M-beds for the Belgian territory

Scenario	Number of nursing days	Bed availability based on normative occupancy rate of 70%	Required number of beds per 1 000 births	Accounting for 10% of nursing days for non-delivery related conditions
Based on current practice: number of nursing days per type of delivery (anno 2014)	4.51 nursing days or 4 510 nursing days per 1 000 births	255.5 days per licensed bed	4 510/255.5= **17.7 M-beds per 1 000 births**	17.7+10%= 19.4 M-beds per 1 000 births
Baseline forecast (2025)	3.57 nursing days or 3 570 nursing days per 1 000 births	255.5 days per licensed bed	3 570/255.5= **14.0 M-beds per 1 000 births**	14.0+10%= 15.4 M-beds per 1 000 births
Scenario with shortened length of stay	2.72 nursing days or 2 720 nursing days per 1 000 births	255.5 days per licensed bed	2 720/255.5= **10.6 M-beds per 1 000 births**	10.6+10%= 11.7 M-beds per 1 000 births

Note: shortened length of stay is hypothesized to be 3 days for APR-DRG 540 (SOI 1), 4 days for APR-DRG 540 (SOI 2), 2 days for APR-DRG 560 (SOI 1), 2.5 days for APR-DRG 560 (SOI 2), and unchanged for other APR-DRG-SOI.

As noted above, programming standards will have to be adapted to a changing context. The alternative programming standards presented in Table 20 anticipate these expected evolutions (e.g. decreasing length of stay; increased proportion of C-sections) resulting in programming criteria ranging between 10.6 to 19.4 M-beds per 1 000 births.

While applying these programming standards to the regional level takes into account regional differences (e.g. higher birth rate in Brussels) it does not account for patient transfers between regions. Since Brussels attracts substantial more patients from outside the own region (24.5%) to its maternity services compared to the other regions (Flanders: 2.1%; Wallonia: 2.4%), these programming standards have to be reweighted when they are applied to the regional level.

Rationalisation of maternity services: a net reduction in the number of M-beds will not be sufficient

The internationally observed reduction in length of stay for deliveries resulted in drastic reductions in capacity of maternity services in the studied countries (England, France, Sweden). This capacity reduction included a reduction in the total number of beds (e.g. capacity maternity services level I in France reduced with 50% during the last three decades) as well as in the total number of maternity services. In all three countries smaller maternity services were closed resulting in a larger number of deliveries per maternity service. In France, for instance, in 2014 about 40% of the maternity services performed more than 1 500 deliveries while this was only 13% in 1996. In fact, only 10% of the maternity services have less than 500 deliveries per year. These services are mostly in rural areas. In England and especially in Sweden, the concentration of maternity services was even more pronounced. Rationalisation efforts of maternity services abroad tried to balance efficiency, accessibility and quality:

- Indeed, economies of scale are a main driver in these reforms. While literature on the economies of scale for maternity services is relatively scarce, several studies using various methods, pointed out that hospital costs are lower when the size (measured as the number of deliveries) is larger. While defining a minimal number of deliveries per maternity service, based on this literature, is difficult, when studies report a minimum efficient scale they are consistently above the current Belgian median number of deliveries (i.e. 897 deliveries per year). This is not surprisingly given that maternity services have large fixed costs (e.g. 24/7 availability of staff for the maternity service, but also for the labour & delivery room and the neonatal care department). Unless whole wards or departments are closed, decreasing the number of M-beds is insufficient to have a financial impact on government budgets. Moreover, larger maternity services will have larger staffing pools which allows greater operational flexibility (e.g. midwifes allocated to the maternity unit can help in the delivery room at peak moments).

- The quality argument (volume-outcome relationship) is less important for the concentration of maternity services (at least for general maternity services and low-risk pregnancies) than it is for complex and rare care. Also the scientific evidence regarding the volume-outcome link in maternity services is quite mixed, especially for low-risk births. Some studies[115-117] have found that delivery (for low-risk women[k]) in a small unit is associated with lower outcomes, but others[118, 119] found that outcomes are unrelated to the size of the maternity service.
- A third criterion is accessibility. Although there are no clear indications in the literature for a relationship between travel time to a maternity service and infant mortality, travel times to maternity services should be kept reasonable. After all, as is shown by one French study[120] the risk of stillbirth and perinatal mortality increases for travel time longer than 45 minutes. In addition, also the likelihood of out-of-hospital delivery increases with travel time.[120-122] The accessibility criterion seems to be differently applied in the three studied countries. In France and England a travel time of <30 minutes is aimed for (in 2012 this threshold was not met in France for 22.7% of the deliveries; in England 8% of the women of childbearing age have no obstetric unit within a 30 minute drive). In Sweden travel distances are much larger and often result in protests from local communities having to travel >65 km or even >100 km to the closest maternity.

It is clear that also in Belgium a capacity reduction of maternity beds is indicated. This capacity reduction should combine a reduction in total M-beds for the country (e.g. by applying new programming standards) with a reduction of the number of maternity services. The former will not result in large budgetary gains for the public authorities since the hospital payment system is mainly based on justified beds (which reflect activity) and not on licensed beds. Nevertheless, it seems reasonable to cut down the number of licensed M-beds to a level that better reflects today's reality. Although the available literature and international best-practice examples do not allow to define strict volume thresholds, it is clear that the largest efficiency gains for hospitals are to be expected by closing a number of maternity services with low activity levels. Exceptions to this rule should be made when accessibility is jeopardized (remote areas).

In Figure 18, three possible scenarios are illustrated: 1) <500 deliveries per year (or 1.4 deliveries per day); 2) < 600 deliveries (or 1.6 deliveries per day); 3) < 700 deliveries (or 1.9 deliveries per day). In 2014, there were 19 (scenario 1), 30 (scenario 2) and 41 (scenario 3) maternity services not meeting these volume threshold. It is clear from the maps that many of these maternity services (indicated in red) are at close distance from larger maternity services. Maternity services can be considered as a 'specialised care assignment' in the context of loco-regional networks. As such not every hospital will need to have a maternity service. However, using minimal thresholds also entails the risk of a regression to the mean. Indeed, given the importance of maternity services (e.g. reputation, link with other services), hospitals within a loco-regional network might refer patients to each other such that all current maternity services can meet this threshold. Programming the number of deliveries based on minimal thresholds alone will therefore be insufficient, parallel policy interventions (hospital payment system and licensing criteria) will be required to incentivize some hospitals to give up their maternity service.

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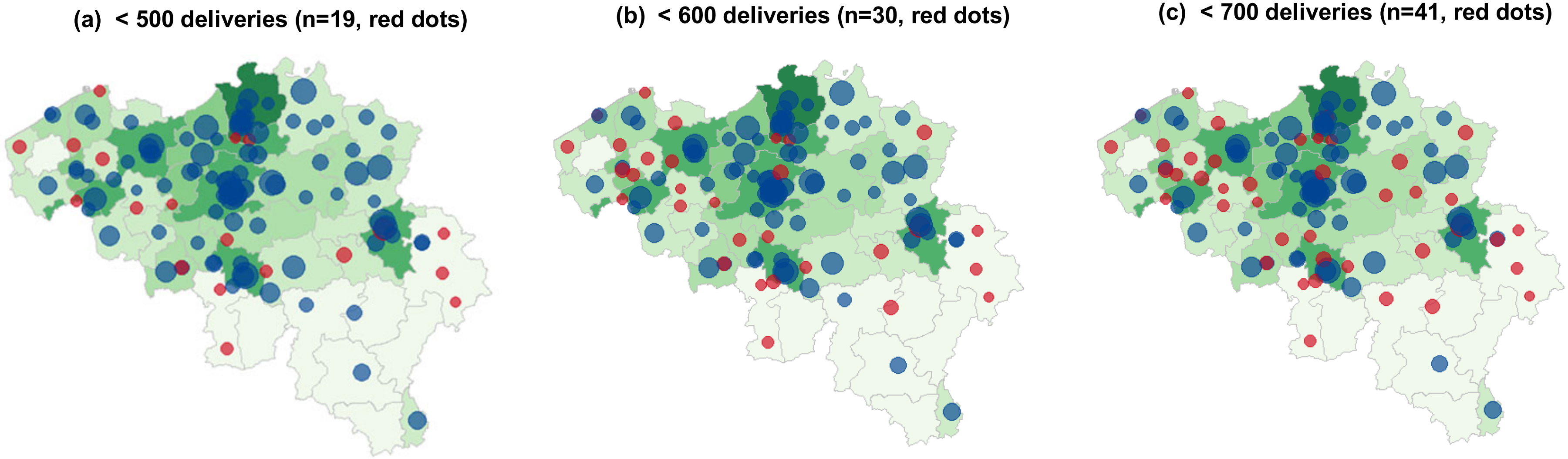
k High-risk pregnancies being considered as out of scope for this report.

Figure 18 – Maternity services in Belgium with less than 500, 600 and 700 deliveries in 2014



Note: the size of the dot represents the number of licensed M-beds; the background colour represents population (women 15-44) density (darker corresponding to higher density, see Figure 16 for the scale).

Most hospitals in the Brussels region have no overcapacity, on the contrary

It is clear that the regional differences should be taken into account when the maternity services are reformed. As indicated previously, in the Brussels region, several maternity services face capacity problems which is illustrated by a larger number of justified than licensed M-beds (see Chapter 8 of the Scientific Report), by less licensed than normative M-beds (see Table 5) and a high number of peak occupancy rates. Since birth rates in Brussels will rise at a faster pace than in the other regions, this problem will continue to intensify when no policy action is undertaken.

Maternal intensive care beds require a specific evaluation

Also in the three studied countries different levels of maternity services exist. Higher levels of maternity services act as a reference centre for high-risk pregnancies and births. Both in France and England hospital networks are set up to improve referral policies between hospitals. The evaluation of maternity services with MIC-beds was out-of-scope of the current report. Nevertheless, already in 2008 the KCE recommended to improve and support (e.g. financial incentives) the referral policies of women at risk; to re-evaluate the required capacity of MIC-beds and to improve the geographical distribution.[123] Since no specific policy actions were undertaken to remediate these problems they might still exist today. An update of the previous KCE study is necessary to enable targeted policy recommendations on this matter that are relevant in the context of the changing hospital landscape.

3.6. The changing role of hospitals

As described above the reforms in most countries try to balance proximity of general services with concentration of specialised services. This will change the role of both smaller and larger hospitals. Regardless of size, for every hospital the question *"which services can the hospital in question safely and sensibly deliver?"* should be evaluated. The three cases (i.e. maternity; complex cancer surgery; radiotherapy) confirm that in the years to come important choices have to be made that will reshape the Belgian hospital scene. From the comparative case study of France, England and the Netherlands, the following observations are of importance in light of the Belgian reforms.

A full range of services in all hospitals is no longer feasible nor desirable

As a consequence of the concentration of specialised care, the number of specialised services in smaller general hospitals decreased noticeably but slower than expected. Despite the international consensus that the traditional system with all general hospitals having the full range of services cannot continue, most general hospitals still have a wide range of services.[124] In the Netherlands, for instance, health insurers can differentiate their purchasing on the type of medical specialist treatments/care. General or basic care embodies high volume care in combination with low complexity. Specialised care has the characteristics of low volume in combination of high complexity care. Although health insurers point out that they would like to establish treatment driven contracts, reality does not align with this yet. In general, hospitals and health insurers make all-inclusive contracts which contain all types of care services. Selective contracting takes place but remains limited to examples such as breast cancer care and hernia operations.[125] Another Dutch attempt to concentrate care based on quality reporting (assumed to have an impact on referral patterns and patients' choice) seems to have only a limited impact.

Specialised care is mainly concentrated in large general teaching hospitals which puts pressure on the smaller hospitals

The concentration of highly specialised services abroad takes often (but not exclusively) place in teaching hospitals located in large cities. These hospitals are affiliated with a medical school, often with a large academic department and a reputation for excellence in research. In the Netherlands, academic hospitals play an important role in the concentration of highly specialised care and distribute tasks between each other (not every academic hospital performs all specialised care). In addition about one third of general hospitals have a role as tertiary care hospital providing specialised services. In France, the more complex surgery is mostly performed by larger public hospitals.

The concentration of specialised services puts pressure on the smaller general hospitals. First, recruitment problems of medical staff are reported especially if a smaller hospital is located in a rural area. While in several reports the idea about a flexible healthcare workforce is put forward in order to keep the work in smaller hospitals with less services attractable (in combination with work in other settings), the feasibility of this idea is questioned since healthcare workers identify themselves with the '*culture of the institution*' and are as a consequence very loyal to their organisation and its values.[124] A second problem is that it is more difficult to survive financially for smaller-sized hospitals that continue to provide a wide range of services.[58] This is due to several factors. In England, for instance, smaller hospitals have a higher percentage of activities under the national tariff. This can be disadvantageous in case larger hospitals can negotiate better payments for the out-of-national tariff services.[58] In addition, smaller hospitals might have problems to achieve economies of scale, a problem that might increase when additional quality standards are introduced (e.g. minimal medical and nursing staffing requirement). Nevertheless, it is also suggested that other factors are more important than hospital size to survive financially like for instance, leadership; provider reputation and '*buyer power*' in procurement.[58] As such, in order to ensure that smaller general hospitals can continue to deliver hospital care to the local population they will have to think out of the box and develop new care models, such as:

- Smaller hospitals will have to join larger hospital networks to address workforce shortages, ensure comprehensive service provision and to make further savings (e.g. for procurements; back office activities). Sometimes, smaller hospitals become part of a larger hospital collaboration and choose to focus particular activities on one hospital site (e.g. day surgery; geriatric care). Yet it shoud be noted that the most commonly applied collaboration, 'the hospital merger', has reached its limits. In all three countries it were often neighbouring hospitals who merged, mostly with a similar service offer resulting in the perpetuation of the traditional model of large, full-service hospitals.[58] In addition, evidence suggests that past mergers were not so successful in terms of better financial performance, productivity, or other process (e.g. waiting times) and quality outcomes.[58, 126, 127] Today, mergers are slowing down and a whole spectrum of other collaboration forms (from joint ventures to hospital networks) is being explored. It is expected that the application of various new collaboration forms will increase in the near future and that the stand-alone general acute hospitals will cease to exist. This can be illustrated by recent developments in France where hospital networks ('*communautés hospitalières de territoire'* (CHT)) were recently reformed to a more structural form of collaboration called 'Groupements Hospitaliers de Territoire' (GHT). While networks such as CHTs were assessed to be useful to create the willingness to use care pathways, their development has been judged insufficient. Since January 2016[80], all French public hospitals have to be part of a GHT. This mandatory collaboration form aims to ensure better access to care by strengthening the collaboration between public hospitals. They are organised around a 'shared medical project' that responds to the population's medical needs (see Box 6). Although GHTs do not explicitly imply concentration of care it is expected that financial solidarity between the members of each GHT will result in a group strategy.[128, 129] With such a common budget for the group, the financial viability of each hospital will no longer be linked to the activity realised in that particular hospital. Therefore, individual hospitals will no longer have incentives to provide the same care activities as their neighbours. Rather than competing with each other, they will develop a group strategy, based on the complementary between hospitals.
- Specialising in particular services (e.g. elective orthopaedic surgery) to build up expertise and gain reputation. This evolution already started abroad. In all three studied countries independent treatment centres (e.g. ZBCs in the Netherlands; specialised private hospitals in France) have grown over the years. The main reason to concentrate these specific services is to obtain efficieny gains. Since there is no competition with unplanned care, these services can also be better carried out as planned (i.e. care is not postponed because of interruptions by unplanned care). Typically, these centres do not treat complex patients. It is, however, unclear that this is so because of financial ('cream skimming') or clinical reasons (e.g. no back-up facilities in case something goes wrong).[63] Examples in both England, France and the Netherlands show that this bussines model works.
- Investing in integrated care models with the ambition to provide primary, social, mental health and secondary care to patients in the local community. In England, for instance, pilot projects are launched to realise this ambition. These projects are based on the US model of accountable care organisations where hospitals are operating together with other care providers in one single organisation.[130] Yet, given the strong differences in historical and cultural backgrounds of primary and seciondary care organisations virtual organisations are deemed more realistic than single merged organisations. This can take the form of a general acute hospital that collaborates with a federation of general practices by using joint ventures or other contractual mechanisms.[130] The Regional Health Agencies ('*Agences Régionales de Santé'*, ARS) and the Regional Strategic Health Plan '('*Plan Stratégique Régional de Santé*'') are a good example for how policymakers in France try to achieve these goals. In every ARS the strategic direction of the region should be defined every five years in such a plan that aims to coordinate ambulatory care, hospital care and health and social care, based on population needs.

Box 6 – ‘*Groupements Hospitaliers de Territoire’* in France

‘Groupements Hospitaliers de Territoire’ (GHT): a new collaboration form in France that is characterised by five key elements:[131, 132]

- The participation is mandatory. Each public hospital must be part of a GHT. Derogations may be granted by the ‘*Agences Régionales de Santé*’ (ARS) if the size, the location or the specialisation of the hospital makes the collaboration irrelevant.
- The GHT is based on a ‘shared medical project’ that describes the supply chain within the GHT.
- Some functions (information, purchases, coordination of training) are pooled and transferred to the designated ‘support hospital’.
- The organisation of medico-technical activities (imaging, clinical biology, etc.) is defined in common. The technical platform does not have to be unique, but the organisation should be.
- The GHT has no legal personality by itself. It functions through the support hospital.

Purely concentrating complex services is of course no guarantee for success. The way this policy intervention is designed and implemented makes a huge difference. From the evaluation of stroke care in London it is clear that the service reconfiguration redesigns should be based on evidence as much as possible. A ‘top down’ approach is advocated in combination with a ‘bottom up’ approach to allow for radical changes and hands-on support should be provided during the implementation phase.[133]

Box 7 – Implementation choices determine the success of reforms: the case of stroke care in England

The importance of implementation choices can be illustrated via the English case of stroke care services where acute stroke units were introduced in two areas (i.e. London and Manchester) in a different way. Although mortality rates dropped in both London and Greater Manchester, only in London it decreased more than in other urban areas in England.[134] The different choices in the implementation process are one possible explanation for these different results. After all, it was illustrated that stroke patients in London had higher chance of receiving evidence-based care compared to Manchester because more patients were treated in hyper-acute stroke units (39% in Manchester compared to 93% in London).[134] As such, it is recommended to design a simple and inclusive model (i.e. all stroke patients) rather than a complex and selective (i.e. only patients below a certain time threshold). Other differences that contributed to the different results were: the launching of the system (one single day in London versus a phased implementation in Manchester); the level of support (hands-on support in London versus passive knowledge sharing in Manchester) and leadership style and the management of local resistance (a combination of ‘top-down’ system leadership with ‘bottom-up’ clinical leadership in London versus a more bottom-up and consensus-driven approach in Manchester).

4. EVIDENCE-INFORMED PLANNING AND PROGRAMMING: NEXT STEPS

Healthcare planning is a core component of health system governance as it forms a key instrument for decision makers to influence and direct health service provision. Health systems differ in their approach to planning, reflecting the institutional, legislative and political framework of a country.[10] In most countries the central government is responsible for developing the overall framework for funding and organising healthcare, but the governance of the system is often shared with regional and local authorities.[14] In the Belgian context, with the division of competencies between the federal government and the federated authorities, this is certainly the case.

A framework for assessing planning and programming

Fazekas et al. (2010) developed a framework 'assessing, improving and enhancing health service planning'.[10] They emphasize the importance of a transparent, evidence-based and goal-oriented approach, certainly because healthcare planning is embedded in the wider economic and political context of a country. In the reform plans of the minister, evidence plays a central role in programming, much more than was the case before. This policy direction certainly fits in that approach.

The framework considers healthcare planning as an explicit process of defining objectives and devising strategies for how these objectives can be met. Although theoretical in nature, the framework was developed as a set of criteria that can easily be applied to the planning reality of a country (see Box 8).

Box 8 – Assessment criteria for healthcare planning

Vision

Alignment of planning goals with health system goals

Comprehensiveness of the planning approach

Planning horizon

Governance

Clear responsibilities and lines of accountability

Appropriate sanctions and incentives

Balanced stakeholder involvement and commitment

Consistency of strategic and operational planning approaches

Intelligence

Availability of high quality data, of appropriate analytical tools and of adequate analytical and administrative capacity

Continuous monitoring and evaluation

Throughout the report we already discussed the first five steps of evidence informed decision making (see Figure 10). The process of evidence-based decision making requires two additional steps: implementation and evaluation. Policymakers have to decide whether the evidence, adapted to the local context, will be used and whether/how the implemented changes will be evaluated. The criteria for 'governance' and 'intelligence' are clearly related to the implementation and evaluation phase of planning (and programming).

For example, consistency of strategic and operational planning approaches refers to the extent to which strategic goals are translated into operational objectives and thus outline actionable and measurable items. These are more likely to be put into practice if they are aligned with incentives and/or sanctions. Moreover, implementation appears to be easier to enforce in healthcare systems in which planning is linked to resource allocation.

‘Intelligence’ refers to the availability of instruments and means to implement and evaluate reforms: a sound information base to assess current and future healthcare needs of the population. High-quality data are essential in any policy reform that has the intention to reduce the mismatch between supply of services and population needs. Effective planning also requires the ability to project future healthcare needs. Analytical tools, as the one developed in the current study, should be developed and updated to that end. Last but not least, lack of human capacity can undermine the (timeline of the) planning process. Sufficient and adequate analytical and administrative capacity is required to support effective planning.

In line with the final step in Figure 10, continuous monitoring and evaluation are crucial. New information and insights should be fed back into the planning process. Indicators reflecting to what extent planning goals are attained play an important role in the monitoring process because they allow for measuring achievements and detecting gaps.

RECOMMENDATIONS[I]

GLOBAL HOSPITAL CAPACITY

To the Minister of Social Affairs and Public Health, after advice of the competent bodies

- **The available bed capacity in acute hospitals, in terms of licensed beds, can be reduced by 9 308 beds. A reduction for all bed types is needed, except for G- and S-beds.**
  - **When translating the reduction in bed capacity to the level of the federated entities, the results should be corrected for patient flows between the regions.**
  - **When the increased ageing from 2030 onwards is anticipated it is advisable not to reduce the hospital bed capacity entirely to the estimated need in 2025 but to keep a spare capacity of 3 476 hospital beds to accommodate the additional needs from 2030 onwards. Next to the reduction in bed capacity, it is needed to transform part of the hospital bed capacity into S- and G-beds. By 2030 capacity will have to be expanded by 1 308 G-beds and 669 S-beds.**
- **As was the case in the past, accompanying policy measures are needed to make the recommended reduction in bed capacity possible (e.g. financial incentives to substitute inpatient by day-care stays and to reduce hospital length of stay).**
- **Parallel to the recommended changes in hospital bed capacity an evaluation of the required number of qualified personnel will have to take place. Budgets will have to take into account that the remaining nursing days for inpatient stays will become more labour intensive and more complex as a consequence of a shortened length of stay and an increased shift towards day care. Given that the average number of patients per nurse in Belgium is higher than in other European countries, measures are needed to prevent overload of hospital staff and to ensure the quality of care.**
  - **A possible measure is to reinvest the due to the rationalisation effort released budget, in budget for staffing on top of the general staffing budget and existing measures (e.g. budgets for ‘bank nurses’ and ‘Social Maribel’).**
- **Since the trend analysis conducted in the current study is associated with a number of uncertainties, the analysis should be updated periodically to pick up emerging trends and**

[I] The KCE has sole responsibility for the recommendations.

disruptive changes in a timely manner. The necessary resources must be provided for this purpose.

- **To tune the current and future supply with the population needs as best as possible, more detailed analyses at the level of the care assignments (or cluster of care assignments) are needed.**
  - **These analyses should allow that the matching of supply to needs is as much as possible supported with scientific evidence. In this regard, a balance must be sought between quality, efficiency and accessibility based on different criteria (e.g. urgency level of interventions, capital intensity, size and composition of the target population, degree of specialisation and complexity, availability of staff and frequency of the intervention per patient, seasonal variations, variations in occupancy rate during weekends and holidays, etc.).**

To the Interministerial Conference Public Health

- **The future need for hospital beds depends on the availability of alternatives for traditional hospital care. It is advisable to further expand these alternatives such as home care, residential care for older persons or rehabilitation care.**
- **The further expansion of G- and S-beds should permanently be aligned with the policy on alternatives for hospital care such as:**
  - **S2-beds (locomotor rehabilitation) and S3-beds (neurorehabilitation) aligned with ambulatory rehabilitation**
  - **S4-beds (palliative care) aligned with palliative home care**
  - **S6-beds (psychogeriatric rehabilitation) aligned with care in nursing homes**
- **Further efforts should be made on interventions that avoid or shorten the hospital stay. For people with dementia**
  - **a further expansion of capacity is required, e.g. specialised units in nursing homes.**
  - **geriatric expertise in primary care and nursing homes (e.g. geriatric consultations) should be reinforced.**
  - **it is advisable to invest in interventions with demonstrated impact on hospital admissions (e.g. advance care planning, palliative home care).**

To the federated entities

- **By 2025 an additional capacity of 119 S-beds will be needed in the specialised hospitals (‘categorical hospitals’), by 2030 an additional expansion with 81 S-beds is needed.**

To the hospital sector

  - **The medical and surgical day hospital should evolve towards an infrastructure and organisational model where day-care stays do not longer have to compete with inpatient admissions (e.g. staff, patient flows).**
  - **Part of the C- and D-units should be reoriented to G- and Sp-units.**

CARE ASSIGNMENT MATERNITY SERVICES

To the Minister of Social Affairs and Public Health, after advice of the competent bodies

- **Taking into account the current and estimated (2025) length of stay after delivery, and a normative occupancy rate of 70%, the required number of licensed M-beds is 17.7 or 14.0 M-beds, respectively, per 1 000 births.**
- **Based on an analysis of current use (e.g. other admission reason than delivery) and after consultation with experts, the programming criteria can be increased by the current percentage of 10% or an adjusted percentage.**
- **To ensure accessibility within a reasonable period of time (e.g. within 30 minutes) it may be necessary to maintain maternity units with a suboptimal bed occupancy rate in certain geographic areas, which requires an increase in the programming criteria.**
- **For allocation to the federated entities, the programming criteria should be corrected for patient flows between regions.**
- **The programming criteria should be revised periodically and when necessary adjusted to (desired) evolutions in length of stay. Based on the evaluation of the pilot projects ‘shortened length of stay after normal delivery’ a first revision may be necessary.**
- **Increasing the minimum standard of 400 deliveries per maternity service seems, based on literature and international practice, necessary to achieve economies of scale. To determine a specific threshold research into the relationship between the number of deliveries and (staff) costs should be set up.**

- **It should be investigated whether the number and spread of MIC-beds is geared to the need for a more intensive follow-up of pregnancies and deliveries at risk.**

To the federated entities

- **Current licensing norms (e.g. an average of at least 400 deliveries per year over a period of three years, with some exceptions based on geographical grounds) must be applied.**

CARE ASSIGNMENT OF RADIOTHERAPY

To the Minister of Social Affairs and Public Health, after advice of the competent bodies

- **In order to achieve economies of scale, the programming criteria should be adapted such that radiotherapy is concentrated on a maximum of 25 sites with on each site at least 3 EBRT devices and a minimum of 1 000 treatments per year.**
- **Sites with less than 1 000 treatments per year should be gradually closed or merge with a larger centre.**
- **Distribution of radiotherapy centres across the regions should take into account the differences in cancer incidence and patient flows.**
- **Loco-regional networks without a radiotherapy centre will have to collaborate with radiotherapy centres from other loco-regional networks.**
- **For a selection of specialised indications and techniques reference points should be appointed at the supraregional level on the basis of demonstrable expertise.**
- **Based on evolutions in cancer incidence, the optimal utilisation rate per cancer type and medical/technological developments, the need for additional devices must be evaluated regularly.**
- **For promising innovative technologies with insufficient clinical evidence, but with sufficient indications that they are safe and (cost-)effective, a temporary 'Coverage with Evidence Development (CED) in Research' approach can be considered in centres that meet the expertise and volume requirements. At the end of the evaluation period a final decision can be made to reimburse the new technology/indication or not.**

CARE ASSIGNMENT COMPLEX SURGERY FOR CANCER OF THE PANCREAS, OESOPHAGUS AND LUNG

To the Minister of Social Affairs and Public Health, after advice of the competent bodies

- **To reduce the current fragmentation of complex cancer surgery, a concentration within a limited number of reference points is required. Based on practice in other countries and taking into account previously recommended minimum volume criteria for Belgium, the number of centres that are allowed to perform complex cancer surgery should be limited to:**
  - **2 to 13 centres for pancreatic cancer**
  - **4 to 5 centres for oesophagal cancer**
  - **23 centres for lung cancer.**
- **The minimum volume to be considered as reference point is best determined only on the basis of complex surgery in cancer patients, in particular:**
  - **For pancreatic surgery: minimum 10 to 20 pancreatic resections in cancer patients per year; the minimum number of the most complex surgery (i.e. Whipple-surgery), has to be determined as well.**
  - **For oesophagal surgery: minimum 12 oesophagal resections in cancer patients per year.**
  - **For lung surgery: minimum 20 lung resections in cancer patients per year. (Note that billing codes urgently need to be adapted to distinguish a lobectomy from a pneumonectomy; when adapted and after a first observation period it may be decided to further reduce the number of reference points.)**
  - **Similar complex interventions performed in non-cancer patients also should be concentrated in the reference points concerned, but are not taken into account to determine the minimal thresholds.**
- **The minimum volumes should be determined per hospital site as an average of the three most recent available years.**
- **To apply statistical testing of the performance of a centre, the minimum volume must be set to a sufficiently high level.**

- **Also for surgeons minimum volume requirements should be defined.**
- **Each reference point should have at least two surgeons who comply with these thresholds and must be able to demonstrate adequate absorption capacity (staff, operation theatre, intensive care…) to ensure that patients are operated within a reasonable time frame. In addition a reference point must meet other conditions, such as nursing staff and allied health professionals, quality assurance, etc. These additional criteria were not part of the scope of the current report.**

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COLOPHON

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