

Vision for the Future Hospital in Response to the Challenges of the Current Reality

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Received: October 22, 2024; Accepted: November 06, 2024; Published: November 11, 2024

Literary Study

Preface

Healthcare is confronted by enormous challenges such as financial and demographic changes, exponential technological progress, an increasing incidence of chronically ill patients with changing needs for care.

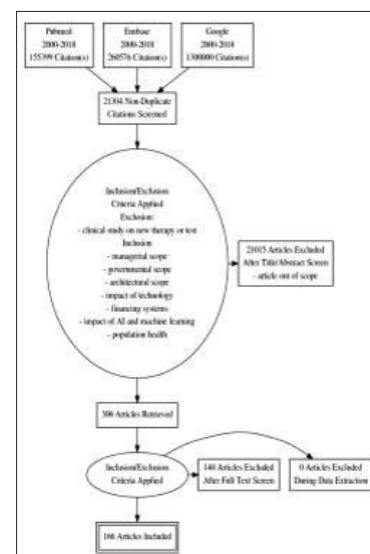
To meet these challenges and the associated changing of social needs and expectations, our healthcare is constantly evolving. When there is an acceleration or fault line in the variable care needs, it is insufficient to make adjustments only to the current models but also there is a need for a fundamental reform. If health care is to be affordable, high-quality and accessible in the future too, then the use of scarce resources is crucial. This research focuses on the hospital of the future and the future of the hospital within a larger healthcare system and consists of two large sections.

The first part comprises a literary study with an objective representation of the challenges in care view and trends that are described nationally and internationally as possible answers to these challenges.

In the second part of this study, we look for the most supported vision of the interpretation of the hospital of the future within Flemish landscape in response to the challenges described. What are the main points that must be used?

Search terms: hospital of the future; future hospitals; future of hospitals; evolution; innovation; development; pitfalls; future; genetic profiling; personalized medicine; health app; medical technology; telemedicine; artificial intelligence; machine learning; big data; privacy; hospital architecture; healthcare workforce.

The inclusion and exclusion criteria can be found in the Prisma chart below.



Technology: Development and Innovation

A hospital without technology is almost inconceivable when it comes to the hospital of the future. The use of robots, big data, etc. is already a path that can be further developed until 2030.

New medication and treatments will be available in the hospital of the future, thanks to the progress that is being made. However, many people will not be able to pay for it or have access to it (The Telegraph, 2017).

Data Collecting and Processing (Big) Data

The amount of data that is digitally collected and stored is huge and is increasing rapidly. As a result, the science of data management and analysis is also being improved to enable organizations to turn this huge tool into information and knowledge that help them achieve their goals. Computer scientists have invented the term "big data" to describe this technology.

While the entire healthcare system is evolving into patient-centred care, effective data management is essential to provide doctors and other healthcare providers with insight not only into individual patients' data, but also into public health data, data of patient's

history, and family history in order to identify underlying patterns and to discover disorders.

Social media also contribute to the development of knowledge. On social media you find all kinds of experiences, a detailed overview of daily evolutions and activities, possible side effects, etc.

In addition, there are advanced technologies and informatics that are used to generate and process large sets of biological data (omics data), which causes a huge shift in the biomedical sciences. The question can be raised whether this will continue to be a role for hospitals in the future, or whether this role is more likely to shift to large research institutions that have the proper methodology and people to achieve this.

Big data can considerably increase the capacity to generate new knowledge. The cost of answering many clinical questions prospectively and even retrospectively, by collecting structured data, is priceless. Big data can also help in distributing knowledge. In the future, patients will themselves have access to their medical data and will play a more active role in this data collection. The possible consequence is that patients can help determine who can access their health and disease data (for example, general practitioner, pharmacist, caregiver, etc.).

This data sharing must not only take place between hospitals, but also with primary care, home care, chronic care and the government. This can form the basis of real-time quality control.

Security

Data security in healthcare is not just about protecting the confidentiality of data. If its integrity and availability are compromised, there is a potential risk for patients. What threats will hospitals face in the future? How can they protect themselves? What are the challenges of the future? There are three major problems when considering the use of data: the availability, integrity and confidentiality of data. In healthcare, it is not the confidentiality of data that is most important, but the integrity of data.

For many years, all hospitals have automated three important administrative functions: payroll, economic and financial management, and invoicing. Most hospitals have also digitized their medical data, reports and prescriptions. After all, before the medical records were automated, nobody was concerned about data security. As soon as hospitals started to automate the core activities of the hospital, namely health care, safety concerns arose.

With the spread of digital technologies, cyber offenses can pose a major threat to the hospitals of the future. Managers must understand that cyber security is the other half of digital implementation.

Artificial Intelligence (AI) and Machine Learning (ML)

Large companies and governments worldwide see Artificial Intelligence technology as one of the important strategies to deal with the huge amount of digital data that is generated. The application of Artificial Intelligence and Machine Learning in healthcare ensures that data from large groups of patients can be used to predict disease progression.

Integrating Machine Learning with clinical decision-making tools, such as automated alerts or diagnostic support, provides health professionals with focused and up-to-date information that can improve clinical decision making.

New Slopes

Development of Medication

Medicines Optimization is defined as a person-oriented approach to safe and effective drug use, to ensure that people obtain the best possible results from their medicines.

A shift from chemically synthesized to biological drugs has recently occurred, which can be considered a minor revolution in the development of medication. Biomarkers, in particular, provide information about the risk of disease, treatability and/or long-term progression.

The hospital of the future will make data-driven decisions possible to automate the patient's 5Rs (right doctor, right medication, right time for medication, right dosage, right delivery).

Genetics

Since the launch of Human Genome Project, more than 1,800 disease genes have been discovered and more than 2,000 genetic tests have been developed for human diseases. Genomics has become an important part of digital health. Computers and robotics are needed to, among other things, scale genomic sequencing and enable gene editing. This development has delivered the most value for oncology, but also on a smaller scale, non-cancer indications have identified targeted approaches.

The hospital of the future will provide new and extremely complex healthcare services, such as genome-based and personalized medicine based on new health technologies that require expert skills. Hospital professionals will therefore no longer focus solely on health problems of diagnosed/confirmed diseases, but will also focus on treating potential health problems that have not yet been diagnosed.

Developments in Genetics Improve the Scientific Understanding of Links between Genetics and Susceptibility to Diseases Technology of Point of Care, Lab - on - a - chip and Liquid Biopsies

Nanotechnology and 3D printing technology are evolving rapidly and the construction of micro- and nanomachines is rapidly approaching. As a result, it will be possible to perform tests faster and closer to the patient or the patient's bed and thus saving time and ability to start the necessary therapy faster. This is preceded by the continuous blood sugar measurement, which it is currently used.

Liquid biopsies will allow you to make faster and perhaps better cancer diagnoses. Nanotechnology could also be used to bring therapeutic agents in the body to the right target organ.

Providing Care Robotics

The use of robots is also a widespread phenomenon in the industry. Since 2000, robots have also been used as a helping hand by the surgeon in the "digital operating theatre". The use of robotics in the operating theatre ensures less invasive surgical techniques and therefore a shorter stay in the operating theatre and in the hospital, as well as a faster recovery and a reduced risk of complications for patients.

In health care, people turn increasingly to chatbots to reach patients. The idea of a chatbot is not new. Eliza, the world's first chatbot, was created 50 years ago by MIT scientists. Since then, different types of virtual assistants have emerged: robots that act as virtual nurses to help patients with their compliance, robots

that give clinical advice to patients to assess their condition and propose follow-up, robots that let patients chat, robots that are able to send photos (or copies) of lab results to doctors, etc.

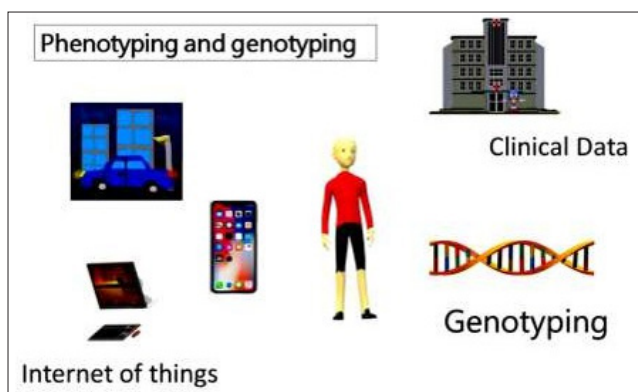
In a number of hospitals (such as Mission Bay Medical Centre, University of California, San Francisco, USA) many of tasks are already performed by logistics robots. With the help of their own programmed lifts, food and other supplies can be automatically transported from one part of the hospital to another, and even to a patient's room. In addition, robots will also be used to move patients through the hospital for tests or interventions, and physical therapists will largely be replaced by robots for (rehabilitation) exercises of patients. It is important to note that the robots of the future will be much more lifelike than we can imagine and that they will also be able to converse.

The challenge will be to enable penetration into the hospitals of the future through a sufficiently diversified and competitive range of robots.

Health Apps

Through health applications the patient can follow up his health closely. The most popular categories of health and wellness apps are: apps that monitor sports and fitness activities, apps for diet and nutrition, apps with weight loss coaching, apps that analyse sleep cycle, apps for meditation, apps for medical advice, etc.

The hospital of the future will use incentives based on games (gaming) to improve patient compliance and / or collaboration with the care team. Moreover, these technologies can be used in and out of the hospital upon discharge. This conversational interface allows direct and immediate communication with care team, let the patient feel at ease and in control of his / her health. The hospital of the future will use digital patient journals or apps that are directly shared with the hospital and medical staff to gain a better understanding of how the patient feels.



Telemedicine

The telemedicine technology is already available and its use is nowadays largely limited by questions about the best way to put it into practice.

Telesurgery will also be increasingly used in surgical procedures, in which surgeons operate from their office with remote robotic arms, without actually having to go to the hospitals to practice their profession.

Although telemedicine facilitates communication with the patient and between the care team, it also has four drawbacks, namely: blurring of patient-doctor relationship, threat to patient privacy,

too much focus on a 'one-size-fits-all' implementation, and the attraction to assume that a new technology must be effective.

One of the old principles in patient-doctor relationship is the therapeutic value that comes with a face-to-face encounter. The relationship between patient and doctor is important to promote mutual trust and empathy. It is therefore important that telemedicine is only used as a supplement on top of face-to-face meetings, and only for those patients with whom the health care provider already has an existing relationship.

Evolution of the Population

The population is constantly changing. This evolution has important parameters that must be taken into account when drawing up a future health policy.

- The Epidemiological Transition
- People Live Longer, But Also in Good Health: State of Affairs

Life Expectancy

According to 2015 figures, life expectancy at birth in Belgium was relatively high among 81.1 years of the age compared to 77.9 years in 2000. With this, the Belgian still scores above the EU average (80.6 years).

According to more recent data, average life expectancy at birth in 2017 for entire Belgian population was 81.4 years, with men's life expectancy of 79.0 years and women's life expectancy of 83.7 years. Life expectancy at birth was higher among Flanders (82.2 years) compared to Brussels (81.2 years) and Wallonia (79.8 years).

Causes of Death

According to 2014 figures, cardiovascular disease appears to be the leading cause of death among Belgian women. In men, cancer is the main cause of death, followed by cardiovascular disease. A total of 30,260 people died of cardiovascular disease in 2014 (compared to 27% of all deceased Belgian men and 31% of all deceased Belgian women). In addition, more than 27,200 people died of cancer (compared to 29% of all deceased Belgian men and 23% of all deceased Belgian women).

Heart Disease (ischemic and other) and Stroke Remain the main Causes of Death According to the Trends of more Specific Causes of Death.

Important Determinants for Quality of Life

Muscle and joint disorders (including low back and neck pain), diabetes and major depressive disorders are (in addition to the main causes of death) the main determinants of poor health in Belgium. These disorders are not fatal, but they can seriously affect health-related quality of life and also lead to various functional limitations.

In the total Belgian population, 74% of them say they are in good health, which is better than the EU average of 67%. However, there is a large socio-economic gap in this regard. This is evidenced by a lower score of less than 60% for people in the lowest income quintile compared to 88% for people in the highest income quintile.

Risk Factors

The main Determinants are Alcohol Consumption, Smoking, Lack of Exercise and Nutritional Risks.

The Aging Population

The impact of aging will become increasingly clear in the coming decades. It is necessary to plan ahead and to ensure that we meet care needs of this aging population in the future.

Chronic Disorders, Comorbidities and Long-Term Functional Limitations

In the future, integrated care, whereby care providers will work together in a coordinated manner, will become a necessity more and more. It is important for health policy to know the prevalence of chronic disorders and to recognize which disorders occur most frequently, since persons suffering from chronic disorders have more health needs and higher health costs.

Mental Health

Mental health problems and mental distress have a major impact on different levels. They cause suffering to the person and his / her environment and, in addition, these problems are often accompanied by a deterioration in social and physical health.

The Elderly Hospitalized Patient

The recent KCE study on developing hospital beds in 2025 assumes an increasing need for geriatric hospital beds.

Important points of concern here are: cognition / delirium, functionality and mobility, falls, pain, medication and pressure ulcers.

What Does the Future Hold? Some Prospects

In an attempt to map out future trends in aging populations, Eurostat made a forecast for the period from 2015 to 2080. Given the high number of baby boomers, the number of older people will increase in the coming decades.

In Belgium, four people of working age are currently responsible for one over-67, but this ratio will increase sharply in the future. As a result of the extinction of the baby boom generation, this ratio will stabilize at one over-76s per 2.6 people by 2040.

From Patient to Partner in Healthcare More Involvement of the Patient

The hospital of the future is confronted with a more articulate patient who wants more involvement in his / her care. The patient expects personalized, real-time access to his / her healthcare services and staff via his / her connected devices, such as mobile applications.

Self-Care

Patients have primary responsibility for managing their health in the context of their future lives and this must be recognized within the service and in the way healthcare professionals treat patients.

It is also important to involve the patient in decision-making. When discussing decisions about examinations and treatments, one should do this in such a way as to enable the patient to express his personal needs and preferences.

Personalized Care

The hospital of the future will become more user-friendly. For example, the hospital of the future has no waiting times, and family members (including children) can come and visit the patient at any time and be present during treatment if desired by family and / or patient. Parents will be encouraged to stay with their sick child, for which pediatric rooms will be matched with a

shower and kitchen to prepare meals. The hospital rooms will be light and spacious, and will be equipped with large interactive screens on which patients can see their own results and progress, request a consultation with their doctor or therapist via video link, view individual medical information about their condition via internet searches, order room service and contact other patients with similar conditions. Patients will be better informed and the patient's autonomy will play a greater role in decision-making on all aspects of their care, including treatment options and end-of-life care. The traditional form of care whereby each patient receives the same care will be replaced by a much more personal approach to the patient.

The hospital of the future will systematically redesign the service experience based on innovation to work in a truly patient-oriented method. Hospital services will have to evolve along with clinical knowledge as well as with patient expectations, systematically evaluate and improve patient experience and quality of service. The future innovation of hospitals will promote the establishment of partnerships with other healthcare providers and business community to discover, conceive and model new services and new ways of providing services. Patients' involvement in redesigning health services will be promoted and their perception of health services will be consistently evaluated for quality.

Higher Involvement of Patient Care for Higher Quality of Care Patients, health care providers, hospital managers, researchers and policy makers all agree that patients (and families) involvement in care is essential for safe care.

Moreover, the patient also expects to receive this safe care. Other quality dimensions include: effectiveness, efficiency, timeliness, equality and patient orientation.

Moreover, it is important that hospitals communicate transparently about the quality of care they provide.

Financing Current Hospital Financing

The current financing of Belgian hospitals is characterized by two important income streams, namely: The Budget of Financial Resources (BFM) and the fees of doctors. The BFM, the first most important income stream, is a nationally closed budget.

Innovative Forms of Financing Pay-for-Quality

Financing via Pay-for-Quality focuses exclusively on financing the quality of the care provided.

Bundled Payment

Bundled payment refers to a form of payment that is based on a predetermined expected cost for a group of related health services.

Low-Variable Care

An example of bundled payment that was recently implemented in Belgium is low-variable care (Law on the bundled financing of low-variable hospital care, 2018).

From Non-Profit to Profit?

The commercialization of hospital sector is mainly noticeable by the increasing number of private clinics in Belgium.

It was necessary to incentivize doctors in order to get doctors and hospitals better aligned to safeguard continuity together. We proposed three possible mechanisms:

- Incorporating an outpatient clinic in BFM.
- Fee remittances for investments in a jointly managed investment fund.
- An HRM policy aimed at remunerating intramural tasks (call-on waiting staff, head of department, head of MR, etc.).

Collaboration

- The pressure on the current health system and the need for cooperation
- Evolution towards formal partnerships in Flanders

A number of initiatives have also been taken in Flanders to connect hospitals with each other and other care actors.

It aims at transforming the competitive model and unnecessary duplication of technology and infrastructure between hospitals into a collaborative model in order to jointly strengthen the quality of care provision. These objectives are only partially achieved.

In the future, hospitals need to be connected to networks. These networks can consist of several hospitals, later referred to as 'clinical networks', or hospitals in a network with other care actors, hereinafter referred to as 'integrated care', 'horizontal networks' or 'local care networks'.

Clinical Networks: Collaboration with Other Hospitals Fragmented Collaboration between Hospitals

To date, there are 55 active hospitals in Flanders, spread over 105 hospital campuses, accounting for 29,577 hospitalization beds. Flemish hospitals currently work together on an informal basis. So, there is an essential need for formally structured partnerships at the organizational level. Clinical networks or hospital networks are formal partnerships between hospitals and emerging organizational forms that are designed to meet these new challenges of health systems.

Creation and Development of the Clinical Networks

Two categories of clinical networks are proposed in the publication, which will be given a more appreciable concept description of the further elaboration of the proposal.

Loco-Regional Clinical Networks

Loco-regional networks are clinical networks that offer basic or proximal care within a reasonable distance from each patient's place of residence. The target population of each network comprises 400 to 500 thousand potential patients in a geographically bordering area.

Supra-Regional Clinical Networks or Reference Networks

Supra-regional networks fulfil (very) complex and / or (very) rare care tasks that require fewer hospitals, less than 1 in every 400 to 500 thousand potential patients. These networks consist of a reference point, namely the hospital that offers the supra-regional assignment, and the connected loco-regional networks.

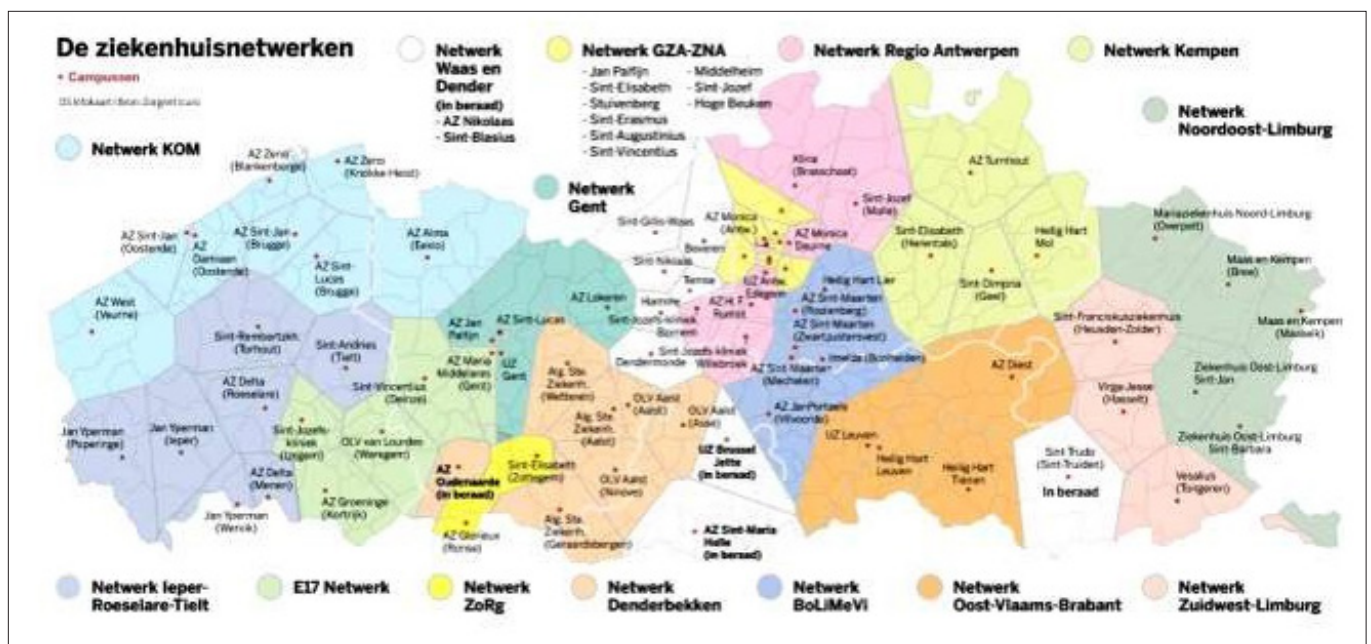
The supra-regional assignments will be offered by a limited number of (university or general) hospitals.

The supra-regional assignments will be split into reference assignments and university assignments. The latter can only be offered in a University Hospital.

Progress in the Formation of the Clinical Networks

After a number of changes to the preliminary draft bill on forming clinical networks between hospitals on the advice of the Council of State, the Council of Ministers approved the preliminary draft bill on 20 July 2018 (Presscenter, 2018). The law itself was finally approved in the parliament on 14 February 2019 (approved bill of 14 February 2019).

Hereby, the phase of hospital networks formation can start. The current consultations are visually translated for Flanders as follows:



Integrated Care: Cooperation with Other Care Actors

The need for Integrated Care

There are various reasons why it is becoming increasingly complex to offer optimal care. Fast-growing medical and scientific knowledge leads to more diagnostic procedures and treatment modalities. For this reason, optimal collaboration and coordination between healthcare professionals have become essential requirements in the provision of high-quality healthcare.

Cooperation between all care providers is therefore necessary, because there is no profession that can meet all the needs of a chronic patient. As a result, cooperation will not be limited to reciprocal hospitals, but must also be interdisciplinary. In this context we speak about integrated care.

A Conceptual Framework: What is the Integrated Care?

"Integrated care", "managed care", "patient-centered care", "coordinated care", "disease management" and "case management" are often common terms. Despite the difference in terminology, avoiding fragmentation of care and optimizing coordination and continuity by focusing on the patient in the care process is the goal of each of these concepts.

Terms that are often used interchangeably, but have different meanings, are "integrated care" and "disease management". In disease management, the disease is central and the focus is on patients with a specific disorder (for example care pathways). The term that is more broadly defined is "integrated care". Care is central here; it is for people with complex needs that arise from various chronic conditions. In addition, the patient is highlighted instead of the disease.

Vertical and horizontal integration are two forms of integrated care between which a distinction is made. Bringing together services at different levels is referred to by the term "vertical integration" (for example, hospitals and outpatient care). With this form of integration, the first, second and third lines are brought together. When services of the same level are linked, this means "horizontal integration" (cooperation between care providers in a multidisciplinary team within the same setting).

The Goal of Integrated Care

Patients with multiple chronic conditions need an integrated care model acts to maintain self-reliance. For this purpose, networks must be developed in which the care needed by these patients is brought together.

The Institute for Healthcare Improvement introduced "Triple Aim" concept. These main goals of this concept are to promote public health, improve the experience of patient care and reduce the cost per capita for care.

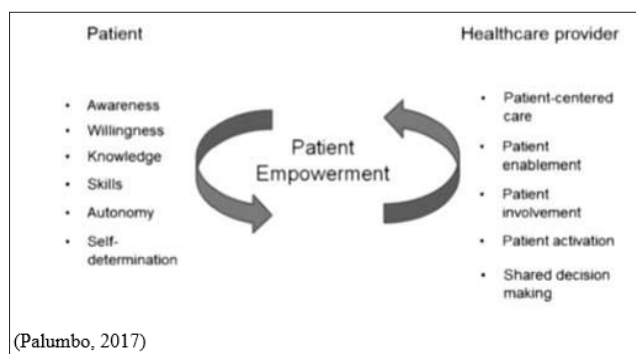
The Patient is Central

The central starting point for our new, integrated care model is the patient. Patient-oriented care strives to recognise the person behind the patient, to fully answer his / her specific health and / or social needs; and to improve the quality of care.

Patient Empowerment

Patient-oriented care goes hand in hand with patient empowerment.

Patient empowerment can be described as "patients accept responsibility for managing their own condition and are encouraged to solve their own problems with information (not directives) from health care providers".



The Current Situation in Belgium

Because of the need for integrated cooperation and international evolution towards better integration of care, Federal Health Care Knowledge Center (KCE) published in December 2012, commissioned by the Minister of Health, the Position paper "Organizing care for the chronically ill in Belgium", as a start to more integrated care for the chronically ill in Belgium. This paper was written from an international framework in which fundamental ideas were already being considered by the UN (United Nations), WHO (World Health Organization) and the EU (European Union). However, this frame of reason still need to be implanted into the Belgian context. The Belgian situation was mapped out through an extensive study, an activity model was drawn up and policy recommendations were subsequently formulated.

Following this, an orientation paper was published at the end of 2013 about the integrated vision for care for the chronically ill in Belgium, with the aim of concluding a protocol agreement between the federal and the federated entities for a National Action Plan.

The implementation of Common Approach Plan will be implemented in, among other things, pilot projects for integrated care, of which twelve already started since 1 January 2018, spread across Belgium (six in Flanders, five in Wallonia and one in Brussels). These projects aim to focus on the patient and his/her environment and to view help and care as a whole (across the lines and silos of the care and care providers).

Transmural Care: An Incentive for Integrated Care

As mentioned above, the number of chronic patients with comorbidities and a higher multidisciplinary need for assistance increases continually, partly due to the aging population and better medical and scientific treatment modalities. These people need an integrated care model acts to maintain self-reliance in home environment.

First, Second and Third Line of Care

In addition to hospitals, there are many other active care actors around the patient. Healthcare is traditionally subdivided into first, second and third line of care. This classification is mainly made on the basis of echo cancellation. The role of gatekeeper is to refer problems to the second line that is taken over by general practitioners. The second line in turn refers to the third line.

Gatekeeper

Healthcare in Belgium is characterized by direct access to the specialist, which does not require a referral from a doctor. According to the Christian Mutuality (health insurance company), however, there is a central role for general practitioner as a pivotal figure of the first line who is responsible for referral to the specialist.

Short Waiting Times

Belgium is doing well in terms of waiting times, both for accessibility of primary care, as well as direct access to specialist and waiting times for planned surgery, Belgium scores well in Europe. This makes Belgian healthcare very accessible. However, consideration should be given to introducing a gatekeeper into the Belgian health system. There is a downside to introducing a gatekeeper in the health system. One fact has become clear over the years: the presence of gatekeepers in the system means waiting. Waiting times for specialist care are mainly found in systems where a referral of first-line care (gatekeeper) is required, and waiting times are not created by direct access to specialist care.

Free Choice of Healthcare Provider

Since a doctor-patient relationship must consist of mutual trust, it is important that the patient can choose for himself/herself care provider who will treat him/her. If this mutual trust is not possible with a certain healthcare provider, it is best for the patient to choose another healthcare provider. If the patient is referred to another healthcare provider, the freedom of choice also applies here. However, the free choice of care provider does not mean that the care provider must accept every patient. It may therefore be that the caregiver no longer decides to accept new patients. An exception to this is when it concerns an emergency situation.

Intra, Extra, and Transmural Care

Care is also divided according to terms, i.e. intramural, extramural and transmural care, whereby intramural care refers to care within the walls of the hospital and extramural denotes care that is offered outside the walls of the hospital.

Transmural care is care that is tailored to the needs of the patient and is provided on the basis of agreements on cooperation between all care partners, both in primary and secondary healthcare. Transmural care is an umbrella term for many concepts: shared care, managed care, disease management, series care, patient navigation, transmural care

Pathways, Discharge Management, Seamless Care, Patient Transfer, Interdisciplinary Cooperation, etc.

The terms "transmural care" and "integrated care" seem to overlap, but actually transmural care is only a part of integrated care. In transmural care, a central role is attributed to hospitals and the focus is on cooperation between hospitals and external care providers. In contrast to transmural care, the role of a hospital is placed in the margins of integrated care. The hospital will therefore have a variable role in the healthcare perspective of the future.

Care Paths and Care Processes

As an example of transmural care, care paths and care processes are also briefly mentioned in this literary study. Care pathways are defined as "a complex intervention to achieve joint decision-making and organizing care processes for a specific group of patients during a defined time frame."

Care path is aimed at improving the quality of care, beyond the boundaries of an organization, by optimizing risk-adjusted results, promoting patient safety, improving patient satisfaction and optimizing materials use".

Care paths differ from care processes. When care providers conclude agreements with each other and with individual patients for chronic disorders, it is referred to as 'care pathways'.

Electronic Patient File (EPF)

The use of ICT has taken an important place in the medical and paramedical world. In addition to the diagnostic and curative purposes, technology can also be used as a means of communication to exchange intra- and interdisciplinary information quickly.

In the context of cooperation, there is an emerging medium in which care actors are digitally connected to each other. This is enabled by the electronic patient file (EPF). The stored information mainly consists of demographic data, history, diagnoses and prognoses, medication, vital parameters, observations, clinical research data, etc. The EPF is therefore not a goal in itself, but a facilitator.

The use of the electronic patient file has been known for a long time in hospitals in high- income countries. The initial objective was merely to facilitate administrative matters. In the current IT-oriented era, attempts are also being made to link medical functions to EPF. This movement has a positive effect on the efficiency, effectiveness, quality and safety of care.

Optimize the Patient Flow

The patient flow is the movement of patients to a healthcare institution. This concerns the medical care, material resources and internal systems that are needed to get patients from the point of admission to the point of discharge, while maintaining quality and patient satisfaction. Improving patient flow is a crucial part of process management in hospitals and other healthcare institutions.

Inefficient planning leads to problems with patients' flow. Hospitals, therefore, need to consider critically their admission and referral processes to make improvements.

Patient flow can be optimized by: spreading scheduled operations throughout the week to relieve pressure on postoperative units, increasing the number of morning discharges, and by using patient flow software and telemedicine to automate processes and collect data for analysis. In the near future there will probably not be a separate process for patient registration. Clinical, financial and demographic information can be entered in advance from the patient's file.

Cooperation with Support Services

Two major questions arise in the future:

- With the evolution from residential to more outpatient care, will these services be phased out or will more cooperation be established to provide these services?
- Due to the increasingly complex regulations, it is necessary to consider how best to deal with this.

One of the main reasons for outsourcing support services is to reduce operating costs.

However, before executives can implement outsourcing, they must consider four key questions:

- The reasons why they outsource
- outsourcing obstacles
- best practices for outsourcing and
- The implications of outsourcing for hospital management.

There is no one-size-fits-all, but with a careful, thoughtful and well-considered approach, outsourcing can be successfully implemented in a way that benefits administration, staff, facility service provider and especially patients.

According to forecasts, in the future external parties will provide most of support services that are currently offered by the hospital companies (for example, catering, laundry, etc.).

Intensive Specialist Care Versus Proximity to (General) Care Current Care Offered in Belgian Hospitals

The current health care system in Belgium is characterized by a fragmented perspective in which institutions function as separate organizations. In the near future, health system will face several new major challenges, such as changing patient expectations, aging population and implementing new innovations and technologies. Redrawing the care perspective is necessary to meet future care needs.

Reforming health system should take into account the expected changes in needs, medical-technological progress and the possible budget. The hospital will act as a link in a larger network. The purpose of these networks is to set up a system in which the patient and his care needs are central.

In Belgium today there is abundance of care in almost every hospital. In the future, hospitals will be organized in such a way that only basic care is offered in a hospital in the vicinity of the population. Complex pathologies will be treated in reference centers that are mainly characterized by high specialization and a high use of technology.

A Shift from Inpatient to Outpatient

In recent years, hospitals have witnessed a decrease in the number of admitted patients (inpatient) and a corresponding increase in outpatients. This continuous shift has been largely driven by advances in minimally invasive surgical techniques and advanced anaesthesia techniques that allow patients to recover faster.

Belgian health policy also focuses on the trend to shift care wherever possible to a setting outside the hospital.

Day Surgery

The terms "outpatient surgery" and "day surgery" have the same meaning in the international literature. Outpatient surgery is, however, performed in Belgium in a doctor's office (outside or inside the hospital) and not in an operating theatre. We use the term "day surgery" - to avoid any confusion - when referring to procedures performed at a surgical day centre

If day surgery expansion is required, a number of things must be taken into account:

- Care pathways and clinical practice guidelines must be developed, together with their implementation and follow-up.
- The need for a coherent financing system that financially encourages day surgery.
- The need for a clear separation between the traditional hospital and the surgical day hospital.
- The need for good communication with all actors (general practitioner, patient, caregiver, pharmacist, home nurse, physiotherapist).
- The need for functional training to provide optimal post-operative care outside the hospital.
- The need for benchmarking: Healthcare providers and hospitals should have access to their own percentage of procedures performed in day surgery compared to other hospitals and healthcare providers through a feedback system.
- The need for monitoring a number of quality parameters (for example, unplanned re-admission, unplanned stay in classical

admission, emergency visit).

- The choice between a traditional admission and day surgery must be cost neutral for the patient.

Further Decrease in Duration of Stay

The hospital of the future should offer a solution in which the length of stay of elderly patients can be reduced in a responsible manner.

Evolution Towards Concentrating Specialist Care vs. Proximity to (General) Care

In the future, hospitals will be smaller and more specialized.

University hospitals will become high-tech centres with a focus on specific interventions and research; they will be high-tech centres where patients will only stay for a very short time.

Intensive Specialist Care

More and more disorders will be diagnosed and treated in the future without hospitalization. Hospital admissions will therefore almost exclusively be for patients with severe acute conditions.

The hospital of the future is expected to be absolutely smaller than in the past with many ICU beds, but very few other beds.

Hospitals are expected to increasingly focus on high-quality and highly complex services and will become highly efficient organizations without high activity volumes.

Specialist hospitals will become less capacity-oriented and more result-oriented, whereby process improvement is implemented to reduce waste and to increase the value for patients and payers.

Proximity to (General) Care

This proximity can be realized by concepts such as low-threshold care, one-minute clinics, mobile clinics, home care, etc., which are further explained below.

- New care professions with a view to accessible care
- Home care
- Hospital @ home
- Mobile clinics
- Walk-in clinics
- Telemedicine

Employment

The hospital of the future will remain the most important center for research and for training new healthcare professionals, where knowledge and skills are generated.

Change in Job Content (e.g. Technological Change, New Functions, etc.)

The hospital of the future also needs sufficient trained staff. They must also be able to adapt to changing circumstances. All caregivers must regularly update their skills.

The evolution towards the use of telemedicine, robotics, etc. in hospitals implies a change of both doctors and nurses in their role as hospital health workers.

The hospital of the future is characterized by new professional roles that will require health coaches, genetic advisors, disease-specific case managers, information management experts and "med-engineers". In high-tech hospitals of the future, there

will be help to bridge the gap between technology and hospital professionals.

Technological progress will also have a major impact on fulfilling the job as a health worker. In the hospital of the future, a large part of the routine hospital administrations will be performed via touch screens. Electronic medical records will be automatically updated with every test that is requested and results are immediately available to all parties, including the patient. Advanced software will continuously integrate a patient's signs and symptoms with the results and updates of controlled variables and laboratory test results, propose and even initiate treatment, and then monitor its effects.

Quadruple Aim

A generally accepted concept that serves as a compass to optimize the performance of the health system is the Triple Aim.

The Triple Aim has a threefold goal of:

- Improving patient experience.
- Improving the health of the population.
- Reducing costs.

Changes in Education and Training

Training based on virtual reality (VR) will increasingly occur in the future. Virtual training can help surgeons to chart operations before they are performed, and they can also share images of the actual operation with students and colleagues.

Healthcare sector will continue to present itself in the future in terms of employment. It is important to encourage the influx of new professionals and to maintain interest in this labour market in both the short- and long-term. However, continued efforts are needed to stimulate the training of nurses and healthcare professionals in the future.

Prevention

A Conceptual Framework

Within health care, prevention is described as “a part of health care that is aimed at preventing or limiting damage to of individual people’s health, certain groups of the population or the population as a whole”.

Three types of prevention can be distinguished:

Primary Prevention

Preventing conditions that form a precursor to a certain disorder; preventing people from becoming ill or developing a condition (such as brushing teeth, sex education).

Secondary Prevention

There is already an existing predisposition - but no condition -; this type of prevention is aimed to early detect a potential problem that can be treated without further negative consequences (for example blood pressure, breast cancer screening, evaluating diabetes signs, risk of infection after, for example, dog / insect bite, etc.).

Tertiary Prevention

A disorder, illness, disease or disability is already present here; this type of prevention is aimed to prevent the disease from getting worse and limiting the consequences of the trouble by preventing negative complications in various areas (social, emotional, cognitive, perceptual, motor) as much as possible.

The Importance of Prevention

We are very interested in preventing diseases, the consequences of illnesses can be huge, both on the social and individual level; they influence public health and cause large costs.

Prevention in Belgium: State of Affairs

Better prevention (a federated responsibility) is also a major challenge in Belgium. This requires strong coordination between different levels of government and is based on common goals.

In drawing up the action plan with health objective of "The Flemish population healthier in 2025", nine guiding principles were used:

Guiding Principle	Synthesis
1. Policy is more than just the health objectives	The health objectives are a valuable policy instrument which by definition by no means encompasses the entire policy on health promotion and disease prevention. Themes that are not included in the health objectives must receive proper attention.
2. Ambitious but realistic goals	We wish to formulate health objectives taking into account the context and to establish measurable indicators with targets based on research (trend analyses based on measurement cycles), in consultation with the field and aligned with (inter) national frameworks.
3. Less is more	The better we succeed in making informed policy choices, and therefore strive for fewer, rather than more, health objectives, the more effective the health objectives will be as policy instruments.
4. A long-term policy	We choose 2017 as the starting year and 2025 as the year in which the health objectives must be achieved in order to allow sufficient time for realization in the field and to stimulate long-term cooperation, with an interim evaluation in 2021.
5. Towards a uniform structure of the action plans	To shape the new policy, we opt as much as possible for a uniform pattern for all themes that fall within the scope of this health objective.
6. Health in all policies as a starting point and goal	HiAP as an ambition has led to opting for health objectives at the setting level (instead of only at the level of behaviour or health effect).

7. More focus on implementation via settings	We choose setting-oriented health objectives in order to be able to focus on implementation within a sound policy framework.
8. Attention for specific target groups	We opt for the principle of proportional universalism in which we argue for a generally available offer, for everyone, but with special attention to the support needs of weaker groups within this universal service.
9. Integration of the thematic perspective	We wish to add the thematic perspective to the context of setting-oriented health objectives. For this purpose prevention strategies are provided for each setting-oriented health objectives with matching thematic indicators (behavioural, health and / or policy indicators, whether or not per target group where desirable and feasible).

Based on the 9 principles described above, the overall health objective “The Flemish lives healthier life in 2025” was subdivided into 9 sub-objectives:

The Flemish Live Healthier Life in 2025

By 2025 we will be living healthier in terms of healthy eating, sedentary behaviour, workout, tobacco, alcohol and drugs.

For this, we pursue a policy in the domain of life, family, leisure, education, work, care, welfare and the neighbourhood. We focus directly on the citizen and we pay attention to good governance. All this leads to the improvement of various indicators in various population groups with a focus on vulnerable groups.

Health in Your Own Hands

By 2025, citizens will have accessible information and tools to make healthy choices themselves.

Family Source of Health

By 2025, parents will have accessible information and tools to raise their children to a healthy lifestyle.

By 2025, an increasing percentage of childcare facilities and out-of-school care initiatives will pursue a policy that promotes healthy lifestyles in children that meet minimum quality criteria.

Free Time, Healthy Time

By 2025, leisure actors will pursue a policy that promotes a healthy lifestyle.

Health Education

By 2025, % of primary schools and % of secondary schools have a preventive health policy that meets minimum quality criteria.

By 2025, an increasing percentage of colleges and universities will pursue a preventive health policy that meets minimum quality criteria.

Work, Also on Health

By 2025, % of companies have a preventive health policy that meets minimum quality criteria.

More Health in Healthcare

By 2025, an increasing percentage of care and welfare facilities will implement a preventive health policy that meets minimum quality criteria.

Healthy Neighbourhoods

By 2025, % of local authorities will implement a preventive health policy that meets minimum quality criteria.

Good Governance, The Way to Health

By 2025, the relevant policy areas of the various governments will pursue a policy aims to avoid health risks, promote healthy choices and a healthy lifestyle, at least at the level of environmental interventions, agreements and regulations.

These sub- objectives are achieved with the help of 4 types of strategies, namely:

- Education,
- Environmental intervention
- Policy through agreements and rules.
- Care and guidance.

Based on these strategies, concrete action points were formulated for each of the sub- objectives, which can be reviewed in the publication of this discussed strategic plan.

Depending on the achievement of the aforementioned sub-objectives, the strategic plan also includes various indicators (process indicators and health indicators) that facilitate the (interim) evaluation and allow timely adjustments where necessary.

What about Prevention in the Future?

Primary care appears to play a key role in care and prevention. In addition, prevention should also be an important part of the education of medical students. Prevention should become a specialization in or alongside with medical training.

Also, according to other visions of healthcare in the future, it is predicted that healthcare networks will no longer be paid to treat diseases, but to preserve customers’ health. The incentive is hereby shifted from recovery (curative) to preservation of health (preventive).

Architecture

The hospital environment will evolve strongly in the future. After all, a spatial response must also be formulated for each of the above challenges.

Changing Scale and Proximity of Care

Hospitals can be found in many different contexts - from urban centres to rural locations. They exist in the most crowded communities and in communities with relatively low population densities. They exist on locations on the water, in open plains, in dry areas and in forests. They exist below sea level and in high-altitude communities. In short, every hospital is partly determined by the immediate spatial context of the site.

Sites on the outskirts of the city are often the most attractive locations from mobility and market expansion points of view. During the past 50 years, preference has therefore been given to establishing potential hospitals at greenfield locations, often

outside city centres, which gives freedom for layout design. The relatively high costs of urban land contributed to this trend. Hospitals are often as large as a few building blocks and almost as complex as a city or town. Their design, in terms of readability of the layout, hierarchy of the components and opportunities for growth and change, can learn a lot from good urban development principles. Moreover, as well-considered expansions of the urban area, they have great potential for regeneration and help to increase economic activity in the neighbourhood. Today, newly established medical centers tend to follow a similar pattern to shopping centres or cinema complexes because they require large lands and large plains of paved asphalt in the same way. In the future, however, this is not a sustainable evolution.

Thanks to technological developments, more and more care can be provided as an outpatient. This will lead to a significant decrease in the required number of hospital beds, despite the expected increases due to the aging of population. Hospitals as we know today will therefore have a much smaller place in the spectrum of health services. Disconnecting the various facilities in a hospital from one another and spreading them across the city lets the current hospital to shrink. By (partially) splitting the hospital program into smaller programs (in combination with other facilities at neighbourhood and neighbourhood level), healthcare is brought to the people. This way care is made more personal. After all, routine health care can also be offered in accessible places outside traditional hospitals, for example in the supermarket, at the pharmacy, in the community centre, etc. Healthcare thus becomes part of everyday life and does not remain restricted to hospitals. Future health care will be shaped on the basis of four places for the delivery of care: home, integrated health and social care centres, community centres (mainly concerned with mental health) and finally specialized care centres. Care that requires a high-tech environment with specialized equipment and skills remains in these specialized care centres.

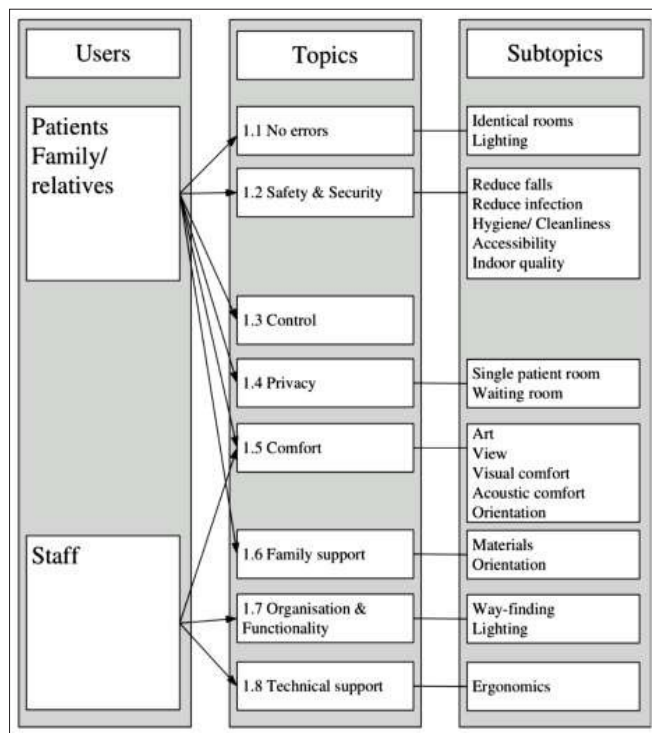
This will result in two different types of care delivery sites: a technological site with specialized centres and a "nearby hospital" that, depending on the level of care, is related to health, social and community centres. To respond to this now, a hospital can be approached by shell method, a method devised 10 years ago by the Dutch Construction Care College with a view to more profitable financing of hospital buildings. A hospital that is designed using shell method contains four housing typologies: "hot floor", hotel, office and factory. The "hot floor" houses the core tasks of a hospital, in particular operations, high-tech examinations, medical imaging, emergencies, intensive care, etc. The hotel contains bed houses where patients (and possibly family members) will spend the night. All administrative functions and consultation rooms are assembled in the office, while the factory serves as logistical and facility areas such as labs and pharmacy. In the hospital we know today, the functions are spread over the entire building. By applying the peeling method (and placing each function in a separate building or part of a building), the disposal of the hotel, the office and the factory can only preserve the "hot floor" in which the technological equipment is present. These may become specialized centres in the future, whereby only patients who require intensive care will be admitted. Depending on the position, the nearby hospital can then be found in the local centres.

In Charleroi, a hospital is currently being built using the shell method. This claims to be the first hospital of the future on Belgian soil.

Focus on the User: Spatial Qualities for a Healing Environment People, with their complex needs and responses, are increasingly placed at the centre of health services. This applies to patients and visitors as well as staff.

In the second half of the 20th century, functional and process-based thinking dominated hospital design. Although both still have a great influence, there is a growing awareness that a purely medical approach does not see the patient as a complete person, with emotions, intellectual and physical needs that are inextricably linked. Although there is a consensus that stress is negative for the healing process, many hospital environments are still perceived by patients as stressful. Stress factors include the frightening uncertainty of waiting, poor acoustics (among other things due to many hard, maintenance-friendly surfaces), smells, harsh lighting, the difficulty of finding your way in a maze of impersonal corridors and the abundance of inconsistent information. At the beginning of the 21st century, the trend of consumerism has emerged - the need to identify and offer things that patients and their family members wanted to receive. In addition to more staff contact, less waiting, better standards for cleanliness and good food, the environment is high on the list. In a truly person-oriented hospital building, not only attention is paid to spatial qualities in patient rooms, but also departments, corridors, waiting areas and all other technical and non-technical patient areas, that are meticulously designed with respect to the diversity of patients who use them.

In recent decades, research has pointed to the direction of faster recovery and lower medication use in a more pleasant hospital environment. A good design of an institution can promote physical, spiritual and mental health and thus contribute to a faster recovery of the patient. The most recent overarching study on the impact of spatial aspects on users, highlights the aspects in the diagram below as the most relevant.



User perspectives ordered by topics and subtopics based on a review of the literature Ulrich et al. [2004, 2008].

Although each of these aspects, discussed in detail, goes beyond the scope of this study, in addition to interventions that directly affect patient safety, it can be concluded that art, views, lighting, sound management, orientation, adapted patient rooms and smart ergonomic buildings also contribute to well-being of patients, relatives and staff.

In the future this can be taken into account for example on these points:

- Patient rooms were initially developed from dormitories for several patients. Over time, the large rooms became smaller and smaller, with fewer and fewer patients in one room. Newer hospitals almost never find a room for general care with more than four beds. With regard to nursing care, this room size has the advantage of efficiency: one nurse can take care of four patients in one visit. Moreover, a room for four people is the most economical alternative. However, the disadvantage is the lack of privacy for the patient. However, most patients seem to prefer a double room. Apparently, the presence of a neighbour, for many people, offers sufficient opportunity for communication, but above all a desired degree of safety. The double room is therefore the most important basic cell of the hospital.
- However, the CM believes that single rooms should be the new standard in the hospital of the future. In a survey conducted by the CM, the majority of respondents indicated that they would prefer a single room. Fee supplements must be eliminated before singlerooms can serve as a standard in hospitals (CM, 2018). The demand for single rooms, however, increases and is expected to rise. Given the further decrease in the length of stay, there is increase in the percentage of seriously ill people who are best cared for in single rooms. Patients at risk of infection and infectious patients must be isolated for a certain period of time. Patients increasingly express the desire to have family members with them, not only during the day but also at night. In addition, single rooms provide more privacy, better sleep, dignity with less anxiety and stress. As we build more hospitals with single rooms, we must not forget the importance of giving patients and families access to rooms that take them out of their rooms. Special attention should also be paid to staff, policies and culture that enable patients to be active participants in their care. The recommended room size is therefore the one that the patient must be able to choose between a single or double room.
- Although corridors are usually seen as gaps that are mainly used for movements between more relevant places, research shows that these, nevertheless, have an important impact on user experience within healthcare context. Not only does their design influence way finding and spatial orientation, very long corridors or corridors with limited visibility between patients and staff also cause stress and anxiety among patients and a lower sense of safety among staff. In addition, the travel time is dependent on the time that staff can spend with patients. In addition, corridors also prove to be an important place for informal contact, between patients, staff and between both groups. More attention to the corridor as a place for social interaction and knowledge sharing is therefore recommended. The function as a “spill-over” space, where everything finds a place that belongs nowhere else, deserves additional attention. Corridors that serve as storage space does not only cause an unpleasant feeling, but can also seriously compromise safety.
- A large number of patients with varying needs and limitations come together in waiting rooms. This, in combination with the time spent, means that an adapted and meticulous design of the space is not of superfluous luxury here. In addition to

sufficient space, air quality, temperature and acoustics are at the top of the list of spatial qualities that must be taken into account. (Natural) light or even the ability to go outside effectively has a positive influence on the experience of waiting. Either way, the room must facilitate making waiting times meaningful. This can be done by creating allocated places for different activities (work, reading, social contacts) and ensuring that no information is lost regarding the waiting and the appointment at each of these places.

- Individualized adaptability of the environment can contribute to well-being. On the organizational level, this may mean that space is provided for family members to stay asleep or that patient rooms are designed in such a way that a "change of environment" becomes possible for long-term patients. For example, within a room, a wall can allow you to show personal photos of family members or a recent trip. In addition to this image wall, the patient can also adjust the music, make video calls with friends and family over the internet or access entertainment via headphones or virtual reality applications. These personalized technologies are essential to involve the patient in his / her recovery. As technology becomes even smarter in supporting (natural) human behaviors, patients can change their preferences in their room with their voices, touches, or gestures through their own devices.
- Bright and atmospheric lighting that is not intrusive and easily adjustable can lead to a major change in personal care. Good lighting can improve the patient's experience, especially in terms of fatigue and the perception of pain.
- Since hospital noise can be linked to sleep interruption, stress and re-admission, the use of silent alarms for medical devices and call systems leads to improve ambient noise.
- Integrated sensors that monitor unusual activities, such as a patient's fall and an automatic call for immediate help, can increase safety.

In addition to comfortable, safe and adaptable patient rooms, the hospital of the future also needs attractive visitor lobbies and day centers with a natural or green environment view through the building, as this reduces patient anxiety and speeds healing.

Staff needs (including nurses and assistant staff) also deserve due attention. Their well-being is essential for providing personal care. After all, it is the behaviors of the staff that makes the biggest difference to the patient's well-being. Working conditions for staff are therefore crucial. Experience and studies on designing modern offices suggest that the quality of the working environment has a major impact on work performance. As the diagram above already indicates, many architectural qualities that improve patients' well-being also promote that of employees. Both cannot be viewed separately.

Prevention An Active Hospital Building

In addition to responding to the well-being of patients and staff, a hospital building can also play an active and preventive role in maintaining and improving their health. Care buildings in general and hospitals in particular all too often encourage inactivity; just think of lifts that are easier to find than stairs, corridors where you have the feeling that you are getting in the way between the carts and (patient) transports, or the lack of meaningful places outside the room. Although some of the staff themselves travel quite a few kilometers on a working day, they also contribute to the sedentary behaviors of patients. Taking someone in a wheelchair is not only faster, the policy often also prescribes this.

Research on the urban scale has shown that how the built environment is designed can have a major impact on reducing sedentary behaviour and motivate people to be physically active. We also see within a hospital that how a department is organized spatially has an important impact on patients' physical activity and social interaction. Single or multi-person rooms, for example, play a role, but the location and accessibility of shared areas also make a significant difference in patient mobility. Even within a high-tech medical environment such as the intensive care unit, supporting patients' physical activity is potential.

Not only through physical activity, but also through healthy food, the hospital can focus on the population's health (including health workers). In the U.K. mandatory standards for hospital nutrition have already been implemented. These standards have been developed to improve the quality of food for staff and patients.

The hospital of the future will support the preventive health policy of Flanders in order to achieve health benefits at population level. In this way, the hospital of the future does not focus exclusively on patient people, but also becomes a place for healthy people in function of their health and well-being. Although research, with which architectural qualities respond to activation, is still in its infancy, this must certainly be kept in mind when considering the role of future hospitals in dealing with patients, their relatives and caregivers.

Safety

Hospitalized patients often experience severe emotional trauma. Upon arrival, especially in the immediate aftermath of a trauma, they have a critical need for a safe, secure and predictable treatment environment. Lockable doors, secure windows, safe places for storing personal items and a general sense of (personal) safety are essential. Theft threat, or worse, can cause a fundamental disruption of a person's well-being. Attention should be paid to security measures such as video surveillance technology in public places and electronic card access. However, advanced security and surveillance technologies must be balanced against their inconspicuous appearance. They must be invisible: the greater the invisibility, the better they are.

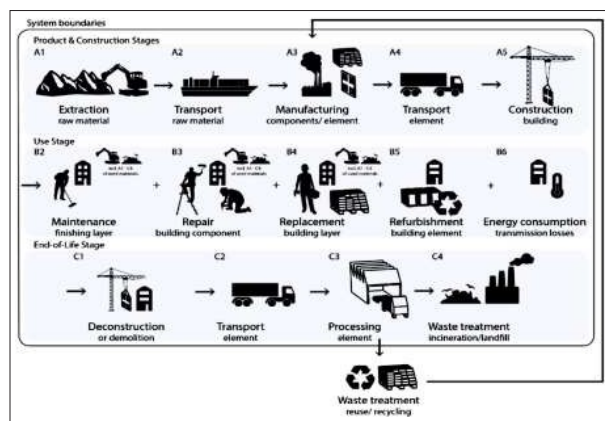
Environmental Impact

Sustainable construction means first and foremost the development of a long-term vision for designing, constructing and operating a building. In addition, awareness of the impact of these activities on the wider environment is also important. Since the aforementioned is mainly related to the social sustainability of the hospital environment, the environmental impact is discussed in more detail below.

Already, people vote to judge hospitals for their "Eco humanistic" value: how successful are they in helping "heal" the earth, in parallel with healing people? The aim is to have a regenerative hospital, a hospital that is self-sufficient in its energy use. The hospital of the future must find ways to reduce its ecological footprint. This must be done throughout the entire construction process, from site selection to material selection and life cycle.

By opting for gray field and brownfield locations, the construction of a new hospital can contribute to the remediation of older (sub) urban and / or industrial sites. In addition to remediation, the location also offers potential for reevaluating the landscape, inter alia by buffering rainwater (whether or not for reuse) and a good relationship with the urban fabric. This strategy also promotes

mobility alternatives. These may be reasons that make brownfield locations attractive again.



Dynamic or change-oriented building also has an important role. Dynamic or change-oriented buildings promote the closure of material cycle in two ways.

- Firstly, a building that can take on various functions (= change-oriented building) will generate less waste because fewer intensive renovations are required.
- Secondly, dynamic buildings make it possible to disconnect or reuse certain building elements (for example interior walls). Dynamic building has important qualities ecologically, socially and economically.

An additional argument for opting for hospitals with a low environmental impact is the financial issue. When financing the infrastructure, it is important to make a distinction between the initial costs and the life cycle costs. If the long-term performance of hospitals is completely ignored, their cost is decreased significantly. The operating and operational costs of a hospital building will certainly be in the same order of magnitude, if not strongly exceeded.

Finally

The above literary study serves as the basis for important themes that will (continue to) play an important role in the hospital of the future.

The hospital of the future will be in society, connecting the patient's home environment with other healthcare institutions (clinics, healthcare companies, etc.). The hospital of the future will be linked to the wider environment, with transparency about quality, specialization and risk management as important points for attention. The hospital of the future aims at cooperating social responsibility in five important aspects:

- Acting for the patient's interest.
- Maintaining an appropriate information policy.
- Guaranteeing good accessibility.
- Focusing on general public health.
- Acting as a 'community' in which different types of people come together (this concerns care for: a safe climate, safe working conditions, maintaining hygiene, being open to different cultures, offering accommodation, recreation and eating options, etc.).

International examples

Preface

The assignment in relation to the hospital of the future may, of course, not get bogged down in a futuristic discourse, without

taking into account financing and the infrastructure. This means that some flexibility will be required in financing.

There appear to be several examples in the United States. It must be realized, however, that financing is often based on private contributions or contributions from local health care system (= insurance system). This is more difficult to achieve in the Belgian context.

The Scandinavian countries have taken policy decisions in recent years, which have nevertheless led health care to a new direction. Their financing models also better match those we know in Belgium and Flanders. That is why a set was made of Scandinavian realizations that take into account various aspects of the hospital of the future:

- Architecture and organization of hospitals
- New forms of delivery or care
- More outpatient cares
- Focused factory
- Attention to care of population needs.
- Solutions for high-tech care

Architecture and Patient Centric Organization

The Central Finland Health Care District Central Hospital in Jyväskylä was chosen for these aspects.

The purpose of this newly built hospital was to reduce operating costs by 10-20% compared to a traditional hospital. The experience of the patient was taken into account, whereby the logistical and operational aspects were adapted to patients' needs.

The hospital was funded by the Nordic Investment Bank for an amount of € 500 million. The building is 85,000 m², which makes the cost per square meter € 6,000 approximately. The hospital is operated by an intercommunal authority of 21 municipalities. It serves a population of around 250,000 inhabitants and employs 3,800 people, of which 466 are doctors.

The hospital comprises 368 beds, 10 delivery rooms, 32 intensive care beds and 24 operating rooms. There are also 75-day hospitalization places, 3 NMRs and 3 radiotherapy bunkers.

In traditional hospital construction, the various hospital functions and services are intertwined. In this Finnish concept, a clear distinction is made between hospitalization units, administrative areas, critical services and logistics services. By clearly separating these functions, a much more readable concept is established.



Focused Factory

Coxa hospital in Finland is specialized in orthopedic surgery, in particular prosthetic surgery. About 4000 primary hip and knee prostheses are replaced in the hospital every year.

To achieve this, this type of operation was removed from 5 surrounding hospitals and concentrated in Coxa hospital. Clinical and care pathways have been developed in collaboration with general practitioners, orthopaedic surgeons and rehabilitation and primary care. By focusing on quality and costs, an efficiency was achieved that allowed savings to be made in the health system.

Care paths apply not only to Coxa hospital, but were rolled out throughout the region. Patient referral and referral processes were systematized. Ownership of these processes belonged to the employees themselves, which clearly motivated the staff. Scale benefits and lean management ensure that clear progress has been made in terms of quality and costs.

This system was also exported to other countries. For example, a similar project was set up in Armenia, with favourable results.



High Technology Center

The recently built Sona Hospital Karolinska in Stockholm aims to be an integrated oncology centre. The construction was based on a bed house of approximately 400 single rooms, 100-day beds and 40 operating rooms. Approximately 1,800 outpatients are expected per day of which 10-20% would come via emergencies. The expected admissions are 150-200 per day and 600-800 helicopter transports per year. Good thought was given to patient flows and various entry ports are used to properly direct these patient flows. The stacking of different hospital functions in the building was carried out in a logical manner.



Care Needs of a Population

Jönköping County Council is very active in organizing healthcare for a population of around 350,000 residents in a region in Sweden. The focus is on understanding the needs of different population groups, improving the health of the older population while striving for a good outcome. This is done in an integrated way in which care needs of the population are translated into a way by which a health system makes facilities available. There are currently 3 major construction projects in progress in this region, where both hospitalization departments and care centers that operate closer to the patient's home are being developed. The population is actively involved in this. So-called live cafés were organized where people can collectively discuss improvements that need to be made to the care provided.

In order to guide this, there is integration between services for prevention and for care. There is also management of various data sources at population level. There are four population groups receiving special attention: children and young people, people with mental problems, drug and alcohol addiction and the older population. Strong emphasis is placed on patient empowerment and care management is placed in the patient's hands.

One of the concrete projects is the so-called "Esther" project in which people try to improve care for the elderly with complex care needs. The objective of this model is to reduce hospital admissions and readmissions, and to make hospital stays as short as possible while improving patient experience.

This integrated approach of prevention, care and welfare, which is extended to the provision of infrastructure and resources, is a very interesting model to study.



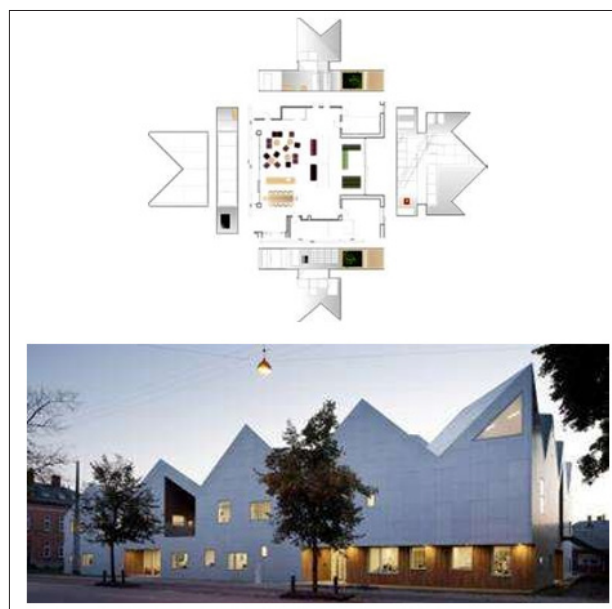
Ryhov hospital Jönköping

Alternative Forms of Care

Various services are brought together in the Copenhagen Centre for Cancer and Health patients with cancer should make the transition from the medical setting to home care easier to make. The centre focuses on rehabilitation and counselling, physical activity, diet and patient education. A wide range of social services is also offered.

These types of transition houses, which are not located on a hospital campus, but in a city, can offer an interesting model for the socialization of this type of care. These centres keep a little in the middle between convalescent places, which we know from different mutuality's, and a formal care hotel that is usually on a hospital campus or near it is located. This is indeed a social choice for the transition between organize hospital and home care in normal society.

Architecturally, the hospital consists of various smaller units that have been brought together below roof.



System Supervision

Denmark has been experimenting, for some time, a new model of supervision. Their accreditation systems, such as JCI, were compromised and now try to set up their own monitoring system based on electronic data from the hospitals. Copenhagen has the headquarters of the Dansker Regions, which have the most experience about this. This is an interesting place to visit to learn about the advantages and disadvantages of this approach.

Population Survey

Preface

Healthcare costs increase continuously due to the aging population, the increasing number of chronically ill people and technological progress, etc. In order to keep healthcare in Belgium affordable, qualitative and accessible, the budgets for healthcare, and also specifically for hospitals, must be used correctly.

Depending on the policy choices that are made, hospitals can evolve in different directions. Knowing the vision of people and population involved in is considered important by the Flemish government. What does the Flemish population think is important? According to the population, which pillars should the policy focus on? Which pillars are less important for the population?

The purpose of this survey is to provide direction to guide the development of the hospital of the future. By questioning the involved people and the population according to their vision, an attempt is made to align the policy with the real needs and expectations.

The results of this report are supported by a previous literary study and a population survey.

Main Trends from the Literary Study

Healthcare faces enormous challenges:

- Exponential technological progress
- An increasing incidence of the chronically ill with changing needs for care
- Financial portability
- The changing role of hospitals

To meet these challenges and the associated changing social needs and expectations, our healthcare is constantly evolving. The government will have to decide what course will be taken if it is desired to continue to guarantee accessible, affordable and high-quality healthcare. It was determined from the literature that these challenges are not limited to our country, but that all Western countries are confronted with this. Ways to meet these challenges are investigated both nationally and internationally.

New Slopes Using Technology

The digital and technological development has many opportunities that can be used in the future within healthcare and can meet the new needs of care.

The Changing Role of the Patient

In the hospital of the future the patient wants to be more involved in his / her care and expects more personalized care.

Innovative Forms of Financing

The hospital of the future will have to find a balance between commercialization and public financing, in order to strive for equal accessibility for the population and to avoid a two- speed concern.

Cooperation at Different Levels

Sharing information and / or distributing services offer contributes to creating opportunities, optimizing service and reducing the costs, so that everyone benefits from collaboration.

Reorientation of the Care Offer

In the future, basic care will be offered in the vicinity of the population outside the known hospital context. Complex pathologies, on the other hand, will be treated in reference centres that are mainly characterized by high specialization and high use of technology.

Adjustments in the Field of Employment

The hospital is and will remain an important centre for research and training, where knowledge and skills are generated. The hospital of the future will also focus on improving the working life of health workers, so that they experience an increased well-being at work.

Continuous and Stronger Commitment to Prevention

We are very interested in preventing illnesses or relapse. A proactive, population-based approach of health care through prevention continues to gain importance. This approach can be motivated by the government through further focusing on prevention campaigns and screening programs.

Architectural Adjustments

The above trends ensure that the architecture of the hospital of the future will also change. The hospital of the future is made up of four housing typologies: the 'hot floor', the hotel, the office and the factory. Eventually the hotel, the office and the factory can easily be divested, so that only the hot floor is retained, in which the core tasks of the hospital take place (such as operations, high-tech investigations, etc.). In addition, the hospital will become a person-oriented building in the future, whereby spatial qualities ensure a healing environment for the patient. The hospital will invest in activating hospital building in which safety and environmental friendliness are considered important.

Methodology

Establishment of the Survey

The aforementioned literary study forms a guideline for the survey, which was drawn up as part of the "Hospital of the Future" project.

The 42 statements of the survey, can be found in the literary study. In the table below, both the abbreviation of the statement and the place where the statement can be found in the literary study are given.

Statement	Abbreviation statement	Can be found in the literature study:
Statement 1	Telemedicine	Technology: development and innovation – Telemedicine
Statement 2	Referral from another hospital	Collaboration - Fragmented collaboration between hospitals
Statement 3	Inform specialists	Technology: development and innovation - (Big) data
Statement 4	All social workers at height	Technology: development and innovation - (Big) data AND Collaboration - The need for integrated care
Statement 5	Referral to a foreign hospital	Collaboration - Fragmented collaboration between hospitals
Statement 6	Foreign hospital inspection	Technology: development and innovation - (Big) data
Statement 7	Create a genetic profile	Technology: development and innovation - Genetics
Statement 8	Targeted health advice	Prevention - Prevention in Belgium: a state of affairs
Statement 9	Knowledge of large databases	Technology: development and innovation - (Big) data
Statement 10	Robotics	Technology: development and innovation - Robotics
Statement 11	Specialist centres	Concentration of specialist care versus proximity to (general) care - Concentration of specialist care
Statement 12	Screening for genetic diseases	Prevention - A conceptual framework
Statement 13	Enough routine checks	Prevention - A conceptual framework

Statement 14	Training own treatment	From patient to partner in healthcare - Self-care	Statement 31	Smooth flow	Collaboration - Optimize the patient flow
Statement 15	Avoid medical errors	From patient to partner in healthcare - Higher patient involvement ensures higher quality of care	Statement 32	Support processes efficient	Collaboration - Collaboration with support services
Statement 16	Guarantee personal safety	Architecture - Prevention - Security	Statement 33	Modernize training	Employment - Change in job content / Changes in education and training
Statement 17	Leave faster	Concentration of specialist care versus proximity to (general) care - Further decrease in duration of stay	Statement 34	Health and wellbeing	Architecture - Prevention - An activating hospital building
Statement 18	Pay for quality	Financing - Pay-for-Quality	Statement 35	Adjust hospital building	Architecture - Prevention - Environmental impact
Statement 19	Optimal stay	Architecture - Focus on the user: spatial qualities for a healing environment	Statement 36	Basic care close to home	Concentration of specialist care versus proximity to (general) care - Proximity to (general) care
Statement 20	Attention mental health	Evolution of the population - Mental health	Statement 37	Travel far for specialized care	Concentration of specialist care versus proximity to (general) care - Concentration of specialist care
Statement 21	Welcoming and warm	Employment - Change in job content	Statement 38	Transparent reporting on quality of care	From patient to partner in healthcare - Higher patient involvement ensures higher quality of care
Statement 22	Determine access data yourself	Technology: development and innovation - (Big) data	Statement 39	Easy place for routine care	Architecture - Changing scale and proximity of care AND Concentration of specialist care versus proximity to (general) care - Walk-in clinics
Statement 23	Medication effective and safe	Technology: development and innovation - Development of medication	Statement 40	General practitioner as gatekeeper	Collaboration - First, second- and third-line care
Statement 24	Extra cost of own choices	Financing - Current hospital financing	Statement 41	Accessible care	Concentration of specialist care versus proximity to (general) care - new care professions with a view to accessible care
Statement 25	Care in the home environment	Concentration of specialist care versus proximity to (general) care - Home care	Statement 42	Well-being of healthcare professionals	Employment - Quadruple Aim
Statement 26	Determine treatment yourself	From patient to partner in care - More involvement of the patient / Personalized care			
Statement 27	Choose doctor / hospital yourself	Collaboration - First, second- and third-line care			
Statement 28	Different types of rooms	Architecture - Focus on the user: spatial qualities for a healing environment			
Statement 29	Also focus on prevention	Prevention			
Statement 30	Minimum waiting times	Collaboration - First, second- and third-line care			

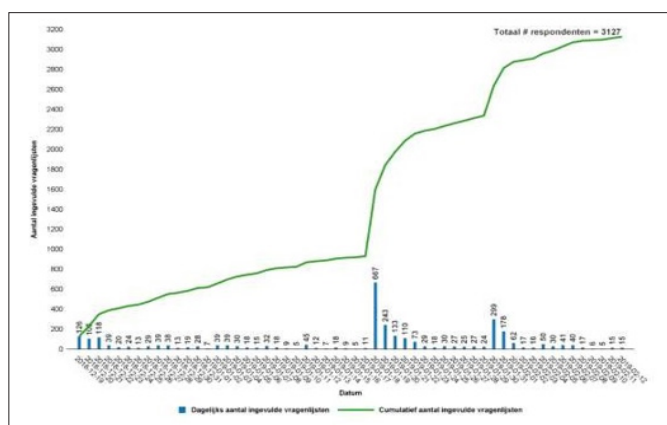


Figure 1: Number of Fully Completed Questionnaires During the Data Collection Period

Data Collection and Participants

In order to reach sufficient potential participants for participating in the survey, various interest groups were contacted. An email was sent to 458 contacts from Vlerick Business School, 1,400 contacts from the Leuven Institute for Healthcare Policy, 1,100 contacts from the Flemish Hospital Network.

Statistical Analysis

In the first phase, the total number of questionnaires that are suitable for statistical analysis was evaluated (Table 1). A total of 7,545 respondents started the questionnaire, of which 3,127 were included in the statistical analysis. In other words, 4,418 respondents were excluded from the data analysis.

Table 1: Selection of Data for Analysis

Procedure	Aantal respondentens verwijderd	Aantal respondentens voor analyse
1. Volledige dataset	—	7545
2. Keuze voor 10 stellingen	2a. Respondenten die deze vraag niet beantwoordden. 2b. Respondenten die deze vraag beantwoordden, exact 10 stellingen aanduidden, maar ten minste 5 opeenvolgende stellingen aanduidden.	5729 3618
3. Bedrag toewijzen aan de 10 gekozen stellingen	3a. Respondenten die deze vraag niet beantwoordden. 3b. Respondenten die deze vraag beantwoordden, voor wie het totaal bestede bedrag exact op €100 uitkwam, maar die aan elk van de 10 gekozen stellingen €10 toekenden.*	491 3127

* Deze respondenten worden weerhouden in de analyse

Main Trends from the Survey Descriptive Analysis

Table 2: Sample Characteristics

Kenmerk	Aantal	Percentage
Leeftijd		
18-24	140	4,5%
25-34	462	14,8%
35-44	608	19,5%
45-54	904	29,0%
55-64	879	28,1%
65-74	663	21,3%
75+	343	11,0%
Opvoeding		
Wettelijk	10	0,3%
Leger (wettelijk)	296	9,5%
Proper (wettelijk)	837	26,8%
Proper (wettelijk) (bestuurder of niet-voorzitter)	2252	72,4%
Werkzaam in de sector van gezondheidszorg		
Neen	6962	91,6%
Ja (wettelijk)	552	7,3%
Ja (niet wettelijk)	2074	27,3%
Ja (niet wettelijk) (bestuurder of niet-voorzitter)	1129	14,8%
Ja (niet wettelijk) (bestuurder of niet-voorzitter) (bestuurder)	11	0,1%
Ja (niet wettelijk) (bestuurder of niet-voorzitter) (niet-voorzitter)	18	0,2%
Ja (niet wettelijk) (bestuurder of niet-voorzitter) (andere)	10	0,1%
Ja (niet wettelijk) (bestuurder of niet-voorzitter) (andere) (niet-voorzitter)	178	2,3%
Ja (niet wettelijk) (bestuurder of niet-voorzitter) (andere) (andere)	228	3,0%
Ja (niet wettelijk) (bestuurder of niet-voorzitter) (andere) (andere) (niet-voorzitter)	239	3,1%
Ja (niet wettelijk) (bestuurder of niet-voorzitter) (andere) (andere) (andere)	71	0,9%
Ja (niet wettelijk) (bestuurder of niet-voorzitter) (andere) (andere) (andere) (niet-voorzitter)	302	3,9%
Werkzaam in de sector van gezondheidszorg		
Neen	5368	71,3%
Ja	2178	28,7%
Werkzaam in de sector van gezondheidszorg (bestuurder of niet-voorzitter)		
Neen	291	3,8%
Ja	384	5,1%
42000-10000	127	1,7%
42000-20000	257	3,4%
42000-30000	831	10,9%
42000-40000	608	8,0%
42000-50000	837	11,0%
42000-60000	508	6,7%
42000-70000	244	3,2%
42000-80000	197	2,6%
42000-90000	207	2,8%
42000-100000	107	1,4%
42000-110000	107	1,4%
42000-120000	107	1,4%
42000-130000	107	1,4%
42000-140000	107	1,4%
42000-150000	107	1,4%
Werkzaam in de sector van gezondheidszorg (niet-voorzitter)		
Neen	188	2,5%
Ja	442	5,8%
12000-13000	233	3,0%
Huisarts	61	0,8%
Algemeene geneeskunde	131	1,7%
Overige geneeskunde	928	12,1%
Wetenschappelijk	60	0,8%
Overige	379	5,0%
Deelname	187	2,5%

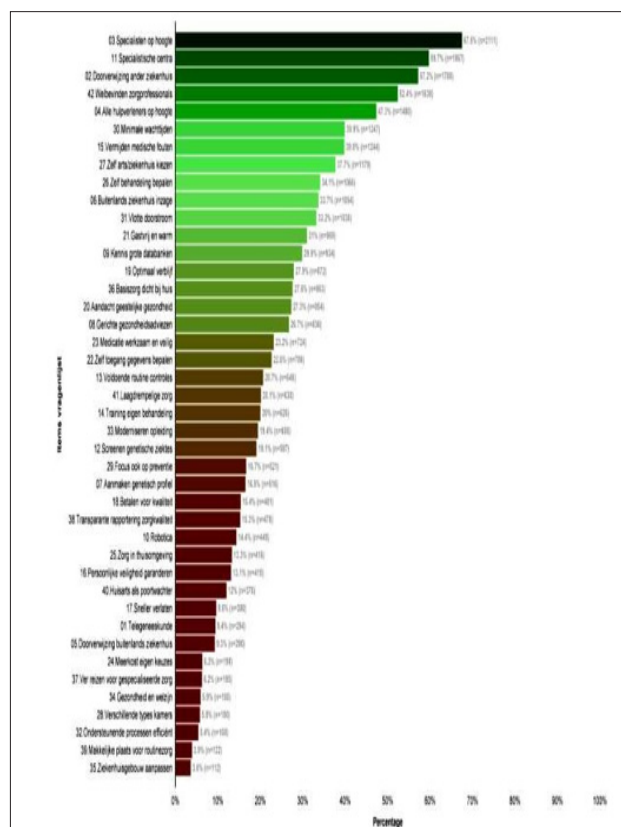


Figure 2: 42 Statements and the Percentage and Number of Respondents Opting for this, Sorted by Preference

The Ten Trends that the Population Attaches the Most Importance are:

- I wish my treating specialists to be aware of my treatments / diagnoses made by other specialists from another hospital (67.5%).
- I think it is a good thing that specialized care is brought together in specialist centres (for example, when I need treatment for oesophageal cancer, I would like to go to a centre specialized in this) (59.7%).
- I want a good referral from my hospital to another hospital if this benefits me (57.2%).
- I think it is important that people who work in healthcare feel good in their job (52.4%).
- I would like all care providers (specialist, general practitioner, (home) nurse, pharmacist, caregiver, physiotherapist, etc.) who guide me in my illness to keep each other informed of important information (47.3%).
- I want waiting times to be as short as possible (39.9%).
- I want care providers to pay extra attention in order to avoid medical errors (for example through double check using a checklist, etc.) (39.8%).
- I wish to choose the doctor / hospital where I want to receive my care (37.7%).
- I want to help determine / decide which treatment I choose from the various proposed options (34.1%).
- If something happens to me abroad, I wish the foreign hospital to have access to the information about my health in the hospital in my hometown (33.7%).

The Ten Trends that the Population Gives the Least Importance are:

- I wish that the hospital building can be adjusted depending on how care is offered (3.6%).
- I want to be able to go for routine health care in an easily accessible place outside the traditional hospital (for example supermarket, at the pharmacist, community center, etc.) (3.9%).
- I wish that support processes in a hospital (for example, cafeteria, laundry, etc.) are organized as efficiently as possible so that the hospital can focus more on its main task of providing patient care (5.4%).
- I wish that there are different types of rooms, depending on the length of stay (for example larger, accessible (private) outdoor space, etc.) (5.8%).
- I wish that a hospital is not only a place for the sick, but also for healthy people in function of health and well-being (for example training rooms, stores for healthy food, app stores, self-care training centers, etc.) (5.9%).
- I am willing to travel far for specialized care (6.2%).
- I am willing to pay more for my own choices of care that deviate from good basic care (6.3%).
- I want a good referral from my hospital to a hospital abroad when this benefits me (9.3%).
- I wish to receive medical care at home via computer instead of having to be present in person at the hospital or with the doctor (for example, a consultation behind my computer) (9.4%).
- I wish the hospital focus on faster discharging (if this is reliable for my health) (9.6%).

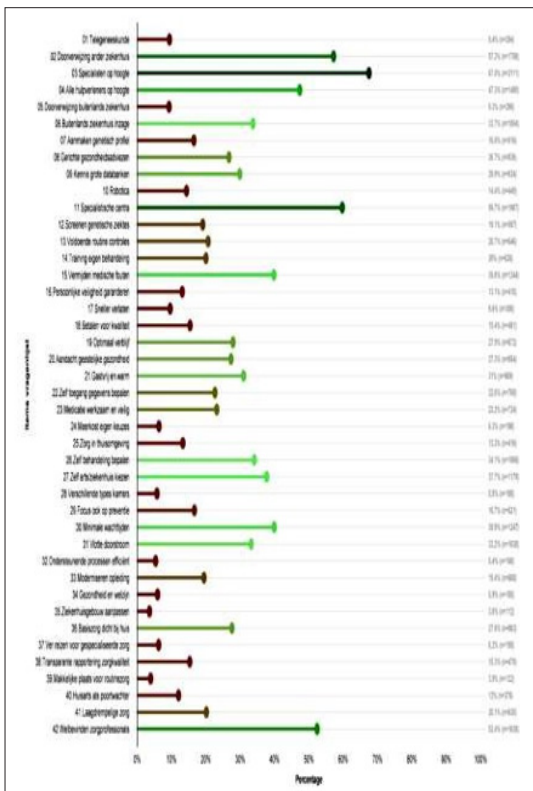


Figure 3: 42 Statements and the Percentage and Number of Respondents Opting for this, Sorted According to Surveys

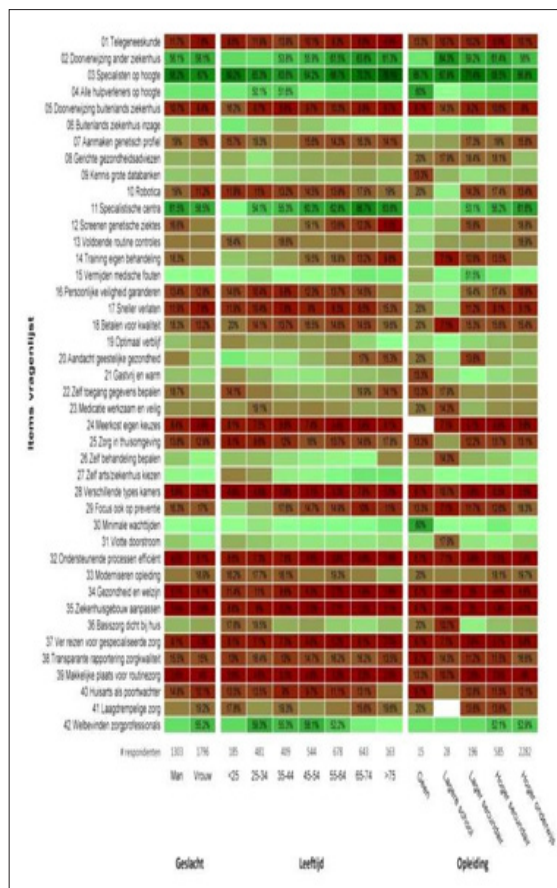


Figure 4: 42 Statements and the Percentage and Number of Respondents that Opt for this, Sub-Analysis for Gender, Age and Education

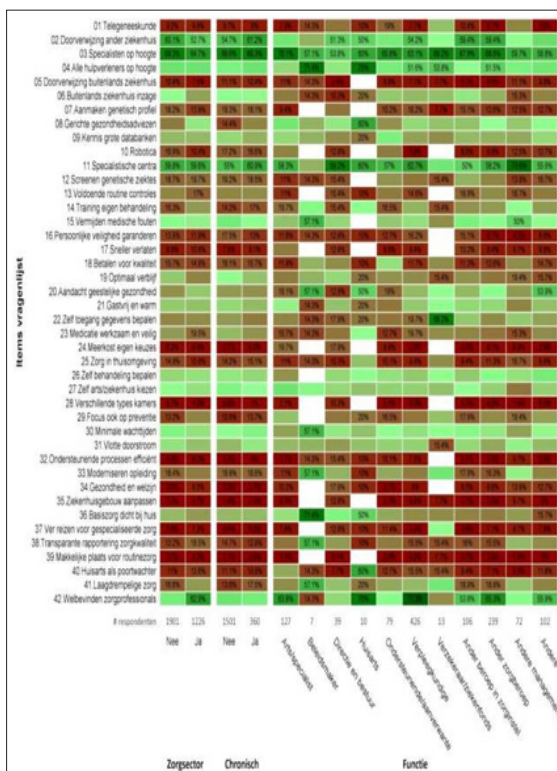


Figure 5: 42 Propositions and the Percentage and Number of Respondents that Opt for this, Sub-Analysis for Working in the Care Sector, Status of Chronic Disorder and Function

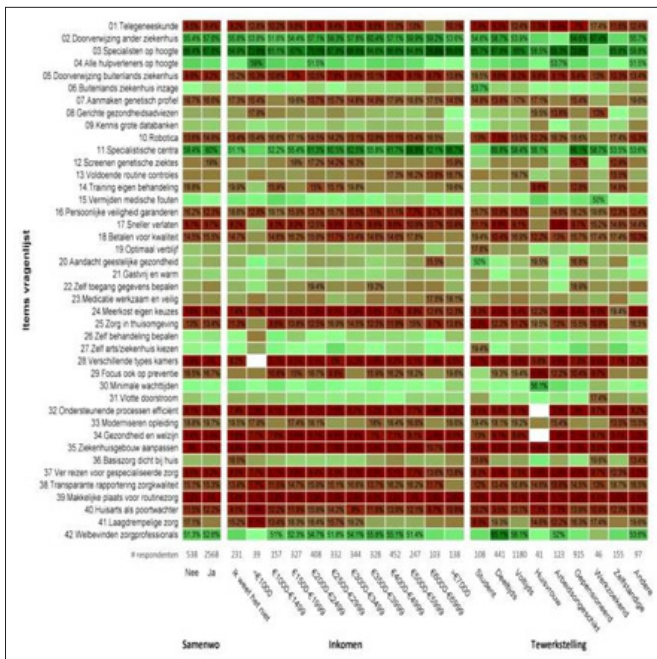


Figure 6: 42 Statements and the Percentage and Number of Respondents that Opt for this, Sub-Analysis for Housing Situation, Income and Employment

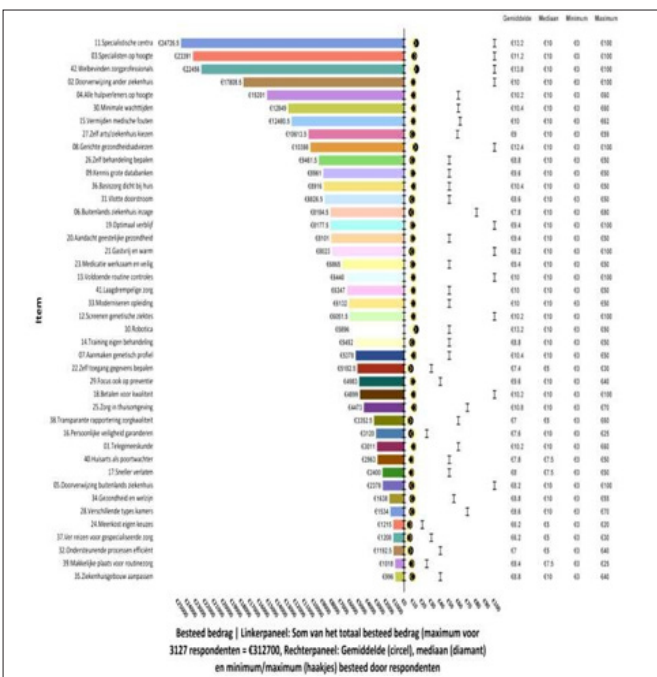


Figure 7: 42 Statements and the Amount that Respondents Spend on the 10 Statements They Have Chosen, according to the Total Amount Spent and Variation in This Over the Respondents

Association Rules

From the entire set of possible associations, 334 association rules are retained with a support of at least 5% and a confidence of at least 60%. In other words, 334 sets of statements occur in at least 5% of the respondents, and the probability that part of the set of statements results in a subsequent part of the set of statements is at least 60% for these 334 association rules. Applied to the first line in Table 3, this means that the set of propositions 20, 21 and 42 was chosen by 6.75% of the respondents, and that 68.28% of the respondents who chose propositions 20 and 21 also chose

proposition 42. Table 3 shows, from the set of 334 association rules, 20 association rules with the strongest association (rise) between the antecedent and the result.

Tabel 3. 20 associatieregels met hoogste lift uit een set van 334 regels

Regel	Antecedent	Gegoev	Support	Confidence	Lift	Aantal
1	(21) Aandacht gestelijke gezondheid, 21. Gezond en warm	(42) Welbevinden zorgprofessionals	6.75%	68.28%	1.30	211
2	(21) Gezond en warm, 36. Beroep dicht bij huis	(42) Welbevinden zorgprofessionals	5.72%	65.23%	1.25	179
3	(21) Speciale centrum, 21. Gezond en warm, 3. Specialist op hoogte	(2) Doornwijzing ander ziekenhuis	7.13%	70.85%	1.23	223
4	(21) Speciale centrum, 15. Vermijden medische fouten, 3. Specialist op hoogte	(2) Doornwijzing ander ziekenhuis	11.12%	68.91%	1.21	348
5	(21) Aandacht gestelijke gezondheid, 30. Instructies op kort mogelijke	(42) Welbevinden zorgprofessionals	5.82%	67.78%	1.20	182
6	(21) Speciale centrum, 3. Specialist op hoogte, 36. Beroep dicht bij huis	(2) Doornwijzing ander ziekenhuis	6.84%	68.15%	1.19	214
7	(21) Speciale centrum, 23. Medicatie werkzaam en veilig, 3. Specialist op hoogte	(2) Doornwijzing ander ziekenhuis	5.95%	68.13%	1.19	186
8	(21) Speciale centrum, 15. Vermijden medische fouten, 27. Zelf arts/ziektehuis kiezen	(2) Doornwijzing ander ziekenhuis	5.34%	67.89%	1.19	167
9	(21) Speciale centrum, 3. Specialist op hoogte, 9. Kennis grote databank	(2) Doornwijzing ander ziekenhuis	8.82%	67.48%	1.18	276
10	(21) Speciale centrum, 3. Specialist op hoogte	(2) Doornwijzing ander ziekenhuis	27.81%	67.44%	1.18	870
11	(21) Speciale centrum, 23. Medicatie werkzaam en veilig	(2) Doornwijzing ander ziekenhuis	6.63%	67.35%	1.18	209
12	(8) Butenlands ziekenhuis toegang, 9. Kennis grote databank	(3) Specialist op hoogte	7.93%	79.84%	1.18	248
13	(2) Doornwijzing butenlands ziekenhuis	(2) Doornwijzing ander ziekenhuis	6.23%	67.24%	1.18	195
14	(21) Aandacht gestelijke gezondheid	(42) Welbevinden zorgprofessionals	16.75%	62.34%	1.17	524
15	(21) Speciale centrum, 2. Doornwijzing ander ziekenhuis, 6. Butenlands ziekenhuis toegang	(3) Specialist op hoogte	10.23%	78.82%	1.17	320
16	(21) Speciale centrum, 4. Alle huis verlaten op hoogte, 6. Butenlands ziekenhuis toegang	(3) Specialist op hoogte	6.71%	78.65%	1.17	203
17	(21) Speciale centrum, 3. Specialist op hoogte, 6. Butenlands ziekenhuis toegang	(2) Doornwijzing ander ziekenhuis	10.23%	68.53%	1.16	320
18	(21) Speciale centrum, 3. Specialist op hoogte, 31. Vlotte doorstroming	(2) Doornwijzing ander ziekenhuis	8.57%	68.50%	1.16	268
19	(2) Doornwijzing ander ziekenhuis, 4. Alle huis verlaten op hoogte, 6. Butenlands ziekenhuis	(3) Specialist op hoogte	6.94%	78.34%	1.16	217
20	(21) Gezond en warm	(42) Welbevinden zorgprofessionals	18.62%	60.78%	1.18	589

Support = hoe frequent komt de set van items voor (zie ook Aantal), Confidence = percentage dat Antecedent gevolgd wordt door Consequent, Lift = maat voor de associatie tussen Antecedent en Consequent

Table 3: 20 Association Rules with the Highest Lift from A Set Of 334 Rules

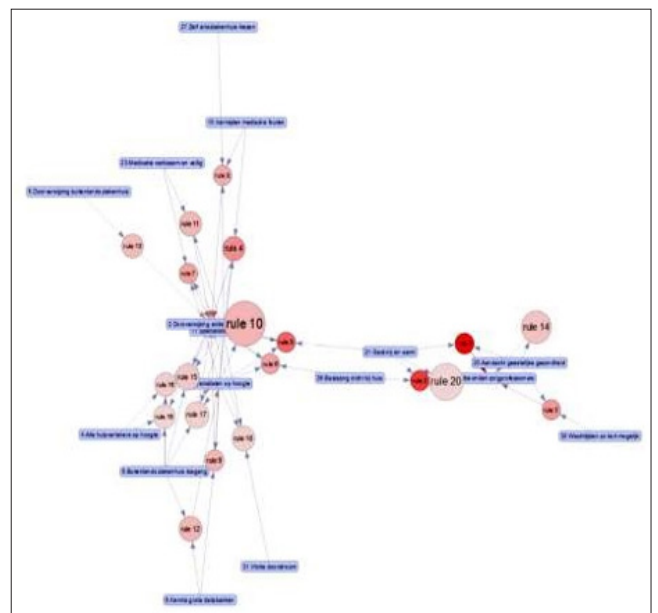


Figure 8: Graphical Representation of 20 Association Rules with the Highest Lift for the 334 Resulting Association Rules

Limitations of the Investigation

Below is an overview of the limitations of the study.

- A literary study is always retrospective, but this "Hospital of the future" research concerns the mapping of future predictions.
- The questionnaire was only prepared and distributed in Dutch. The limitation may be that the opinion of Flemish people with a limited knowledge of Dutch was not taken.
- During data collecting it was established that there was an under-representation of low- educated respondents.
- Respondents working in the healthcare sector had to assign themselves in the questionnaire to a professional category (e.g. nurse, doctor, etc.).
- The questionnaire examined whether or not a respondent works in the healthcare sector. It was not ascertained whether or not this is within the walls of the hospital.
- Given that the questionnaire had to be accessible to all socio-economic groups in society, with or without affinity with the care sector, it was decided to formulate the statements

from the questionnaire as understandable and accessible as possible.

- The hospital of the future is inextricably linked to the care of the future.

Summary and Recommendation

Role of the hospital of the future in the healthcare perspective

- The patient is really central
- Hospitals become smaller but more specific partners in networks
- Encourage and interconnectivity
- From Triple aim to Quadruple aim
(Infrastructure) structure and financing for future hospitals

Bridging Home or Transitional House

This is an architectural unit where patients who are sufficiently strong to return to family and society after a recent hospitalization is received. These types of entities can prevent bed blocking in the bed house and can relieve the caregiver.

Facilities for Chronic Care

It means rehabilitation hospitals and residential care centres. While rehabilitation hospitals have a rehabilitation goal in mind, the residential care centres are more likely to focus on care and living. Rehabilitation hospitals will therefore have a larger and better rehabilitation infrastructure, while this will be more limited for residential care centers.

Centre for Outpatient Care

A distinction is made here between the surgical and internists day hospitals, which are currently mostly located in hospitals, the outpatient clinics located in or outside hospitals, and community centres where, for example, wound care, infusion therapy and possible chemotherapy can be administered. In these centres, strong integration can also be achieved with other primary care actors. The technical design of such outpatient centres will depend on whether or not anaesthesia is administered. Appropriate rooms for the preparation of chemotherapy, for example, must also be taken into account [1-50].

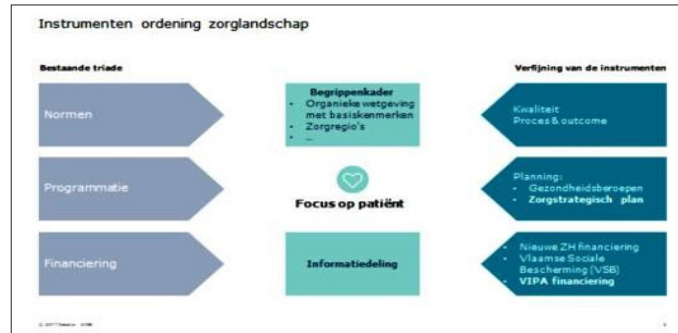


Figure 9: Instruments for the Organization of the Care Landscape

Typology Based on Healthcare Components

Figure 10 visualizes the components that we can use to further define the future hospital infrastructure and shows patient flows/outflows and logistical flows. The components let us delineate different future typologies.

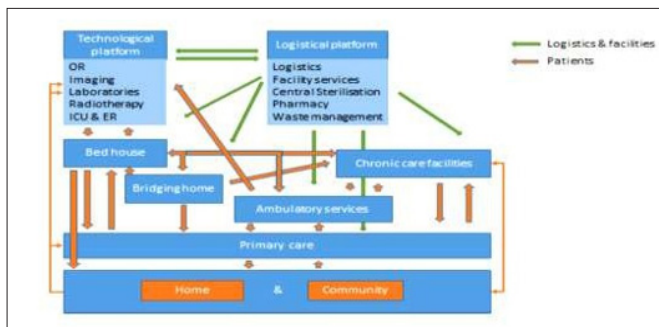


Figure 10: Healthcare Components and Their Mutual Patient and Logistical Flows

In the following sections, there is brief description of the various components, followed by some illustrations that clarify the difficulties of current financing and legislation, as well as some lines of thought that can give direction to further concrete steps for the following steps:

Beds House

This means that the traditional hospitalization beds for surgical, internists, paediatrics and other pathologies. In principle, this concerns traditional hospital rooms with one or more beds and with the presence of technical facilities such as sanitary, compressed air and oxygen supply. The surface and the configuration of the room may change depending on the length of stay and the type of patients.

This means that adequate infrastructure must be provided for this in the hospitals of the future.

Technological Platform

By this we mean all services that are dependent on complex or expensive technology: operating theatres, medical imaging, laboratories, radiotherapy, intensive care and emergencies. These services are currently interwoven with the architecture of the hospitals. It may also be necessary to differentiate between a standard technological platform, such as those that may be present in every hospital, for example, operating theatres and imaging. In addition, one could think of an advanced technology platform where, in addition to the aforementioned functions, radiotherapy, PET scan and advanced intensive care can also be provided.

In the future, these investments could be viewed together or in a parallel with other technology-dependent investments such as laboratories, operating theatres and the like.

Logistics Platform

Cooperation in logistics and facilities can lead to significant savings. Such a logistics platform could not only serve traditional hospitals - as they currently exist but could develop a different offer for technology platforms, bed houses, transitional homes, outpatient care centres and chronic institutions in the future.

If the logistics and facility services for a group of hospitals and care institutions can be brought together, this naturally leads to economies of scale in purchasing materials domain. But there are also economies of scale in terms of organizing logistics flows and the performance of facility services.

In terms of logistics, various national and international companies are highly active and have important expertise, which has not been sufficiently invested by hospitals. It is therefore important to consider the possibility of public-private partnerships and mixed forms of financing, where part is subsidized by the government and part is contributed by industry.

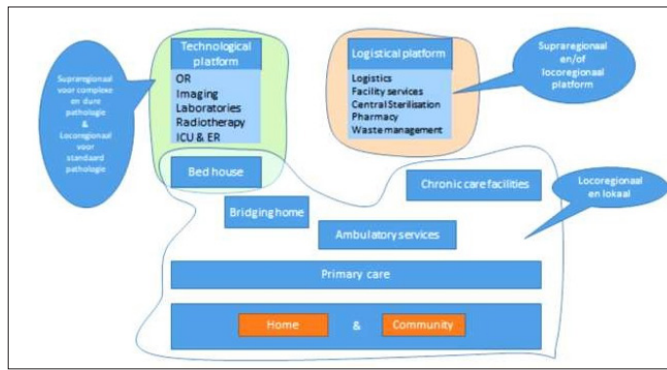


Figure 11: Organization of Platforms at Local, Locoregional and Supra-Regional Level

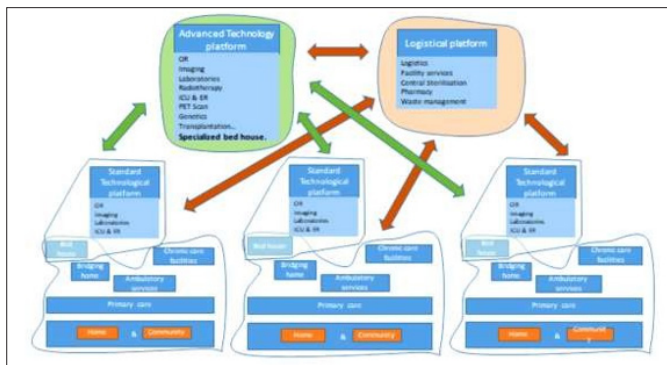


Figure 12: Theoretical Example of Three Loco Regional Partnerships with One Superregional High Technology Platform and One Logistics Platform

Adjustment of Financing and Legislation

Each hospital must have a minimum of 150 beds and must organize the following services:

- A service where both surgical activity and field activity of internal medicine are performed (C-D service).
- A service for geriatrics (code G), a service for neuropsychiatry for observation and treatment (code A), a maternity home (code M) or a paediatrics service (code E).
And must have the following functions:
- Anaesthesiology;
- Radiology;
- Basic activities of clinical biology.
- Rehabilitation;
- Basic activities of hospital pharmacy.
- Palliative care.

The Number of Beds is also Defined

- A service where both surgical activity and field activity of internal medicine are performed: 60 beds.
- A paediatrics department: 15 beds.
- A service for intensive neonatal care: 15 beds.
- A service for geriatrics: 24 beds;
- A service for infectious diseases: 15 beds.
- A tuberculosis treatment service in general hospitals: 15 beds.
- A service for neuropsychiatry for observation and treatment: 30 beds.

The **activity level** is expressed in terms of bed occupancy and performance in terms of length of stay and day hospitalization.

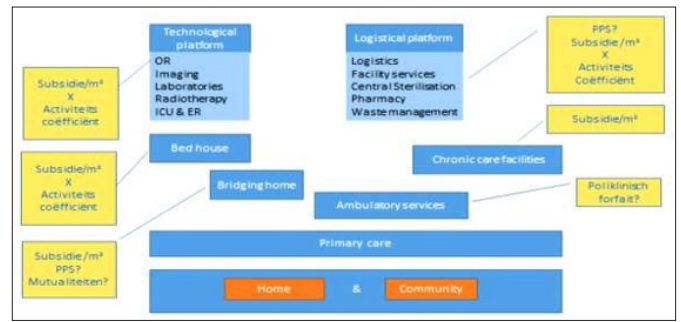


Figure 13: Healthcare Components and Financing Modalities

Recommendations for Further Research

- Within this research, emphasis is placed on the limiting factors in legislation and financing with regard to (infrastructure) structure. Mapping a detailed and comprehensive list of the limiting factors in legislation and financing for hospitals is recommended for further research.
- Within this research, an initial impetus is given for further research into the financing system of the infrastructure of Flemish hospitals. The further elaboration of this topic will be elaborated in the study "Research into the suitability and value of the parameters in the financing system for the infrastructure of the Flemish hospitals 3" of the Support for Welfare, Public Health and Family (SWVG) currently underway.
- Hospitals function within a larger healthcare system. This study is limited to indicating the future responsibilities of hospitals as institutions in themselves, however it does not unfold or prioritize care assignments for the entire care system.
- Furthermore, hospitals are embedded in a complete society that is also subject to many other factors. Consider, for example, socio-economic, cultural and ethical parameters within a society; because of their size and due to the limited time span of the study, all of these parameters could not be included within the scope of this study, but this does not exclude the possibility of further consideration of hospital functions within this scope in further research. Wider framework.

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