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RETHINKING:
STROKE REHABILITATION
SPACE OF TOMORROW

CHALMERS
UNIVERSITY OF TECHNOLOGY

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Rethinking stroke rehabilitation space of tomorrow:

Investigating human-centered physical environment factors that promote stroke patients' well-being and healthcare staff synergy.

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Master's Thesis in Architecture with in the master's program
Architecture and Urban Design at Chalmers School of Architecture,
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Göteborg, Sweden, 2023.

.. How can the built environment best support stroke patients' ***well-being*** and ***synergies*** with healthcare staff in stroke units and rehabilitation facilities via ***empowerment***, ***communication***, and ***levels of risk*** as parameters?

Research question of the master's thesis

ABSTRACT

Stroke is one of the biggest health threats to society. More than 25,000 people in Sweden suffer from a stroke annually, which can result in long-term physical, emotional, and cognitive challenges and disability. Consequently, stroke survival and the decrease in brain damage are dependent upon early acute treatment and rehabilitation.

Many studies indicate that stroke unit patients are alone and inactive. Patients spent the majority of the day by themselves in their rooms and similarly took part in a limited number of training activities, which reflects the low use of specialized training facilities. In addition, many new building units were created with many single rooms and limited characteristics of shared space, which may have prevented patients from being visible in public areas and to staff. The conclusion of this study was that the architecture failed to promote patients' recovery and well-being.

Stroke rehabilitation is a unique and under-studied part of healthcare. Because of this, most of the research on healthcare design has been done in acute care settings like operating rooms and intensive care units. Which primary aims for acute care patients who are frequently bedridden are diagnosis. But even so, people in stroke rehabilitation are more aware and must be active, motivated participants in their care. Thus, the findings from acute care environments may not be applicable to stroke rehabilitation. During stroke patients' stays in a unit, they must train and participate in activities throughout rehabilitation, but boredom, a lack of excitement, exhaustion, and feelings of powerlessness frequently demotivate patients.

This thesis aims to improve the user experience and outcomes of rehabilitation by curating a human-centered design approach in collaboration with a multi-professional team (stroke patients, relatives, staffs, and architects).

Applying empowerment, communication, and risk levels as parameters, design an inpatient stroke and rehabilitation facility at Hässleholm Hospital with a focus on how the physical environment can best promote stroke patients' well-being and synergies with healthcare staff.

KEYWORDS:

Stroke rehabilitation, Healing environment, Supportive environment, Design for health, Evidence-based design, Sustainability

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AS AN ARCHITECT

“ I am drawn to care environments, particularly stroke rehabilitation. It is not only the various risk levels in stroke survivors and their rehabilitation processes but also the opportunities to learn from the Swedish healthcare architecture standard as well as cooperation design with multi-professional teams between patients, staff, relatives, and architects. I want to communicate this subject to contribute to stroke patients' well-being and a healing environment designed for health and sustainability. ”

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. . .

My supervisor and examiner

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Magdalena Karlsson, Maja Kevdzija,
Malin Reinholdsson, Maria Kristin Carlsson,
Matts Nilson, Thylander Mikael,
All stroke survivors, healthcare staffs and researchers

All supports

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01

INTRODUCTION

Source: Pinterest

PROBLEM STATEMENT

Stroke is one of Sweden's top health hazards. It results from brain hemorrhage or ischaemia and is a leading cause of severe and protracted disability (Socialstyrelsen, 2018). Hence, stroke survival and brain damage reduction depend on early acute treatment and effective rehabilitation (Brainin et al., 2004).

A study revealed that stroke unit patients were often alone and inactive (Bernhardt et al., 2004). In a new unit with many single rooms, patients may have been isolated from staff (Anåker A. et al., 2016). This caused individuals to stay in their rooms, be less active, and engage less with staff and family than in the original unit (Anåker A. et al., 2017). Boredom, lack of stimulation, fatigue, low mood, and disempowerment are also major barriers that lower motivation and lead to ineffective rehabilitation (Luker J., 2015).

Because rehabilitation and physical factors in stroke units are as important as medical treatment, this area is understudied (Jane C., 2021) and must be integrated into future stroke guidelines planning and design (Anåker A. et al., 2017). So, this thesis will investigate the physical environment of an inpatient stroke unit that promotes stroke survivors' well-being and rehabilitation.

AIM

The project looks at how stroke patients' experiences and outcomes are affected by current stroke units and rehabilitation facilities' physical environments. It investigates these places' barriers, needs, and opportunities applying a human-centered design approach to find new knowledge and strong evidence for healthcare planning and design. To understand how to gather data from various sources, analyze it, and turn the findings into practical strategies that lead to design prototypes.

RESEARCH QUESTION

1. How can the built environment best support stroke patients' well-being, and synergies with healthcare staffs in stroke unit and rehabilitation facilities via empowerment, communication, and levels of risk as parameters?

DELIMITATION

In this master's thesis, international case studies and evidence-based research on stroke patients and stroke units' physical environments will be referenced and developed into a design proposal in a Swedish context.

An inpatient stroke unit with rehabilitation facilities and medicine treatment, or a rehabilitation medicine unit in a local hospital or rehabilitation center, will be the scope of study. This study does not include the connection to intensive stroke medical treatment (surgery) on a large hospital scale.

The final proposal will represent a theoretical study of the possibilities of the new design building on the site at Hässleholm Hospital, Skåne, Sweden. Importantly, take into account the future timeline when the new orthopedic building project is completed and the old-unused buildings are planned to be demolished.

Due to the project's economics and short duration,qualitative data is collected from study visits and a limited number of interviewees from various roles and institutions (n = 9) relation to the stroke unit. which emphasizes multi-professional collaboration as an initial learning process focused on physical care-environment values rather than solving all stakeholders' needs or finding a single-stroke recovery solution.

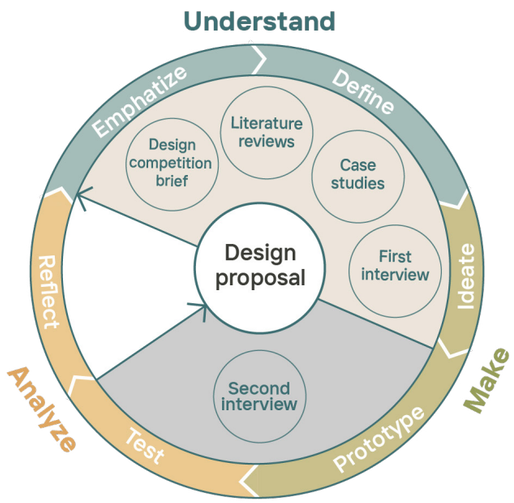
METHOD

Research for and by design base this thesis. It looks into stroke patients' well-being and staff-patient synergies in an inpatient stroke unit. The theory of NOVELL aspects of design: Empowerment, communication, and risk levels were examined as parameters.

The work included field-related theory and research, case studies, and two rounds of qualitative interviews with patients with stroke, healthcare workers, and researchers.

The first interview (n=9) focused on user-experience, workflows, and pain points. While the second interview (n=3) focused on feedback on design strategies and prototypes to develop a design proposal.

Sketching and modeling were used as methods to concretize and develop the information found in the research. The process has been iterative and adapted from a human-centered design perspective and consists of three main stages: Understand; Make; and Analyze.



READING INSTRUCTIONS

The booklet is divided into chapters with subcategories within. To fully understand the choices made in the design proposal, the study should be read from start to finish.

THE INTRODUCTION CHAPTER:
The research topic are introduced, together with stroke background, healthcare system, and current recovery barriers for stroke patients.

THE THEORY AND RESEARCH CHAPTER:
To answer thesis questions, the initial stage in developing ideas is to examine previous field research, case studies, and interviews.

THE CONTEXT, PROGRAMME AND DESIGN INVESTIGATION CHAPTERS:
Explanation of the preconditions and process for the design proposal.

THE DESIGN PROPOSAL CHAPTER:
Hässleholm Hospital's extension building concept and theoretical architectural design.

THE CONCLUSION CHAPTER:
A summary of the work's results, problems, and references.

AS PART OF DESIGN COMPETITION

This study integrates an international student design competition by the Public Health Group of the International Union of Architects (UIA-PHG) with the Novell Redesign as a part of a master's thesis on the theme "Next Generation of Stroke Rehabilitation Centers 2022".

This project aims to build an evidence-based framework for rethinking stroke rehabilitation facility design into new models of care to improve stroke patients' health and well-being. Best practices, user co-design, research, and evaluation are used to generate new knowledge for future health design.

The competition seeks innovative ideas for thirty stroke survivors within a maximum of 1,600 sq.m. The site location can be anywhere from urban to greenfield settings, and competitors must address novel aspects of design to improve stroke and rehab experiences.

The study will focus on stroke units with rehab facilities, even though Swedish healthcare design guidelines are more specific from the global standard in that they require inpatient stroke rehabilitation to be located in hospital connections with multi-professional support. which means the author will reference only particular portions of the competition brief into design proposal.

DESIGN COMPETITION BRIEF: Next Generation of Stroke Rehabilitation Centers 2022

Maximum area of 1,600 sq.m. in total

Site location can be anywhere from an urban to a greenfield area

WHAT THE AUTHOR WILL BRING TO THE STUDY:

NOVELL aspects of design

Empowerment
Feel personal control over the space and able to choose the space that supports their choice.

+

Communication
Feeling of being supported and encourage social interaction with allow privacy (in physical or via technology) activity and skills.

+

Level of risks
Adaptable, versatile and stimulating environment that suits patients' desired level of risk to promote activity and skills .

Design for 30 stroke patients

Technical equipment rehab area:

Parallel bars, Exercise bike, Cross trainer, Pilates reformer, Moto med, Exercise stairs, Exercise steppers, Treadmill, Plinth areas (curtained off), Hand wash basin, Storage, and staff area.

Source: Design Competition brief: www.uia-architectes.org/wp-content/uploads/2022/08/220801-UIA-PHG-Competition-Brief.pdf

02

BACKGROUND

Source: Pinterest

WHAT IS STROKE?

Stroke is defined as brain damage caused by a lack of oxygen and consists of two main types with different causes. First called ischaemic stroke or a cerebral infarction, which occurs when a blood clot has formed in one of the brain's blood vessels, while the second is called hemorrhagic stroke or a brain haemorrhage; when a blood vessel bursts inside the brain or on the surface of the brain.

From the report of Socialstyrelsen, it reveals that 85% of cases are ischaemic strokes, while 15% are hemorrhagic strokes and subarachnoidal haemorrhages. There are also nearly similar signs called transient ischemic attack (TIA), which differs from stroke in that symptoms resolve within 24 hours, and from conditions that mimic stroke, such as seizures, migraines, and psychiatric disorders (McClelland G, 2019).

Many risk factors for stroke exist. Examples include high blood pressure, smoking, atrial fibrillation, diabetes, inactivity, high blood lipids, carotid stenosis, a history of stroke or transient ischemic attack (TIA), old age, a family history of cardiovascular disease, and excessive alcohol intake (Socialstyrelsen, 2018).

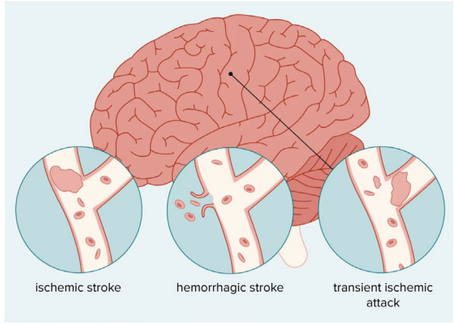


Figure 01 - Type of stroke in the brain (Illustration by Bailey M.)

CONSEQUENCE OF STROKE

Lack of oxygen or bleeding, damaged brain cells from a stroke are leading to physical, emotional, and cognitive difficulties. Also cause substantial life changes and a decline in social activity (Arntzen et al., 2015).

According to the World Health Organization, one-third of stroke patients are permanently disabled. While the study of Sennfält S. shows that the probability of another stroke is roughly 10% within three years, The physical and mental symptoms of stroke will be presented in the diagram below.

- THE CONSEQUENCE AFTER STROKE -

Physical symptoms

Paralysis
Bed sores and pain
Seizures
Sensation changes
Movement and balance problems
Trouble seeing, eating, and swallowing
Trouble speaking, speech and language
Cognitive impairment

Mental symptoms

Fatigue
Impaired memory
Difficulties understandings
Mood or emotional swing
Depression

(Stroke: Symptoms, Causes, Treatment, Types & More, n.d.)

- STROKE STATISTICS -

IN GLOBAL

"Around **80 million** stroke survivors in the world today."

(Stroke center west, 2022)

40% Suffer moderate-severe impairments
25% Suffer minor impairments
15% Die shortly after stroke
10% Recover almost instantly
10% Require long-term care facility

(National stroke association, 2015)

IN SWEDEN

3rd

Most Swedes' common cause of death

(Stroke center west, 2022)

Estimated > 140,000 stroke surivors in Sweden

(Sennfält S., 2020)

Women experience fewer strokes than men in 2018 in Sweden.

(Riksstroke, 2019)

75 years old is the average age of stroke patients in 2018 in Sweden.

(Riksstroke, 2019)

STROKE TREATMENT

Stroke patients in Sweden are treated in hospital stroke units. MRI and CT scan, or blood tests are normally used to diagnose stroke patients in most hospitals (Maria C., personal communication, 2023). Then they receive medications that control blood pressure (antihypertensive drugs), high blood lipids (statins), or treatment with anticoagulants (drugs that thin the blood). Treatment depends on the type of stroke, which will not be addressed in detail in this study. Those who need advanced technical treatment, such as thrombectomy or other surgeries, will be referred to regional or large hospitals.

STROKE HEALTHCARE SYSTEM IN SWEDEN

Socialstyrelsen states the Ministry of Health and Social Affairs runs Sweden's welfare and healthcare systems. As part of the guidelines, the National Board of Health and Welfare monitors, develops, and evaluates social services, health and medical services, patient safety, and epidemiology for county councils, regions, and municipalities.

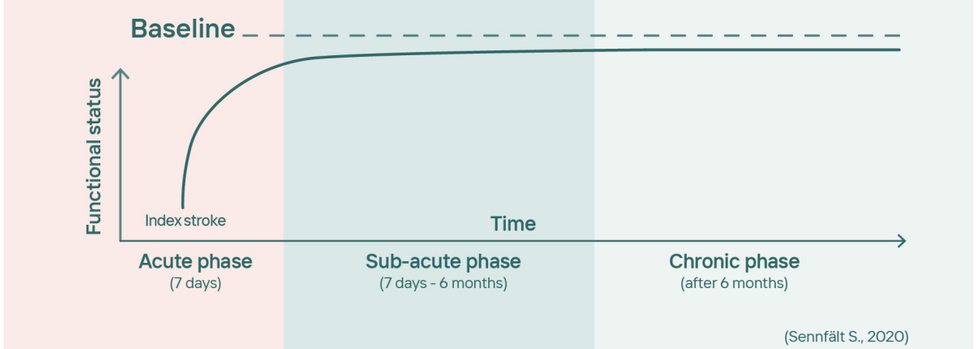
The Swedish stroke care chain is extensive and complicated. All 21 of Sweden's regions are individually in charge of important financial decisions and resources. There are a total of 72 stroke units nowadays, and each region includes at least one hospital with access to full-scale stroke care and several smaller hospitals with limited access to full-scale care.

Recovery after a stroke consists of three stages: acute, sub-acute, and chronic stage (Bernhardt J. et al., 2017). In the acute phase, patients get an early diagnosis, receive treatment, and remain in hospital acute stroke units for an average of eight days. At first, the rehabilitation can begin as soon as the patient is stable from a medical perspective in an acute stroke unit. Most rehabilitation happens in the first three months, but it can also take longer depending on the degree of disability.

During sub-acute phase, stroke patients stay in the hospital for 7 days to 3 months. Those who need more rehabilitation, extensive care, or are older will be able to stay longer in inpatient units (a stroke unit or another department of the same hospital, depending on each region). Those who have had a stroke and have mild to moderate disabilities can continue rehabilitation in different settings, between outpatient settings, primary care, and at home (early supported discharge).

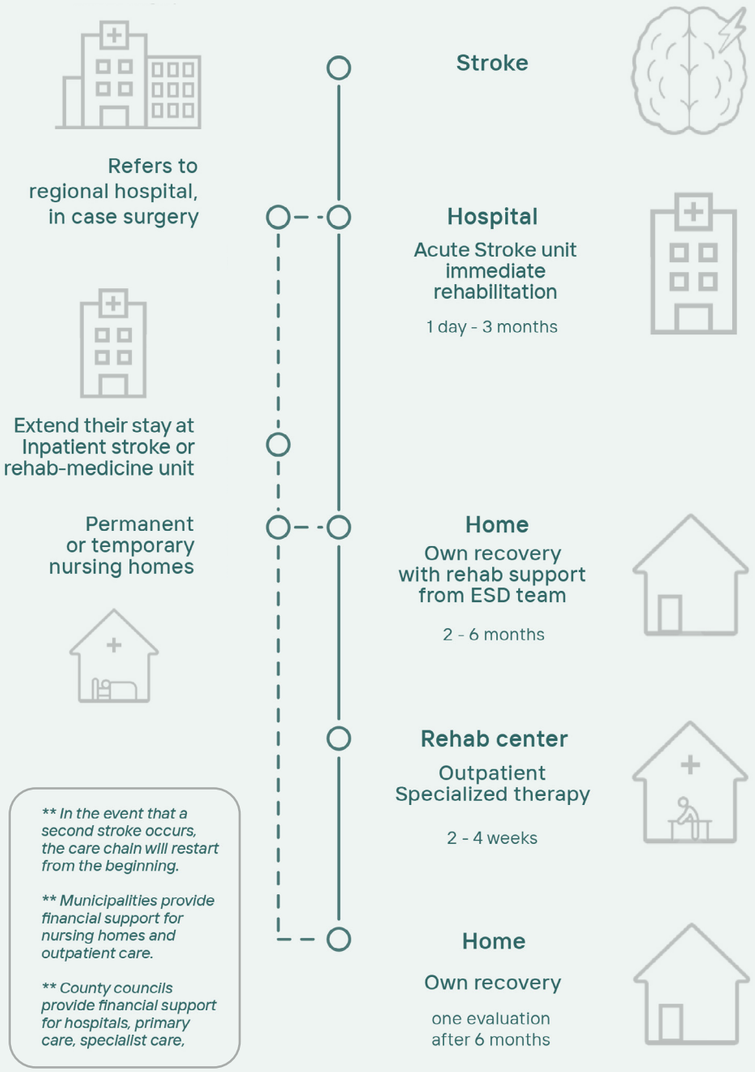
In the chronic phase, rehabilitation proceeds in the same way as in the previous stage, but a follow-up visit is recommended 3-6 months after a stroke and 1-3 months after a TIA to look at secondary prevention, needs, or offer a referral. A stroke survivor and family members will collaborate with social workers at the hospital to locate a suitable living arrangement. Many stroke survivors return home, but some move into a medical facility.

- STAGE RECOVERY AFTER A STROKE -



(Sennfält S., 2020)

- STROKE HEALTHCARE SYSTEM IN SWEDEN -



Source: *macro user journey (corrected by the author from first interview), the information of financial support (referenced from Sennfält S., 2020).*

- RELATED STROKE INSTITUTIONS -

To have a clear vision of stroke organizations and their participation, the author selected some examples of global and Swedish stroke institutions, which are briefly explained in the chart below. The source of the information is the institution's official website.

- IN GLOBAL -

WORLD STROKE ORGANIZATION

3,000 individuals and 90 society members worldwide represent approximately 55,000 stroke professionals in clinical, research, and community settings. "A Life Free of Stroke" aims to minimize the global stroke burden through prevention, and long-term care.

STROKE ALLIANCE FOR EUROPE

Brussels-based non-profit founded in 2004. Representing stroke support organizations (SSOs) from over 30 European countries, it advocates for stroke survivors. It seeks to reduce strokesin Europe and their effects on Europeans.

NOVELL REDESIGN

Neuroscience Optimized Virtual Environments Living Lab: A special department focused on an evidence-based framework for redesigning stroke rehabilitation facilities and care models. The institution is based at the Florey Institute of Neuroscience and Mental Health in Melbourne, funded by the Felton Bequest and the University of Melbourne, Australia.

- IN SWEDEN -

SWEDISH STROKE ASSOCIATION

Strokeförbundet: A non-profit and independent organzation that covers all of Sweden and includes people affected by stroke, their families, and others. Also provide a fund for supporting stroke research, arrange activities, and spread information about stroke via online articles and podcasts.

STROKE INVEST

The stroke research foundation was founded in 2016. It supports stroke research in Western Sweden at the University of Gothenburg, Chalmers, and other universities and works with social actors and corporations to develop a fund to make Western Sweden a global leader in stroke research.

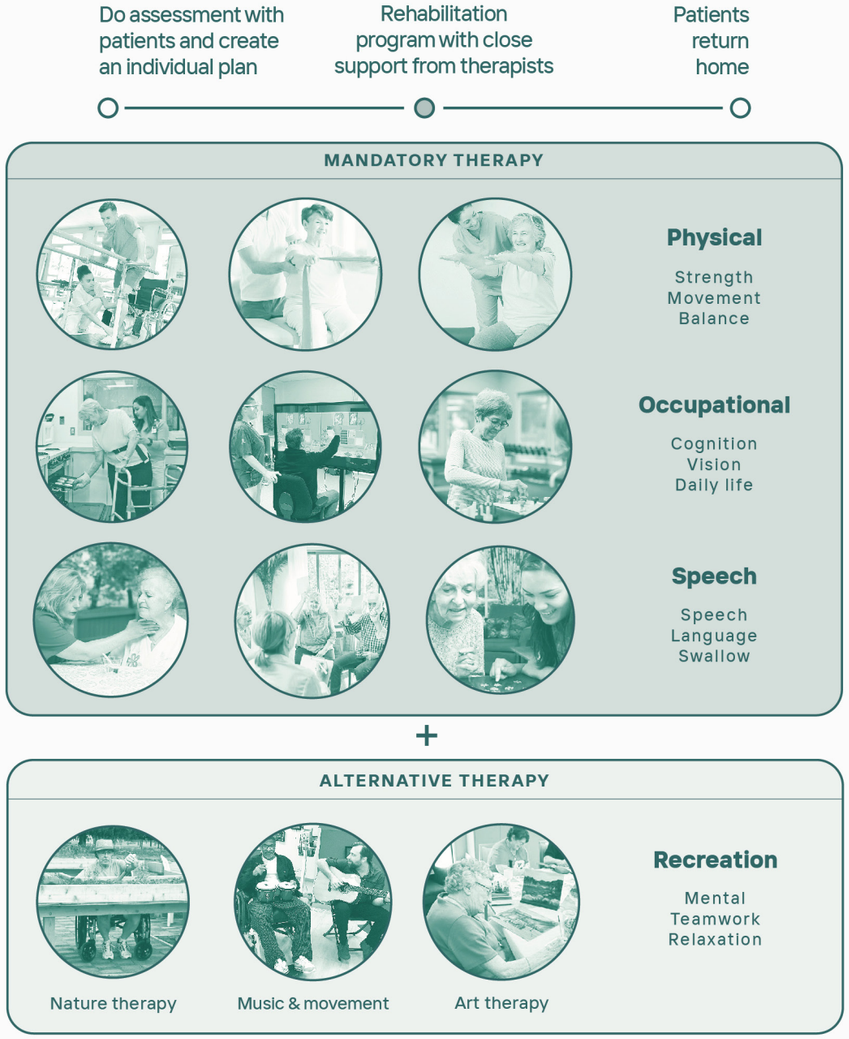
STROKE REHABILITATION

Rehabilitation is "the process by which a person with a disability learns the knowledge and skills needed for optimal physical, mental, and social functioning" (Lipson-Smith, 2021). Which aims to get the person back to normal, or as close to normal as possible.

Rehabilitation services are operated in various ways by a county council, a municipality, or a private organization. Which typically serves as an inpatient, outpatient (day care) hospital, rehab clinic, or health center (Ullberg, 2016).

According to the National Board of Health and Welfare regulations of Sweden, individual rehabilitation plans are needed for stroke patients to respond to their impairments, problems with activity and participation, goals, and action needs (Socialstyrelsen, 2018). The types and processes of stroke rehabilitation will be explained in the diagram below.

- TYPES & PROCEDURES OF STROKE REHABILITATION -



(Source: Illustrator created by author, source of photos from the internet)

STROKE UNIT

Stroke unit was defined by the Swedish National Stroke Guidelines as " organized care provided by multidisciplinary teams specializing in stroke care and rehabilitation in a geo-graphically isolated hospital area and able to address stroke-specific concerns and have access to specialized equipment." Stroke units typically reside in acute stroke units, stroke units with rehabilitation facilities, and rehabilitation medicine units.

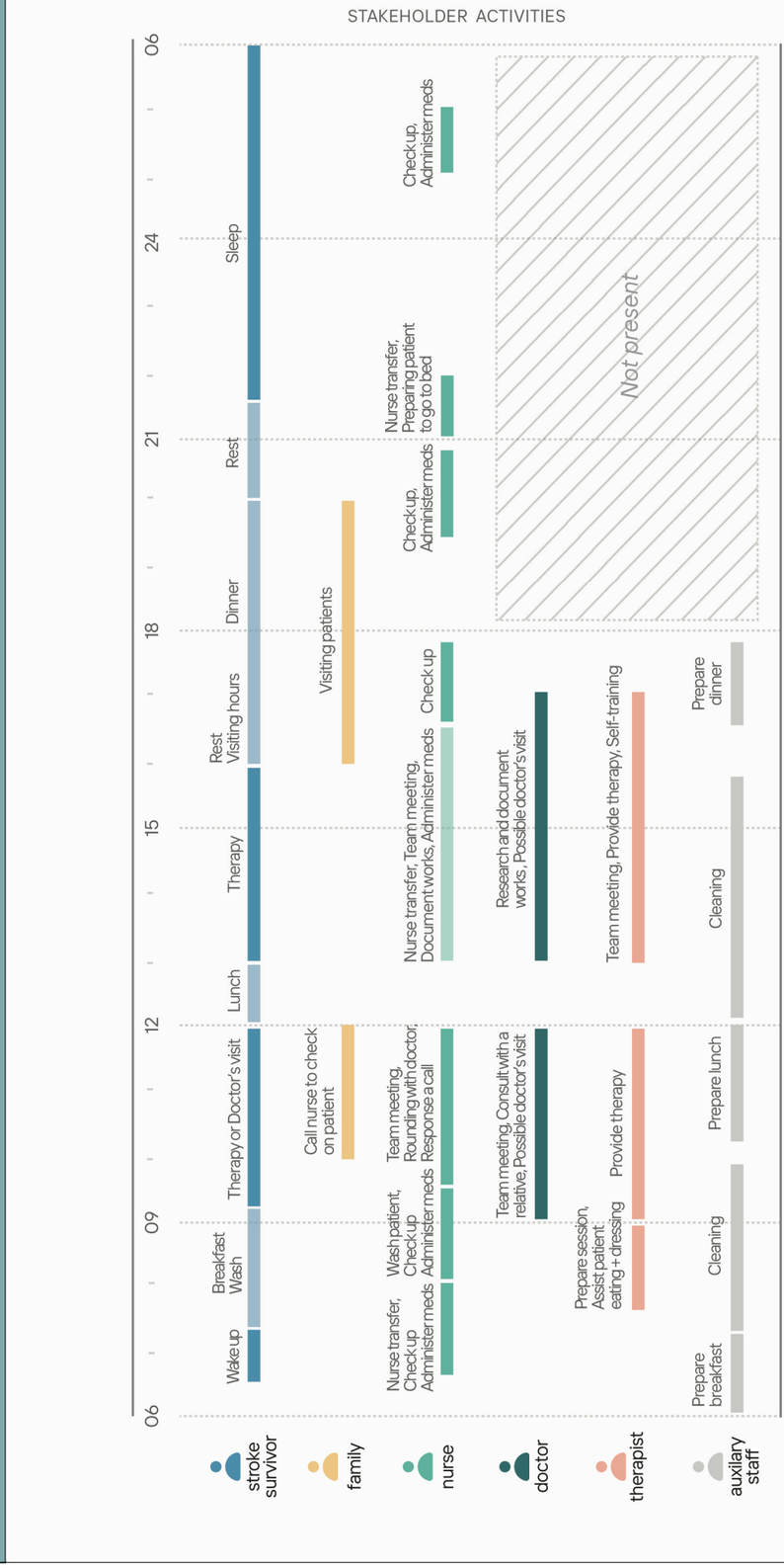
STAKEHOLDERS OF STROKE CARE

When it comes to inpatient stroke care stakeholders, multidisciplinary team-based care was called for and formed. This involves doctors, nurses, therapists, counselors, and psychologists (preferably neuropsychologists) in a patient-centered and goal-oriented process. while social workers and dieticians support patients and families through additional work (Clarke D., 2013). The diagrams below show the relationship between stakeholders, their duties, and daily routines.

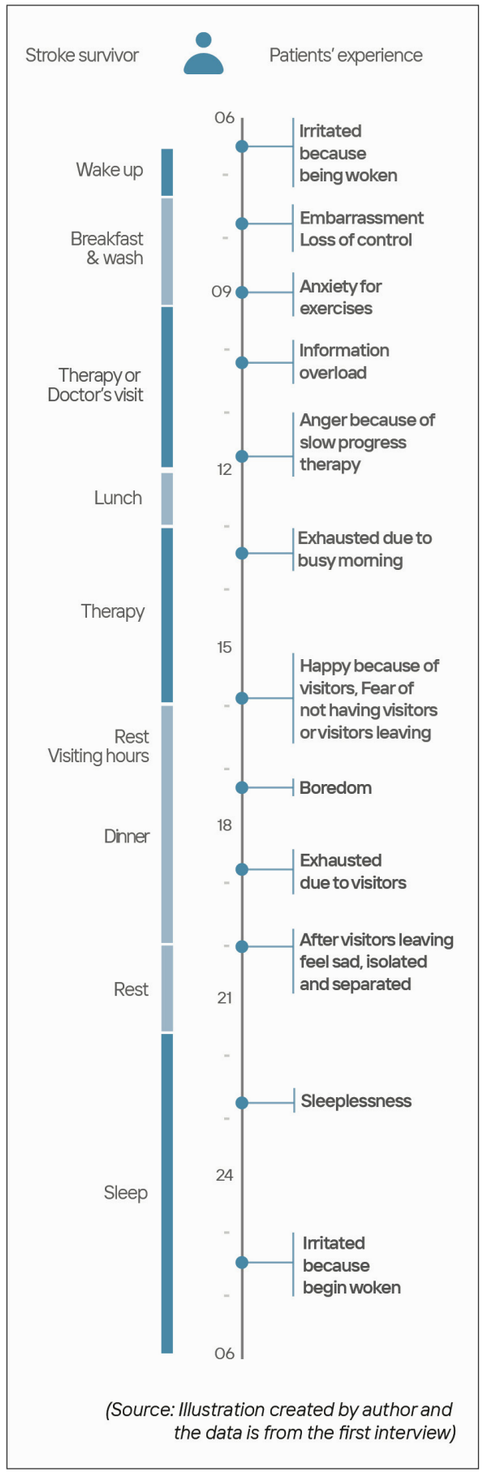
- RELATION OF STROKE CARE STAKEHOLDERS -

(Source: Illustrator created by author and the data is from the first interview)

- A DAY IN THE LIFE AT THE STROKE AND REHABILITATION UNIT -



Source: created by author, and the data was collected from the first interview



(Source: Illustration created by author and the data is from the first interview)

BARRIERS IN STROKE PATIENTS' RECOVERY

To better understand patients' experiences and what obstacles patients suffer in the ward. Patients' daily routines and their possible emotions that can affect recovery were collected via a first interview with various stakeholders and supported via related research, which is illustrated in the diagram above.

The author may divide the challenges into three key ones: feelings of powerlessness, loneliness, boredom, and having an ineffective resting quality. All of these might be hints that the physical care setting fails to promote patients' well-being.

Research shows that feelings of exhaustion and loss of control demotivate stroke patients (Luker J., 2015). Similarly, stroke patients are alone and inactive; they take part in a few training activities and spend the majority of their time in their personal rooms (Anker A. et al., 2016). These scenarios may occur due to a restricted and unempowered ward layout, as well as the unappealing space and strict division between private and shared spaces.

If this assumption is true, how can we transform these patients' barriers into positive encouragement and encourage them to be more social and active?

These assumptions will be looked into through literature studies, case studies, and interviews, which will lead to design strategies that resolve the research question:

How can the built environment best support stroke patients' well-being and synergies with healthcare staff in stroke units and rehabilitation facilities?

03

THEORY & RESEARCH

Source: Pinterest

HEALTH AND WELL-BEING

Health, as defined by the World Health Organization (WHO), is "a state of complete physical, mental, and social well-being and not merely the absence of disease or infirmity." While **Well-being** refers to being healthy, happy, and fulfilled and includes physical, social, and psychological components (Pressman S.D. et al., 2013).

There are several approaches to looking at health and well-being: physical, social, and psychological well-being. In this regard, physical well-being includes feelings of health, vitality, and energy. Social well-being, on the other hand, focuses on positive relationships, social support, and a sense of belonging in the community. Opposed to psychological well-being, which means having an optimistic outlook, self-acceptance, personal growth, and a sense of fulfillment in life.

In the context of stroke patients, it is subjective and changes from person to person. It will depend on numerous factors, such as your physical and mental health, your social connections, your personal circumstances, and the support you get. In a similar way, the physical care environment has an impact on how well an individual recovers from a stroke by influencing how well they sleep and how well their rehabilitation works.

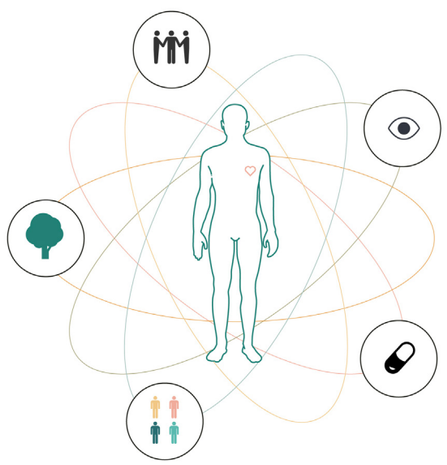


Figure 02 - Relationship between human, health, and well-being

PHYSICAL CARE-ENVIRONMENT

Changes in the physical environment have been found to affect patients' activity and social interactions in stroke units (Shannon MM, 2019). While it is necessary to understand an individual's basic needs when creating an environment that promotes health (Heerwagen et al., 1995).

In addition, Harris, McBride, Ross, and Curtis (2002) discovered that the physical environment's features can be categorized in numerous ways:

1. The ambient environment, which includes the lighting, noise level, contact with a nature and quality of the air.

2. The architectural features like the layout of a hospital, the size and shape of rooms, as well as window placement.

3. The interior features, such as color and materials, furniture, and artwork.

In this study, the author will build on the supportive environment theory (p. 17) and evidence-based design linked to the healing environment theory (p. 18) in order to implement architectural design strategies to promote health and well-being in stroke patients.

Figure 03 - Stroke patient in a physical care environment

THE SUPPORTIVE ENVIRONMENT THEORY

Grahn et al. (2010) examined the supportive environment theory (SET), which claims that people need strong supportive environments for their physical (senses, muscles, and movement) and mental (feelings and thinking) growth to recover from illness or life crises.

Which supportive environments a person needs depend on their physical and mental abilities, situation, and emotional state. While nature, culture, and an individual's mental and physical abilities can also change their meaning (understandability, manageability, and significance).

TRIANGLE OF SUPPORTIVE ENVIRONMENT

Bengtsson and Grahn (2014) demonstrated how the social and physical environments of a person affect their executive functions at different stages of well-being according to a triangle of supportive environments. To begin with, people at the bottom of the triangle seem to be less happy and more sensitive to their surroundings.

They cannot engage with others, so they need places where they can be alone.

People who can handle emotional engagement make up the second level of the triangle. These individuals still care about their privacy but seek distant visual contact with others.

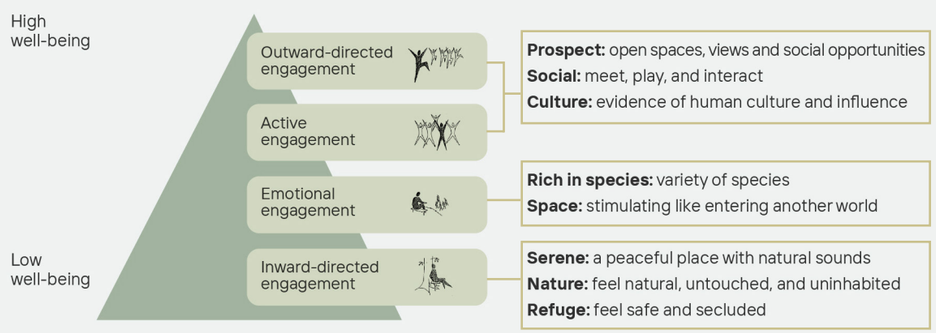
At the third level, individuals are able to take part in group activities and be active in social and active environments.

At the fourth level, individuals show commitment to the outside world. They have regained high executive functions and can easily handle situations that are socially and/or physically demanding.

To take into consideration every individual's preferences and limitations, the author considered it would be highly intriguing to apply this theory to stroke patients and observe how the relationship between the physical environment and each different level of engagement could be applied to formulate a shared space with a different restorative characteristic in a ward design.

PERCEIVE SENSORY DIMENSION

Grahn et al (2010) identified eight restorative characteristics connected to a triangle of supportive environment theory.



(Bengtsson & Grahn, 2014)

HEALING ENVIRONMENT

This study using Bovenberg et al. (2010) definition, "as an environment in which physical, psychological, and social aspects contribute to a client's well-being, recovery, and healing, reducing patient stress and encouraging self-recovery."

Most studies on healing environments focus on the physical aspects of the environment, such as natural light and nature, which have been shown to stimulate and support people's healing capacities. All the stuff that surrounds an organization is part of its physical environment, and interacting with some of it can have an effect on psychological and social aspects.

Below is an example of evidence-based research on the physical, psychological, and social aspects of healthcare settings:

- EVIDENCE-BASED DESIGN USING PHYSICAL ENVIRONMENT ASPECT -

DAYLIGHT AND VIEW

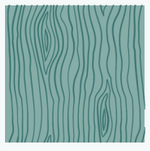
Access to daylight and views of nature can both help people stay in the hospital shorter, feel less stressed, sleep better, and feel less depressed (Ulrich 2008).

ENRICH ENVIRONMENT

Increasing patient activity may have a positive effect on their emotions and recovering outcome. Askim et al. (2012) and Indredavik et al. (1999) stated that a meeting place with computers, games, books, newspapers, and comfortable seats where respond individuals' activities can promote the patients' well-being.

POSITIVE DISTRACTION (NATURE)

Research by Becker & Douglass (2008) has shown that high levels of attractiveness in the form of colorful contemporary furnishings, artwork, and a healing garden can reduce patients' anxiety and increase patient satisfaction with the care given.



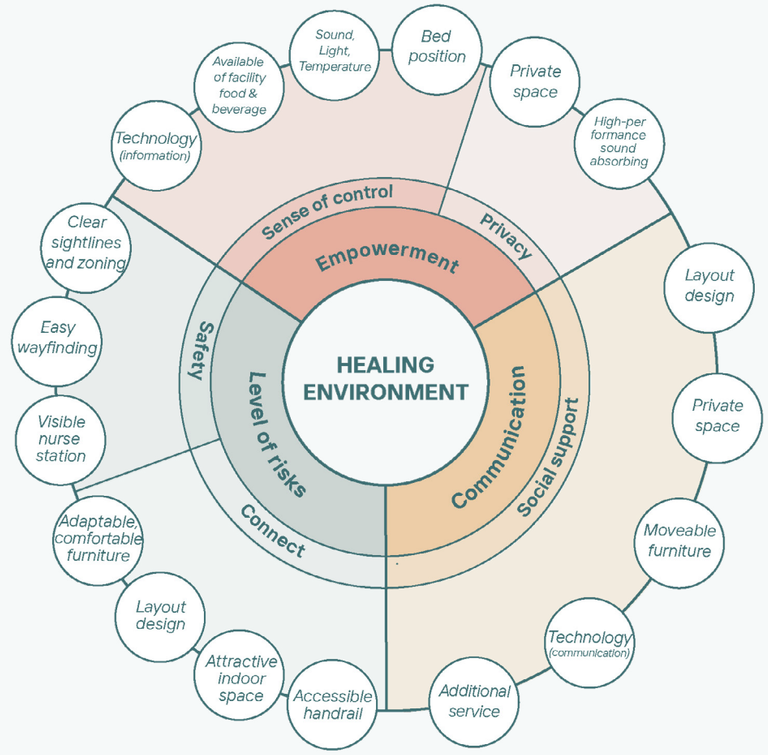
MATERIALITY

Material choices can also help patients feel safe and secure. A study by Frost & Hammarling (2017) shows that patients' emotions are affected by color palettes and physical combinations, and the material wood enhances the wellness of patients.

AMBIENT CONDITIONS

Poor ambient conditions, including temperature, air quality, and light, can affect patients with stress (Ulrich et al., 2008). It is assured that patients in general feel comfortable with a stable temperature of 21.5-22 °C and a humidity level of 30-70% (Prevosth and Van der Voordt, 2011). Good air quality can be reached with good airflow and the right direction.

- PSYCHOLOGICAL AND SOCIAL ASPECTS OF THE ENVIRONMENT -



(Source: Illustration created by the author, and the data was developed by the author from the study by Janine N., 2017)

To find out more about three parameters: empowerment, communication, and amount of risk, which the author mentioned from the **NOVELL aspects of design** (Chapter 1, page 4), Research by Van Nijhuis J. (2017) will be applied to come up with a more detailed description of the physical environment, which is connected to psychological and social aspects.

Empowerment: A patient's sense of control is often correlated with their well-being. They should be able to occupy a space that fits their needs and activities. In a similar way, well-accessible food, comfortable seats, facilities, and necessary information On top of that, how they can manage and personalize their space is crucial (e.g., the position of the beds, temperature, lights, and sound). Privacy is also a big issue for patients; they can choose to be alone or with someone else by curated sound-absorbing materials for privacy.

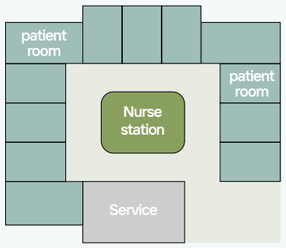
Communication: providing social support, the layout, furniture arrangement, and the addition of technology and services would be great tools to encourage socialization and reduce anxiety and stress in patients.

Levels of risk: Safety must account for these considerations, which means they should have clear sightlines and zones, the visibility of the nurse station, and easy wayfinding. These would make the person feel more secure and less inclined to fall or get lost. Furthermore, individuals with all levels of impairments are required to be able to participate in social activities without feeling left out of the community. This problem can be solved with flexible furniture, accessible handrails, sufficient seats, and various characteristics of shared spaces.

- DESIGN OF INPATIENT WARD IN SWEDISH CONTEXT -

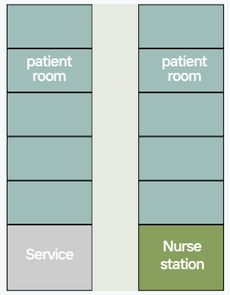
Den Goda Vrdavdelningen (Chalmers, CVA, PTS, 2019) describes inpatient wards as places where patients remain overnight or for an extended period of time. In many cases, outpatient clinics and inpatient wards for the same specialty are located close by. Generally, an inpatient ward consists of two to four units with five to eight patient rooms per unit, depending on the type of ward and care provided along with its logistics. Depending on the ward layout, the different units in a ward may interact fluidly or be strictly separated.

Besides the patient rooms, support units are required. It can be a day room for patients, group rooms to discuss in private, or workstations for the staff to do their daily duties. (Schmitt & Strid, 2017). There are also support functions such as storage, recycling rooms, and kitchens that are not frequently utilized and therefore these areas may also be shared with other units within the ward. The diagram below portrays typical unit layouts along with their pros and cons analyzes.



RADIAL LAYOUT

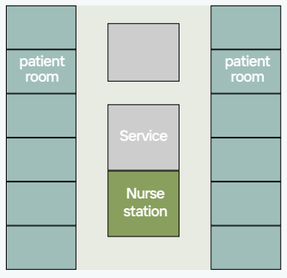
- **Pros:** The plan allows all patient rooms to be seen from the central nurses' station, and there are no physical barriers that block the view of patient rooms from the central nurses' station. One side of the hallway is always linked to the nurse station.
- **Cons:** The nurse station doesn't have a solid wall, so staff might feel like they've lost their privacy and worry that their computer screen can be seen. There's also no window for letting light into the space.



SINGLE-CORRIDOR LAYOUT

The rooms for patients are usually lined up along a corridor and face each other.

- **Pros:** The nurse station has a window for light and a view, which is good for the well-being of the staff. Also, a solid wall on at least one side would give staff a few private. This layout also encourages clear sightlines and is accessible for patients.
- **Cons:** The layout could make a long, dark corridor, which make it harder for staff to get to patient rooms that are further away.



DOUBLE CORRIDOR LAYOUT (RACE-TRACK)

Patient rooms face service rooms in the center.

- **Pros:** It offers an effective space in which the staff can access all patients rooms from a close distance. It also has one solid wall for privacy. Additionally, it creates clear zones and makes it easy to move around, which can make people feel less anxious.
- **Cons:** Since the nurse station doesn't have a window, the area may lack sufficient daylight.

- DESIGN OF PATIENT ROOMS IN SWEDISH CONTEXT -

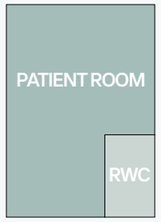
SINGLE PATIENT ROOM VS SHARED PATIENT ROOM

According to "Den goda vrdavdelningen 2019" (Chalmers, CVA, PTS, 2019), new hospitals should be designed with single patient rooms. The positive effects of single-patient rooms are greater integrity, person-centered care, fewer fall accidents as well as healthcare-associated infections, a quieter and calmer environment, improved collaboration among staff, and improved sleep. The drawbacks of this are that it can take longer for the staff to reach all of the patients, and it can be difficult to monitor all of the patients since they are spread out in separate rooms.

A new study by Anåker A. et al. (2020), on the other hand, found that patients were more active in a stroke unit with a combination of single and shared patient rooms than in a unit with only single rooms. This study result is an adequate reason to rethink and value the benefits of shared patient rooms, such as making patients feel less alone, making it easier for staff to monitor, or even being cost-effective from a business point of view.

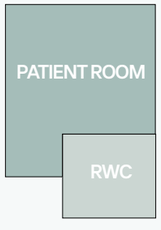
PATIENT ROOMS' LAYOUT OPTIONS

In the same study, three primary categories of patient rooms were identified. Each has pros as well as cons, and depending on the project, one may be better than the others (Chalmers, CVA, PTS, 2019).



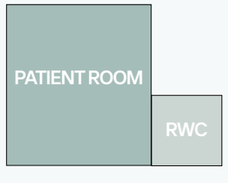
RWC PLACED IN THE ROOM

- **Pros:** Offers a private area for the bed and a hallway with space for a sink.
- **Cons:** It might be difficult for staff and patients to see one another from the door/bed.



RWC PLACED HALF IN THE ROOM/CORRIDOR

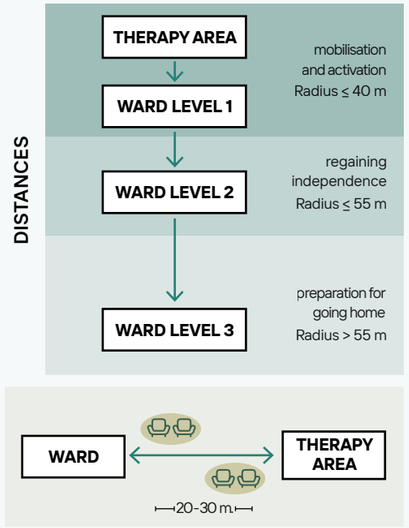
- **Pros:** Offers a private area for the bed as well as a niche in the corridor that shifts the door out of the way.
- **Cons:** It might be difficult for staff and patients to see one another from the door/bed.



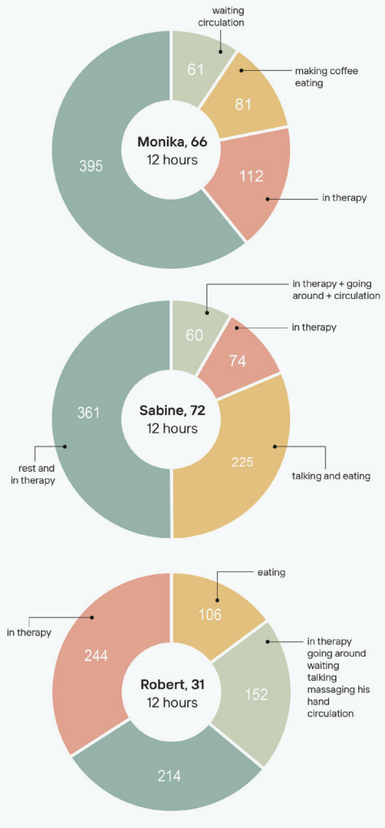
RWC PLACED IN-BETWEEN THE ROOM

- **Pros:** The room is smaller and has a clear sightline from the entrance because there is no hallway.
- **Cons:** Longer corridors.

- DESIGN FOR STROKE - DIVERSE STROKE PATIENTS -



(Source: Kevdzija M., 2020)



(Source: Kevdzija M., 2022)

ACCESSIBILITY

The research by Kevdzija M. classified stroke patients into distinct mobility levels and presented three ward types based on differing mobility levels in order to determine the optimum distances between wards and therapy areas. From level 1: the least mobile patients, to level 3: the most mobile patients who are preparing to return home, the distances are 40 m and 55 m, respectively. This extended path can be utilized for critical walking and wayfinding training for patients, providing additional mobility exercises during therapies.

Also suggested are corridor rest areas connecting wards to therapies. This may involve minor corridor enlargements with wheelchair access and seats. Every 20–30 meters along the path to the therapy location should feature resting areas.

PATIENTS' BEHAVIORS

A shadowed 12-hour study by Kevdzija M., A Day in Stroke Rehabilitation: Exploring Different Inpatient Experiences, observed five stroke patients. Research indicates that stroke patients in rehabilitation employ the built environment differently based on their post-stroke impairment, age, and personal preferences.

Accessible community spaces and distance from patient rooms are essential in rehabilitation settings. Increased communal space and its diversity are necessary. Some patients prefer socializing with others, while others prefer privacy. Both conditions demand free-time activities to alleviate boredom and aid stroke recovery. Thus, the built environment should offer various recreation opportunities.

The author chose the three most distinct personas from the study to reflect their various location times in minutes.

- patient room
- ward's dining room
- therapy room
- corridor

- DESIGN FOR STROKE - TECHNOLOGY IMPLEMENTATION -

NEW TECHNOLOGY HELPS COGNITIVE ABILITY

Figure 04 - Occupational therapy at CogTech lab

The CogTech unit incorporates robotic pens, laptops with eye controls, VR computers, Hololens, game consoles, and recently, a large tablet in occupational therapy that focuses on cognitive and hand training.

"The technology may make rehabilitation of varied talents more fun and provide patients with motivation for an out-of-the-ordinary hospital experience", according to Birgitta Johansson, an occupational therapist who has worked for 17 years to bring new technology into rehabilitation (CogTech, Danderyds Sjukhus, n.d.).

Large tablets were used for various purposes. It's easy to find content for everyone and use it with a wide range of patients. Similar to the huge plate, it can divert the patient from their hospitalization and rehabilitation as well as help develop scanning and concentration. Many commercials, large tablet rehabilitation apps, and sometimes patients' mobile device games can be used.

ADAPTIVE HEALING ROOM FOR STROKE PATIENTS

Figure 05 - Adaptive healing room for stroke patients

The study of adaptive healing room design for stroke patients by Daemen and colleagues is a good example of how technology can help patients enjoy a pleasant, unobtrusive environment in their own rooms.

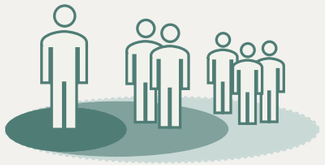
Adaptive Daily Rhythm Atmosphere (ADRA) controlled the artificial skylight and patient wall to allow dose stimuli throughout the day, provide structure, gently wake up, sleep undisturbed, and balance a personal and therapeutic atmosphere. Also, the Dynamic Adaptive Healing Light System (DAHLS) will mimic the daylight spectrum throughout the day, improving nocturnal sleep and alertness, lowering perceived stress, increasing stroke patients' pain tolerance, and improving satisfaction, general feeling, activity, and appetite (Daemon et al., 2017).

The author finds the topic relevant and worth addressing. However, the study will not cover this topic.

SUMMARY: THEORY & RESEARCH

☑ What the author will bring to the study:

THE SUPPORTIVE ENVIRONMENT



Offer different characteristic restorative spaces that promote various levels of social engagement with a connection to nature.

HEALING ENVIRONMENT BY EVIDENCE BASED DESIGN

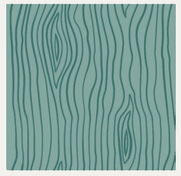
Views toward greenery in all patient rooms

Enrich environment easy-access to facility

Make good use of natural daylight in the building

Healing garden connects between indoor and outdoor

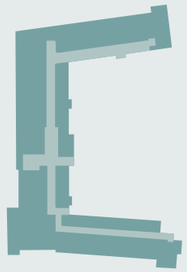
Healing art of nature scenery

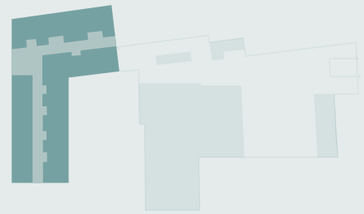


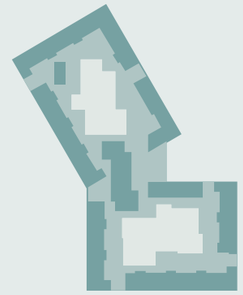
Wooden material imparts a sense of a warm, healthful interior

04

CASE STUDIES & INTERVIEWS



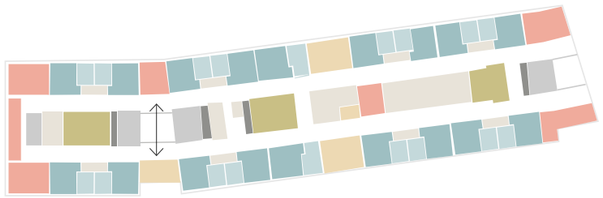




DANDERYDS HOSPITAL, STOCKHOLM, SWEDEN

Type: Inpatient rehab-medicine unit (specialized for stroke)
Year: 2017 (newly designed building)
Shape of layout: I-shaped
Location: 2nd floor of a 3-story building

Floor plan area: Approx. 1,570 m²
Preference: Double corridor with three decentralized nurse stations
Number of beds: 20




Ward's shared space


Training apartment


Training apartment

CogTech lab for occupational therapy

The case study properly demonstrates how each function operates on a limited floor plan. The author gains a full set of references with staff synergy and ward management in relation to shared space and technical room dimensions, as well as an exclusive Cogtech lab in which technology is utilized in an occupational therapy and training apartment where patients are able to experience a real situation a few nights before returning home.

✓ **Pros:** Due to space constraints, patient rooms were paralleled on both sides with a support and staff area, and a double corridor made all areas efficient. Staff can store carts in front of a small storage area facing a corridor between two patient rooms. In addition, the common area was in the middle of the floor, and rehabilitation functions were mainly at the ends of both sides of the floor plan, allowing for obvious zoning and wayfinding.

⊗ **Cons:** A double corridor with an I-shaped layout makes a long and dark corridor, which might affect patient anxiety and staff performance. Second, the rehabilitation gym's outdoor space and recreation space are on another floor and in a long distance part of the building, making them inaccessible to patients without professional support.

ALINGSÅS HOSPITAL, ALINGSÅS, SWEDEN

Type: Inpatient stroke unit
Year: 2021 (newly extension building)
Shape of layout: L-shaped
Location: 5th floor of a 6-story building

Floor plan area: Approx. 2,050 m²
Preference: Single corridor with three decentralized nurse stations
Number of beds: 16

Figure 06 - Alingsås case study

Nurse station


Corridor space


Patient room


Meeting space in front of ward

Due to COVID-19 and the hospital's restriction policy, the author is able to investigate digitally through staff-recorded video. The case study indicates that a middle corner is a ward's heart, with a ward entrance, main nurse station, and support functions including storage and the drug room in the center and serving as a communication place for staff and patients.

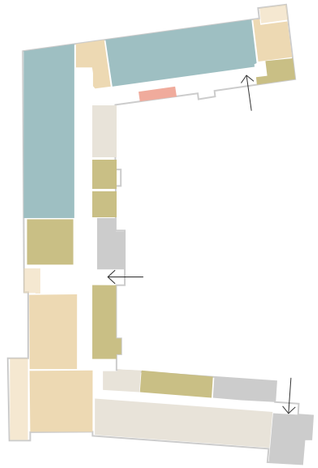
✓ **Pros:** The corner as a ward's heart simplifies navigation and gives staff an overview of the ward. The L-shaped arrangement with three nursing stations will boost staff communication, place the staff break room at the end of the corridor, and create a visual connection between the nurse station and the shared area. Thus, all staff can rapidly assist the patient. Although the hallway is dark, a single corridor allows patients to meet staff or other patients more intimately.

⊗ **Cons:** Due to limited shared areas, patients may spend most of their time in their rooms. A few rehabilitation areas without a rehab gym on the same floor will reduce patient activity and hinder their recovery.

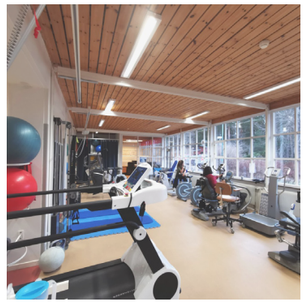
MÄLARGÅRDEN REHAB CENTER, SIGTUNA, SWEDEN

Type: Inpatient rehabilitation (private)
Year: 1970s (old building)
Shape of layout: U-shaped
Location: 1st floor of a 2-story building

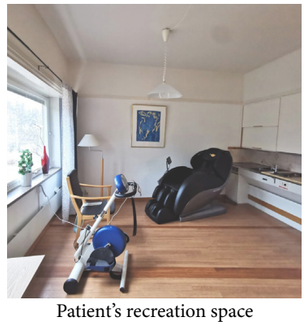
Floor plan area: Approx. 2,220 m²
Preference: Single corridor with two nurse stations
Number of beds: 25




Main entrance

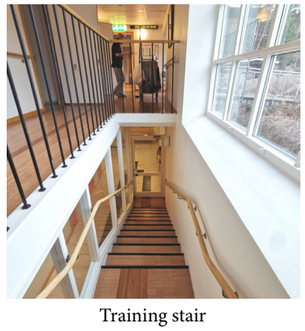

Rehab gym

The case study is an organized solution to the site's different topography. A U-shaped structure with a two-story human-scale building maximized the picturesque surroundings around it. The patient zone was on the top half of the floor plan, linking to the staff area in the middle, while the shared space, therapy, and support rooms were on the bottom half.


Patient's recreation space

Pros: Clear zoning between patients, staff, and the rehab area reduces patient disorientation. A training stair, rehab pool, and gym, with a connection to a wonderful environment outside, make patients enjoy training.

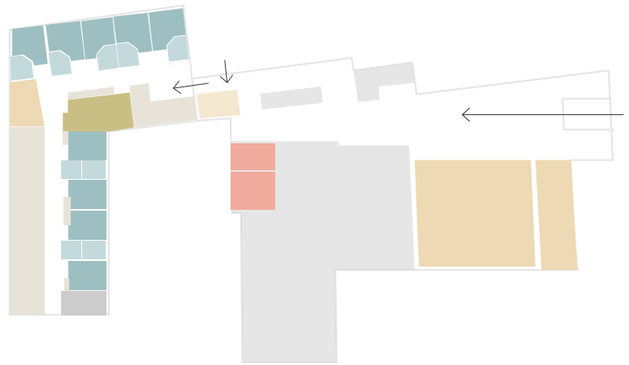
Cons: A dark, narrow corridor would be unpleasant for patients in lower-floor patient rooms because the building is old and its geography demands some areas have solid walls without windows. For mobility-impaired individuals, the rehab gym was on a lower floor and might be difficult to reach.


Training stair

REHAB STATION, SOLNA, SWEDEN

Type: Out & Inpatient rehabilitation (private)
Year: 2017 (extension building)
Shape of layout: Combination
Location: 1st floor of a 3-story building

Floor plan area: Approx. 10,500 m²
Preference: Single corridor with one nurse station per ward
Number of beds: 9 (one ward on ground floor)




Shared space

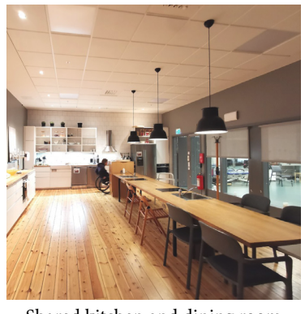

Outdoor green space

The case study shows how interesting design could incorporate expansion buildings into a challenging context, particularly between two architectural languages: historical, vividly colored plaster and a modern brick facade. The architect utilized timber to balance the facades with wide windows. The interviewee stated that patients with strokes preferred ground-floor units for easy access to all services.


Corridor

Pros: The facility's qualities outside the ward are a strength of this place. An enormously common kitchen and dining room with accessible furniture allows people with mobility impairments to participate and interact without feeling excluded. Also, a large patient room is advantageous.

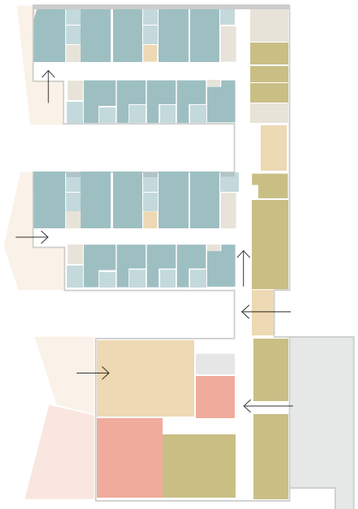
Cons: A deep space in front of each patient room may accommodate staff amenities, but it makes access tough. A hidden nurse station and a lengthy, dark corridor depress patients, as does the enforced separation of private and shared space in a ward.


Shared kitchen and dining room

WOY WOY REHAB UNIT, NEW SOUTH WALES, AUSTRALIA

Type: Inpatient rehabilitation (private)
Year: 2013 (new extension building)
Shape of layout: E-shaped
Location: 1-story building

Floor plan area: Approx. 2,200 m²
Preference: Single corridor with two nurse stations
Number of beds: 26



This case study shows a well-designed hospital expansion. Human-scale architecture and distinct zoning between patient zones and rehab facilities improve way-finding. To introduce nature into the building, a courtyard between each zoning border and pathway training were recommended.

Pros: It was proven that clear patient, staff, and rehab facility zones are valuable. The administrative area and supporting services are located along the public front facade to connect the main hospital building, promoting communication between staff and providing privacy to all patient zones. This project offers different characteristic spaces for patients, such as an outdoor terrace at the end of each ward corridor, a medium-sized common area between two wards, and a large dining room at the rehab facilities zone, which is interesting.

Cons: Patients with faraway rooms might have to walk far to the rehab facility. Importantly, half a patient room is a double room, which may not meet all patients' needs.


Exterior view


Corridor with a green courtyard

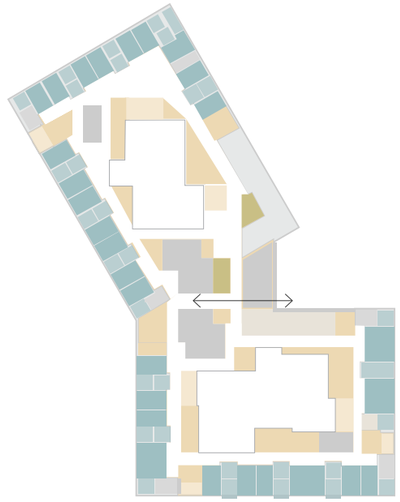

Rehabilitation walkway

Figure 07 - Woy Woy rehab unit case study

GLOSTRUP NEURO REHAB HOUSE, COPENHAGEN, DENMARK

Type: Inpatient rehabilitation
Year: 2013 (Competition proposal by NORD architects)
Shape of layout: Double donut-shaped
Location: 4-story building

Floor plan area: Approx. 21,150 m²
Preference: Single corridor with one nurse station per ward
Number of beds: 31 per floor



Unfortunately, this project was not selected to be built. This example has an impressive idea and unique expression, particularly how to bring the most positive features of its courtyards and surrounding nature to users. By curating a double-donut layout with a huge green courtyard at the center surrounded by an inner shared space and patient rooms as an outline.

Pros: A spacious courtyard allows easy access to the outdoors, good daylight quality, and a pleasant view of the ward through nature, creating a dynamic and intriguing corridor. A variety of common spaces and furniture layouts surrounding the courtyard allow patients to participate in more activities and socialise.

Cons: A spacious courtyard allows easy access to the outdoors, good daylight quality, and a pleasant view of the ward through nature, creating a dynamic and intriguing corridor. A variety of common spaces and furniture layouts surrounding the courtyard allow patients to participate in more activities and socialise.

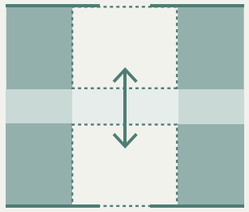

Shared space with a courtyard


Main reception

Figure 08 - Glostrup neuro rehab house case study

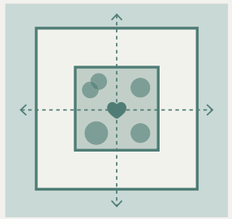
SUMMARY: CASE STUDIES

☑ What the author will bring to the study:

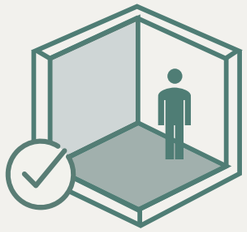


Visual connection as well as access between the nursing station and the ward's shared areas are necessary.

Adjustable and comfy furniture which responds to diverse social activities, with ample space for wheelchair users to engage.



A courtyard layout brings qualities of nature into a building.

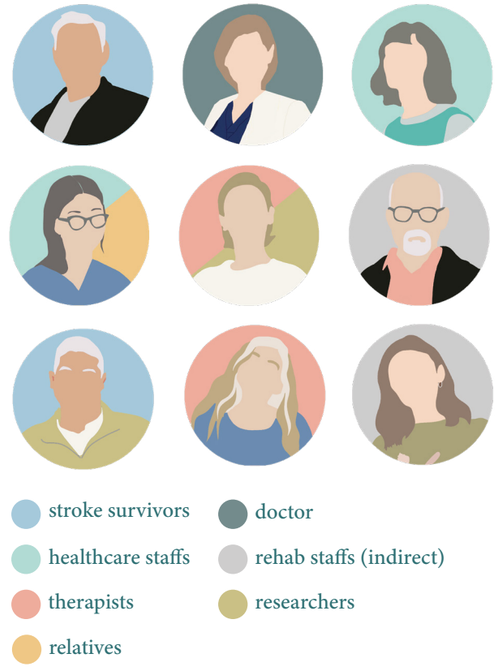


Colors on the walls and floors identify different zoning borders and encourage navigation (e.g., each nurse station zone has a different color wall).

QUALITATIVE DATA VIA INTERVIEWS

During the stages of data collection, two rounds of interviews focused on separate parts. The main goal of the first interview was to gain insight into the emotions and barriers of the stroke-built environment's users in order to gain insight into multiple viewpoints on the environment. Nine stake-holders in the stroke care environment were interviewed via physical and digital methods for a minimum of 45 minutes and a maximum of 90 minutes.

The selected three interviewees continued with the second interview, which focused further on gaining feedback about design strategies and mock-up design and lasted between 45 minutes and an hour.



FINDINGS FROM INTERVIEWS

" Faraway and rehab facilities located on different floors with wards affect patients recovery and staff synergies. "

It was found that convenient access between the training area and the wards is required, which suggests that it should be located on the same floor.

Many interviewees agreed that their hospital's rehab gym and ward are located on different floors and, in some cases, on the opposite side of the building, resulting in slow communication, huge challenges, and limited opportunities for patients to travel to the training area as part of their recovery.

In order to reduce patients' tension and e ncourage stimuli prior to their training, it is also imperative to provide easy way-finding and a resting area with a connection to green views along the path leading to the rehabilitation zone.

" Limited ward space with a strict division between the common room and the patient room might make patients feel isolated. "

Limited space and too rigid division between the communal area and the patient's room are classified as major barriers and lead to patients spending an extensive amount of time in their own room, feeling isolated, and taking part in few activities.

This may have resulted from the insufficient size of the room, the formal and unappealing atmosphere that fails to promote the patient's needs, and a failure to offer space qualities that relate to their desired activities as well as promote a sense of community. Some interviewees remarked that their hospital has also faced unoccupied common rooms, despite the room's great view and ample size. It could be due to a range of factors, such as proximity to the nurse station, a sense of place, or the level of comfort and facilities in patient rooms.

" 6 out of 9 interviewees preferred single patient rooms to shared patient rooms, while combinations between those are acceptable for the majority. "

It is apparent that a large number of participants endorse a single-patient room since it provides complete privacy and rest without disturbances from other patients. They believe that effective recovery must begin with a high-quality private space and proceed to more public levels. To motivate patients to spend more time outside their rooms, it is reasonable to display nature-themed artworks instead of televisions.

However, the minority, which included one stroke survivor, argued that there would continue to be a demand for shared patient rooms, particularly double bedrooms, among patients who valued the benefits of having a roommate to make them feel less lonely and safer while accepting its disadvantages.

" Alternative quiet space is on demand not only for stroke patients but also for staffs. "

Alternative quiet spaces are frequently demanded by participants. Due to the stress and exhaustion of their rehabilitation process for patients or their work tasks for staff, they need a temporary refuge where they can occasionally find peace and solitude to rest alone. It makes no difference whether the room is closed or connected to a natural view.

Many interviewees concur that the semi-shared space in the corridor and the adjacent shared meeting room with a glass wall that can be controlled from the inside and outside are feasible options. Consequently, users are permitted to choose the desired level of privacy and ambiance based on their individual activities.

" Having meal is the most effective time for socialise among stroke patients. "

It is unsurprising that mealtime, especially lunch and dinner, is the most effective time for socializing for patients. It was an ideal chance for patients to spend time and interact with other patients and staff, or at least to feel like they were surrounded by people. These activities can reduce patients' anxiety and foster a sense of community.

Having a meal with another stroke survivor is highly recommended, according to one stroke survivor, because they can genuinely understand each other's situations and provide positive encouragement. Therefore, the design of a communal dining area ought to take into account the various possibilities for social interaction.

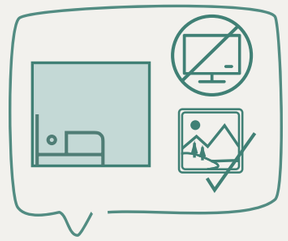
" Design elements and decorations was a powerful positive distractions. "

All interviewees believe that physical design elements such as color, artworks of nature, green elements, gentle noise, and music of nature may enhance the well-being of patients and the user experience within the ward.

It is critical to incorporate these design elements to provide patients with positive distractions. These would reduce their nerves and make them overlook that they are in a hospital, replacing it with a more relaxed and welcoming environment. The earth tone color scheme and a nature or animal sculpture sound appealing and relatable to most patients, but they must be utilized with moderation.

SUMMARY: INTERVIEWS

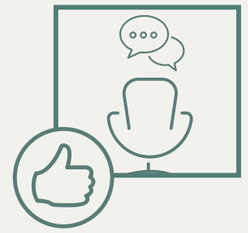
☑ What the author will bring to the study:



Artwork of nature is prefered instead TV functions in patient room. Also efficient storage and flexible space.

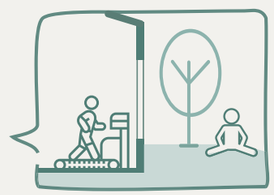
A combination of single and double patient rooms in a ward is accepted. At least 70% of rooms should be single-patient.

The interaction board is in the common area as an alternative communication tool and to personalize their space in the patient room.



A temporary silent area for staff, patients, and relatives for consultation or a refugee space for double-bed patients is required.

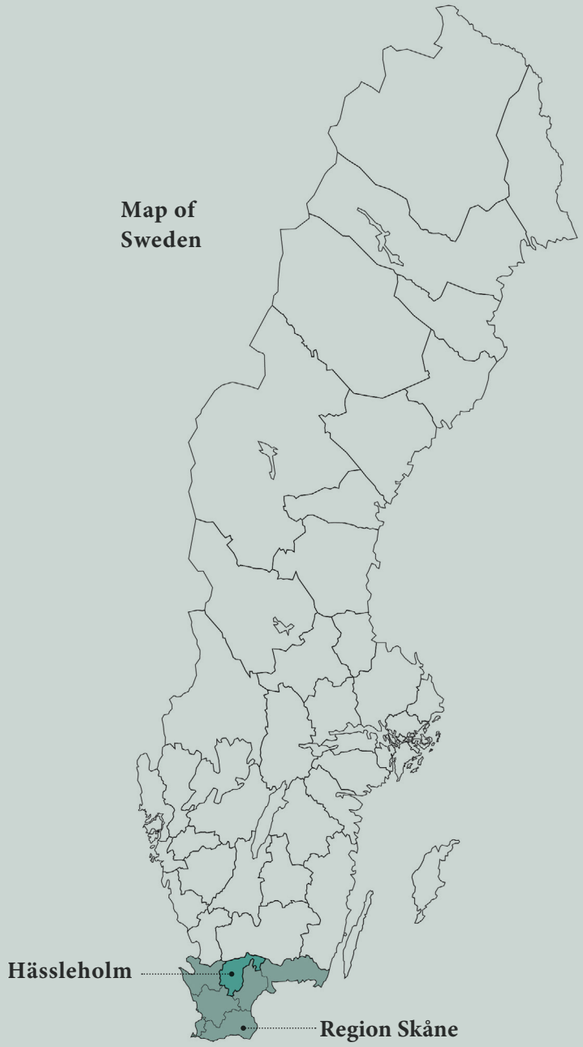
A graphic on the floor might promote stroke patient safety (e.g., balance, keeping a safe distance from a door swing).



Access to the green outdoors and views from the gym is vital, as are curated design elements to provide a stimulating environment for patients.

05

SITE & CONTEXT



HÄSSLEHOLM HOSPITAL

Hassleholm's Hospital is a community hospital affiliated with one of the region's five healthcare administrations, Skåne's Hospital Northeast. Their mission is to provide specialized care in orthopedics, medicine, and rehabilitation.

The hospital has various specialized operations, reception, and care departments with approximately 600 employees. Here, there is an emergency department that treats patients with medical conditions. The orthopedic center here is one of the largest in Sweden in terms of hip and knee arthroplasty procedures (Om Sjukhuset, Hässleholms Sjukhus, 2018).

Figure 09 - Hässleholm hospital

NEW ORTHOPEDIC DEPARTMENT BUILDING PLAN AND FUTURE POSSIBILITY

The plan for a new orthopedics building at Hässleholm Hospital was published on the Skåne-regionfastigheter website in 2023.

The project includes building a new orthopedic care building, a service building, a backup power plant, and technical infrastructure. On the hospital grounds, there will be approximately 24,000 square meters of new construction and approximately 1,200 square meters of renovations to existing buildings. which the architectural firm Krook & Tjader will design.

Due to this scenario, the current functional building will be unused and demolished in the future. (Thylander M., project manager, personal communication) This implies that a new inpatient stroke unit is possible in this area.

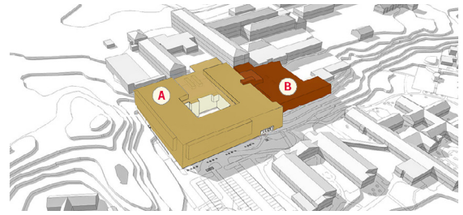


Figure 10 - New Orthopedic department building

Figure 11 - New Orthopedic department building

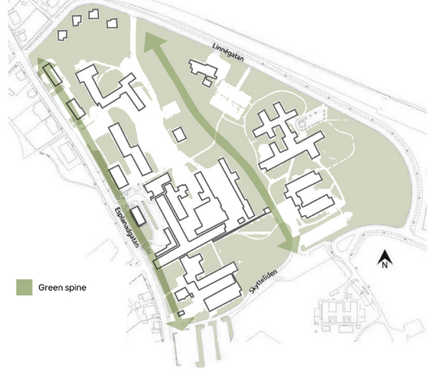
A HIGH NUMBER OF STROKE REHAB PATIENTS IN HÄSSLEHOLM

According to Webrehab stroke registration, almost 58% of Hässleholm Hospital rehabilitation patients experienced a major stroke between 2018 and 2023. while the hospital has only 9 of 26 beds for intensive rehabilitation patients today. (Brittamari, education teacher, personal conversation)

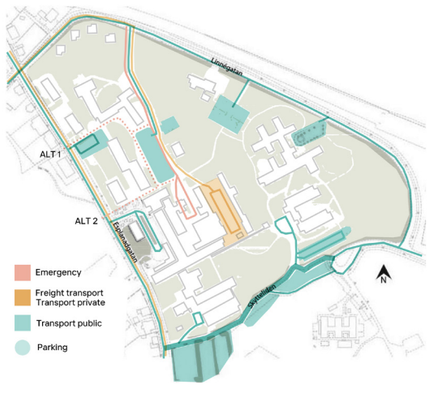
To support the region's vision, forecasts indicate an almost 50% increase in the number of 80-year-olds in Skåne by 2030. Since stroke care is anticipated to rise, the healthcare system will have to adapt to an aging population.

HOSPITAL LOCATION IN HÄSSLEHOLM CITY AND STRATEGIC PLAN

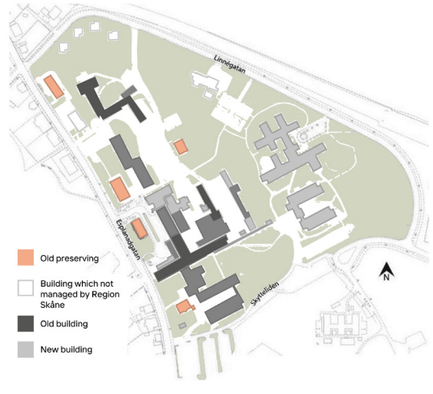
Development by zoning



Green spine strategy



Circulation



Preserving buildings

ABOUT THE SITE

The site is located at Hässleholm Hospital, in the south boundaries with a connection to the main building to the north in order to get access to the diagnosis facilities (e.g., x-ray machines, intensive equipment) and goods and service zone. The new orthopedic building was added to the east of the site. From the west (a residential area) and south (parking and an outdoor stadium), the site faced a public road. On the other side of the road, there was a green space.

With roughly 5,000 sq. m. of the plot area, the old extension building will be torn down, and a theoretical design of a new stroke inpatient unit will be investigated related to improving existing flows to the south wings of the hospital. The Region of Skåne's property development plan for the hospital area in Hässleholm, version 2.0 (2017-06-30), was used to study the hospital buildings and how they connect to the city. This was carried out to further understand the region's goal of a sustainable hospital approach. Previous strategic diagrams demonstrate how the zoning of development, green space, circulation, and preserving buildings was made.

FINDINGS FROM THE SITE VISIT

A physical observation on the actual site made the author truly understand how the site topographies, hospital flows work on the site, and specific dimensions of the walkway connect to the extension building, as well as what user's barriers were. In the south wing of the hospital (the site area), the geography is quite complicated. There are different ground levels and terrains on the site, and there is a yard area that could be turned into a green landscape in front of and behind the buildings mentioned.

Materiality, like the red bricks, light gray plaster, and light gray window frames, represents one of the place's main features. The author has access to look around the building from the outside but can only enter through the public routes inside the main building.

Green barrier beside the public road

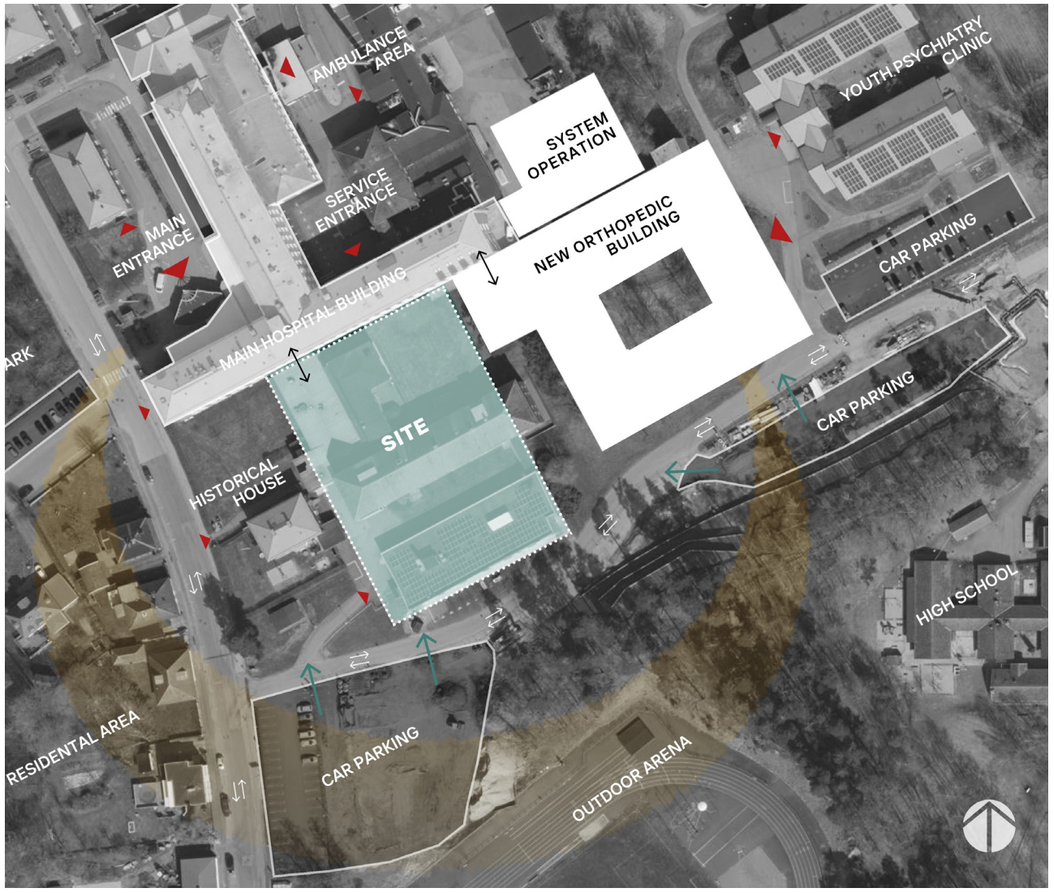
The old-extension building (site)

The old-extension building (site)

The old-extension's entrance (site)

Backside of an old extension (site)

Material: red brick, light grey colored



Site location in the hospital area

Main hospital building

New orthopedic department building

SWOT ANALYSIS

STRENGTHS

- A well-connected location to the main hospital building makes effective communication and access to the related facilities possible.
- A close access by walking, biking, public transport and car parking.
- Have an open space connected to the west and south of the site

WEAKNESS

- Various site topographies, different ground levels, and a need to fill in the soil level on some parts of the site

OPPORTUNITIES

- Possible to connect the concept of green spine to Esplanadgatan of Hospital's strategies.
- Possibility of strengthening hospital flow to the south wing area by linking bike and car parking to the building as a mobility hub entrance.
- There is a chance that the architecture will be able to express a modern vision of the hospital, paired with a new orthopedic building to the south and west of the site.

THREATS

- There is a possibility that the new building will create a shadow over a new orthopedic building in some time.
- There is a chance that a green area on the site will decrease.

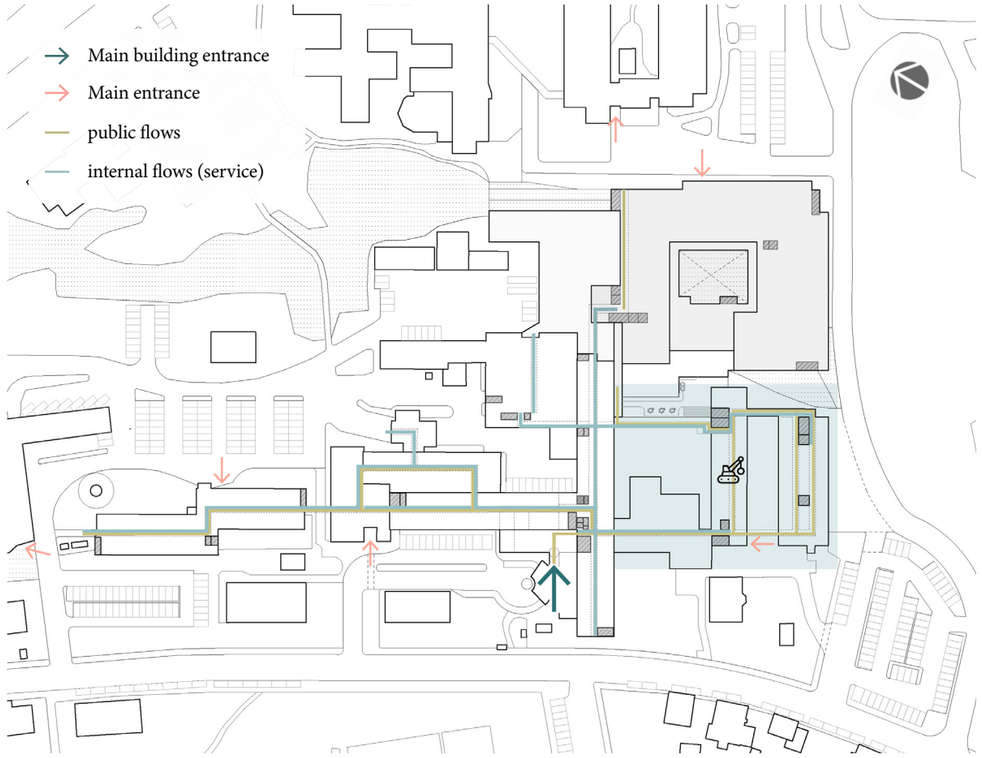
SITUATION PLAN WITH HOSPITAL FLOW

The current hospital flow with the addition of a new orthopedic building was investigated. The color green represents public flow, while blue indicates internal flow. The chart reveals that the majority of pathways are shared both within the building and between the buildings outside, particularly the main horizontal one, which provides a strong existing flow and connects the building together, whereas the vertical one at the main building is an internal path that connects a good, logistical, and infrastructure area as the point of service zone.

Due to several constructions of extensions from the main building, the building's layout and circulation are obviously lacking in relation to the main flow and the south area, especially in the demolished area (the site). Therefore, it is necessary to rethink and enhance the current flow to make it more integrated with the whole South Parking System.

Extension building corridor

Extension building pathway (site)

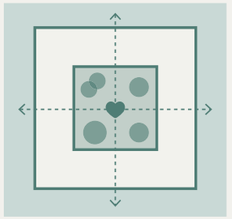


06

DESIGN STRATEGIES & PROGRAM

SUMMARY: DESIGN STRATEGIES

SITE STRATEGIES

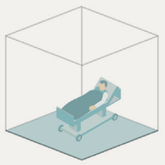


Human building scale and a courtyard layout brings qualities of nature into a building.

Strengthen a main hospital flow, and respect surroundings

EMPOWERMENT

Offer four different characteristic restorative spaces that promote various levels of social engagement.



PRIVATE SPACE

A safe-rest space for patients' personal passive activities.

- patient rooms -

SEMI-PRIVATE SPACE

A place where patients can feel a sense of safety during their training with close support from staff.

- rehab gym & facility -

SEMI-SHARED SPACE

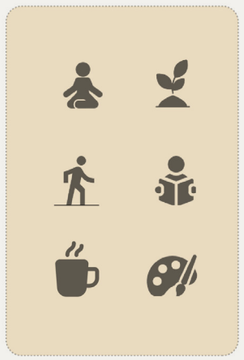
A place where patients can relax individually or with a low social interaction level during their resting.

- shared corridor space -

SHARED SPACE

A sense of community, where patients can engage in full active social activities.

- dining area & tv room -



SUMMARY: DESIGN STRATEGIES

EMPOWERMENT

Artwork is prefered instead TV functions in patient room

A combination of single and double patient rooms in a ward

A temporary silent for consultation or a refugee space is required.

COMMUNICATION

The interaction board as an alternative communication tool

Adjustable furniture which responds to diverse social activities

Enrich environment easy-access to facility

Healing art of nature scenery

Healing garden

Colors identify different zoning borders and encourage navigation

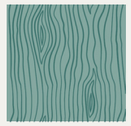
LEVEL OF RISKS

Visual connection between the nursing station and shared areas

A graphic on the floor might promote patient safety

Views toward greenery in all patient rooms

HEALTH PROMOTIVE



Wooden material imparts a sense of a warm interior

Make good use of natural daylight in the building

Access to the green outdoors from gym

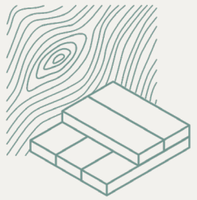
SUMMARY: SUSTAINABILITY

To address global sustainability, sustainable design strategies were linked to the Sustainable Development Goals (SDGs) by United nations and divided into three categories.

ENVIRONMENTAL SUSTAINABILITY Low-carbon footprint building

11 Sustainable cities and communities

12 Responsible consumption and production



Wooden structure supported by a cross laminated timber (CLT), while implementing the **local material of wood** as a facade. These reduce the embodied carbon of external walls by up to 70 percent compared to a typical concrete structure. (Lever Architecture, n.d.)

Preserved the **green area** with a **connection** to its surrounding context. Also strengthen an **effective hospital flows**.

SOCIAL SUSTAINABILITY Supports healthy lifestyle and well-being

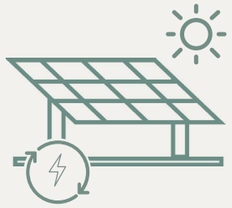
03 Good Health and well-being

Offer **various characteristic restorative spaces** for empowerment and engage social participation in patients.

Mobility hub that fosters healthy biking and electric car use. (eg. bike parking & repair, charging facilities, bike sharing, micro-mobility, and shelter area)

ECONOMICAL SUSTAINABILITY Long-term, effective renewable energy

07 Affordable and clean energy



Renew energy resource by **solar** photovolatics **panels** and **comprehensive insulation**.

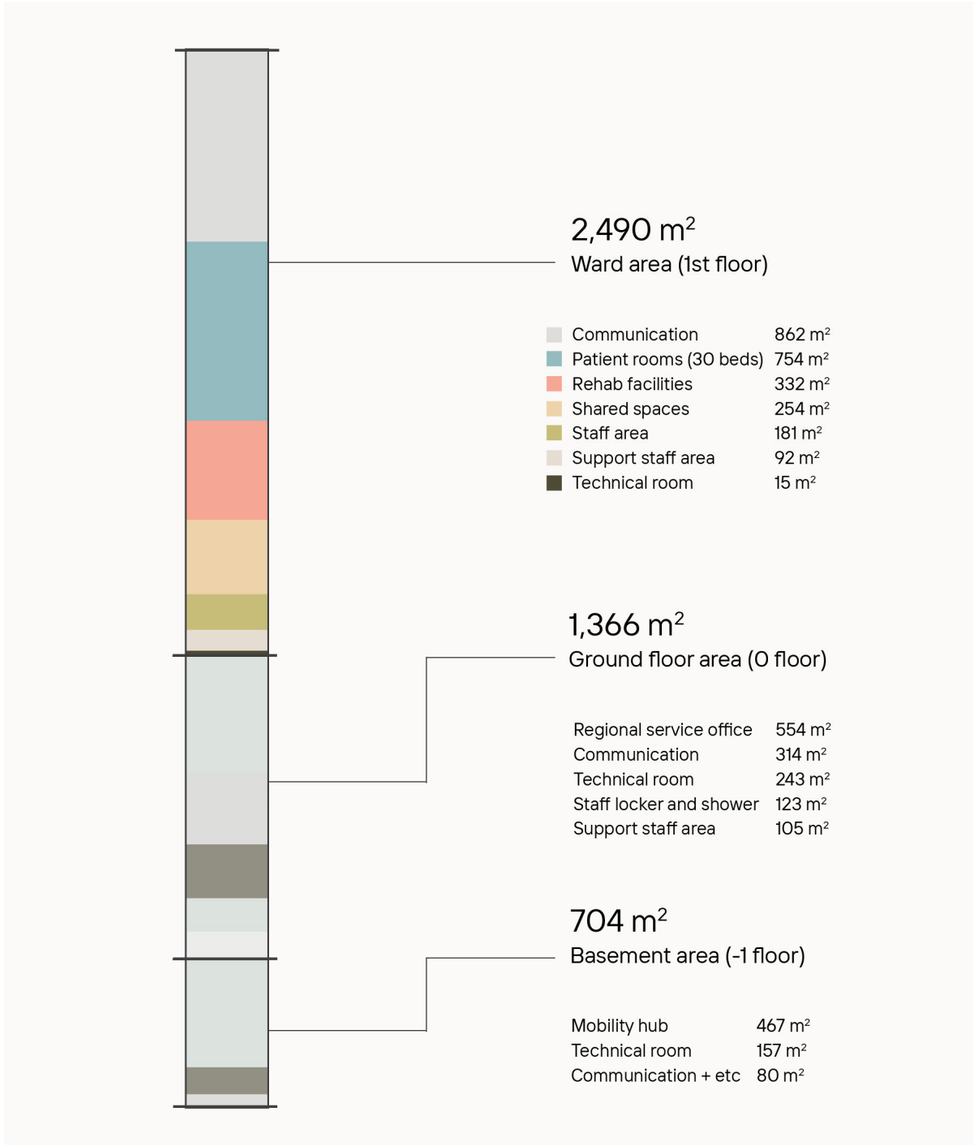
PROGRAM & AREA

As for program and area. All numbers and programs are shown in order from highest to lowest area. The main study program is a stroke unit with rehab facilities on the same floor, which includes 30 patient beds and totals approx. 2,500 sq.m. and 5,100 sq.m. of building gross area. While another support staff function and regional service office are on the ground floor, and the mobility hub is on the basement floor.

*Building gross area (5,164 sq.m.) is the building total area, exterior walls included.

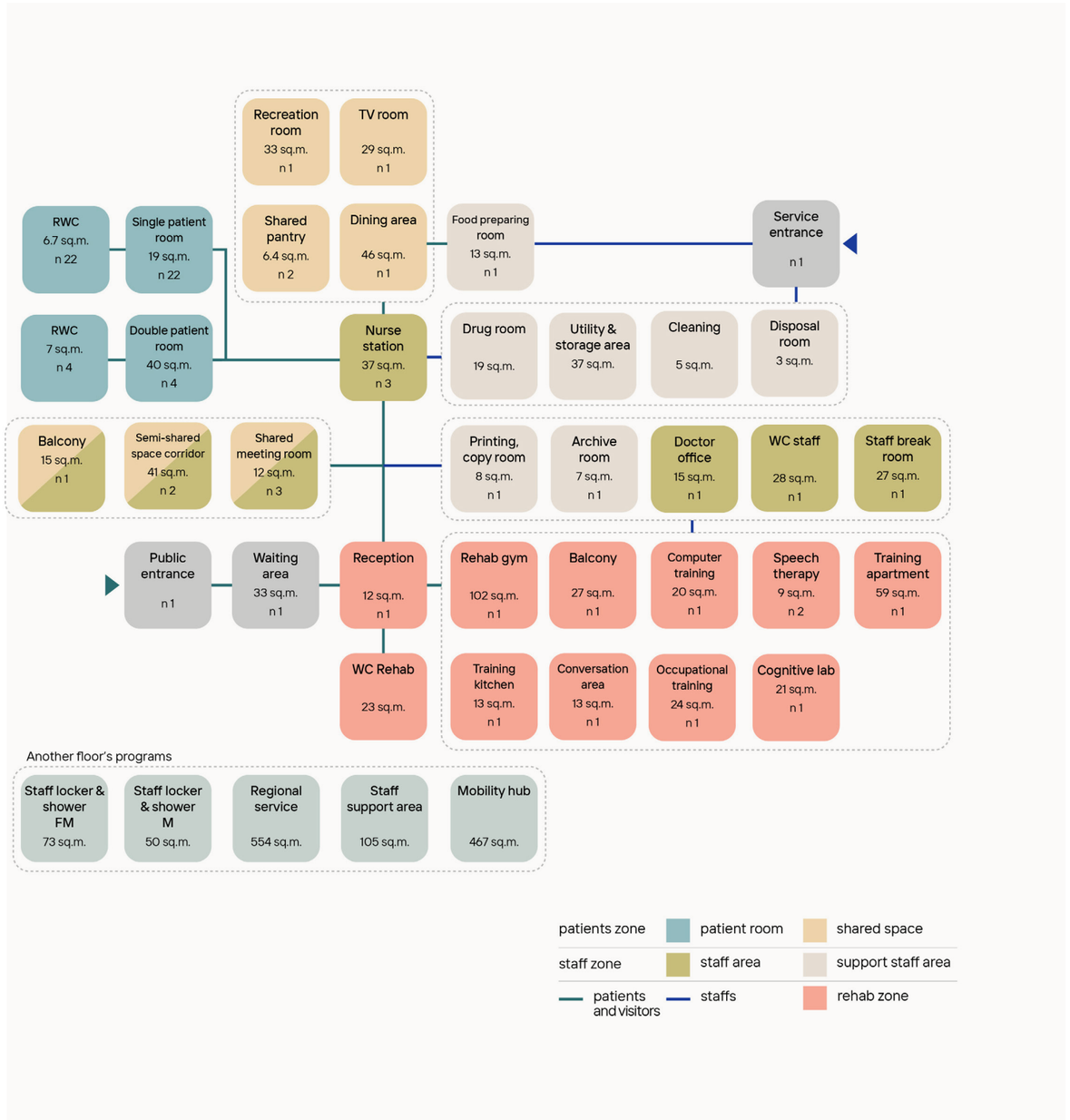
**Effective care area (1,613 sq.m.) is the area of all ward's room without communication anc technical rooms.

***Utility ward area (2,412 sq.m.) is the total ward's area without exterior walls.



WARD'S ROOM CONFIGURATION

The illustration below demonstrates the area, number, and logistics of the rooms in an inpatient unit. The rooms are close to the rooms to which they belong, and a line between the rooms denotes the connections that are most significant. The color represents the type of room.



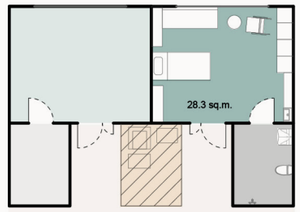
07

DESIGN INVESTIGATION

PATIENT ROOM DESIGN STUDY

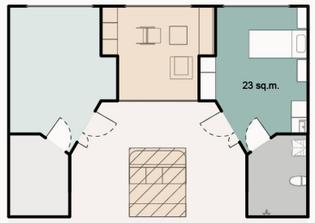
For the sake of patient safety, the layouts of patient rooms were examined in terms of a clear line of sight between patients in the room and staff outside the room. Incorporating a small shared space, seating area, or even storage space between the units is also possible. The author selected the most practicable and compact schemes for each single patient room and double patient room (schemes 3 and 4). which are displayed in the diagrams below, along with a discussion of their pros and cons.

1 A single patient room with RWC placed in the corridor



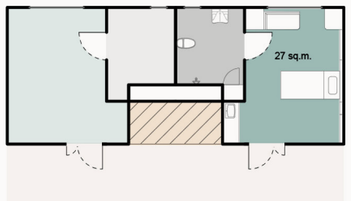
- **Pros:** clear sightline and room zoning; good room size and quality; small seating area in front of the room.
- **Cons:** A deep space in front of the room might make it hard for staff to access it (this might work on a single corridor facing a green view).

2 A single patient room with RWC placed in the corridor and shared space in-between



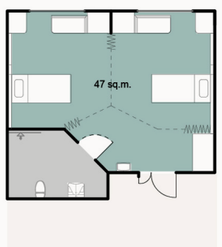
- **Pros:** clear sightline; good room size; a small shared space; and a pantry close to the room.
- **Cons:** Required a lot of space while gaining limited patients' space. A deep hallway in front of the room might make it tough for staff to access it (it might work in an elderly care center).

3 A single patient room with WC placed in a room and against the headwall



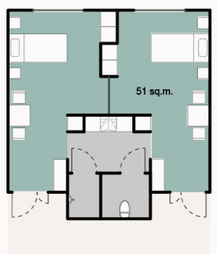
- **Pros:** clear sightline and zoning; good RWC size with a compact solution; a small storage or niche between the units.
- **Cons:** long corridor due to the RWC placed in the room might create a longer path for staff to access patients.

4 A double patient room with WC placed half in the room/ corridor



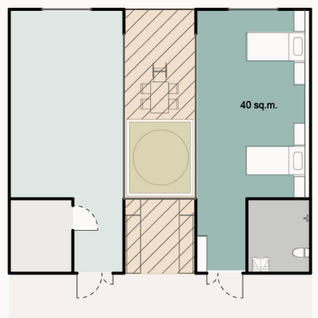
- **Pros:** clear sightline and zoning; good RWC size with a compact solution; visual connection between patients.
- **Cons:** the bed on the left side might gain more privacy, while the bed on the right side will gain better sight-lines from the staff outside.

5 Two single patient rooms shared one WC with sliding door in-between



- **Pros:** clear sightline and zoning.
- **Cons:** the hallway is quite narrow and not accessible for patients with wheelchairs; the shared WC might affect hygiene and infection control (it might work in an elderly care).

6 Double patient rooms and shared space in-between



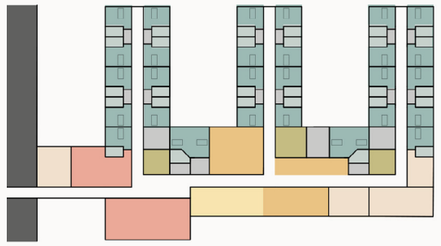
- **Pros:** clear zoning, interesting shared space, both outdoor and indoor. Both patient beds benefit from green views.
- **Cons:** deep room and small hallway might make patients whose beds are far from WC difficult to access, while one bed does not have a clear sightline connecting to the corridor

ZONING LAYOUT STUDY

During the investigation, the main goals were to provide clear zoning for easy wayfinding and staff synergies and to ensure that all patient rooms had a pleasant view of nature. In parallel with how the building's volume fit on the site, various zoning layout were examined. Due to a limited site area and a requirement for 30 patient beds as well as rehabilitation facilities on the same floor, the author decided on Scheme D, which brings together the best comprehensive strategy via the most compact solution.

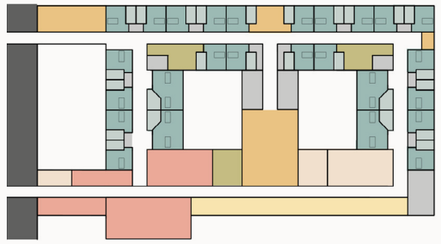
patient room | nurse station | rehab and training area | storage and support staff | administration | shared space

A E-shaped with all rehab, staff, and shared area placed to the west of the side.



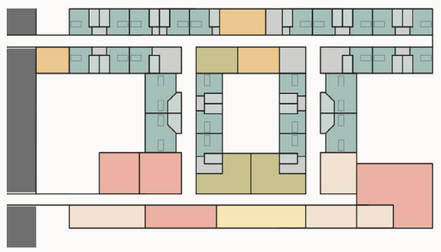
- **Pros:** A finished corridor, the placement of nurse stations at the front corners, and all shared areas placed at the center of the ward make it easy for patients to find them.
- **Cons:** As a result of the shared entrance between the public and service, logistical and commodities transport may be obstructed. Due to the limited site area, the courtyard dimension between units appears to be small, which can result in insufficient use of daylight and concerns regarding privacy.

B Double donut-shaped with two separate entrances and a spread-out shared area.



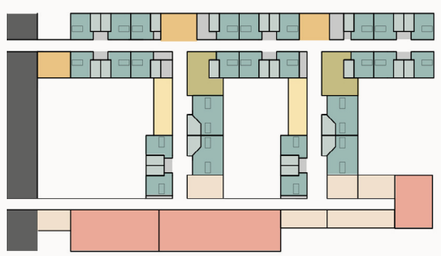
- **Pros:** Separated entrances between the public and service areas are advantageous; a large shared area within the center, in particular, encourages patient movement.
- **Cons:** A nurse station located on the rehabilitation side of the hospital may encounter numerous challenges relating to their work synergies; the shared area's randomized layout may make it challenging for patients to navigate their way. Also, the narrow dimension of a middle courtyard

C Double H-shaped with two separate entrances and shared areas placed in the middle.



- **Pros:** Separate public and service entrances are beneficial. Also, the separation between the shared area (TV room and dining area) and the semi-shared corridor on the opposite side of the building may produce a more tranquil environment for the latter.
- **Cons:** A separate location for the rehabilitation facility and another training area, as well as its remote location, may result in inefficient flow. The middle courtyard's dimensions are quite small for privacy reasons

D Double H-shaped with two separate entrances and a spread-out shared area.

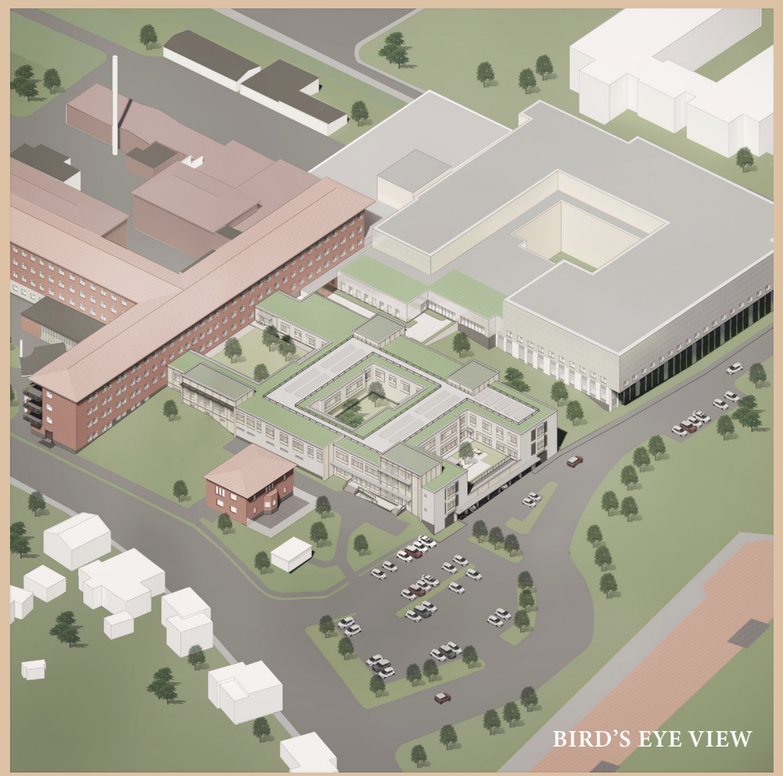


- **Pros:** Separated public and service entrances are helpful, while all the spread shared spaces are visually connected to each adjacent nurse station and their distance is feasible for patients of all mobility levels. The rehabilitation and administration zoning is harmonious with its surroundings.
- **Cons:** The single and loop corridors might hinder patients' ability to find their path, but these barriers are resolved via multiple physical feature designs.

08

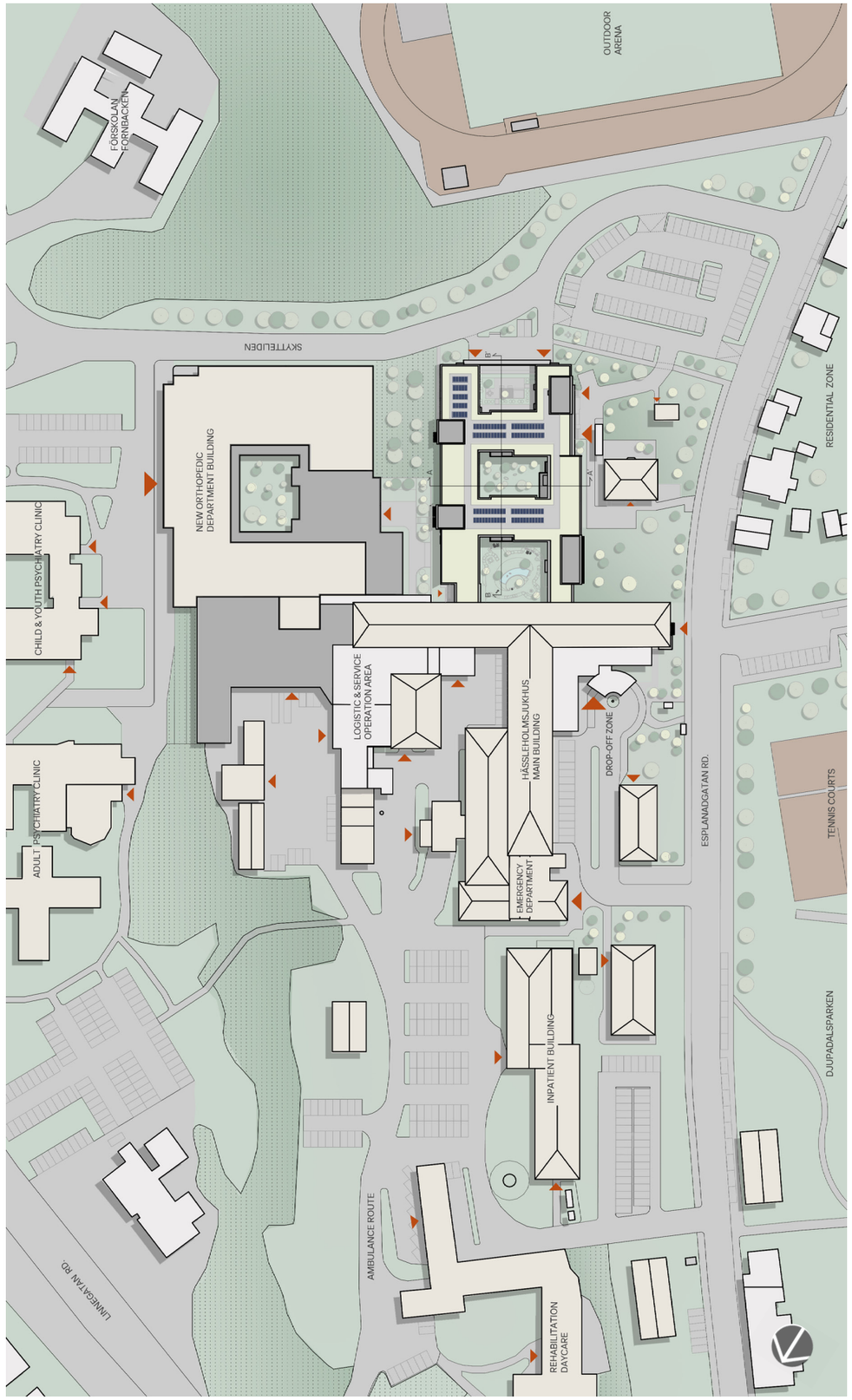
DESIGN PROPOSAL

Overview of the new extension and its relation to the existing hospital.

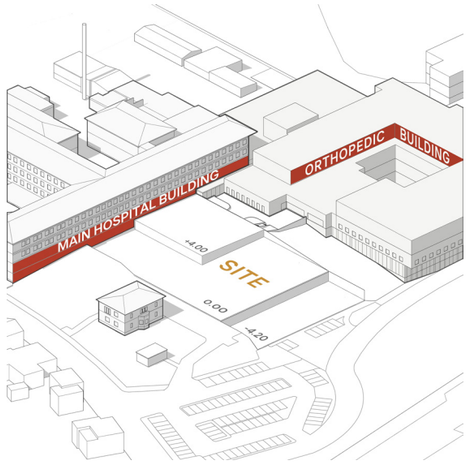


BIRD'S EYE VIEW

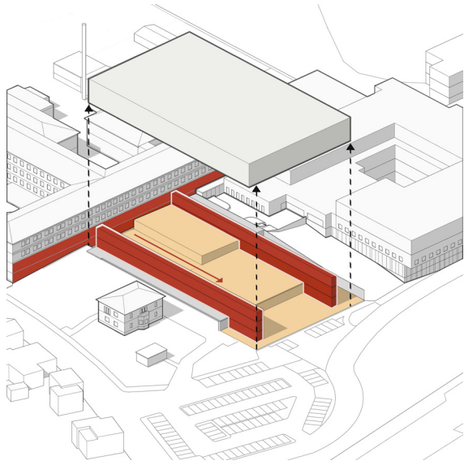
SITE PLAN 1:1250



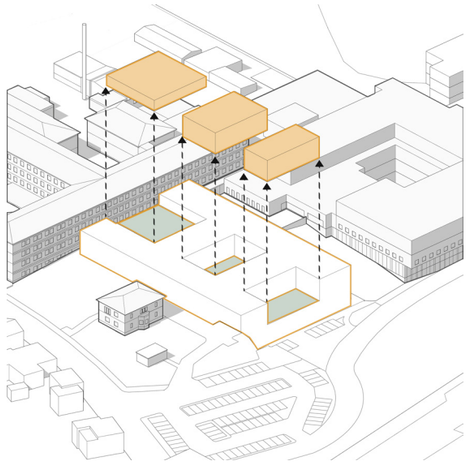
SHAPE DESIGN DEVELOPMENT



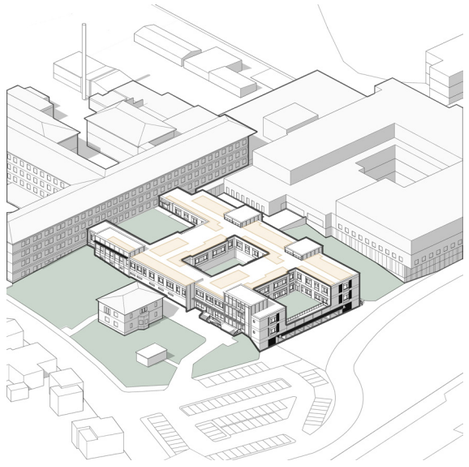
Analyze the site's footprint, its topography, and its context with the existing hospital flow.



Strengthen the main hospital's flow and connect the main building with the stroke ward with rehab facilities and programs on other floors.



Make inner courtyards to create a healing environment, while arranging zoning and space around the courtyard to promote the patient's well-being and safety.

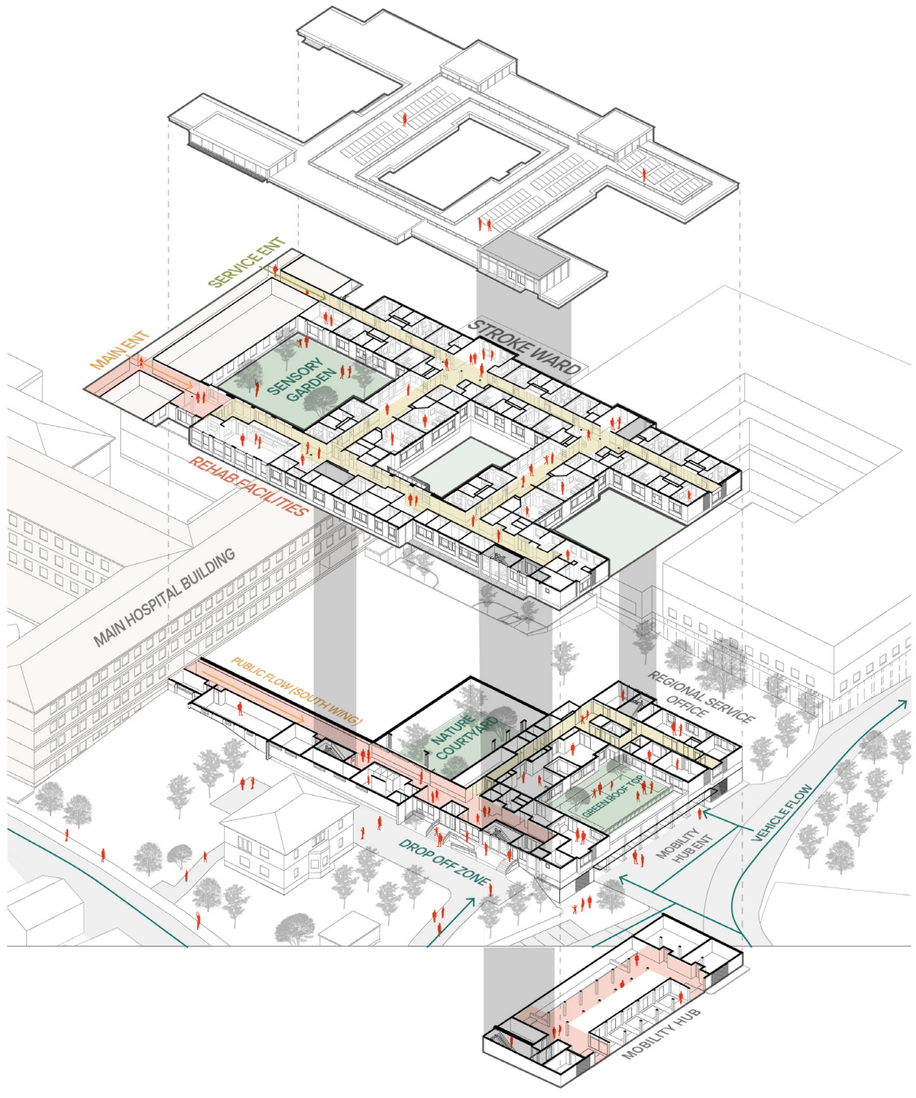


Working on a grid system, a spatial design, detailing materiality, facade expression, and landscape design.

PROGRAMS AND FLOW EXPLANATION

The isometric diagram illustrates the site's building volume in relation to buildings nearby. The double-H layout was chosen to maximize the most beneficial green space inside and around the structure. The three-story expansion aligns with the site's topography, preserving the primary flow and linking it to the south parking lot, to complete the hospital flow system.

The basement floor (-1 floor) links to the south parking lot and public road. It is a sustainable mobility hub with a place to park bikes and charge electric cars for staff and guests, as well as stairs or an elevator for access to the upper floor. The main hospital lobby and the entrance to the south wing are connected by a corridor on the ground floor (0th floor). This floor's main functions are system and storage, staff lockers and shower rooms, and the regional service office. On top of that is a stroke unit ward with rehab facilities on the 1st floor and the service floor on the roof, where only staff can access the solar panel and other equipment for maintenance.

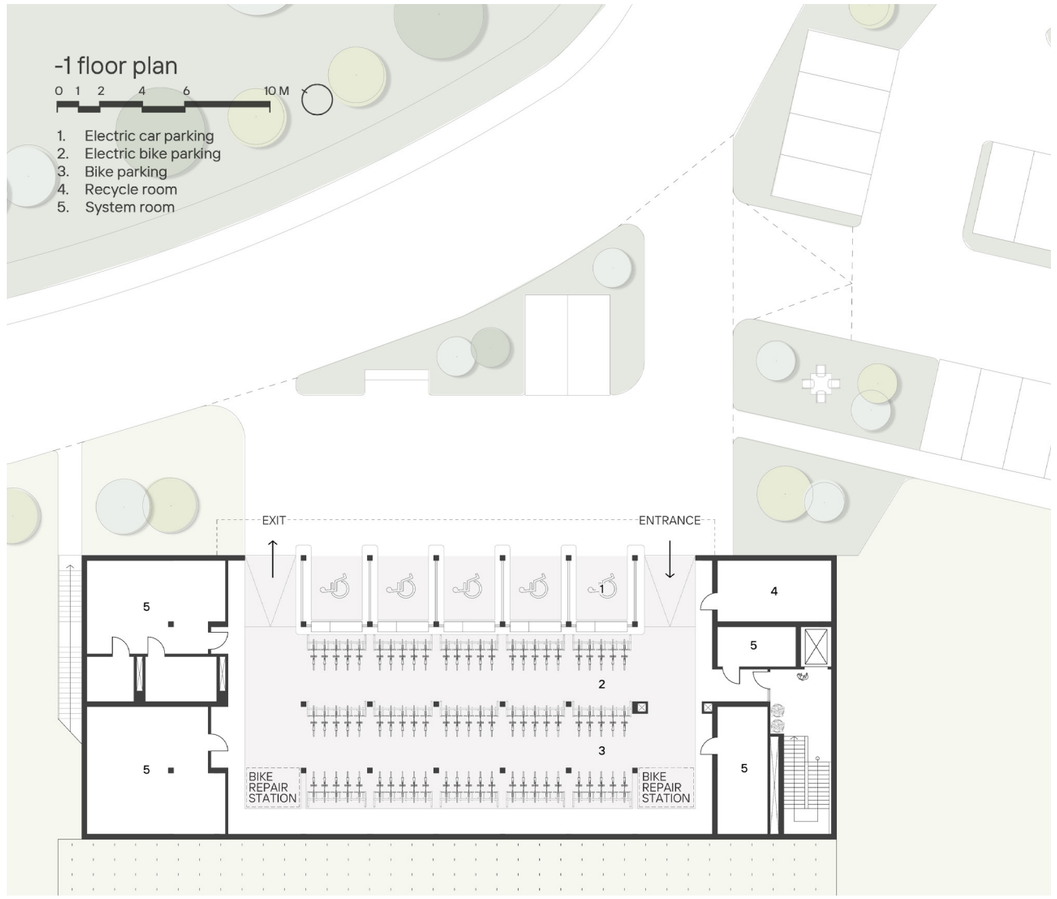


BASEMENT FLOOR PLAN

A basement floor works as a mobility hub to link the hospital's flow from the parking at the south and encourage staff's sustainable lifestyle (e.g. bike parking, and electric charging bikes and cars parking in a front of the building).

MOBILITY HUB ENTRANCE

This illustration shows the user's view approaching the hospital from the south. The extension building is linked to the old main building and a new orthopedic department building. The mobility hub entry incorporates wooden accents with an electric car parking lot at the front.



Mobility hub entrance

GROUND FLOOR PLAN

Most programs on this floor include a system and storage room, a staff locker and shower room, and a regional service office with a staff break area, where the last is a previous program on the site. All office rooms are able to access views of nature and rooftop gardens.

SOUTH'S WING SEMI-ENTRANCE

This west entrance has a warm greeting environment with outdoor seats for patients and visitors. They reach the hill through a temporary drop-off zone before the entrance to wait outside for their appointment or rest before returning home after the visit.

South's wing semi-entrance

0 ground floor plan

0 1 2 4 6 10 M

1. Main entrance (East-wing)
2. Semi entrance (East-wing)
3. Temporary bike parking
4. East-wing waiting area
5. Restroom (public)
6. Staff's shower & locker room (M)
7. Staff's shower & locker room (FM)
8. Linen room
9. System room
10. Janitor's room
11. Staff's break room
12. Regional service office
13. Meeting room
14. Storage room
15. Nature courtyard
16. Printing room
17. Phone room
18. Staff's dining room
19. private working room
20. Green rooftop

1ST FLOOR PLAN (WARD)

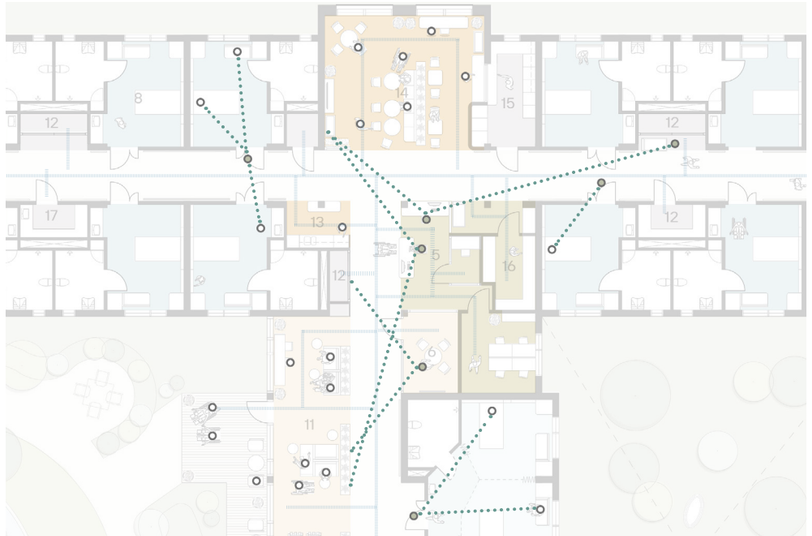
All design strategies were utilized in this floor plan. Every rehabilitation program confronts the public on the south side, while the patient zone is on the north side for privacy. Two courtyards with a green rooftop in the center provide the maximum visual connection to nature and allow patients can take a short walk, pot plants, and rest in nature. The intersection area serves as a meeting point and communication zone (the nursing station and self-pantry) to enhance staff-patient synergy with clear sightlines and close range.

1st floor plan

0 1 2 4 6 10 M

1. Lobby
2. Main reception
3. Rehab gym (semi-private space)
4. Sensory garden
5. Nurse station
6. Staff meeting room
7. Phone room
8. Restroom & shower
9. Single-patient room
10. Double-patient room
11. Corridor (semi-shared space)
12. Utility storage
13. Shared pantry
14. Dining area (shared space)
15. Food preparation room
16. Drug room
17. Disposal room
18. Recreation room (plant & art)
19. Cleaner's utility storage
20. TV room (shared space)
21. Nature courtyard
22. Green rooftop
23. Staff's restroom
24. Staff's breakroom
25. Training apartment
26. System room
27. Doctor's office
28. Archive room
29. Printing room
30. Speech therapy room
31. Computer training area
32. Cognitive rehab room
33. Training kitchen
34. Occupational therapy room
35. Rehab consulting room
36. Accessible balcony

SUPPORT STAFF'S SYNERGY



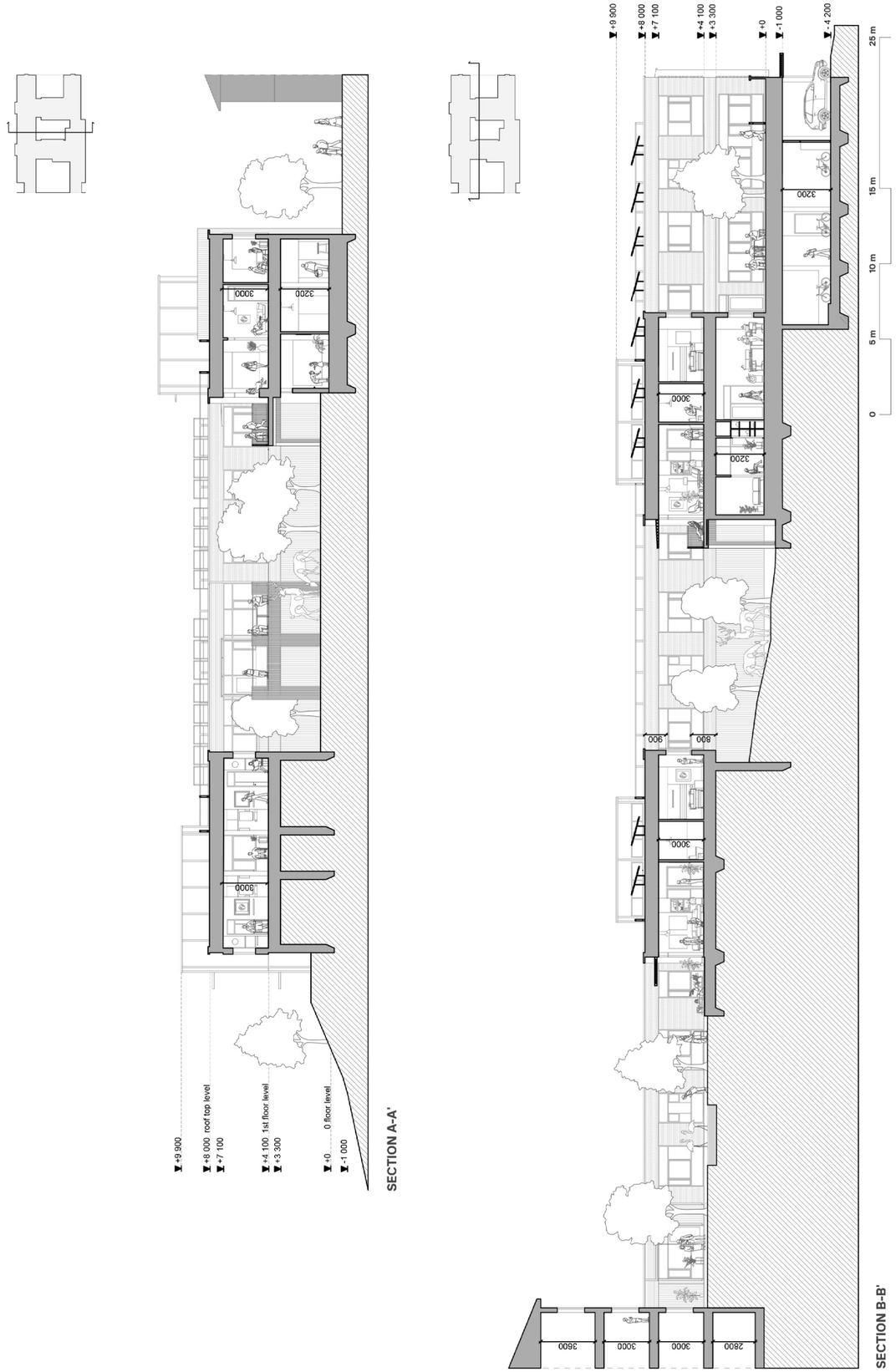
With effective zoning and the nurse station as an intersection, staff has an overview of the patients in the shared space and their rooms and can safely assist patients within close proximity.

Second, easy way-finding via color code on walls, interior elements, and outdoor features decreases patient anxiety as well as enhances staff communication on their responding borders and routes. Lastly, a semi-shared area is a new characteristic space that enables staff to take a short break or be temporarily isolated with nature access.

SECTIONS

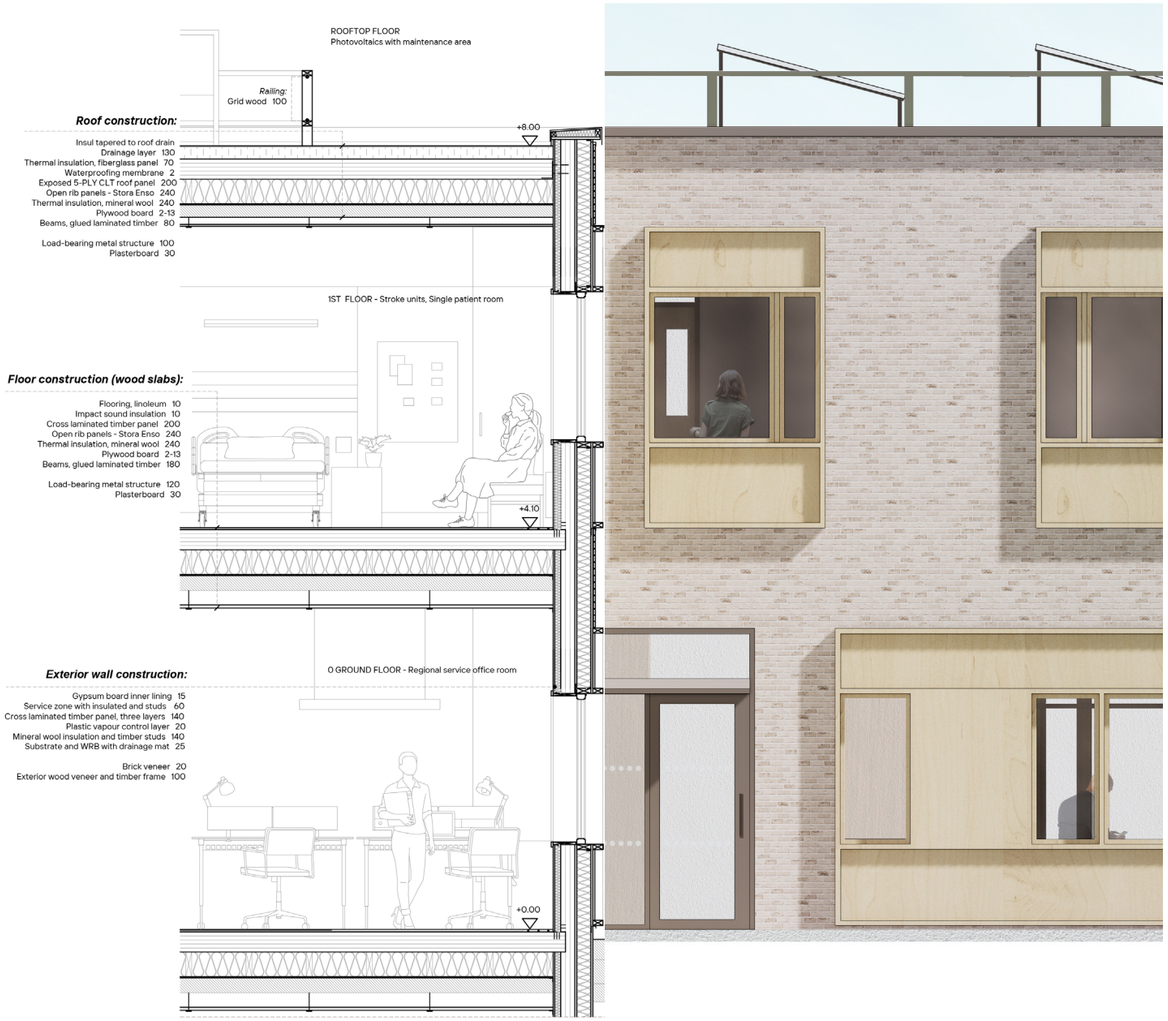
The floor-to-ceiling height of the ward (1st floor) is 3.0 meters, which is exactly the same height as the main hospital building. On the same level, the double space of shared space and gym is 5.1 meters high. The floor-to-ceiling height of the ground floor (floor 0) and the lowest level (floor 1) is 3.2 meters. This was determined according to the topography.

In sections A-A, a cut through the nature courtyard is shown. whereas Section B-B shows the relationship between a building extension and the main hospital as well as the various topographies and landscapes within the buildings. Until the lowest part, which is a mobility hub, joins a public road.



DETAIL SECTION 1:40

The detailed drawing reveals a section through the bay window of a patient's room, and a regional office room.



STRUCTURE

The diagram shows the grid system of the building's timber structure, including the column, beam, and CLT wall-bearing positions.

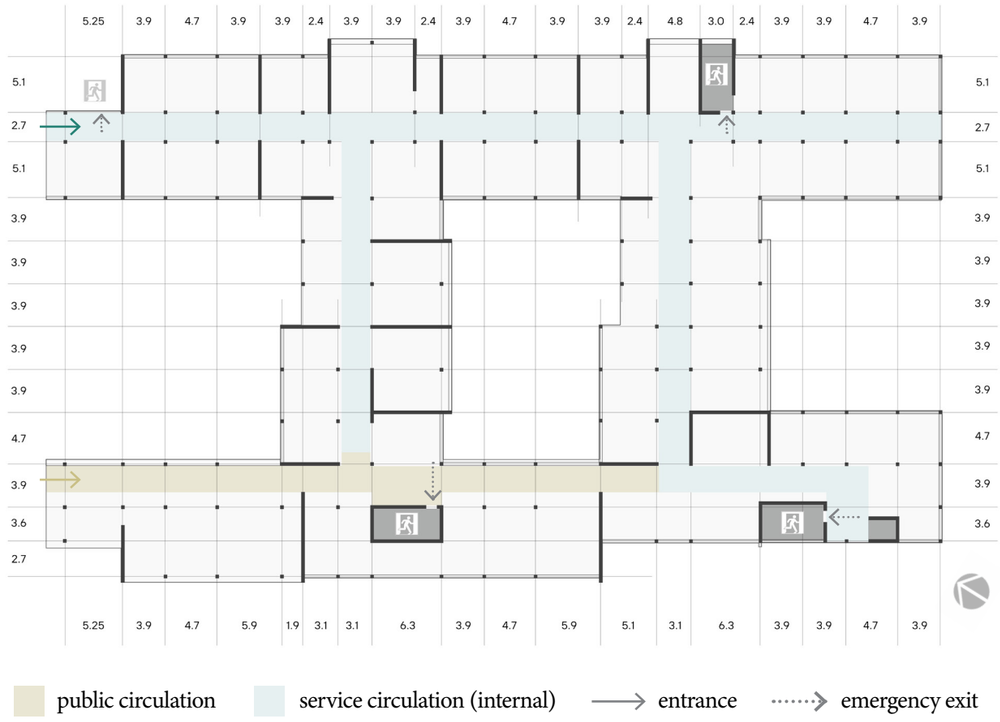
The variation between columns ranges from 2.4 meters to a maximum of 6.3 meters in double-space areas that require a truss structure with special support.

FLOW

The extension stroke unit's main and service entrances were separated from the main hospital building to the north.

The main entrance leads to the rehabilitation reception and gym before reaching the ward. The service entrance is for staff, x-ray patient transport, and logistics channels for goods, food, and trash to the main hospital service route.

Another entrance by the stairs and elevator from the south side is limited to staff on the level of the ward and technical rooftop above, however, the public can access other floors. Additionally, the ward floor had four emergency fire exits to the the outside.



FACADES

To match the new orthopedic building to the east and offer it a modern look while still complementing the red brick of the main hospital building, a lighter gray brick veneer, warm wood, and a flat roof were utilized as the exterior dominant materials.

The facade was designed in a minimal style with a wooden frame around the windows and some parts of the walls. This was implemented on a variation system every 40 cm, which can be easily removed or adapted if the requirement changes.

MATERIALITY

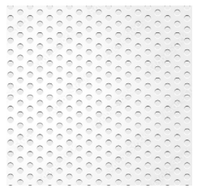
grey brick veneer

wood window frame

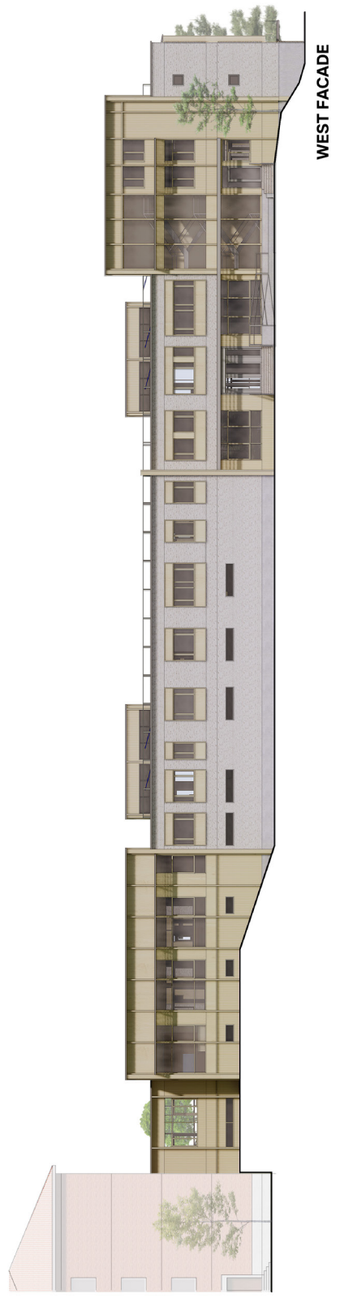
wooden wall panel

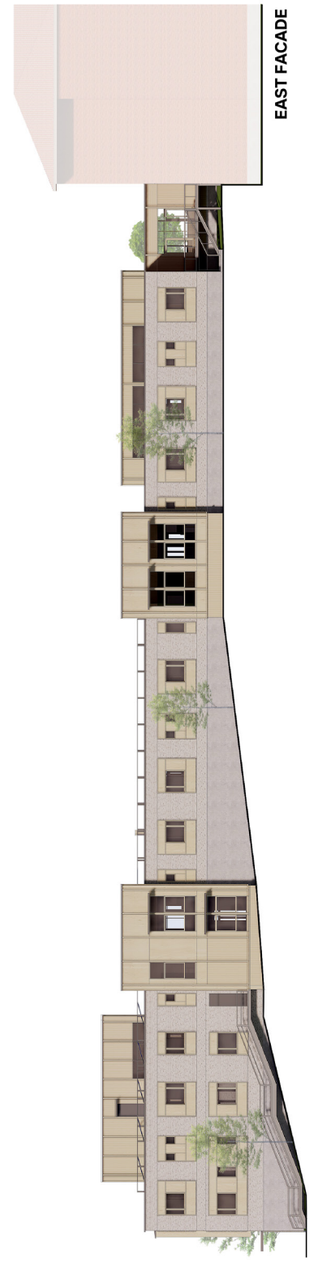
plaster

wood lattice



white perforated metal panel (mobility hub)





the corner's color (responding nurse station)

scenery artworks

landscape features

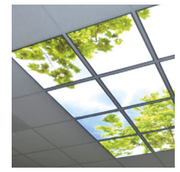
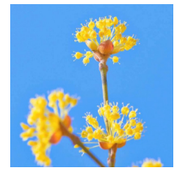
outdoor sculptures

WAYFINDING

The double H-shaped layout might make wayfinding complicated. Thus, it's essential to apply various design elements that let users recognize the space and its location.

A zoning border is created by matching the colors of the corners on a corridor wall to the area of each responding nurse station. Starting with the patient rooms and heading all the way to the nurse station, different colors and graphics were applied to the walls and doors in each corner. Second, the various characteristics of artworks, the landscaping in the courtyards, outdoor sculptures, varied finishes on the floors, and high ceilings in all shared spaces assist users in finding their way.

INTERIOR MOODBOARD

Private space patient room	**Semi-private space** rehab gym / training	**Semi-shared space** corridor	**Shared space** Dining area / TV room
SAFE INDIVIDUAL RELAX	BE ACTIVE CLOSE SUPPORT	PASSIVE CREATIVE RELAX	ACTIVE WELCOMING SOCIALISE
blue colored, the bay window with comfortable dayseat	yellow colored and movement decoration	 nature scenery ceiling make semi-outdoor mood	 high-ceiling space with a wood homie vibes
 artwork of forest, and field	 artwork of mountain, and nature movement	 artwork of field, lake, and beach	 artwork of summer vibes, flower blooming
 save space and light-weight furniture	 visual connection with nature and daylight	 high-back sofa, comfortable desk with plant partition	 light-weight furniture with a socially adjustable layout

PATIENT ROOM (PRIVATE SPACE)

SINGLE PATIENT ROOM

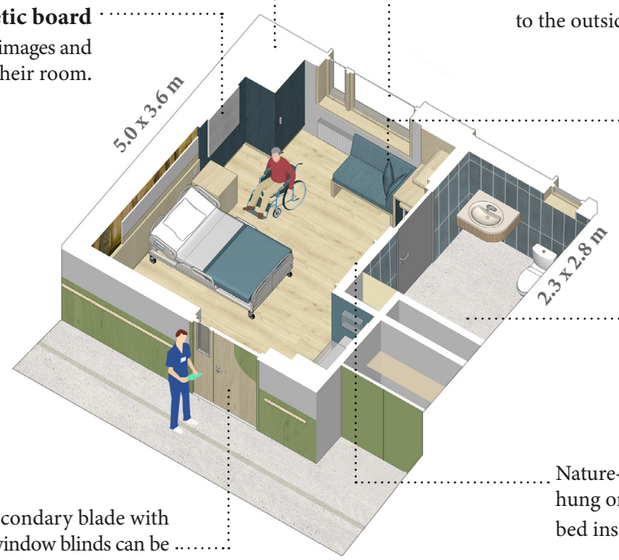
Wardrobe
for personal belongings

The bay window
connects the room to the outside world.

A magnetic board
makes it easy to put up images and notes to personalize their room.

Comfortable dayseat
for patients and visitors

The patient room's layout gives both patients and staff a good overview.



There is enough space in the restroom for a wheelchair or two staff members if needed.

Nature-scenery art should be hung on the wall opposite the bed instead of a TV.

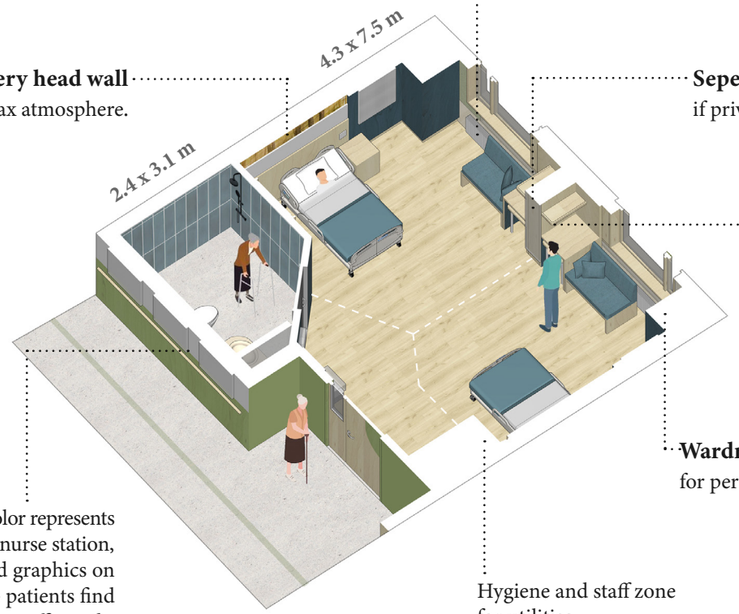
The door has a thin secondary blade with glass for monitoring. The window blinds can be controlled from both inside and outside the room.

DOUBLE PATIENT ROOM

An empty space for a wheelchair is needed.

Nature scenery head wall
to create a relax atmosphere.

Seperate partition
if privacy is needed.



Shelf with a light-weight table
which can be movable to save space.

Wardrobe
for personal belongings

A different wall color represents each responding nurse station, and artwork and graphics on the doors help patients find their rooms efficiently.

Hygiene and staff zone for utilities

Single patient room

"The patient's room is a place where they can be alone, with family, or with friends. The layout of RWC between rooms provides a good sightline between staff and patients and keeps patients safe. This graphic shows what patients experienced when relatives visited.

The bay window frames nature outside, and the artwork on the other side of the bed reduces patient stress as a positive distraction. The walls and floors are mostly wood with a combination of calm blue colors, and the head wall's forest scene makes the patient feel safe and reserved, allowing them to have a quality resting time."

interior's wood wall and floor

friendly furniture (comfortable and save space)

calm-blue-colored decoration

scenery artwork (forest, field)

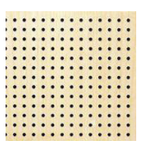
REHAB GYM (SEMI-PRIVATE SPACE)

“A semi-private space full of equipment where a few patients work out closely with a therapist at a time, according to the daily schedule. To maintain a sense of privacy while remaining connected to society as well as the outside world.

A gym was built with a high ceiling, sound-absorbing materials on walls and ceilings, and big windows with glass on two sides that lead toward a green area outside alongside a corridor and an inner courtyard. Also, warm yellow colors and wallpaper with natural scenes, particularly those that represent movement, were positive distractions that offered patients energy and made them feel refreshed while training.”

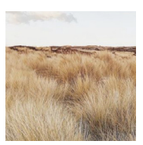
safety floor

big windows with glass connects to green view



sound-absorbing wall and ceiling

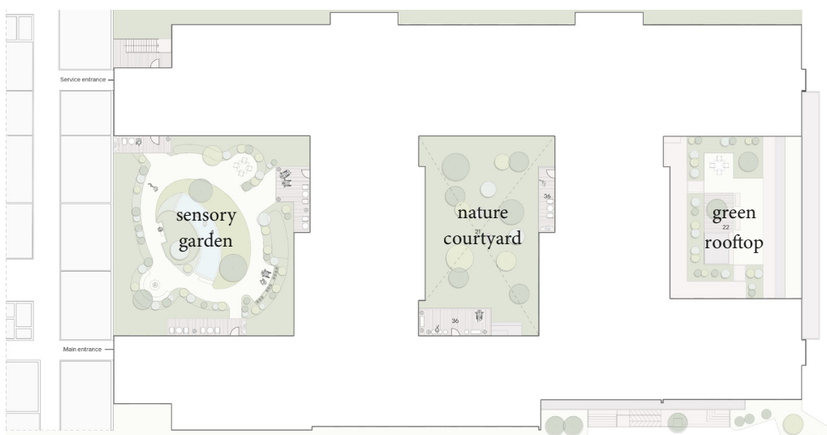
yellow-colored decoration



scenery artwork (mountain, field, movement of nature)

BALCONY & EXTERIOR LANDSCAPE

Connected to a natural place where patients and staff can take a break from training, or be isolated along with nature during the day. Further, various outdoor landscape atmosphere and animal sculptures help users navigate their way and calm their nerves. (For instance, the sensory garden has a curved design with a fountain puddle, a balcony within the simple nature courtyard, or even a green rooftop with a view of the nearby outdoor arena.)



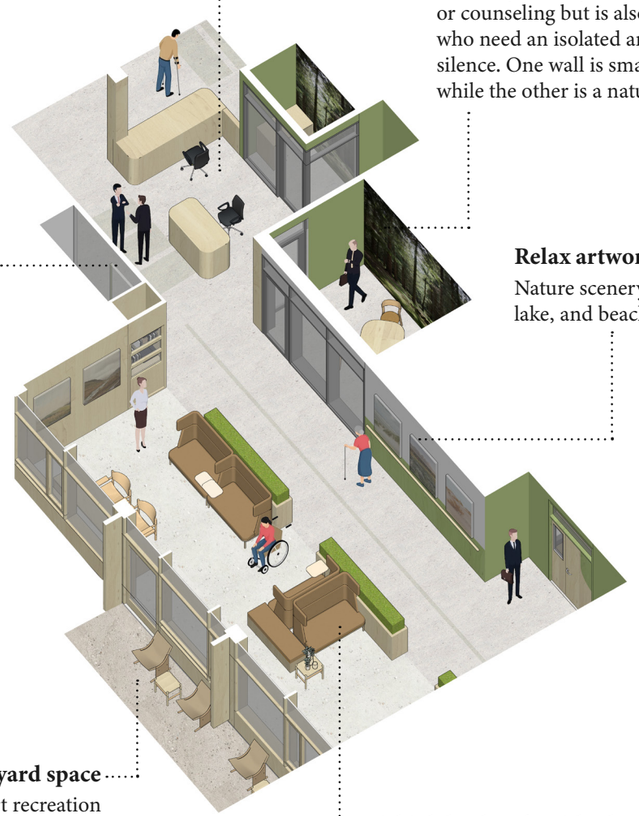
CORRIDOR (SEMI-SHARED SPACE)

Nurse station
located at the center corner for accessibility and good sightlines.

A shared meeting room
is usually used by staff for internal meetings or counseling but is also accessible by patients who need an isolated area to work or relax in silence. One wall is smart glass for isolation, while the other is a nature scenery wall.

Hobby cabinet
contains chess, board games, art, and knitting.

Relax artworks
Nature scenery with field, lake, and beach is preferred.



Nature scenery ceiling
to create a unique sense of in-between outdoor and indoor space.

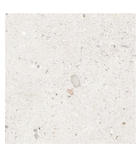
Linked to courtyard space
to support recreation activities with access to outdoor terraces and nature.

A high back sofa with plant partition
create a sense of semi-privacy and blur the boundaries between corridors.

"A temporary shared space among patients and staff during the day especially for passive activities or those requiring more privacy.

The wood walls, terrazzo-patterned floor, and nature-scenery ceiling give the room a warm, unique mood, like being outside the building."


wooden wall


terrazzo patterned floor


private sofa


scenery artwork (field, lake, and beach)


nature scenery ceiling

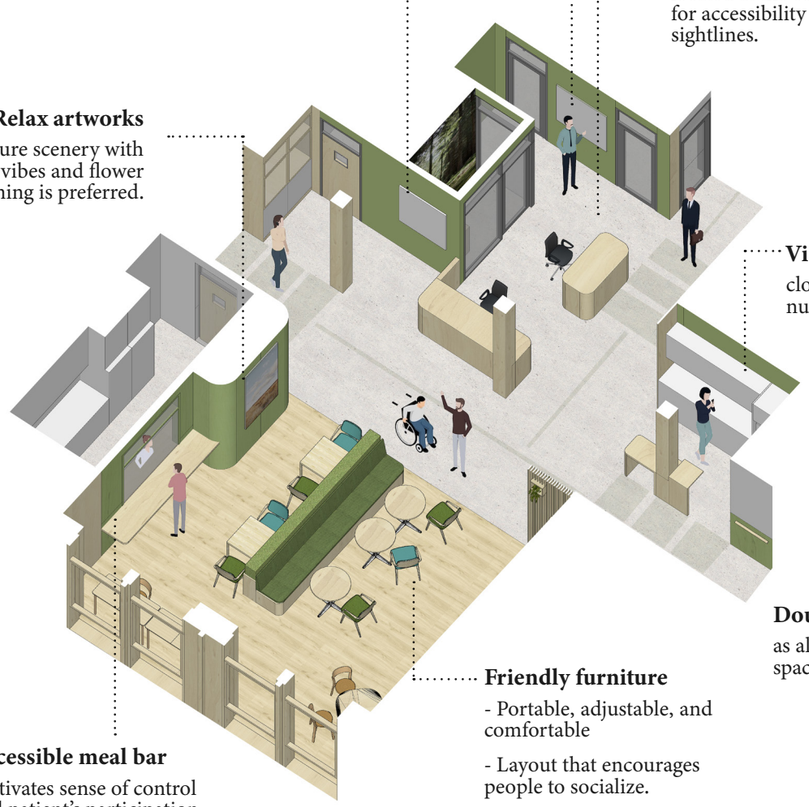
DINING AREA (SHARED SPACE)

Staff-to-patient board
communication regarding news, special events, or weekly meal menu.

Staff-to-staff board
communication regarding workshifts, rehab schedules, etc.

Nurse station
located at the center corner for accessibility and good sightlines.

Relax artworks
Nature scenery with summer vibes and flower blooming is preferred.



Visible shared pantry
close connection to the nurse station.

Double space
as alternative shared space perception

Friendly furniture
- Portable, adjustable, and comfortable
- Layout that encourages people to socialize.
- Always have empty space for wheelchairs.

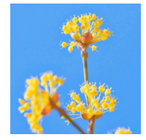
Accessible meal bar
motivates sense of control and patient's participation.

"A homie meeting place for full social interactions, where wood material is mainly curated in combination with a vibrant color wall representing each corner space.

A double space was designed not only to be more spacious with more daylight but also to work as an alternative to the user's perception of the ward shared space."


wood material

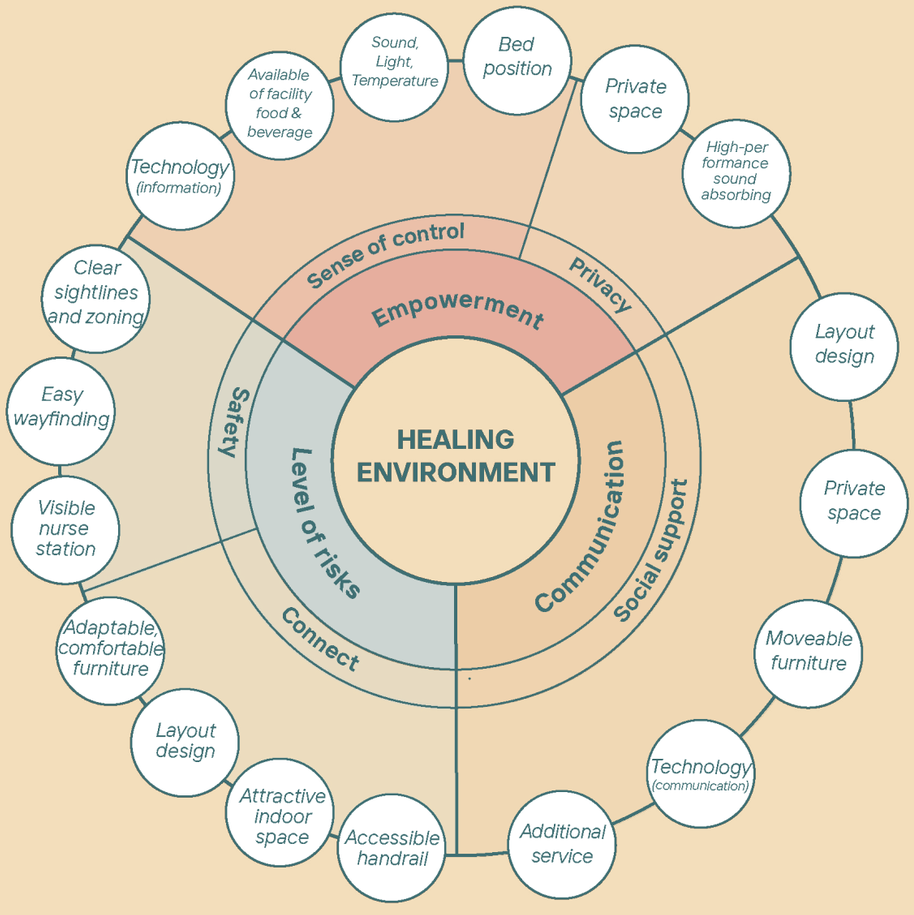

light-weight furniture with different seating arrangements


scenery artwork (summer vibes, flower blooming)


double space

09

CONCLUSION



CONCLUSION

The built-environment of stroke rehabilitation is complex. In light of this, a comprehensive approach is required to consider the physical, psychological, and emotional needs of both patients and healthcare staffs, and the facility itself. In this study, healing and supporting environments theory were characterized by empowerment, communication, and level of risk. The physical features and design strategies implemented must prioritize patient safety, accessibility, privacy, and social support, which will be described below.

Empowerment: Stroke patients require tools and resources to reclaim their sense of control. For example, a patient's room should have enough space for a wheelchair and utilities, lightweight and moveable furniture, a personalized magnetic board with photos and notes, or even an adaptive technology like a voice-activated system that lets them manage their environment. Also, the possibility of the food bar and facility on their own is counted.

Using sound-absorbing materials, glass walls, or plant partitions to divide space and having patients choose between a single room and a double room gives each individual the privacy they need.

Communication: The ward's layout, in particular its location, can be crucial for social support and a sense of belonging. To illustrate, the dining area and TV room should be close to the nurse's station and easy for patients to gain access to. There should also be a board where staff and patients can post messages about events, or positive encouragements.

Due to patients having distinctive needs and behaviors, giving them various types of spaces will motivate them to spend time outside of their rooms while providing them the level of privacy they desire. In this study, four levels of social interaction linked to different activities (private, semi-private, semi-shared, and shared spaces) were discovered, each with its own character, mood, and furniture arrangement.

Level of risk: Clear sightlines, a visible nursing station, and easy wayfinding reduce stroke patients' fall and anxiety risks. Non-slip flooring, lights, handrails, and seats help mobility-impaired patients.

Lastly, natural light and views of the outdoors can have a positive impact on patients' well-being and recovery. Utilizing windows, skylights, and high ceilings enhances the connection to the outside while adding greenery decoration, comfortable seating, natural scenery artworks, and outdoor sculptures also help reduce stress and enhance patient and staff well-being.

REFLECTION

The thesis investigated how the built environment can enhance stroke patients' well-being and staff synergy. The aim was to bring together design strategies and a proposal to shape the inpatient unit with stroke rehabilitation function by applying the healing environment and supporting environment theories. Furthermore, the proposal was influenced by stakeholder interviews and the author's experience of how architecture and atmosphere affect human well-being.

A challenge for the author was to transform all the knowledge from multiple sources into design strategies. Thus, an iterative design process, including a second interview, is necessary to ensure an effective design fulfills the needs of users.

In further development, several aspects could be expanded further. e.g., color, graphics, and nature images in way-finding become intriguing when evaluated with cognitive impairment patients, as well as how to implement a modular system in ward space or a rehab facility.

The author would like to end the thesis with the hope that the physical setting for stroke rehabilitation will be a standard part of the design of care facilities in the future.

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Brittamari., education teacher at Hässleholm hospital (phone call).

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ILLUSTRATIONS & PHOTOS

All illustrations and pictures are made/taken by the author if no source is mention.

Figure 01: Type of stroke in the brain. Retrieved from https://www.healthline.com/health/stroke

Figure 02: Relationship between human, health, and well-being. Illustrated by the author.

Figure 03: Stroke patient in physical care environment. Retrieved from the Hässleholm hospital's instagram page

Figure 04: Occupational therapy at CogTech lab Retrieved from https://it-halsa.se/hjarnskadepatienter-pa-dander/

Figure 05: Adaptive healing room for stroke patients Retrieved from Daemon et al., 2017

Figure 06: Alingsås case study. Retrieved from https://www.sweco.se/projekt/alingsas-lasarett/

Figure 07: Woy Woy rehab unit case study. Retrieved from https://www.archdaily.com/551038/woy-woy-rehabilitation-unit-woods-bagot

Figure 08: Glostrup rehab neuro house case study. Retrieved from https://www.nordarchitects.dk/glostrup-neuro

Figure 09 - Hässleholm hospital. Retrieved from https://vard.skane.se/hassleholms-sjukhus/om-oss/om-sjukhuset/hassleholms-sjukhus-fyller-85-ar/

Figure 10 - New Orthopedic department building. Retrieved from https://www.skane.se/om-region-skane/bygg--och-fastighetsutveckling/ny--och-om-byggnationer/framtidens-ortopedi-i-hassleholm/

Figure 11 - New Orthopedic department building. Retrieved from https://www.krooktjader.se/projekt/forth-framtidens-ortopedi-i-hassleholm

APPENDIX

List of interview questions
Design strategy's mockup slides
Interview data

LIST OF QUESTIONS (INTERVIEW I)

Introduction:

1. Please introduce yourself in relation to stroke and your organization.

2. What is your organization's type of stroke healthcare service?
   (stroke unit, outpatient care, inpatient with rehab facilities)

3. How many patient beds does your facility have?

4. How many healthcare staff and teams does your department have?

5. With how many stroke patients does one nurse cope?

6. How do you classify the degree of severity of stroke patients?

7. How do you assist patients with a high level of severity?
   (feeding assistance, rehabilitation, cleaning)

8. How do you handle an emergency case in the department?
   (e.g., a patient suffering a second stroke)

Healthcare system:

9. How does the transition from acute patients to inpatient rehabilitation units occur?

10. Please briefly explain the daily activities of stroke patients related to functional rooms and spaces.

11. Please explain briefly the daily activities and working procedures of healthcare staff related to functional rooms and spaces.

12. Which treatment or rehabilitation activities are suitable for group participation?

Physical environment:

13. How does the ward environment influence, stimulate, or inhibit the healing process of a patient, according to your observations?

14. In your current ward, what do you believe is an issue that affects the recovery process of stroke patients, and do you have any suggestions? (poor wayfinding, illumination, location/ambiance / fewer possibilities for socializing, poor accessibility to nature)

15. What do you believe patients would like to alter about their patient rooms if they had the opportunity to do so?

16. What is your opinion about the patients sense of control over the space and their participation?

17. Do you feel that visual communication among patients in the rehab gym might motivate other patients?

18. According to your observations, are patients concerned about their privacy during rehabilitation?

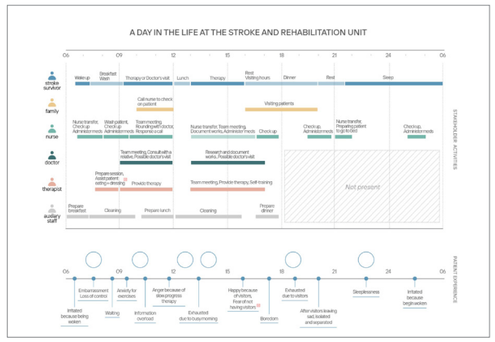
19. From personnel's perspective, if there were any adjustments or additions to the workplace to enhance staff's work productivity, what would they be?

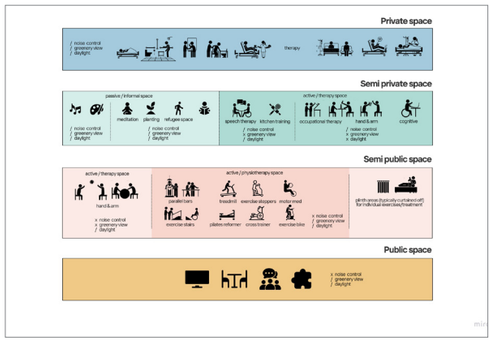
20. What is the level of family involvement in the unit ward?

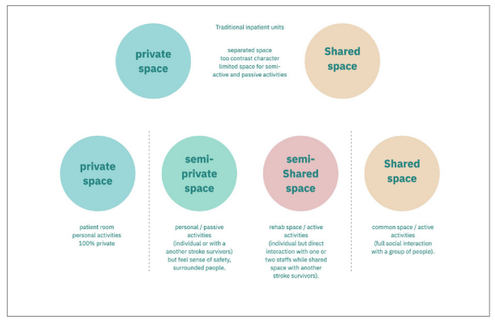
21. Please characterize the significance of the ward's corridor and its obstruction?

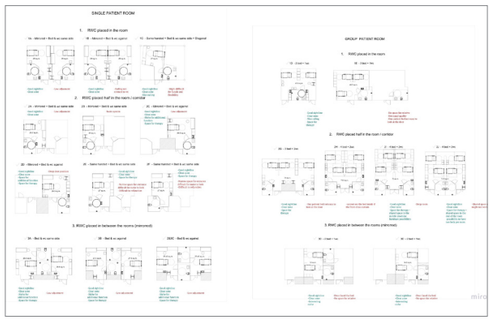
22. What kind of space, room, or place would you like to have in the clinic or stroke unit, from your perspective? (comfortable seating area, café, music/board game, terrace, garden, etc.)

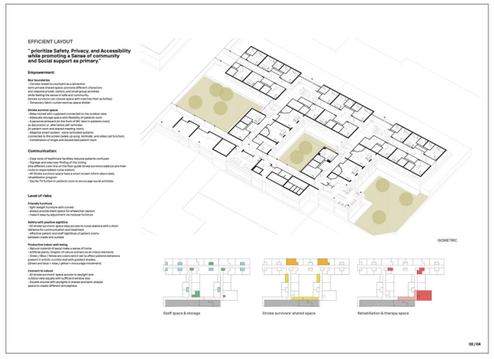
SOME PART OF DESIGN STRATEGY'S MOCKUP SLIDES (INTERVIEW II)

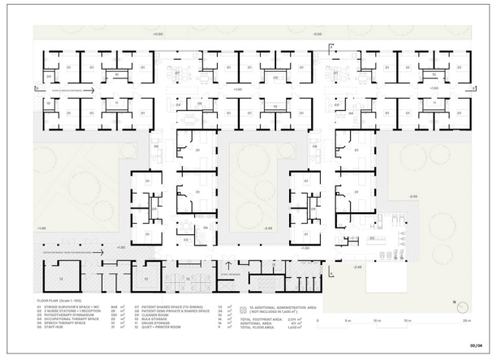


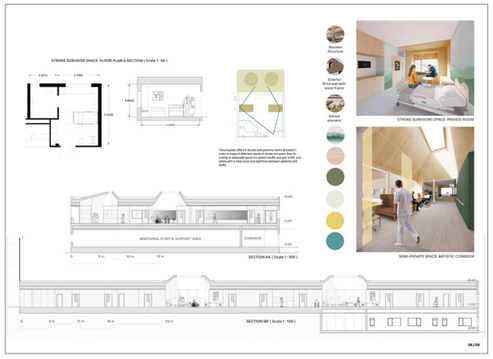












Interview I

Karlsson M., Nurse at stroke forum

8 February 2023, at stoke forum, Goteborg

Q: Professional background related to stroke and rehabilitation?

Ans: I was a stroke unit nurse at Molndal Hospital in the mid-1980s. Since 2009, I became a Stroke Forum nurse and worked with group activities (speech therapy, arts, cultural, etc.). "At the stroke forum, we believe that group activities can reduce loneliness and inspire stroke survivors' recovery by saying that if you can do it, so can I."

Q: Stroke healthcare system in your institution?

Ans: Initial stroke patients in Molndal Hospital are referred to the acute stroke unit or neurology unit, where their length of stay depends on their condition. Stroke sufferers can select between at-home and specialist rehabilitation clinics under the supervision of nurses, physiotherapists, and occupational therapists. Outpatient training and follow-up diagnosis are needed in primary care, rehabilitation, or neurology. While at the stroke forum, participate in group activities to share knowledge, guidance, and support after a stroke. A nurse and occasional therapist should lead 3-6 registered individuals.

Q: Contact, discharge and financial support?

Ans: Stroke survivors and their families contact us directly from numerous sources. After becoming a member, they can attend weekly registered classes and special activities. Actually, it is quite a low charge because Vastra Gotland and Sahgrenska support a part of the financial side. The charge is roughly 350 SEK for each semester; in the summer, it is free.

Q: Scope of work and process related to functional room?

Ans: My task is to coordinate and manage the course and events with the Folkuniversitet and to also support stroke survivors during the class. I have used all rooms from meeting and workshop rooms, a computer room, a communal space for fika, and an office and administration space.

Q: Group rehabilitation and activities?

Ans: In a hospital's rehabilitation department, patients usually start with individual training and then gradually include group activities, generally recreational.

Q: Challenge and possibilities related to functional spaces?

Ans: **Communal space:** Space efficiency—how to arrange a small area efficiently with plants, colors, and curtains—supports well-being.Meal time during the day is the most important time for social interaction in stroke survivors; they can meet, speak, eat, or even watch TV with one another; however, the communal space atmosphere in stroke units is not appealing and welcoming.

Patients room: I recommend single-patient rooms as a nurse practitioner. In a multi-patient room, one patient can interrupt another's sleep quality, which is crucial, especially for longer stays that require personal space. Every stroke patient's room should have a huge window to view trees and the sky. Sense of owned space is essential, because each patient is unique, some like to see a window and some do not, so it is possible to make it more flexible, e.g., patients can change the orientation of the beds to suit their needs, such as hanging their art or frames.

Q: Collaboration between patients and relatives?

Ans: We do not have activities between patients and their relatives, but it is possible to have relatives nearby and provide support. The main thing is that the patients should do activities on their own.

Interview I

Bildsten B., Business Manager at Mälargården

9 February 2023, at Mälargården, Sigtuna

Q: Professional background related to stroke and rehabilitation?

Ans: I'm Mälargården's business manager, managing funding, rehabilitation classes, and program lectures. Our non-profit hospital treats neuro-patients with 30 healthcare professionals. The rehabilitation facility started initially as a summer camp in 1971 until a group of people raised money and found this site, making it an official one of Stockholm County rehab centers.

Q: Stroke healthcare system in your institution?

Ans: Our patients were hospital-referred and doctor-described. The doctor and patients decide and register a queue on the system we use. After our rehab facility accepts the case, patients meet the coordinator, have an interview with a nurse and therapist, and develop a customized plan before starting our on-site recovery program. The inpatient program consists of 10-15 training days during the week, and patients must return home on weekends. Few outpatients are accepted daily.

Q: Contact, discharge and financial support?

Ans: It was free of charge, and 120 SEK/day includes all three meals, accommodations, and treatment.

Q: Scope of work and process related to functional room?

Ans: The patient receives their schedule paper and attends the lectures and training on it. Patients can rest in their rooms, walk outside, or socialize in communal area during off-hours.

Q: Group rehabilitation and activities?

Ans: Individual and group therapy are always mixed here. For instance, group activities begin in the introduction session and include a daily group lunch, pool training, table tennis, and even dance. If the weather is nice, they walk with sticks or swim in the lake. In contrast, patients will get individual training with physiotherapists once a week, and I think having enough break time (1-1.5 hours) is most vital. Also individual activities like attending specific lectures or talking to a psychiatrist in a closed group with the same ailment.

Q: Challenge and possibilities related to functional spaces?

Ans: **Communal space:** Nowadays, we adapt our dayroom into a Lecture room. I would prefer that we have more and in different sizes for various purposes.

Corridors: I agree that our corridor is too long and dark and could be lightened, but it ought to be designed with weather and ventilation in mind. Our outdated ventilation system made it very hot on a sunny day. The light source and angle shouldn't bother patients who are sensitive to light visual.

Patient room: I believe the majority of patients prefer a single room with the option for a family member or assistant to spend the night.

Q: Collaboration between patients and relatives?

Ans: We aim to pair patients of similar age, but we have discovered in some cases that generation does not matter. Once, we observed an elderly woman and a normal adult working well together. It was incredible.

Interview I

Nilsson E., Coordinator staff at Rehab station

9 February 2023, at Rehab station, Stockholm

Q: Professional background related to stroke and rehabilitation?

Ans: I've been a project coordinator at Stiftelsen Spinalis (foundation for spinal cord injury research and development) for over 20 years, where I've worked on a variety of research projects. I have experience with media communication. I experience spinal cord injuries.

Q: Stroke healthcare system in your institution?

Ans: It was the same healthcare system in Stockholm, where patients were referred from the hospital after diagnosis or surgery recovery. The duration of stay depends on the individual but is typically around 25 days. Also, the same government-mandated impose of 150 SEK per day was charged.

Q: Scope of work and process related to functional room?

Ans: The patient's schedule will be given at the start of the week and should be followed between 09:00-16:00. The amount and duration of training depend on their level of fitness. At Rehab Station, there are nearly 150 staff members operating in four separate wards categorized by condition.

One of our three wards has 10 patient rooms, while the other has 30 patient rooms, and the stroke patient ward is located on the ground floor. It appears that we shared facilities between inpatients and outpatients, as well as between our center and the general public, such as the gym, sports hall, and lobby the cafeteria.

Q: Level of severity among stroke survivors who participate?

Ans: We prioritized minor and stable patients and young patients to help them as soon as possible due to our limited medical equipment.

Q: Group rehabilitation and activities?

Ans: We offer both group and private sessions. Individual training consisted of speech therapy and hand training, while group sessions included gymnastics, dancing, and meditation.

Q: Challenge and possibilities related to functional spaces?

Ans: **Communal space:** It was a pleasant area for staff, patients, and visitors to share the canteen, where patients were able to obtain their food and serve themselves without feeling isolated. While providing a separate dining area for staff who bring their own lunches.

Patients room:
Only one visitor per patient is permitted.

Q: Collaboration between patients and relatives?

Ans: We attempt to plan special events for patients' interest groups to connect, dine, or interact, such as girl's night, guy's night, or family night where patients' families can share their experiences.

Interview I

Andersson A., Stroke survivor and coordinator admin at Stroke Association Gothenburg

27 February 2023, at stroke forum, Goteborg

Q: Professional background related to stroke and rehabilitation?

Ans: My first stroke occurred at 30. I recall falling asleep on the sofa in the morning at home. My wife calls an ambulance and the staff take me to Sahlgrenska. My brain MRI showed a hemorrhage and required long hours of surgery. I spent a week in a coma. After I woke up with half my body not working. That was excruciating. Because I have a five-year-old daughter, "I want to see her grow up and be strong" motivates me to persevere and overcome myself during rehabilitation.

Today, I work as a coordinator at the Goteborg stroke association for two hours a day because I become tired and go home to sleep.

Q: Stroke healthcare system in your institution?

Ans: I was admitted to Hogsbo Inpatients Rehabilitation Medicine Unit for two years of rehabilitation. "Try to walk, talk, and do stuff during rehab it was very painful and very tough to get up and so on, I am okay with that but still fatigued so I cannot do much standard work.

Q: Scope of work and process related to functional room?

Ans: Inpatient rehabilitation runs from 09:00 to 14:00 (balance, eating, speech). In my case, I learned quickly and was able to go to the rehab room and eat by myself. I mostly spent time training in the rehab room and resting in patient rooms. I take a 10- to 15-minute break between rehab sessions before lunch.
I also learned how to cook in the ward (I forgot how to boil eggs). Also, we meet monthly with a healthcare team to discuss progress and experience.

Q: Challenge and possibilities related to functional spaces?

Ans: **Communal space:** Sincerely, my main focus is getting well soon. I've spent a lot of time by myself. Swimming in the rehab pool, gardening, or taking small walks outside the building were so important to me.
Mealtime is my favorite social time. I accept stroke survivors of any type or severity. We're friends. Meditation or silence rooms would help shared-room patients more concentration and relaxation.

A windowed communal area was rarely used, possibly because it was excessively formal. If it's nice weather, they prefer the balcony and terrace more.

Rehabilitation gym: It takes a long time to use stairs and train walking, thus it would be wonderful to have a nature view and encouraging emotions in the ward.

Patients room: I stayed in a multi-bed room. Despite the fact that single rooms offer more solitude, I prefer double bedrooms because you can socialize and feel less alone and driven. especially since I don't have trouble sleeping. I can close a curtain with a button. Sharing a room with someone of the same age is good. Also, we did not have a TV in the patient room, so I went to the TV room when I wanted to interact and feel more connected to people.

Q: Collaboration between patients and relatives?

Ans: My family usually visited me for around an hour. If it's more than that, it makes me exhausted.

Interview I

Johansson B.

Occupational therapist at Danderyds hospital

8 February 2023, digital meeting
9 February 2023, Danderyds hospital, Stockholm

Q: Professional background related to stroke and rehabilitation?

Ans: I worked as an occupational therapist at Danderyds Hospital, serving adult brain damage patients in departments 80 and 84. My department, CogTech, uses modern technologies to develop cognitive functions, strategies, and motor skills and explores alternative occupational therapeutic methods. Since 2020, I've participated in and won awards for my research at Cogtech, which shows that creative therapy makes patients feel more engaged and playful.

Q: Stroke healthcare system in your institution?

Ans: At Danderyds Hospital, stroke patients are firstly admitted to the emergency unit for CT scanning and blood tests for diagnosis, then undergo intensive surgery or specific medical care. After stabilizing, patients were referred to our rehabilitation medicine unit. Unofficially, patients stay 28 days before returning home and receiving outpatient care.

Q: Scope of work and process related to functional room?

Ans: Our CogTech used smart and VR glasses, a 65-inch tablet, and all Android apps to improve eye motility, movement, and balance. We shared a ground-floor unit with outpatients and inpatients. Our occupational lab was one enormous room with appliances and a cleaning sink, and my personal desk and computer were in another room nearby.

I usually go to stroke patients' rooms and help them with hygiene, clothes, and eating, then take them to the Cogtech lab for occupational therapy.

The ward has a kitchen training room on the same floor as the ward. Whenever there are no activities after 16.00, I will self-train with therapists and assistant nurses. We also have a training apartment with wheelchairs and geriatric facilities for patients to practice and experience real life for a few nights before returning home.

Q: Level of severity among stroke survivors who participate?

Ans: We have a mixed level of patients sickness here, and we try our best to treat everyone equally.

Q: Group rehabilitation and activities?

Ans: Most physio and occupational treatment is individual with one or two therapists. Our department has a computer room, plant room, green park, and art and craft area for small group activities.

Q: Challenge and possibilities related to functional spaces?

Ans: **Staff:** Our ward's new renovations caused inefficient zoning. Our patient recreational room and gym were far from the ward, so we had to take patients down by elevator and walk through the basement service way.

Common area: The ward should feature visible signs, walk railings, a floor line for balance-sensitive patients, and ceiling lift accessibility.

Patient room: I'm satisfied with our ward's single-patient quarters. I'm interested in ways to get patients out of their rooms, like no TVs function in their rooms. I prioritized patient room efficiency and spaciousness. Ensure the room can store walking aids, wheelchairs, and adequate space for many workers to move patients.

Q: Collaboration between patients and relatives?

Ans: We only schedule visitor time for patients and family. As long as the patient will accept it, patient-family-staff collaboration would be excellent.

Interview I

Reinholdsson M.

Researcher and physiotherapist at Mölndal hospital

1 March 2023, Digital meeting

Q: Professional background related to stroke and rehabilitation?

Ans: I've been a researcher and physiotherapist at Mölndal Hospital's acute stroke unit over 25 years.

Q: Stroke healthcare system in your institution?

Ans: The acute stroke unit and rehabilitation ward were united. However, acute stroke units can now offer rehabilitation. The stroke unit personnel transport patients to get a CT scan or X-ray, then refer them to the acute stroke unit or Sahgrenska for immersion surgery. The average day of care is around 8 days, and High-severity patients typically stay longer than 3 weeks. We may refer patients to the rehab unit. Since the healthcare system has changed, community care increasingly handles rehabilitation, depending on where patients live.

Q: Scope of work and process related to functional room?

Ans: In the morning, I will get the patient report and meet with all new patients to assess their strength, sensibility, and balance with an occupational therapist in their rooms.

Our ward has 22 beds, half of which are for stroke patients. Staff pick up patients from their rooms for training. In stable patients, I recommend assessment and do a rehab in another room while most patients are severely sick, especially if they are unconscious. Rehabilitation is required in their room.

The same-level ward has many exercise rooms (walking, training, sign-stationed self-exercise). The elevator descends to the gym and another training area. Training in outdoor parks with stairs, benches, and grass makes them feel at home. We use pavement instead of context for patients with impaired visibility.

Q: Level of severity among stroke survivors who participate?

Ans: In acute wards, patients rarely acclimate to their space because most are high-severity and moderate patients stays brief. We invite relatives to bring photos, sweaters, and pillows for patients staying longer than a week.

Q: Group rehabilitation and activities?

Ans: One or two healthcare providers train one patient with an individualized program during rehabilitation. Because people have different problems, therapy in groups is rare. We have engaging group settings for longer stays, but they are much more applicable in rehab centers.

Q: Challenge and possibilities related to functional spaces?

Ans: **Common room:** allow patients to employ it alone or with others. We have a glass wall with a door between our TV room and kitchen in the ward. I also require more space for exercise, assessment, consultations with patients, and social activities (room or corridor space). The ward should encourage physical activity and simple things like coffee with relatives or alone for patients.

Accessible balcony or terrace: where patients can walk outside and feel a better sense of life.

Rehab gym: Multiple patients doing individual therapy in the same space may motivate one other, but concentration-impaired individuals may tolerate noise and activity differently. Patient practice requires straight, round stairs and accessible railing, depending on how they look in their homes.

Patient room: allow patients the choice between single or shared bedrooms to suit their needs. Mixed-gender rooms work, and double patient rooms are preferable since four people can be loud and annoy each other, and the divider between patients makes it hard for staff to see faraway beds. The room should be large enough to carry patients and store wheelchairs, especially in the bathroom. Colors, lighting, and natural views matter today. No TV in the patient room is a good way to get people out of their rooms to mingle in the common area.

Interview I

Lilja C., Nurse at the stroke unit, Alingsas Hospital
and stroke patient's relative

23 February 2023, Digital meeting

Q: Professional background related to stroke and rehabilitation?

Ans: A registered nurse since 2017. I became interested in stroke treatment and rehabilitation through my internship at this institution. I lost a family member to a stroke, which probably influenced my career decision.

Q: Stroke healthcare system in your institution ?

Ans: Our acute stroke unit works closely with a rehabilitation team, allowing our patients to be rehabilitated both during and after their stroke. Stroke and TIA patients are admitted from our emergency department, nearby hospitals, or ambulances. The acute phase varies from patient to patient, making it hard to determine when it ends. However, when there are no more medical treatments or care changes, patients are either discharged or stay a little longer for rehabilitation needs.

We mostly rehabilitate people over 65 years old. while most working-age patients are transported to Bors for rehabilitation focusing on returning to work. Even if the patient cannot work, we want them to be able to cope in daily life and learn new coping skills. To that end, we mix therapy with the acute period to provide the patient with as much rehabilitation as possible.

We have "Rädda Hjärnan" (Save the Brain). We do it when we suspect a new stroke (or if someone is in the unit for another medical condition and has stroke symptoms). We call the unit doctor or the on-call doctor for evenings and weekends. They contact radiology and ICU nurses. During NIHSS, we transfer the patient to radiology as quickly as possible. After the CT scan, If viable, the patient receives thrombolysis from the ICU nurse and stays in the ICU for at least three hours.

If an occlusion is extracted, the patient is transported to Sahlgrenska Hospital for thrombectomy via ambulance or helicopter. If there is no new stroke or brain bleed. The patient is transported back to our unit, and we begin our stroke checklist, followed by vitals and observation.

Q: Scope of work and process related to functional room?

Ans: At most 8 patients per nurse and two assistant nurses (days) and 8 patients per nurse and one nurse assistant (evenings). During the night, there is usually one nurse and two nurse assistants. Totally our wards consists around 30-40 staffs, we are divided into two teams, use shared computer, and worked in three shifts (06:45-15:50 / 13:30-21:30 / 21:00-07:00)

06:45 – I read a record from the night shift
08:30 – Rehab team daily meeting
(at white board hallway)
9.15 – Nurse breakfast (15-20 minutes)
9:45 - 10:00 – Medical make round
12:00 – Lunch time (Nurse work at team station and taking call relatives)
17:00 – Dinner time

Before breakfast, bloodwork and vitals begin at 7-8 am. Patients manage their hygiene and morning/evening routines as much as possible. Our goal is to help with their needs and promote their abilities as much as possible.

Patients meet with different rehabilitation team members between 9.30 and 16.00, usually at a set time that they write on a whiteboard in the patient corridor so staff and patients know when to do what. Lunch is from 12:00 to 13:00. There may be regular meal aids or supervision to determine what skills the patient needs to work on or to find new

APPENDIX

23 February 2023, Digital meeting

issues that may not have been apparent until a few days after arrival. New vitals are monitored throughout resting and visiting hours from 15.00-19.00. Nurses and nurse assistants aid patients with dressing, hygiene, and mobility during off-hours.

Among staffs, we have meeting (10-15 minutes per team) three days a week called board rehab meeting. Also individual meeting from 30-45 minutes.

Patients and families use the common area. while staff have a team room with private rooms for rounds and documentation (one per team) and only staff access to the kitchen

Q: Level of severity among stroke survivors who participate?

Ans: NIH (National institutes of health-stroke scale, which quantifies stroke severity based on weighted evaluation findings. We assess each patient's needs and treat them individually. We discuss the patient's ability to accept the treatment/rehabilitation and whether the stroke damage is too severe for in-patient progress. Some of our patients need a lot of care but can't recover, so they're discharged to a short-term rehab center outside hospital or home care.

Q: Group rehabilitation and activities?

Ans: Our unit does not use group therapy/ exercise/treatment. Visual communication like picture boards or whiteboards is used for hearing loss or aphasia after a stroke.

Q: Challenge and possibilities related to functional spaces?

Ans: I don't think the ward's physicality slows a patient's procedure, but having numerous patients needing attention at once with limited resources.

The problem would be the noise and crowds sometimes, which can't be changed. Also our telemetry system and alarms sometimes make the ward noisy, but that's hospital life.
We occasionally have dementia or brain injury patients yell at staff or call their families, which is unfortunate but unavoidable.

The corridors are useful for viewing patients. Our L-shaped corridor makes it hard to see all patient rooms. Sometimes patients collapse or you don't realize your colleague needs help. Since all rooms are numbered or identified, navigating is easy. Our light, airy ward features artwork on the walls work well. It is good to make it more attractive without being distracting.

Staff: Private documentation space. A resting room or a way to remain overnight after your shift would be excellent.

Patient room: I prefer only single bedrooms so they won't have to share rooms with unknown people. and more channels on the TV (a common complaint with patients)

We also want ceiling lifts in all rooms and adjustable sinks in patient toilets so wheelchairs fit and shorter patients can brush their teeth and complete their morning and evening routines.

Q: Collaboration between patients and relatives?

Ans: We advise patients' families to call ahead if they want to visit early. If the patient wants, we offer them a nurse or doctor update on their care and progress. They can stay during visiting hours if they don't disturb the other patient or if the patient getting the visit is getting too tired and needs a rest.

Interview I

Carlsson M., Doctor & Senior consultant neurology
at Nordlandssykehuset HF, Bodø, Norway

7 March 2023, digital meeting

Q: Professional background related to stroke and rehabilitation?

Ans: I am a senior consultant in neurology at the acute stroke unit of the specialized rehabilitation unit at the Norland hospital in Norway.

Q: Stroke diagnosis and treatment?

Ans: As patients arrived at the hospital. First, a CT, MRI, or Ultrasound scan will be performed, followed by a blood test and medication administration. There are few cases requiring surgery, and the acute phase endures three to five days.

Q: Scope of work and process related to functional room?

Ans: Stroke patients are typically admitted to the general neurological ward, where two physicians (one senior consultant and two doctor students) are responsible for more than ten patients.

I spent the normal ward hours and the beginning and end of the day in a private room working on my case. I have one medical round in the morning (10-15 minutes) during which I sit, write a case, examine patients, and converse with their families. Then, meeting with healthcare personnel for going through exams and medication (30–60 minutes per day) until the end of the check operation at 12.00 (lunch) and returning to check up again at the completion of the day after the nurse team's meeting was over.

Q: Challenge and possibilities related to functional spaces?

Ans: **Communal space:** On the sixth floor of our new renovation ward, there is no balcony, so we have to take the patients for a brief walk to the ground floor, which is surrounded by not much greenery. consequently is essential to encourage patients to engage in activities outside of their rooms, for instance by providing access to a park, trees, and benches, as well as calming, easily navigable corridors with images of nature.

Also, it would be preferable if the ward could provide more personal space for patients and staff to breathe, stay relaxed, and relax with a window and a glass wall, as well as a room for visitors or patients where they could sit and receive private information from the staff.

Staff area: the staff room needs more windows because our ward has double corridors, which can make lighting difficult. For optimal team communication, the ward should contain a physiotherapist room. Finally, more doctor rooms and a break area for staff would be ideal.

Rehab gym: It is necessary to have beds in the rehabilitation room.

Patients room: I prefer a combination of half single and double bedrooms, and adjustment of the side of the bed follows the parents' stimulation, and their bathrooms must provide enough space.

Interview II

Nilson M.

Stroke survivor

5 April 2023, at stoke forum, Goteborg

Q: Professional background related to stroke and rehabilitation?

Ans: I am a stroke survivor with a mild stroke condition. Since I recalled having symptoms of a stroke, I was admitted to Sahgrenska's emergency unit and rested in bed for two days while receiving medical care. Physical and speech therapy then commenced. Initially, I thought that my back was damaged. Today, I feel considerably better and continue to use the computer and perform gymnastic exercises at home.

Q: Challenge and possibilities related to functional spaces?

Ans: **Communal space:** Fika space is a vital room for socializing, and it was nice to have a friendly environment with artwork and nature.

Patients room: I choose single-patient rooms because I do not feel well when my sleep is disturbed by noise. Once I had the unfortunate experience of falling from the bed while attempting to get up on my own. Consequently, it is essential for patients' rooms to have a clear sightlines between the inside and outside of the room so that staff can quickly access patients.

Q: Feedback on design strategies and ward layout design?

Ans: The placement of color in each interior space is fascinating and affects patients' emotions. Green, blue, and certain warm hues are appropriate for patients.

As for flooring material, avoid reflective flooring because it can create the illusion of water or other obstacles on the floor in contact with the sunlight, and it should not be highly polished. Furthermore, some patients are sensitive to black or hole-like patterns on graphics or materials.

Interview II

Lilja C.

Nurse and stroke patient's relative

29 March 2023, digital meeting

Q: Feedback on design strategies and ward layout design?

Ans: Most of the design strategies sound reasonable and seem correct. Clear zoning between therapy and ward spaces is advantageous, similarly to the clear sightlines of patients from staff workstations.

The mock-up design and offering different characteristic spaces might work. The most concerning thing is that the double-H-shaped layout design might make patients feel nervous because of the difficult navigation. Therefore, finding a practical solution for easy-wayfinding is required.

Interview II

Johansson B.

Occupational therapist
at Danderyds hospital

30 March 2023, digital meeting

Q: Feedback on design strategies and ward layout design?

Ans: Your stroke patient's journey and barriers diagram is exactly correct. I felt deeply about my patients.

Various restorative spaces sound interesting, and I think that the ward should offer more social opportunities for diverse activities and privacy levels.

Carpet flooring can cause friction between wheelchair wheels and the floor, making it difficult for patients to overcome. The flooring material must be smooth, wheelchair-friendly, slip-resistant, and low-maintenance.

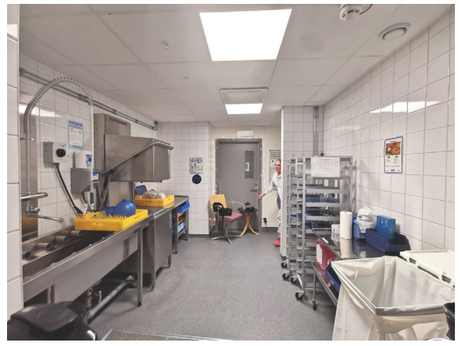
ADDITIONAL CASE STUDY VISITING PHOTO

01 DANDERYDS HOSPITAL, STOCKHOLM, SWEDEN



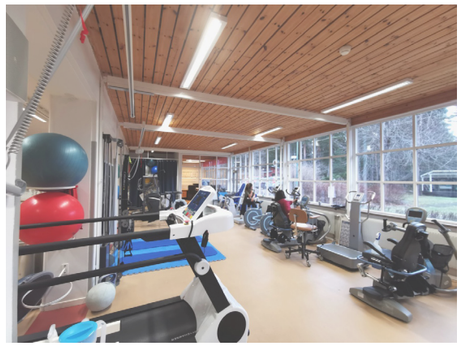




ADDITIONAL CASE STUDY VISITING PHOTO

02 MÄLARGÅRDEN REHAB CENTER, SIGTUNA, SWEDEN



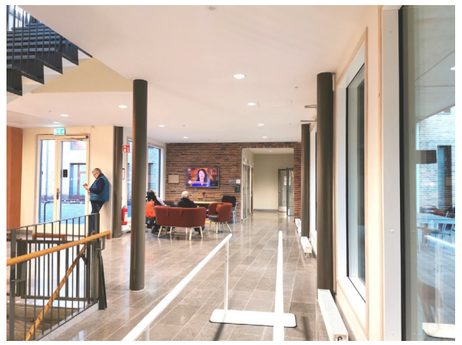


ADDITIONAL CASE STUDY VISITING PHOTO

03 REHAB STATION, SOLNA, SWEDEN





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