Ementor

Landspitali

# Functional Development Plan

04.10.2001

simplifies the future...

# Index

# 1. Introduction

Landspitali and Sjukrahus Reykjavikur have merged to one hospital: Landspitali University Hospital (LSH).

The new hospital is located in various building complexes in the Reykjavik area, where the two main locations are Hringbraut and Fossvogur. Other important locations are Vifilstadir, Kopavogur, Kleppur, Grensás and Landakot.

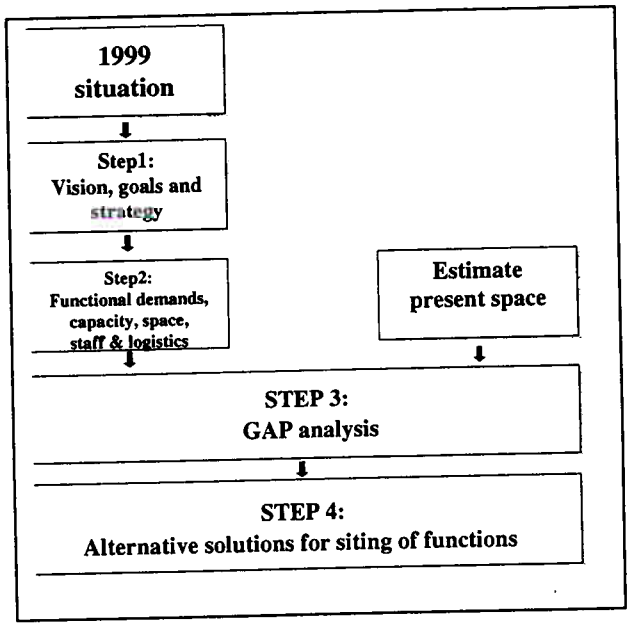
In order to create the framework for development of the new university hospital for Iceland, the Hospital Management has engaged Ementor Denmark A/S to assist in the process and to prepare a Functional Development Plan for LSH:

- A long-term (up to 2020) integrated plan for the functional development of the hospital, which supports the vision, goals and strategy of the hospital.
- A model for the physical infrastructure and logistical demands

Furthermore the plan must consider the future patient profile and patient volume of the hospital, the flow of the main processes (logistical demands), the capacity needed and the existing buildings (conditions and capacity).

Focus of the Functional Development Plan is the hospital sites at Hringbraut and Fossvogur, where the main functions are located. The locations at Vifilstadir, Grensás, Kopavogur, Kleppur and Landakot are also considered, because there might be an exchange of functions between the locations.

The planning process is described as follows:



As shown the project was carried out in four steps:

1. The first step was to describe vision and goals for the future hospital, and how this could end up into a strategy for the hospital functions, patient profile and patient volume.
2. An estimation of the staff needed as well as the future space needed (in 2001 and 2020).
3. A space gap analysis where the present space in the existing hospital buildings in Hringbraut and Fossvogur is compared to the future needed space (short-term gap for year 2001 and long-term gap for year 2020).
4. Alternative solutions for closing the gap and for localization of functions, short-term as well as in the long-term.

The planning process started in August 2000 with collection of data, interviewing of department leaders and visiting the hospital locations.

In October 2000 a strategic workshop was carried out, where the hospital management and department leaders participated. This functional development plan is based on the strategic direction pointed out as a result of the workshop.

The technical department in Hringbraut made an estimation of the present space in the existing buildings, and for Fossvogur the result from the previous planning was used. (The Functional Development Plan, developed by Ementor for SHR in 1999)

During the project we made an evaluation of the present building structure and logistics.

The analysis, conclusions and recommendations in this report are based on above and have during the project period been discussed by a number of occasions with the Steering Group, the Ministerial Committee and the Hospital Management.

# 2. Strategic statements

In the following some of the major strategic issues for the future hospital will be summarized, i.e. goals and strategies with respect to

- Location of functions
- Patient care models in the future
- Organizing the future emergency function

## 2.1. Location of functions

How to locate the clinical hospital functions giving the existing hospital complexes and the potential for building development is one of the main issues of the Functional Development Plan.

The further planning should be based on following strategic goals:

- Concentrate the acute care activities and expensive beds in Hringbraut and Fossvogur, and reduce the number of these beds to a minimum
- Increase the number of beds for rehabilitation, geriatrics and psychiatry outside Hringbraut and Fossvogur
- Exchange functions and beds between the location as follows:
  - Move acute neurology from Grensás to Hringbraut/Fossvogur
  - Move dermatology and venerology out from Vifilstadir/Dverholt
  - Move pulmonary and allergic diseases in from Vifilstadir to Hringbraut/Fossvogur
  - Move rehabilitation and long-term beds out of Hringbraut/Fossvogur
  - Move some geriatric beds out of Hringbraut/Fossvogur
- Use all Grensás for inpatient rehabilitation after inpatient stay in Hringbraut/Fossvogur and use Kopavogur for outpatient and day patient service

## 2.2. Patient care models in the future

To decrease the future need for hospital beds and to avoid a similar increase in costs, patient care will be transferred to more day and outpatient care than what is seen today.

- Transfer some of the inpatients to day care
  - Surgical patients: 25%
  - Medical patients: 20%
  - Psychiatric patients: 20%

- Transfer some of the inpatients to observation beds in the admission phase
  - Surgical patients: 20%
  - Medical patients: 30%
  - Psychiatric patients: 20%
- Transfer some of the inpatients to rehabilitation care and/or long-term care, which in practical term means an earlier discharge to rehabilitation/long-term care (step down unit principle)
  - Surgical patients: 20%
  - Medical patients: 25%
  - Psychiatric patients: 25%

Other suggestions are

- Establishment of a patient hotel on site of the main acute hospital
- Increase outpatient services
- Increase home health care services
- Reconsider the reimbursement system

## 2.3. Organizing the future emergency function

During the strategic planning process it has been discussed how to organize the emergency function of Landspitali in the future.

In principle there are only two main scenarios:

- One emergency function in one house, which means to have all acute admissions and most of the acute specialties in one house and to establish the elective services in the other house
- To establish an emergency function on both houses, which means to admit acute patients in both houses, but only trauma in one house

Clearly there is a preference in the management group for gathering all acute services in one house.

However, if you have to consider some likely criteria for development of a public service organization:

- To use the existing building where appropriate and to keep the investment cost at a reasonable level
- To create an environment where there is a potential for increased efficiency in operations

Then you must realize the following:

- Landspitali will have to stay with all major somatic functions in the two main complexes of today (Hringbraut and Fossvogur)

Giving above options there are only one possible solution with respect to emergency:

- You must split acute admission on the two houses, where you have
  - An emergency function for trauma in one of the houses (the ER-House)
  - And defined acute admissions in the other house (the Non-ER-House)

Giving the present buildings and present location of functions, the naturally solution is that Fossvogur serves as the ER-House – at least in the short-term - and Hringbraut as the Non-ER-House.

# 3. Present functionality, organization and logistics

## 3.1. Clinical specialties

The hospital has organized the clinical specialties into divisions. These are pediatrics, gynecology/obstetrics, internal medicine, surgery, geriatrics, rehabilitation and psychiatry. These specialties are all "owner of" the patients as inpatients, day patients or outpatient.

Most of the somatic specialties are located at Hringbraut and Fossvogur, and some are still located at both places: pediatrics, cardiology, general internal medicine, oncology, hematology, general surgery, orthopedics, urology, geriatrics and psychiatry.

Based on the interviews conducted with the department leaders we will in this chapter summarize the present situation (2000/2001) and the development trends for the specialties with respect to

- Present functions and location
- Organizational aspects and most important cooperation partners
- How to make care more efficient

At this time a number of changes are taken place, specialties are merged and will be moved around during the next year. These 1st steps in the creating a short-term solution are described later. (See chapter 14)

### 3.1.1. Pediatrics

Pediatrics consists of general pediatrics as well as neonatology and pediatric surgery (all surgical children).

Pediatric is located at both Hringbraut and Fossvogur, but neonatology only at Hringbraut.

Admission of children is taking place in both departments except for traumatic children who are admitted at the emergency in Fossvogur.

For the future pediatrics could be one department at one location, and the most important cooperation partners are obstetrics, orthopedics, ENT, neurosurgery and emergency.

A new children's hospital is planned at Hringbraut, which makes it naturally to gather all pediatrics there.

### 3.1.2. Gynecology-obstetrics

Gynecology-obstetrics is located at Hringbraut, and includes an IVF-function with 3-400 treatments per year, gynecologic oncology and a delivery unit with approx. 2,900 births per year.

The department has admittance of patients during daytime, and could reduce number of admitted patients with use of 3-4 observation beds.

The day care activity is rather big, especially with respect to day surgery, and the day activity could be expanded with a number of obstetric patients (observation patients) combined with 8-10 hotel beds.

The high day care activity can be explained by a small private sector in gynecology and no private sector in obstetrics.

The department cooperates with surgery, urology and clinical chemistry, and location at Hringbraut seems reasonable, together with the children hospital.

### 3.1.3. Internal medicine I

Internal medicine I includes general internal medicine, gastro-enterology, nephrology, endocrinology, pulmonology and allergic diseases, cardiology, rheumatology, infectious diseases, dermatology-venerology and neurology.

Most of these specialties are located both at Hringbraut and Fossvogur.

Improvement in efficiency can be obtained by more use of observation beds in the hospital, and by transferring patients to sub acute care, rehabilitation and nursing homes.

**General internal medicine** is located at both Hringbraut and Fossvogur, and includes at Fossvogur also gastro-enterology, nephrology, endocrinology and pulmonology. At Hringbraut the sub specialties are divided into sections.

**Gastro-enterology** is located at both hospitals today, and cover in-hospital services, outpatient clinics and gastrointestinal endoscopies.

The most important cooperation partners are gastrointestinal surgery, oncology, laboratory services and dieticians.

**Nephrology** is located at both hospital units, in Fossvogur as part of internal medicine. The hem dialysis function is located at Hringbraut, at Fossvogur only acute dialysis is performed in the intensive care unit.

It is not necessary with nephrology at both locations in the future, but a specialist must be available where emergency is located.

**Endocrinology** includes diabetes clinic, and is as such located at both Hringbraut and Fossvogur. In Fossvogur there is a lipid clinic and a bone density clinic.

Most of the inpatients are diabetes patients, but day and out patient clinics are of special importance to endocrinology.

**Pulmonology and allergic diseases** are located at Hringbraut, Vifilstadir and Fossvogur (as part of the internal medicine).

At Vifilstadir there are about 30 beds for pulmonology and an outpatient clinic for allergic diseases. There could be some increase in day care, but homecare could be even more efficient as a gatekeeper function.

**Cardiology** is located at Hringbraut and Fossvogur. Both locations have separated cardiac departments; each with heart observation units and a common "invasive" team with 2 invasive labs in Hringbraut and 1 planned at Fossvogur.

Cardiology must be represented at both locations and close to emergency. However, pre hospital identification of acute cardiac/thoracic patients is possible, and a heart/lung center - also for admission - might be a solution.

For the future patient hotel and step-down care will be of increasing importance, and number of inpatients will decrease accordingly.

**Rheumatology** is located at Hringbraut together with the nephrology ward. The specialty includes a clinic for bone density, a function also located at Fossvogur. At Fossvogur there is a rheumatologic consultant. There is a center for rheumatologic research at Hringbraut.

Most of the patients are elective.

Rheumatology cooperates with infectious diseases, hematology, immunology and rehabilitation at Grensás.

There should only be one department with localization at Hringbraut, but with a consultant at Fossvogur.

**Infectious diseases** are located at both hospitals, have beds for isolation and outpatient clinic for hepatitis and HIV patients.

An important cooperation partner is the laboratory services.

The specialty should be gathered in one department.

**Dermatology and venerology** is located at Vifilstadir with 12 beds, and with outpatient services at Hringbraut. Surgery is performed at Hringbraut, and at present the specialty has access to some beds in Hringbraut.

**Neurology** is located at Hringbraut and Grensás. The department also includes Neurophysiology, located in Hringbraut and Grensás.

Acute admission (mostly stroke patients) is taking place at the emergency departments in Hringbraut and Fossvogur, and the Fossvogur patients are transferred to the stroke unit Grensás.

The most important cooperation partners are emergency and rehabilitation. There should only be one department for neurology, located together with the emergency.

### 3.1.4. Internal medicine II

Internal medicine II covers the specialties oncology and hematology as well as radiation therapy and physics.

Oncology and hematology are located at both Hringbraut and Fossvogur, and a hospice function for terminal cancer patients is located in Kopavogur.

In Hringbraut oncology and hematology are separated departments, where oncology includes radiation therapy and hematology includes a laboratory.

In Fossvogur oncology and hematology are part of internal medicine.

Both units in Hringbraut and Fossvogur are rather small in numbers of patients and staff, and could benefit from gathering of functions, for instance for further sub specialization.

Oncology and hematology cooperate with most of the other specialties, but do not need to be located in the same hospital site as emergency.

### 3.1.5. Surgery

Surgery covers the specialties general surgery, vascular surgery, urology, plastic surgery, orthopedics, thoracic surgery, neurosurgery, ophthalmology and ENT.

Vascular surgery, neurosurgery and ENT are only located at Fossvogur, and thoracic surgery and plastic surgery only at Hringbraut. General surgery, orthopedics and urology are located at both hospital sites.

**General surgery** is located at both hospital sites. Fossvogur has the majority of the accidental surgery due to emergency.

For the future it is important to locate general surgery together with emergency. If necessary, one could split acute and elective surgery on the two hospital sites.

An elective surgery unit (day and short-term surgery) for more specialties could be a viable solution.

**Vascular surgery** has on 1.3.2000 moved to Fossvogur, and is sharing a ward together with geriatrics. The specialty moved to Fossvogur due to the high ratio of emergency patients in vascular surgery.

Most important cooperation partners are intensive care unit and the operating theatres, and the specialty needs access to rehabilitation. Another important cooperation partner is cardiac surgery.

There is a very little outpatient activity; all patients are diagnosed in private practices before admission to hospital.

**Urology** is located in both hospital sites, with the stone lab at Hringbraut. Fossvogur has an in-patient unit, a day unit, operating rooms and urodynamic laboratory. Almost half of the patients in Fossvogur are treated with day care, and the length of stay has been reduced over the years.

At Hringbraut, however, there are no outpatients and day patients.

This may be due to the reimbursement system, in Fossvogur the doctors are paid for outpatients and day patients, but in Hringbraut they are not.

Important cooperation partners are nephrology and dialysis, general surgery, vascular surgery orthopedics and geriatrics.

Rather few patients are emergency patients, approx. 15%. A united Urology department does not have to be located at the same hospital site as emergency.

**Plastic surgery** is located at Hringbraut, and perform reconstruction after cancer, traumas etc. A burn unit was established some years ago, but now closed down, and the patients moved to intensive care unit.

Plastic surgery has beds in the urology ward. The specialty has no specific demands about localization.

**Orthopedics** is located at both hospital sites, where the more acute patients (hot orthopedics) are admitted at Fossvogur and the elective patients (cold orthopedics) at Hringbraut.

All smaller surgery is performed in the private sector, and the patients are diagnosed in the private sector too.

The ideal solution would be one department in one building, and to separate acute and elective patients, both in wards and in operating theatres. The elective ward could be located together with geriatrics.

Important cooperation partners are geriatrics, cardiology and pulmonology, rehabilitation and plastic surgery.

**Thoracic/cardiac surgery** is located at Hringbraut, and the department is performing all cardiac surgery except transplantations, most child surgery and lung surgery.

The patients are diagnosed in cardiology, and there is a long waiting time for diagnosis, as well as for surgery.

Important cooperation partners are the intensive care unit and rehabilitation.

Thoracic/cardiac surgery should be located in the same building as trauma, cardiology and neurosurgery.

**Neurosurgery** is located at Fossvogur together with emergency. Due to head traumas proximity to pediatrics is important.

**Ophthalmology** is located at Hringbraut in a separate building. There is a big outpatient and day patient activity. The specialty has no specific demands for location together with other specialties.

**ENT** is located in Fossvogur, with a specialist in Hringbraut. Important cooperation partners are pediatrics and neurology. Also important is cooperation with emergency about face traumas.

All smaller cases are treated in the private sector, day surgery is decreasing, and the services are moved to the private sector. Only the heavy cases remain in the hospital.

### 3.1.6. Geriatrics

Geriatrics is located at Hringbraut, Fossvogur and Landakot.

Geriatric specialists and some bed capacity are important for the acute hospital function and for many of the specialties there.

We suggest gathering the geriatric patients in one location with one ward, and with a consultancy service in the other location.

The geriatric ward can be located in Hringbraut or Fossvogur. The services at Landakot remain unchanged.

### 3.1.7. Rehabilitation

Rehabilitation is today located mainly at Grensás, and some in Fossvogur. Access to rehabilitation is of increasing importance for many of the specialties, in order to discharge patients and to improve efficiency of inpatient care.

We suggest to move rehabilitation beds out of Fossvogur, and to establish the necessary bed capacity for this activity outside Hringbraut and Fossvogur.

We suggest using the facilities in Grensás and Kopavogur for rehabilitation as follows:

- Use all Grensás for inpatient rehabilitation after inpatient stay in Hringbraut and Fossvogur by
  - Moving neurology out of Grensás to either Hringbraut or Fossvogur and
  - Moving outpatient and day patient services from Grensás to Kopavogur.
- Use Kopavogur for outpatient and day patient services. (The hospice remains unchanged)

### 3.1.8. Psychiatry

Acute psychiatry is located mainly at Hringbraut, but also in Fossvogur and at Kleppur. Aftercare, rehabilitation and long-term care are provided at Kleppur, Arnarholti, Vífilstaðir, Gunnarsholti and several other locations within Reykjavik.

For the future the aim is to move all acute beds out of Kleppur to Hringbraut.

Psychiatric services include emergency assessments, liaison work, outpatient care, day patient care, inpatient care, rehabilitation, psychometric assessments, occupational therapy and input from social workers within the Department.

The most important co-operation partners within the Hospital include Emergency services, the various Internal Medicine Departments, Child and Adolescent services, as well as geriatric Medicine and Rehabilitation Departments of Landspitali. Outside the Hospital important agencies include General Practitioners, rehabilitation centres, social services, users associations and the Police.

Options to enhance efficiency include home-based nursing care, access to emergency day-hospital beds and home visits the day after emergency attendances. These options go hand in hand with recent reinforcement of our emergency and outpatient services in order to endeavor to reduce inpatient stay as much as possible.

## 3.2. Clinical functions

The hospital has organized the clinical functions into divisions like emergency, anesthetics/intensive care/operation, clinical services, laboratory services and physiotherapy.

The present distribution of these functions at the locations at Hringbraut, Fossvogur, Vifilstadir, Grensás, Kopavogur and Landakot are shown at the table below.

Most of the functions are located at both Hringbraut and Fossvogur, and some at the other locations.

### 3.2.1. Emergency

Emergency is located at both Hringbraut and Fossvogur, and the two locations share the admission responsibility. At both locations there are an observation unit for observation, diagnosis and short-term treatment of emergency patients.

Acute admission for pediatrics, obstetrics and psychiatry is taking place in the departments at Hringbraut.

Traumatology is only located at Fossvogur. However, thoracic/cardiac traumas and burn patients are admitted at Hringbraut.

How to organize the emergency function is one of the main issues for the Functional Development Plan, and it has already been decided to keep the emergency (traumatology) at Fossvogur at least in the short-term, and to admit acute patients in both Hringbraut and Fossvogur.

### 3.2.2. Anesthetics/intensive care/operation

Anesthetics, intensive care, operation and sterilization are located at both Hringbraut and Fossvogur as service functions for all the specialties. This situation will remain unchanged.

### 3.2.3. Clinical services

**X-ray services** are located at both Hringbraut and Fossvogur as service functions for the specialties. This situation will remain unchanged. Depending on the final distribution of the specialties it might have some consequences for the distribution of examination rooms.

**Pathology** is located at Hringbraut and the function should be seen in connection with the other laboratory functions.

**Pharmacy** is located at both hospital sites today, and it should be considered only to have one pharmacy or getting the pharmaceuticals from an external pharmacy or directly from the suppliers.

**Record rooms** should not be necessary in the future, as electronic medical records are almost ready, and eventually paper filing could be in any location.

### 3.2.4. Laboratory services

Blood bank is located at Hringbraut and laboratories for clinical chemistry and clinical microbiology are located at both Hringbraut and Fossvogur. Some laboratory functions are also located at Armuli.

We suggest only having one laboratory in the future. This laboratory should be organized together with pathology, and location could be in any of the hospital sites or eventually outside the hospital.

### 3.2.5. Physiotherapy

Physiotherapy, including occupational therapy, is located in both Hringbraut and Fossvogur as well as in Grensás, Kopavogur and Landakot.

The tasks for this service is to support the clinical specialties with therapy in the acute phase during inpatient treatment, and thereafter therapy to support the more long-term rehabilitation after surgery, stroke, trauma etc.

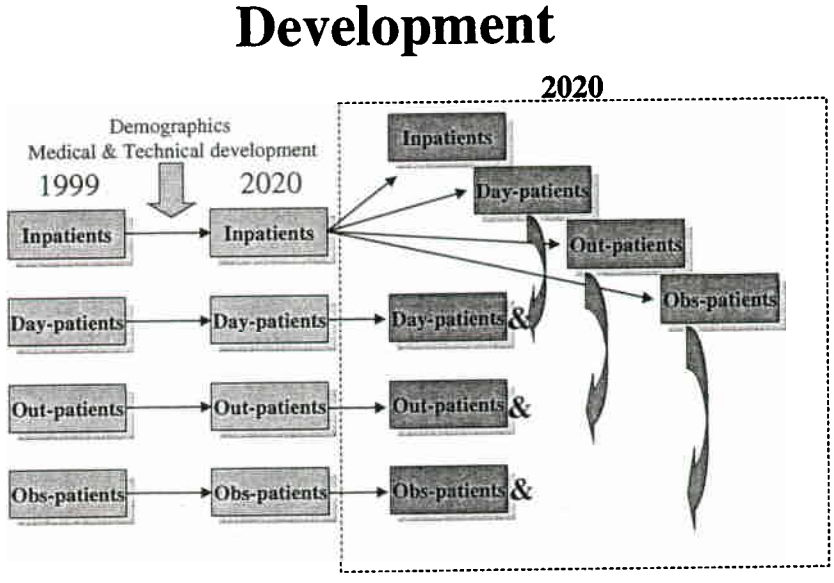
Physiotherapy and occupational therapy is therefore an integrated service and should be served mainly in the wards of the acute hospital and only in fewer cases in a central therapy.

In rehabilitation departments the physiotherapy can be performed in more centralized training departments, swimming pools etc.

# 4. Patient Profile and Volume

In this chapter we describe how the future patient profile and volume for Landspitali up to year 2020 is estimated.

The following illustration shows the extrapolation in two steps.




Step one is a simple extrapolation due to the demographic development. The fact that more and more citizens move into Reykjavik as well as the general population development has been taken into account (36% for somatic and 11% for psychiatry). Development as to a higher number of elderly people in the population has not been taken into account.

Step two is a more advanced extrapolation where the inpatients are moved to a lower grade of care (from bed to chair).

We base this recommendation on the trends that are seen in the Scandinavian hospitals – and other European hospitals – where patients are transferred from in-patient care to day care and/or outpatient care.

We also recommend that some of the long-term patients be moved out of the two buildings into other houses e.g. Kopavogur in order to let these buildings contain only acute functions.

In Appendix 1 and 2 of this report the updated version of both steps in the extrapolation is shown.

Some of the figures have been further qualified. The differences in the calculations is as follows:

- One inpatient now is converted into an average of 1,5 day patient + 1 out patient visit (previously 2 day pat. and one out pat.)
- An observation patients has a LOS of 1,5 bed days (previously 2 bed days).

We recommend that an observation unit as seen in both Hringbraut and Fossvogi today – also in the future will be used as a "gate keeper" function for the wards.

We recommend that this unit be enlarged in order to prevent a lager number of patients from being admitted to the traditional wards and to ensure a quicker diagnostic and treatment services.

In the following calculations we look at the collective patient volume in the two complexes Hringbraut (incl. Eriksgata and Torfinnsgata) and Fossvogur.

The suggested movements of specialties have also been taken into account. This means that we now refer to a total Hringbraut & Fossvogur

- Incl. acute neurology, dermatology, venerology, pulmonology, and allergic diseases
- Exc. rehabilitation and long-term beds and long-term geriatrics

## 4.1. Inpatients 2020

Ementor recommend increasing day and outpatient care, as well as observation care, and at the same time reducing number of in-patients in the different sub-specialties as follows

| Division | | Admissions 2020 simp.ex | Transferred to Day care | | Transferred to Obs. Unit | | Remaining admissions [4] |
|---|---|---|---|---|---|---|---|
| | General pediatrics | 3309 | 662 | 20% | 993 | 30% | 1654 |
| | Neonatology | 510 | 0 | 0% | 0 | 0% | 510 |
| | Pediatric surgery | 1635 | 409 | 25% | 327 | 20% | 899 |
| **Total pediatrics** | | **5453** | **1070** | **20%** | **1320** | **24%** | **3063** |
| | Obstetrics | 4948 | 1237 | 25% | 990 | 20% | 2721 |
| | Gynecology | 1417 | 354 | 25% | 283 | 20% | 779 |
| **Total gyn/obs** | | **6364** | **1591** | **25%** | **1273** | **20%** | **3500** |
| | Gen. int. medicine | 900 | 180 | 20% | 270 | 30% | 450 |
| | Gastroenterology | 801 | 160 | 20% | 240 | 30% | 401 |
| | Dermatology [1] | 229 | 46 | 20% | 0 | 0% | 183 |
| | Cardiology | 4000 | 800 | 20% | 1200 | 30% | 2000 |
| | Rheumatology | 1003 | 201 | 20% | 301 | 30% | 502 |
| | Nephrology | 195 | 39 | 20% | 59 | 30% | 98 |
| | Pulmonary & allergical dis. [1] | 2334 | 467 | 20% | 700 | 30% | 1167 |
| | Endocrinology | 190 | 38 | 20% | 57 | 30% | 95 |
| | Infection | 968 | 0 | 0% | 290 | 30% | 678 |
| | Neurology [2] | 1248 | 250 | 20% | 0 | 0% | 999 |
| **Total Internal medicine I** | | **11869** | **2180** | **18%** | **3118** | **26%** | **6571** |
| | Oncology + Hematology | 1486 | 297 | 20% | 0 | 0% | 1189 |
| **Total Internal medicine II** | | **1486** | **297** | **20%** | **0** | **0%** | **1189** |
| | Gen. surgery | 3922 | 980 | 25% | 784 | 20% | 2157 |
| | Vascular | 336 | 0 | 0% | 0 | 0% | 336 |
| | Urology | 1495 | 374 | 25% | 299 | 20% | 822 |
| | Plastic surgery | 328 | 82 | 25% | 0 | 0% | 246 |
| | Ophthalmology | 305 | 76 | 25% | 0 | 0% | 229 |
| | Orthopedics | 2649 | 662 | 25% | 530 | 20% | 1457 |
| | ENT | 1160 | 290 | 25% | 0 | 0% | 870 |
| | Neurosurgery | 1282 | 0 | 0% | 256 | 20% | 1026 |
| | Thoracic surgery | 455 | 0 | 0% | 0 | 0% | 455 |
| **Total surgery** | | **11933** | **2465** | **21%** | **1870** | **16%** | **7599** |
| | Geriatrics | 558 | | | | | 558 |
| **TOTAL SOMATIC** | | **37664** | **7604** | **20%** | **7580** | **20%** | **22481** |
| **PSYCHIATRY** | | 1567 | 313 | 20% | 313 | 20% | 940 |
| ***GRAND TOTAL*** | | **39231** | **7917** | **20%** | **7893** | **20%** | **23421** |

[1] Inclusive today's numbers from Vífilsstaðir/Þverholt
[2] Inclusive today's numbers from Grensas
[3] These patients will get their LOS reduced with 3 as they are transferred to units outside F&H
[4] Admissions from simple extrapolation minus the ones transferred to day care unit and to observation unit.

## 4.2. LOS 2020

As for the length of stay (LOS), the future conditions can be calculated in various ways. We chose to let the future LOS to be determined by the house with the best practice. This means that we have used the lowest LOS of the specialties that today is located in both complexes.

For those specialties that are located in one place the LOS has been used directly, except for geriatrics where a maximum LOS of 14 days is recommended. Since this is an acute hospital we find it reasonable that patients admitted longer than 14 day are transferred to other locations. Please see appendix 1, page 1 – LOS marked with green color.

The groups of patients transferred to day care/out patient clinic and the observation unit are more "light" in the sense of length of stay. This means that a new LOS for 2020 will have to be longer than the ones of today.

To see the calculation for LOS 2020, please see at appendix 2, page 4 and 5 or the above table.

## 4.3. Day patients 2020

At the same time as the number of inpatients decreases the total number of appearances of day patients will increase. In the following table the future total number of day patients in 2020 is shown.

| Division | Day-patients | | | |
|---|---|---|---|---|
| | Appearances 1999 | Increase in app 2020 - simp.ex. | Increase in appearances from inpatients | Day patient appearances 2020 |
| General pediatrics [1] | 1.908 | 678 | 993 | 3.579 |
| Neonatology | 0 | 0 | 0 | 0 |
| Pediatric surgery | 0 | 0 | 613 | 613 |
| **Total pediatrics** | **1.908** | **678** | 1.606 | **4.192** |
| Obstetrics | 5.976 | 2.125 | 1.855 | 9.956 |
| Gynecology | 2.186 | 777 | 531 | 3.494 |
| **Total gyn/obs** | **8.162** | **2.902** | 2.387 | **13.451** |
| Gen. int. medicine | 1.051 | 374 | 270 | 1.695 |
| Gastroenterology | 115 | 41 | 240 | 396 |
| Dermatology | 0 | 0 | 69 | 69 |
| Cardiology | 766 | 272 | 1.200 | 2.238 |
| Rheumatology | 81 | 29 | 301 | 411 |
| Nephrology | 3.631 | 1.291 | 59 | 4.981 |
| Pulmonary & allergical dis. | 146 | 52 | 700 | 898 |
| Endocrinology | 8 | 3 | 57 | 68 |
| Infection | 20 | 7 | 0 | 27 |
| Neurology | 7 | 2 | 375 | 384 |
| **Total Internal medicine I** | **5.825** | **2.071** | **3.270** | **11.167** |
| Oncology + Hematology | 2.530 | 900 | 446 | 3.875 |
| **Total Internal medicine II** | **2.530** | **900** | **446** | **3.875** |
| Gen. surgery | 550 | 196 | 1.471 | 2.216 |
| Vascular | 0 | 0 | 0 | 0 |
| Urology | 231 | 82 | 561 | 874 |
| Plastic surgery | 11 | 4 | 123 | 138 |
| Ophthalmology | 1.116 | 397 | 114 | 1.627 |
| Orthopedics | 238 | 85 | 993 | 1.316 |
| ENT | 440 | 156 | 435 | 1.032 |
| Neurosurgery | 0 | 0 | 0 | 0 |
| Thoracic surgery | 8 | 3 | 0 | 11 |
| Re-visit from ER [1] | 0 | 0 | 0 | 0 |
| **Total surgery** | **2.594** | **922** | **3.697** | **7.213** |
| Geriatrics | 0 | 0 | 0 | 0 |
| Rehabilitation / long term | 0 | 0 | 0 | 0 |
| **Total medicine** | **8.355** | **2.971** | **3.716** | **15.042** |
| **SOMATIC** | **21.019** | **7.474** | **11.406** | **39.898** |
| **PSYCHIATRY** | 6.045 | 690 | 3.133 | **9.868** |
| **GRAND TOTAL** | **27.064** | **8.164** | **14.539** | **49.766** |

For all inpatients transferred to day care we have calculated 1½ appearance per patient.

## 4.4. Outpatients 2005

At the same time as the numbers of inpatient decreases and the number of day patients increases, the total number of visits to the out patient clinic will increase. In the following table the future total number of out patients in 2020 is shown.

| Division | | Outpatient clinic | | | |
|---|---|---|---|---|---|
| | | Outpat. clinic visit 1999 | Increase of outpatient visits simp.ex | Increase due to increase in day patients | Outpat. clinic visits 2020 |
| | General pediatrics [1] | 11.536 | 4.102 | 496 | 16.134 |
| | Neonatology | | 0 | 0 | 0 |
| | Pediatric surgery | | 0 | 307 | 307 |
| **Total pediatrics** | | **11.536** | **4.102** | **803** | **16.441** |
| | Obstetrics | 14.271 | 5.074 | 928 | 20.273 |
| | Gynecology | 5.480 | 1.948 | 266 | 7.694 |
| **Total gyn/obs** | | **19.751** | **7.023** | **1.193** | **27.967** |
| | Gen. int. medicine | 8.884 | 3.159 | 135 | 12.178 |
| | Gastroenterology | 3.860 | 1.372 | 120 | 5.353 |
| | Dermatology | 21.126 | 7.512 | 34 | 28.672 |
| | Cardiology | 19.075 | 6.782 | 600 | 26.457 |
| | Rheumatology | 225 | 80 | 150 | 455 |
| | Nephrology | 0 | 0 | 29 | 29 |
| | Pulmonary & allergical dis. | 2.621 | 932 | 350 | 3.903 |
| | Endocrinology | 4.928 | 1.752 | 28 | 6.709 |
| | Infection | 639 | 227 | 0 | 866 |
| | Neurology | 2.452 | 872 | 187 | 3.511 |
| **Total Internal medicine I** | | **63.810** | **22.688** | **1.635** | **88.133** |
| | Oncology + Hematology | 14.895 | 5.296 | 223 | 20.414 |
| **Total Internal medicine II** | | **14.895** | **5.296** | **223** | **20.414** |
| | Gen. surgery | 3.508 | 1.247 | 735 | 5.491 |
| | Vascular | 0 | 0 | 0 | 0 |
| | Urology | 4.270 | 1.518 | 280 | 6.069 |
| | Plastic surgery | 0 | 0 | 62 | 62 |
| | Ophthalmology | 4.223 | 1.502 | 57 | 5.782 |
| | Orthopedics | 9.054 | 3.219 | 497 | 12.770 |
| | ENT | 8.405 | 2.988 | 218 | 11.611 |
| | Neurosurgery | 91 | 32 | 0 | 123 |
| | Thoracic surgery | 0 | 0 | 0 | 0 |
| | Re-visit from ER [1] | 14.406 | 5.122 | 0 | 19.528 |
| **Total surgery** | | **43.957** | **15.629** | **1.849** | **61.435** |
| | Geriatrics | 0 | 0 | 0 | 0 |
| | Rehabilitation / long term | 0 | 0 | 0 | 0 |
| **Total medicine** | | **54.202** | **19.272** | **1.858** | **75.332** |
| **SOMATIC** | | **153.949** | **54.738** | **5.703** | **214.390** |
| **PSYCHIATRY** | | 20.059 | 2.290 | 1.567 | 23.915 |
| **GRAND TOTAL** | | **174.008** | **57.028** | **7.269** | **238.305** |

This table is exclusive of the first visit of emergency patients. Ementor have suggested that the revisits from ER were moved out of the hospital into the primary health care system, but this option has been evaluated to be impossible at the present time.

## 4.5. Summery of patient transfer

The present way of financing the health care system in Iceland does actually not support this transfer from inpatient to day patient status.

But due to our experiences from other countries, e.g. as mentioned Norway, where the same complex of problems is known, Ementor will maintain the above stated suggestions as a way of "stressing" the system in order to persuade the financial system to follow.

In order to show the total ratio of transfers the following illustration shows the figures in a total.

**Transfer of patients from 1999 to 2020.**

| | 1999 | 2020 | Difference | Differnce in % |
|---|---|---|---|---|
| Inpatients | 29.191 | 23.421 | -5.770 | -24,6% |
| LOS | 5,7 | 7,1 | 1,4 | 19,9% |
| Beddays | 166.561 | 166.871 | 310 | 0,2% |
| *Observation pat.* | *4.800* | *14.421* | *9.621* | *66,7%* |
| | | | | |
| In pat + Obs pat. | 33.991 | 37.842 | 3851 | 10,2% |
| Beddays incl obs pat. | 171.361 | 188.502 | 17141 | 9,1% |
| LOS incl. obs pat. | 5,0 | 5,0 | -0,1 | -1,2% |
| | | | | |
| Day patients appear. | 27.064 | 49.766 | 22.702 | 45,6% |
| | | | | |
| Out pat. visits | 174.008 | 238.305 | 64.297 | 27,0% |
| *Normal* | *159.602* | *218.777* | *59.175* | *27,0%* |
| *Re-visits* | *14.406* | *19.528* | *5.122* | *26,2%* |

# 5. Estimation of the Staff volume 2020

In this chapter the analysis and calculations for an estimation of the future staff volume for year 2020 will be stated.

The used staff model will be described using the present staff volume and activities to calculate the future staff needed based on the future activities as described in chapter 4 above.

## 5.1. The staffing model

### 5.1.1. Input to the model

The input for the model can be split into three areas: Activity data (patients), the present staff data and preconditions for the standards used in the model.

- The activity data is based on the present patient data from LSH in 1999 and the extrapolated figures for Landspitali in 2020 (appendix 2).
  - The patient activity data includes number of inpatients and bed days, number of day patients, observation patients, and number of visits to the outpatient clinics. In addition to this the number of diagnostic imaging examinations.
- Staff volume from 1999 for both Hringbraut and Fossvogur (appendix 3 plus a few later corrections). The data in the model have been divided into doctors including one department director for each department and other staff including the other director of that department. The figures have been provided by the HR function of Landspitali.
- The preconditions for the calculation are based on re-estimated bed days and admissions in 1999. The estimations are:
  - Day patients and observation patients are recalculated into admissions with a factor 1/3 admission
  - Outpatient clinic visits are recalculated into admissions with a factor 1/12 admission
  - Day patients and observation patients are recalculated into bed days with a factor 2 bed days
  - Outpatient clinic visits are recalculated into bed days with a factor ½ bed day

### 5.1.2. Calculations in the model

From the input data the model will calculate the re-estimated number of admissions and bed days for each department and as a total. In addition a number of productivity data is calculated, e.g. inpatients/bed day per employee in each department, this is use to estimate some key figures.

By choosing a set of productivity standards for 2020 and feeding the model with the extrapolated figures for 2020 it will calculate an estimate of the future staff volume for 2020. The suggested number of staff for 2020 can be evaluated by comparing it for similar departments with those of 1999.

In the model two alternatives for calculating the future staff in 2020 is shown.

- Model A: a calculation of the future staff volume based on unchanged productivity standards in 2020 compare to 1999, e.g. one doctor treats as many patients as today.
- Model B: a calculation of the future staff volume based on a higher productivity in the clinical functions. The calculation is based on a simple comparison to a number of other hospitals in the Scandinavian region. Further more the merger between Reykjavik Hospital and the previous Landspitali is bound to reduce some of the overlapping functions e.g. in the service departments.

For both alternatives it is important to look at this, as an overall calculation thus the future staff volume should not be considered as "correct" for at each department.

In the following the two calculations are described.

## 5.2. Clinical functions

The doctors' work is dependent on how many patients he and her have to treat and this goes for both inpatients, day patients and outpatients. For all other staff groups (which mainly is nurses and secretaries) will workload will be more dependent on the length of stay (number of bed days).

For the clinical departments the model will calculate

- The total number of weighted patients per doctor in 1999 and weighted bed days per other employee in 1999.

### 5.2.1. Model A – unchanged productivity

In model A we use the same productivity-standards in 2020 as in 1999. On the basis of the number of weighted patients and bed days in the clinical departments the model will calculate the new number of employees for 2020.

We assume that there in 1999 was collective staff of Fossvogur and Hringbraut of 241 FTE doctors and 739 FTE others for the somatic clinical functions. For psychiatry there was 39 doctors and 70 others.

In model A (with unchanged productivity) the model will calculate a need for 325 doctors (271 for somatic and 54 for psychiatry) in year 2020. Equally a total of 1.046 others is calculated.

### 5.2.2. Model B – improved productivity

In model B standards for 1999 has been benchmarked with other somatic departments in Scandinavia, mostly Norway and one hospital in Denmark.

The four hospitals that are included in the benchmarking is as follows:

- Sentral Sykehuset i Akershus (SIA) 1999
- Sykehuset Østfold (Østfold) 1999
- Telemark Sentralsykehus (Telemark) 1998
- Kolding Sygehus (Kolding) 1999/2000
- Nordland Sentralsykehus (Nordland) 1998
- Sentral Sykehuset i Vest-Agder (Vest-Agder) 1999
- Sentralsykehuset i Rogaland (SIR) 1999
- Regionssykehuset i Trondheim (RIT2000) 1999

In the tables below the result of this benchmarking is shown. Best-practice for each specialty is marked with yellow. Please note that it has been necessary to look at some of the specialties in a more overall manner in order to make the data more comparable. This also indicates that this method only can give us some indications for where to look for improvements in the matter of staff efficiency. It is thus not to be considered as an exact calculation per department.

Benchmarking of weighted patients per doctor and weighted bed days per other staff

| Benchmarking - standard staff | Weighted patients per doctor | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | LSH | SiA | Østfold | Telemark | Kolding | Nordland | Vest-Agder | SIR | RIT 2000 |
| Total medicine | 188 | 220 | 241 | 186 | 242 | 145 | 259 | 192 | 254 |
| Total surgery | 155 | 162 | 214 | 195 | 195 | 232 | 265 | 198 | 248 |
| Gynecology/obstetrics | 472 | 437 | 303 | 353 | 190 | 250 | 407 | 370 | 317 |
| Pediatrics | 186 | 144 | 191 | 271 | 183 | 158 | 274 | 194 | 158 |
| Opthalmology | 89 | - | 317 | - | - | 282 | 212 | 246 | 202 |
| Psychiatry | 128 | - | 109 | 53 | - | | 160 | - | - |

| Benchmarking - standard staff | Weighted bed days per other staff | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | LSH | SiA | Østfold | Telemark | Kolding | Nordland | Vest-Agder | SIR | RIT 2000 |
| Total medicine | 529 | 188 | 327 | 237 | 368 | 238 | 373 | 249 | 377 |
| Total surgery | 255 | 251 | 301 | 281 | 320 | 258 | 333 | 313 | 398 |
| Gynecology/obstetrics | 337 | 207 | 285 | - | 276 | 240 | 256 | 286 | 231 |
| Pediatrics | 273 | 156 | 266 | 228 | 181 | 137 | 205 | 178 | 148 |
| Opthalmology | 277 | - | 469 | - | - | 296 | 711 | 709 | 452 |
| Psychiatry | 631 | - | 196 | - | - | | 242 | - | - |

Benchmarking of inpatients per doctor and per other staff

| Benchmarking - standard staff | Inpatients per doctor | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | LSH | SiA | Østfold | Telemark | Kolding | Nordland | Vest-Agder | SIR | RIT 2000 |
| Total medicine | 100 | 162 | 176 | 133 | 169 | 112 | 195 | 169 | 167 |
| Total surgery | 109 | 118 | 149 | 143 | 133 | 160 | 189 | 144 | 181 |
| Gynecology/obstetrics | 247 | 331 | 221 | 278 | 140 | 189 | 298 | 286 | 230 |
| Pediatrics | 134 | 110 | 155 | 209 | 150 | 135 | 248 | 164 | 121 |
| Opthalmology | 21 | - | 62 | - | - | 110 | 75 | 50 | 86 |
| Psychiatry | 36 | - | 42 | 53 | - | | 57 | - | - |

| Benchmarking - standard staff | Inpatients per other staff | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | LSH | SiA | Østfold | Telemark | Kolding | Nordland | Vest-Agder | SIR | RIT 2000 |
| Total medicine | 45 | 25 | 40 | 25 | 37 | 26 | 47 | 38 | 34 |
| Total surgery | 32 | 33 | 38 | 41 | 37 | 34 | 45 | 34 | 48 |
| Gynecology/obstetrics | 38 | 36 | 44 | 34 | 42 | 36 | 37 | 39 | 33 |
| Pediatrics | 40 | 18 | 40 | 38 | 28 | 21 | 34 | 25 | 18 |
| Opthalmology | 12 | - | 17 | - | - | 24 | 49 | 25 | 32 |
| Psychiatry | 20 | - | 4 | 3 | - | | 4 | - | - |

Benchmarking of day patients per doctor and per other staff

| Benchmarking - standard staff | Day care per doctor | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | LSH | SiA | Østfold | Telemark | Kolding | Nordland | Vest-Agder | SIR | RIT 2000 |
| Total medicine | 82 | 92 | 52 | 62 | 132 | 21 | 54 | - | - |
| Total surgery | 19 | 54 | 47 | 22 | 67 | 40 | 48 | 35 | 38 |
| Gynecology/obstetrics | 430 | 87 | 49 | 88 | 24 | 51 | 98 | 52 | - |
| Pediatrics | 64 | 25 | 13 | 109 | - | 2 | - | 1 | - |
| Opthalmology | 106 | - | 389 | - | - | 297 | 83 | 194 | 135 |
| Psychiatry | 155 | - | 149 | - | - | | 144 | - | - |

| Benchmarking - standard staff | Day care per staff | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | LSH | SiA | Østfold | Telemark | Kolding | Nordland | Vest-Agder | SIR | RIT 2000 |
| Total medicine | 36 | 14 | 12 | 12 | 29 | 5 | 13 | - | - |
| Total surgery | 6 | 15 | 12 | 6 | 19 | 9 | 12 | 8 | 10 |
| Gynecology/obstetrics | 67 | 10 | 10 | 11 | 7 | 10 | 12 | 7 | - |
| Pediatrics | 19 | 4 | 3 | 20 | - | - | - | - | - |
| Opthalmology | 59 | - | 106 | - | - | 65 | 54 | 97 | 51 |
| Psychiatry | 86 | - | 14 | - | - | | 11 | - | - |

Benchmarking of outpatient visits per doctor and per other staff

| Benchmarking - standard staff | Outpatient clinic per doctor | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | LSH | SiA | Østfold | Telemark | Kolding | Nordland | Vest-Agder | SIR | RIT 2000 |
| Total medicine | 768 | 345 | 524 | 412 | 363 | 318 | 577 | 285 | 1081 |
| Total surgery | 503 | 337 | 568 | 568 | 495 | 735 | 740 | 539 | 678 |
| Gynecology/obstetrics | 1040 | 973 | 816 | 567 | 527 | 552 | 963 | 826 | 1083 |
| Pediatrics | 385 | 315 | 394 | 322 | 409 | 271 | 329 | 376 | 457 |
| Opthalmology | 402 | - | 1593 | - | - | 936 | 1377 | 1653 | 902 |
| Psychiatry | 514 | - | 224 | - | - | | 700 | - | - |

| Benchmarking - standard staff | Outpatient clinic per other staff | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | LSH | SiA | Østfold | Telemark | Kolding | Nordland | Vest-Agder | SIR | RIT 2000 |
| Total medicine | 342 | 53 | 119 | 79 | 80 | 73 | 140 | 64 | 218 |
| Total surgery | 149 | 95 | 147 | 164 | 139 | 158 | 176 | 128 | 178 |
| Gynecology/obstetrics | 162 | 107 | 162 | 68 | 159 | 105 | 120 | 113 | 155 |
| Pediatrics | 114 | 52 | 102 | 59 | 76 | 41 | 45 | 56 | 70 |
| Opthalmology | 222 | - | 434 | - | - | 204 | 893 | 827 | 339 |
| Psychiatry | 287 | - | 22 | - | - | | 53 | - | - |

In the following table the number of weighted patients per doctor and weighted bed days per others are shown again with a clear indication best-practice and the chosen standards for calculating the staff need for LSH 2020 (Bold, Italic and with a higher font).

Benchmarking of weighted patients per doctor and weighted bed days per other staff

| Benchmarking - standard staff | Weighted patients per doctor | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | LSH | SiA | Østfold | Telemark | Kolding | Nordland | Vest-Agder | SIR | RIT 2000 |
| Total medicine | 188 | 220 | ***241*** | 186 | 242 | 145 | 259 | 192 | 254 |
| Total surgery | 155 | 162 | 214 | 195 | 195 | ***232*** | 265 | 198 | 248 |
| Gynecology/obstetrics | ***472*** | 437 | 303 | 353 | 190 | 250 | 407 | 370 | 317 |
| Pediatrics | 186 | 144 | 191 | 271 | 183 | 158 | 274 | ***194*** | 158 |
| Opthalmology | 89 | - | 317 | - | - | ***282*** | 212 | 246 | 202 |
| Psychiatry | ***128*** | - | 109 | 53 | - | | 160 | - | - |

| Benchmarking - standard staff | Weighted beddays per other staff | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | LSH | SiA | Østfold | Telemark | Kolding | Nordland | Vest-Agder | SIR | RIT 2000 |
| Total medicine | ***529*** | 188 | 327 | 237 | 368 | 238 | 373 | 249 | 377 |
| Total surgery | 255 | 251 | 301 | 281 | 320 | 258 | ***333*** | 313 | 398 |
| Gynecology/obstetrics | ***337*** | 207 | 285 | - | 276 | 240 | 256 | 286 | 231 |
| Pediatrics | ***273*** | 156 | 266 | 228 | 181 | 137 | 205 | 178 | 148 |
| Opthalmology | 277 | - | 469 | - | - | 296 | 711 | ***709*** | 452 |
| Psychiatry | ***631*** | - | 196 | - | - | | 242 | - | - |

| | Weighted patients per doctors | | | Weighted beddays per other staffs | | |
|---|---|---|---|---|---|---|
| | LSH 1999 | LSH 2020 | Ændr. | LSH 1999 | LSH 2020 | Ændr. |
| Total medicine | 188 | 241 | 28% | 529 | 529 | 0% |
| Total surgery | 155 | 232 | 50% | 255 | 333 | 31% |
| Gynecology/obstetrics | 472 | 472 | 0% | 337 | 337 | 0% |
| Pediatrics | 186 | 194 | 5% | 273 | 273 | 0% |
| Opthalmology | 89 | 282 | 219% | 277 | 709 | 156% |
| Psychiatry | 128 | 128 | 0% | 631 | 631 | 0% |

The following standards has been chosen for LSH in 2020:

- Medicine I+II: 241 weighted patients per doctor (Østfold) and 529 weighted bed days per others (Lanspitali). For the first standard actually Vest-Agder hospital has the best practice but in order to be more moderate we chose the hospital in Østfold.
- Total surgery excl. eye: 232 weighted patients per doctor (Nordland) and 333 weighted bed days per others (Vest-Agder). This is due to the fact that there in LSH is a high potential for improving the efficiency in the surgical departments. We know there is a rather low rate of day surgery and also there is the possibility to split the elective and acute patients in order to get a higher efficiency.
- Gynecology and obstetrics: 472 weighted patients per doctor (LSH) and 337 weighted bed days per others (LSH), which is the present standards in LSH.
- Pediatrics: 194 weighted patients per doctor (SIR) and 273 weighted bed days per others (LSH). This means a higher productivity for the doctors and a standard for other staff equal to the present situation.
- Eye: 282 weighted patients per doctor (Nordland) and 709 weighted bed days per others (SIR). This means a significant higher productivity for the doctors and for other staff. The difference in these figures indicates that a further investigating of the situation and data in this area is needed.

- Psychiatry. The present standards at LSH have best practice (besides Vest-Agder) and are therefore keep also in 2020. 128 weighted patients per doctor and 631 weighted bed days per others.

By using the above stated standards for LSH the total sum of employees for 2020 will be 3145 in total 325 doctors and 2605 others.

### 5.2.3. Comparison of model A and B

In the following table the calculations of model A and B is shown and compared with the 1999 staffing

**Comparison of the staff need for the clinical functions in 1999 and 2020 model A & B**

| Clinical functions | Staffs 1999 | | | Staffs 2020 - unchanged standards Model A | | | Staffs 2020 - Model B | | |
|---|---|---|---|---|---|---|---|---|---|
| | Doctors | Other staffs | Total | Doctors | Other staffs | Total | Doctors | Other staffs | Total |
| Total medicine | 103 | 230 | 333 | 117 | 283 | 400 | 91 | 283 | 374 |
| Eye (ophthalmology) | 11 | 19 | 30 | 14 | 26 | 40 | 4 | 10 | 15 |
| Total surgery, excl. ophthalmology | 79 | 267 | 346 | 88 | 336 | 424 | 59 | 257 | 316 |
| Gynecology/obstetrics | 19 | 122 | 141 | 22 | 168 | 189 | 22 | 168 | 189 |
| Pediatrics | 30 | 101 | 131 | 31 | 136 | 167 | 30 | 136 | 165 |
| Total gyn/obs. + pediatrics | 49 | 223 | 272 | 53 | 303 | 356 | 51 | 303 | 355 |
| **Total somatic** | **241** | **739** | **980** | **271** | **949** | **1.220** | **206** | **854** | **1.059** |
| Psychiatry | 39 | 70 | 109 | 54 | 97 | 151 | 48 | 97 | 145 |
| **Clinical functions** | **280** | **809** | **1.089** | **325** | **1.046** | **1.371** | **253** | **951** | **1.204** |

## 5.3. Clinical service functions and other service functions

Likewise we have calculated two models for the clinical and non-clinical service functions. The total calculation can be seen in details in appendix 4.

In the table below a comparison of the two models are shown for both clinical service functions and non-clinical service functions.

| Cross service functions | Staffs 1999 | | | Staffs 2020 - unchanged standards Model A | | | Staffs 2020 - Model B | | |
|---|---|---|---|---|---|---|---|---|---|
| | Doctors | Other staffs | Total | Doctors | Other staffs | Total | Doctors | Other staffs | Total |
| Anesthesiology/OP/intensive | 37 | 125 | 162 | 43 | 145 | 188 | 27 | 145 | 172 |
| Radiology & diag. image | 13 | 38 | 51 | 18 | 52 | 69 | 18 | 52 | 69 |
| Pharmacy | 0 | 36 | 36 | 0 | 41 | 41 | 0 | 41 | 41 |
| Emergency/acute reception | 19 | 99 | 118 | 21 | 111 | 132 | 21 | 111 | 132 |
| Occupational- and physiotherapy | 5 | 58 | 63 | 6 | 75 | 81 | 6 | 75 | 81 |
| Total laboratory | 32 | 280 | 312 | 36 | 299 | 335 | - | - | 215 |
| Medical record archives etc. | 0 | 9 | 9 | 0 | 10 | 10 | 0 | 8 | 8 |
| Social workers | 0 | 29 | 29 | 0 | 37 | 37 | 0 | 26 | 26 |
| Various service departments | 0 | 994 | 994 | 0 | 1.284 | 1.284 | 0 | 895 | 895 |
| Engineering, architect, incl. adm. | 0 | 270 | 270 | 0 | 349 | 349 | 0 | 243 | 243 |
| Priest | 0 | 5 | 5 | 0 | 6 | 6 | 0 | 5 | 5 |
| Student | 0 | 60 | 60 | 0 | 78 | 78 | 0 | 54 | 54 |
| **Total cross service functions** | **106** | **2.003** | **2.109** | **124** | **2.488** | **2.612** | [1] **72** | [2] **1.654** | **1.941** |

1) Excl. doctors in the laboratory functions
2) Excl. other staffs in the laboratory functions

## 5.4. Staffing 2020

In total the two models are shown in the following table.

| | Staffs 2000 | | | Staffs 2020 - unchanged standards Model A | | | Staffs 2020 - Model B | | |
|---|---|---|---|---|---|---|---|---|---|
| | Doctors | Other staffs | Total | Doctors | Other staffs | Total | Doctors | Other staffs | Total |
| Total clinical functions | 280 | 809 | 1.089 | 325 | 1.046 | 1.371 | 253 | 951 | 1.204 |
| Total cross service functions | 106 | 2.003 | 2.109 | 124 | 2.488 | 2.612 | 72 | 1.654 | 1.941 |
| **Landspitali (V+H) in total** | **386** | **2.812** | **3.198** | **450** | **3.534** | **3.983** | [1] **325** | [2] **2.605** | **3.145** |

1) Excl. doctors in the laboratory functions
2) Excl. other staffs in the laboratory functions

As indicated in the table the total number of staff will increase from approx. 3.200 to 4000 FTE's in year 2020 with unchanged productivity (Model A).

The table also indicates that this increase might be reduced - or almost eliminated - if you expect Landspitali to be as efficient as the benchmarked hospitals. (Model B)

It is important to emphasize that the benchmarking hospital are not completely comparable to Landspitali. There are a number of differences: Iceland is a small country and the degree of specialization at Landspitali might be higher than the other hospitals. Also some of the other hospitals have better building quality and IT support.

It is however our experience, that the results can be used as an indicator for the future staffing frame for the total hospital, but cannot be used as an indicator for individual departments.

Model B is used as a base for the following space calculations, which means the some efficiency goals are expected as a consequence of investments in newer and better hospital buildings.

# 6. Determination of Present Space

## 6.1. Determination of present space

The present space has been determined from building drawings provided by the technical department of Landspitali (Fossvogur and Hringbraut).

The present space of Fossvogur, has already been determined in our previous work (Functional Development Plan for Fossvogur from 22.12.1999) and has now for this purpose been slightly modified, see below. The present space of Hringbraut consists of many different smaller buildings and includes property on Eriksgata, Torfinnsgata, Rauðarárstigur, and the new children's hospital.

In order to make the figures comparable with the calculations of future needs, where the calculations are made per function, we have divided the different functions into small fractions on each floor of each building. This is due to the fact that mainly the service functions are spread across the hospital as it is today.

The offices are mostly included in the same wings and floors as the departments. It has thus not been possible for us extract the office areas in Hringbraut as we had done earlier in Fossvogur and we have therefore decided to include the offices and meeting rooms in the departments where they are located. This fact has been modified for the Fossvogur figures from 1999. And this fact also means that the future calculations of space for offices and meeting rooms are included in the various clinical functions in order to get a comparable set of figures.

Because of the fragmentation and the natural integration of the functions in the present environments of the wards, the present space is vitiated by some uncertainty on the functional level.

This is primary due to the fact that some functions are not completely separated; e.g. the offices and some of the sleeping quarters for the doctors are integrated into office areas or other secondary rooms of a bed ward, and have therefore not been registered as staff service. Secondary the net area is not a normal parameter on building drawings, and thus it has been a challenge to calculate the exact net square meters of each function on the basis of the official drawings.

## 6.2. Presentation of the present space - Fossvogur

The complex at Fossvogur is divided into five buildings A, B, C, E/F and G.

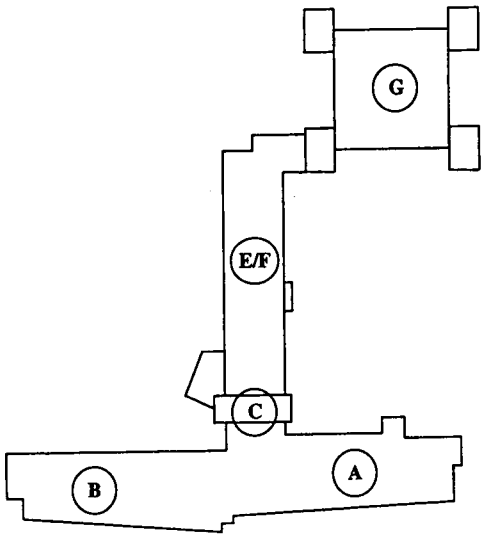
Both A and B has today seven floors plus basement. The E/F wing has seven floors plus basement. The top floor is new on this wing, and has recently been taken into use.

The C wing is the tower located between the A/B and E wings. On the first seven floors this building have mainly functions as Hallway, room for elevators and stairs some meeting rooms and offices. From the 8$^{th}$ floor and up to the 13$^{th}$ floor, the C wing is used for offices (management and accounting) and the hospital library.

The top floor (the 14th floor) is not used presently due to the fact that it is not accessible from the inside. Because of the space required for elevators and staircase there is rather few "functional" square meters on each floor in the C wing.

The G wing has three floors of which the first is in level with the basement of the E wing. The Emergency department is placed on the second floor of the G wing, which is in ground level and thus has entrances for ambulances and patients arriving with helicopter.

The proportional locations of the wings are shown below.




In order to find the right net area of the wings the areas has been divided according to their functions.

This is shown in the table below with each function represented by a different color.

| | $M^2$ Net | $M^2$ Gross | No of beds/ rooms 1999 | Net sqm. perr unit |
|---|---|---|---|---|
| Bedwards for Somatics | 2.969 | | 215 | 13,81 |
| Bedwards for Psychiatry | 557 | | 24 | 23,19 |
| Day care | 193 | | 20 | 9,64 |
| Outpatient clinic | 1.106 | | | |
| Emergency/acute reception | 339 | | | |
| Observation beds | 80 | | 8 | 9,99 |
| Part result | 5.243 | | | |
| Intensive care | 564 | | 11 | 51,28 |
| OP | 1.012 | | 9 | 112,48 |
| Recovery | 104 | | 13 | 8,00 |
| X-ray | 730 | | 11 | 66,36 |
| Lab | 868 | | | |
| Occ + physio | 359 | | | |
| Pharmacy | 215 | | | |
| Part result | 3.852 | | | |
| Offices + meeting rooms | 1.871 | | | |
| University & education | 123 | | | |
| Archives | 239 | | | |
| Wardrobes/canteen/sleeping quart. | 616 | | | |
| Patient service | 356 | | | |
| Supplies & maintenance [1] | 2.772 | | | |
| Part result | 5.978 | | | |
| New Floor | 616 | | | |
| Total area | 15.688 | 29.263 | | |
| Gross/Net factor | 1,87 | | | |

The total gross area of the hospital is 29.263 $m^2$ and the total net area is calculated to 15.688 $m^2$. This gives a Gross/Net factor of 1,87.

The gross/net factor is usually somewhere between 1.75 and 2.0, so this sounds very reasonable.

In some of the square meters stated on the technical drawings of the hospital the inner walls were included. As in fact the walls can represent a significant number of $m^2$, the space has been reduced accordingly.

The factor by which we have reduced the given net areas, has been calculated individually for each building, see the following page. Appendix 6 shows the split of functions per floor in each building and the reductions made due to hallways etc. in details.

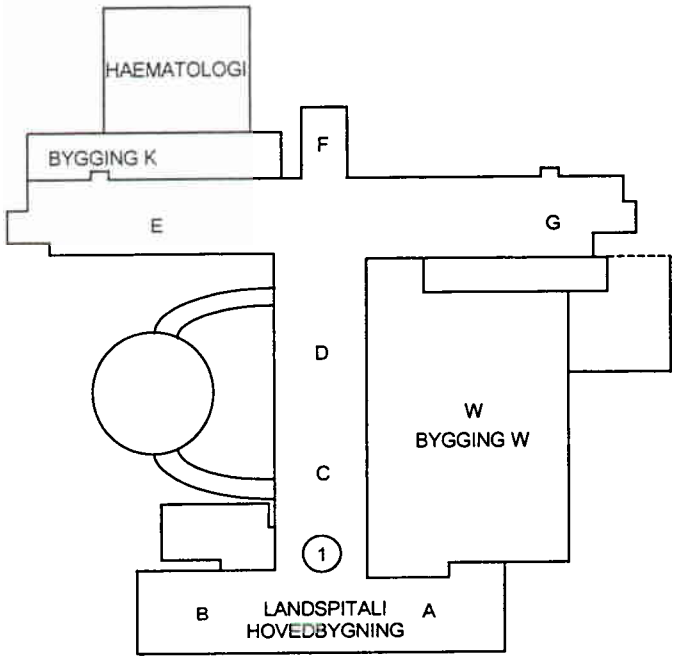
## 6.3. Presentation of the present space – Hringbraut

The complex at Landspitali, Hringbraut, is divided into different buildings in different areas. First we have the main area with building 1 as the main complex divided into ten wings: A, B, C, D, W, E, F, G and K.

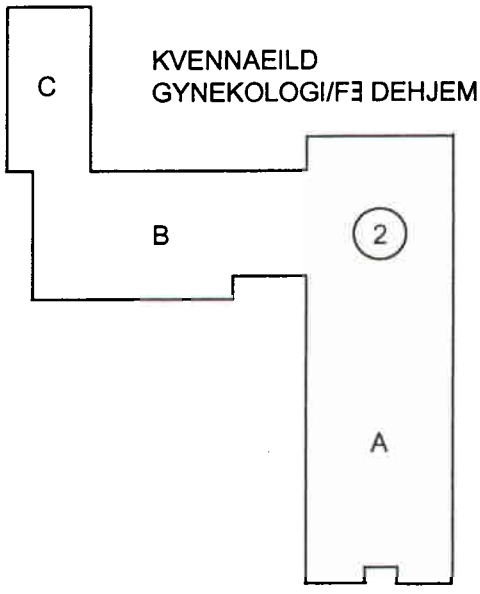
Further there are nine buildings inside the complex of Hringbraut: building 2, 3, 6/7, 8, 9, 10/11, 13, 14 and 16 plus there are six other buildings separated from the main areas in the nearby areas: Torfinnsgata 14-16, Eriksgata 5, 19, 21 & 29 and Raudarárstigur. In addition comes the new children's hospital. Building 12 is not taken into account since it is gong to be demolished in the near future.

Some of the laboratories (Bacteriology and Virology) are located at Armuli, approx. 3 km from Hringbraut. These square meters are included in the space calculations.

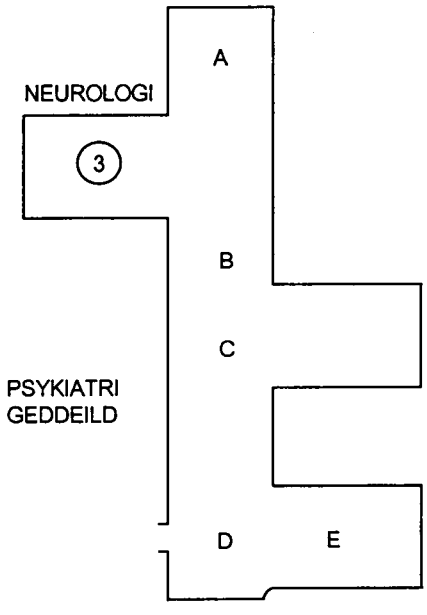
The proportional locations of the main buildings (1, 2 and 3) are shown below.




**Building 1**




**Building 2**




**Building 3**

In order to find the right net area of the buildings, the space has been divided according to their functions like it was done in Fossvogur. This is shown in the table below with each function represented by a different color.

| | M² Net | M² Gross | No of beds/ rooms 1999 | Net sqm. per unit |
|---|---|---|---|---|
| Bedwards for Somatics | 4.899 | 9.459 | 334 [2] | 14,67 |
| Bedwards for Psychiatry | 1.113 | 2.181 | 60 | 18,56 |
| Day care | 544 | 1.044 | | |
| Outpatient clinic | 2.207 | 4.568 | | |
| Emergency/acute reception | 549 | 1.070 | | |
| Observation beds | 154 | 299 | 16 | 9,65 |
| Delivery beds | 205 | 391 | 6 | 34,20 |
| Part result | 9.672 | 18.621 | | |
| Intensive care | 283 | 547 | 11 | 25,68 |
| OP | 654 | 1.559 | 9 | 72,66 |
| Recovery | 248 | 480 | 12 | 20,69 |
| X-ray | 546 | 1.057 | 8 | 68,27 |
| Lab | 1.552 | 2.557 | | |
| Occ + physio | 978 | 1.556 | | |
| Pharmacy | 155 | 300 | | |
| Part result | 4.416 | 8.055 | | |
| Offices + meeting rooms | 6.959 | 12.154 | | |
| University & education | 618 | 981 | | |
| Archives | 185 | 356 | | |
| Wardrobes/canteen/sleeping quart. | 968 | 1.554 | | |
| Patient service | 1.001 | 1.935 | | |
| Supplies & maintenance [1] | 2.301 | 9.904 | | |
| Part result | 12.032 | 26.882 | | |
| New Childrens hospital | 3.579 | 6.800 | | |
| Total area | 29.699 | 60.359 | | |
| Gross/Net factor | 2,03 | | | |

[1] Incl 7.514 gross sqm. from other functions eg. staircase house, technical rooms i basements etc.

[2] 552 beds - 213 from Fossvogur - neurology beds in psych. + 10 obs. beds

The total gross area of the hospital is 60.359 $m^2$ and the total net area is calculated to 29.699 $m^2$. This gives a Gross/Net factor of 2,03, which is not likely to correspond precisely with the actual situation. The gross/net factor is usually somewhere between 1.75 and 2.0, so this sounds very high. But we are still very close to a reasonable result and since the accuracy will have little influence on the final recommendations we decided to accept this uncertainty.

Appendix 7 shows the split of functions per building in details.

Ementor

Landspitali

# Functional Development Plan

04.10.2001

simplifies the future...

# Index

# 1. Introduction

Landspitali and Sjukrahus Reykjavikur have merged to one hospital: Landspitali University Hospital (LSH).

The new hospital is located in various building complexes in the Reykjavik area, where the two main locations are Hringbraut and Fossvogur. Other important locations are Vifilstadir, Kopavogur, Kleppur, Grensás and Landakot.

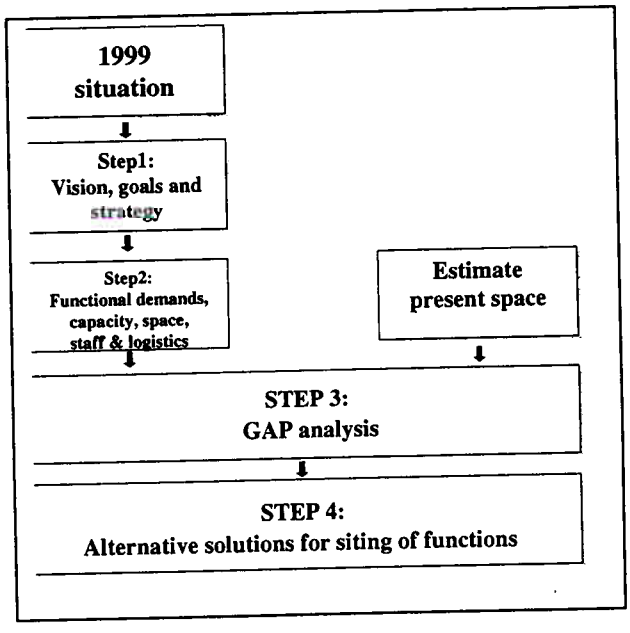
In order to create the framework for development of the new university hospital for Iceland, the Hospital Management has engaged Ementor Denmark A/S to assist in the process and to prepare a Functional Development Plan for LSH:

- A long-term (up to 2020) integrated plan for the functional development of the hospital, which supports the vision, goals and strategy of the hospital.
- A model for the physical infrastructure and logistical demands

Furthermore the plan must consider the future patient profile and patient volume of the hospital, the flow of the main processes (logistical demands), the capacity needed and the existing buildings (conditions and capacity).

Focus of the Functional Development Plan is the hospital sites at Hringbraut and Fossvogur, where the main functions are located. The locations at Vifilstadir, Grensás, Kopavogur, Kleppur and Landakot are also considered, because there might be an exchange of functions between the locations.

The planning process is described as follows:



As shown the project was carried out in four steps:

1. The first step was to describe vision and goals for the future hospital, and how this could end up into a strategy for the hospital functions, patient profile and patient volume.
2. An estimation of the staff needed as well as the future space needed (in 2001 and 2020).
3. A space gap analysis where the present space in the existing hospital buildings in Hringbraut and Fossvogur is compared to the future needed space (short-term gap for year 2001 and long-term gap for year 2020).
4. Alternative solutions for closing the gap and for localization of functions, short-term as well as in the long-term.

The planning process started in August 2000 with collection of data, interviewing of department leaders and visiting the hospital locations.

In October 2000 a strategic workshop was carried out, where the hospital management and department leaders participated. This functional development plan is based on the strategic direction pointed out as a result of the workshop.

The technical department in Hringbraut made an estimation of the present space in the existing buildings, and for Fossvogur the result from the previous planning was used. (The Functional Development Plan, developed by Ementor for SHR in 1999)

During the project we made an evaluation of the present building structure and logistics.

The analysis, conclusions and recommendations in this report are based on above and have during the project period been discussed by a number of occasions with the Steering Group, the Ministerial Committee and the Hospital Management.

# 2. Strategic statements

In the following some of the major strategic issues for the future hospital will be summarized, i.e. goals and strategies with respect to

- Location of functions
- Patient care models in the future
- Organizing the future emergency function

## 2.1. Location of functions

How to locate the clinical hospital functions giving the existing hospital complexes and the potential for building development is one of the main issues of the Functional Development Plan.

The further planning should be based on following strategic goals:

- Concentrate the acute care activities and expensive beds in Hringbraut and Fossvogur, and reduce the number of these beds to a minimum
- Increase the number of beds for rehabilitation, geriatrics and psychiatry outside Hringbraut and Fossvogur
- Exchange functions and beds between the location as follows:
  - Move acute neurology from Grensás to Hringbraut/Fossvogur
  - Move dermatology and venerology out from Vifilstadir/Dverholt
  - Move pulmonary and allergic diseases in from Vifilstadir to Hringbraut/Fossvogur
  - Move rehabilitation and long-term beds out of Hringbraut/Fossvogur
  - Move some geriatric beds out of Hringbraut/Fossvogur
- Use all Grensás for inpatient rehabilitation after inpatient stay in Hringbraut/Fossvogur and use Kopavogur for outpatient and day patient service

## 2.2. Patient care models in the future

To decrease the future need for hospital beds and to avoid a similar increase in costs, patient care will be transferred to more day and outpatient care than what is seen today.

- Transfer some of the inpatients to day care
  - Surgical patients: 25%
  - Medical patients: 20%
  - Psychiatric patients: 20%

- Transfer some of the inpatients to observation beds in the admission phase
  - Surgical patients: 20%
  - Medical patients: 30%
  - Psychiatric patients: 20%
- Transfer some of the inpatients to rehabilitation care and/or long-term care, which in practical term means an earlier discharge to rehabilitation/long-term care (step down unit principle)
  - Surgical patients: 20%
  - Medical patients: 25%
  - Psychiatric patients: 25%

Other suggestions are

- Establishment of a patient hotel on site of the main acute hospital
- Increase outpatient services
- Increase home health care services
- Reconsider the reimbursement system

## 2.3. Organizing the future emergency function

During the strategic planning process it has been discussed how to organize the emergency function of Landspitali in the future.

In principle there are only two main scenarios:

- One emergency function in one house, which means to have all acute admissions and most of the acute specialties in one house and to establish the elective services in the other house
- To establish an emergency function on both houses, which means to admit acute patients in both houses, but only trauma in one house

Clearly there is a preference in the management group for gathering all acute services in one house.

However, if you have to consider some likely criteria for development of a public service organization:

- To use the existing building where appropriate and to keep the investment cost at a reasonable level
- To create an environment where there is a potential for increased efficiency in operations

Then you must realize the following:

- Landspitali will have to stay with all major somatic functions in the two main complexes of today (Hringbraut and Fossvogur)

Giving above options there are only one possible solution with respect to emergency:

- You must split acute admission on the two houses, where you have
  - An emergency function for trauma in one of the houses (the ER-House)
  - And defined acute admissions in the other house (the Non-ER-House)

Giving the present buildings and present location of functions, the naturally solution is that Fossvogur serves as the ER-House – at least in the short-term - and Hringbraut as the Non-ER-House.

# 3. Present functionality, organization and logistics

## 3.1. Clinical specialties

The hospital has organized the clinical specialties into divisions. These are pediatrics, gynecology/obstetrics, internal medicine, surgery, geriatrics, rehabilitation and psychiatry. These specialties are all "owner of" the patients as inpatients, day patients or outpatient.

Most of the somatic specialties are located at Hringbraut and Fossvogur, and some are still located at both places: pediatrics, cardiology, general internal medicine, oncology, hematology, general surgery, orthopedics, urology, geriatrics and psychiatry.

Based on the interviews conducted with the department leaders we will in this chapter summarize the present situation (2000/2001) and the development trends for the specialties with respect to

- Present functions and location
- Organizational aspects and most important cooperation partners
- How to make care more efficient

At this time a number of changes are taken place, specialties are merged and will be moved around during the next year. These 1st steps in the creating a short-term solution are described later. (See chapter 14)

### 3.1.1. Pediatrics

Pediatrics consists of general pediatrics as well as neonatology and pediatric surgery (all surgical children).

Pediatric is located at both Hringbraut and Fossvogur, but neonatology only at Hringbraut.

Admission of children is taking place in both departments except for traumatic children who are admitted at the emergency in Fossvogur.

For the future pediatrics could be one department at one location, and the most important cooperation partners are obstetrics, orthopedics, ENT, neurosurgery and emergency.

A new children's hospital is planned at Hringbraut, which makes it naturally to gather all pediatrics there.

### 3.1.2. Gynecology-obstetrics

Gynecology-obstetrics is located at Hringbraut, and includes an IVF-function with 3-400 treatments per year, gynecologic oncology and a delivery unit with approx. 2,900 births per year.

The department has admittance of patients during daytime, and could reduce number of admitted patients with use of 3-4 observation beds.

The day care activity is rather big, especially with respect to day surgery, and the day activity could be expanded with a number of obstetric patients (observation patients) combined with 8-10 hotel beds.

The high day care activity can be explained by a small private sector in gynecology and no private sector in obstetrics.

The department cooperates with surgery, urology and clinical chemistry, and location at Hringbraut seems reasonable, together with the children hospital.

### 3.1.3. Internal medicine I

Internal medicine I includes general internal medicine, gastro-enterology, nephrology, endocrinology, pulmonology and allergic diseases, cardiology, rheumatology, infectious diseases, dermatology-venerology and neurology.

Most of these specialties are located both at Hringbraut and Fossvogur.

Improvement in efficiency can be obtained by more use of observation beds in the hospital, and by transferring patients to sub acute care, rehabilitation and nursing homes.

**General internal medicine** is located at both Hringbraut and Fossvogur, and includes at Fossvogur also gastro-enterology, nephrology, endocrinology and pulmonology. At Hringbraut the sub specialties are divided into sections.

**Gastro-enterology** is located at both hospitals today, and cover in-hospital services, outpatient clinics and gastrointestinal endoscopies.

The most important cooperation partners are gastrointestinal surgery, oncology, laboratory services and dieticians.

**Nephrology** is located at both hospital units, in Fossvogur as part of internal medicine. The hem dialysis function is located at Hringbraut, at Fossvogur only acute dialysis is performed in the intensive care unit.

It is not necessary with nephrology at both locations in the future, but a specialist must be available where emergency is located.

**Endocrinology** includes diabetes clinic, and is as such located at both Hringbraut and Fossvogur. In Fossvogur there is a lipid clinic and a bone density clinic.

Most of the inpatients are diabetes patients, but day and out patient clinics are of special importance to endocrinology.

**Pulmonology and allergic diseases** are located at Hringbraut, Vifilstadir and Fossvogur (as part of the internal medicine).

At Vifilstadir there are about 30 beds for pulmonology and an outpatient clinic for allergic diseases. There could be some increase in day care, but homecare could be even more efficient as a gatekeeper function.

**Cardiology** is located at Hringbraut and Fossvogur. Both locations have separated cardiac departments; each with heart observation units and a common "invasive" team with 2 invasive labs in Hringbraut and 1 planned at Fossvogur.

Cardiology must be represented at both locations and close to emergency. However, pre hospital identification of acute cardiac/thoracic patients is possible, and a heart/lung center - also for admission - might be a solution.

For the future patient hotel and step-down care will be of increasing importance, and number of inpatients will decrease accordingly.

**Rheumatology** is located at Hringbraut together with the nephrology ward. The specialty includes a clinic for bone density, a function also located at Fossvogur. At Fossvogur there is a rheumatologic consultant. There is a center for rheumatologic research at Hringbraut.

Most of the patients are elective.

Rheumatology cooperates with infectious diseases, hematology, immunology and rehabilitation at Grensás.

There should only be one department with localization at Hringbraut, but with a consultant at Fossvogur.

**Infectious diseases** are located at both hospitals, have beds for isolation and outpatient clinic for hepatitis and HIV patients.

An important cooperation partner is the laboratory services.

The specialty should be gathered in one department.

**Dermatology and venerology** is located at Vifilstadir with 12 beds, and with outpatient services at Hringbraut. Surgery is performed at Hringbraut, and at present the specialty has access to some beds in Hringbraut.

**Neurology** is located at Hringbraut and Grensás. The department also includes Neurophysiology, located in Hringbraut and Grensás.

Acute admission (mostly stroke patients) is taking place at the emergency departments in Hringbraut and Fossvogur, and the Fossvogur patients are transferred to the stroke unit Grensás.

The most important cooperation partners are emergency and rehabilitation. There should only be one department for neurology, located together with the emergency.

### 3.1.4. Internal medicine II

Internal medicine II covers the specialties oncology and hematology as well as radiation therapy and physics.

Oncology and hematology are located at both Hringbraut and Fossvogur, and a hospice function for terminal cancer patients is located in Kopavogur.

In Hringbraut oncology and hematology are separated departments, where oncology includes radiation therapy and hematology includes a laboratory.

In Fossvogur oncology and hematology are part of internal medicine.

Both units in Hringbraut and Fossvogur are rather small in numbers of patients and staff, and could benefit from gathering of functions, for instance for further sub specialization.

Oncology and hematology cooperate with most of the other specialties, but do not need to be located in the same hospital site as emergency.

### 3.1.5. Surgery

Surgery covers the specialties general surgery, vascular surgery, urology, plastic surgery, orthopedics, thoracic surgery, neurosurgery, ophthalmology and ENT.

Vascular surgery, neurosurgery and ENT are only located at Fossvogur, and thoracic surgery and plastic surgery only at Hringbraut. General surgery, orthopedics and urology are located at both hospital sites.

**General surgery** is located at both hospital sites. Fossvogur has the majority of the accidental surgery due to emergency.

For the future it is important to locate general surgery together with emergency. If necessary, one could split acute and elective surgery on the two hospital sites.

An elective surgery unit (day and short-term surgery) for more specialties could be a viable solution.

**Vascular surgery** has on 1.3.2000 moved to Fossvogur, and is sharing a ward together with geriatrics. The specialty moved to Fossvogur due to the high ratio of emergency patients in vascular surgery.

Most important cooperation partners are intensive care unit and the operating theatres, and the specialty needs access to rehabilitation. Another important cooperation partner is cardiac surgery.

There is a very little outpatient activity; all patients are diagnosed in private practices before admission to hospital.

**Urology** is located in both hospital sites, with the stone lab at Hringbraut. Fossvogur has an in-patient unit, a day unit, operating rooms and urodynamic laboratory. Almost half of the patients in Fossvogur are treated with day care, and the length of stay has been reduced over the years.

At Hringbraut, however, there are no outpatients and day patients.

This may be due to the reimbursement system, in Fossvogur the doctors are paid for outpatients and day patients, but in Hringbraut they are not.

Important cooperation partners are nephrology and dialysis, general surgery, vascular surgery orthopedics and geriatrics.

Rather few patients are emergency patients, approx. 15%. A united Urology department does not have to be located at the same hospital site as emergency.

**Plastic surgery** is located at Hringbraut, and perform reconstruction after cancer, traumas etc. A burn unit was established some years ago, but now closed down, and the patients moved to intensive care unit.

Plastic surgery has beds in the urology ward. The specialty has no specific demands about localization.

**Orthopedics** is located at both hospital sites, where the more acute patients (hot orthopedics) are admitted at Fossvogur and the elective patients (cold orthopedics) at Hringbraut.

All smaller surgery is performed in the private sector, and the patients are diagnosed in the private sector too.

The ideal solution would be one department in one building, and to separate acute and elective patients, both in wards and in operating theatres. The elective ward could be located together with geriatrics.

Important cooperation partners are geriatrics, cardiology and pulmonology, rehabilitation and plastic surgery.

**Thoracic/cardiac surgery** is located at Hringbraut, and the department is performing all cardiac surgery except transplantations, most child surgery and lung surgery.

The patients are diagnosed in cardiology, and there is a long waiting time for diagnosis, as well as for surgery.

Important cooperation partners are the intensive care unit and rehabilitation.

Thoracic/cardiac surgery should be located in the same building as trauma, cardiology and neurosurgery.

**Neurosurgery** is located at Fossvogur together with emergency. Due to head traumas proximity to pediatrics is important.

**Ophthalmology** is located at Hringbraut in a separate building. There is a big outpatient and day patient activity. The specialty has no specific demands for location together with other specialties.

**ENT** is located in Fossvogur, with a specialist in Hringbraut. Important cooperation partners are pediatrics and neurology. Also important is cooperation with emergency about face traumas.

All smaller cases are treated in the private sector, day surgery is decreasing, and the services are moved to the private sector. Only the heavy cases remain in the hospital.

### 3.1.6. Geriatrics

Geriatrics is located at Hringbraut, Fossvogur and Landakot.

Geriatric specialists and some bed capacity are important for the acute hospital function and for many of the specialties there.

We suggest gathering the geriatric patients in one location with one ward, and with a consultancy service in the other location.

The geriatric ward can be located in Hringbraut or Fossvogur. The services at Landakot remain unchanged.

### 3.1.7. Rehabilitation

Rehabilitation is today located mainly at Grensás, and some in Fossvogur. Access to rehabilitation is of increasing importance for many of the specialties, in order to discharge patients and to improve efficiency of inpatient care.

We suggest to move rehabilitation beds out of Fossvogur, and to establish the necessary bed capacity for this activity outside Hringbraut and Fossvogur.

We suggest using the facilities in Grensás and Kopavogur for rehabilitation as follows:

- Use all Grensás for inpatient rehabilitation after inpatient stay in Hringbraut and Fossvogur by
  - Moving neurology out of Grensás to either Hringbraut or Fossvogur and
  - Moving outpatient and day patient services from Grensás to Kopavogur.
- Use Kopavogur for outpatient and day patient services. (The hospice remains unchanged)

### 3.1.8. Psychiatry

Acute psychiatry is located mainly at Hringbraut, but also in Fossvogur and at Kleppur. Aftercare, rehabilitation and long-term care are provided at Kleppur, Arnarholti, Vífilstaðir, Gunnarsholti and several other locations within Reykjavik.

For the future the aim is to move all acute beds out of Kleppur to Hringbraut.

Psychiatric services include emergency assessments, liaison work, outpatient care, day patient care, inpatient care, rehabilitation, psychometric assessments, occupational therapy and input from social workers within the Department.

The most important co-operation partners within the Hospital include Emergency services, the various Internal Medicine Departments, Child and Adolescent services, as well as geriatric Medicine and Rehabilitation Departments of Landspitali. Outside the Hospital important agencies include General Practitioners, rehabilitation centres, social services, users associations and the Police.

Options to enhance efficiency include home-based nursing care, access to emergency day-hospital beds and home visits the day after emergency attendances. These options go hand in hand with recent reinforcement of our emergency and outpatient services in order to endeavor to reduce inpatient stay as much as possible.

## 3.2. Clinical functions

The hospital has organized the clinical functions into divisions like emergency, anesthetics/intensive care/operation, clinical services, laboratory services and physiotherapy.

The present distribution of these functions at the locations at Hringbraut, Fossvogur, Vifilstadir, Grensás, Kopavogur and Landakot are shown at the table below.

Most of the functions are located at both Hringbraut and Fossvogur, and some at the other locations.

### 3.2.1. Emergency

Emergency is located at both Hringbraut and Fossvogur, and the two locations share the admission responsibility. At both locations there are an observation unit for observation, diagnosis and short-term treatment of emergency patients.

Acute admission for pediatrics, obstetrics and psychiatry is taking place in the departments at Hringbraut.

Traumatology is only located at Fossvogur. However, thoracic/cardiac traumas and burn patients are admitted at Hringbraut.

How to organize the emergency function is one of the main issues for the Functional Development Plan, and it has already been decided to keep the emergency (traumatology) at Fossvogur at least in the short-term, and to admit acute patients in both Hringbraut and Fossvogur.

### 3.2.2. Anesthetics/intensive care/operation

Anesthetics, intensive care, operation and sterilization are located at both Hringbraut and Fossvogur as service functions for all the specialties. This situation will remain unchanged.

### 3.2.3. Clinical services

**X-ray services** are located at both Hringbraut and Fossvogur as service functions for the specialties. This situation will remain unchanged. Depending on the final distribution of the specialties it might have some consequences for the distribution of examination rooms.

**Pathology** is located at Hringbraut and the function should be seen in connection with the other laboratory functions.

**Pharmacy** is located at both hospital sites today, and it should be considered only to have one pharmacy or getting the pharmaceuticals from an external pharmacy or directly from the suppliers.

**Record rooms** should not be necessary in the future, as electronic medical records are almost ready, and eventually paper filing could be in any location.

### 3.2.4. Laboratory services

Blood bank is located at Hringbraut and laboratories for clinical chemistry and clinical microbiology are located at both Hringbraut and Fossvogur. Some laboratory functions are also located at Armuli.

We suggest only having one laboratory in the future. This laboratory should be organized together with pathology, and location could be in any of the hospital sites or eventually outside the hospital.

### 3.2.5. Physiotherapy

Physiotherapy, including occupational therapy, is located in both Hringbraut and Fossvogur as well as in Grensás, Kopavogur and Landakot.

The tasks for this service is to support the clinical specialties with therapy in the acute phase during inpatient treatment, and thereafter therapy to support the more long-term rehabilitation after surgery, stroke, trauma etc.

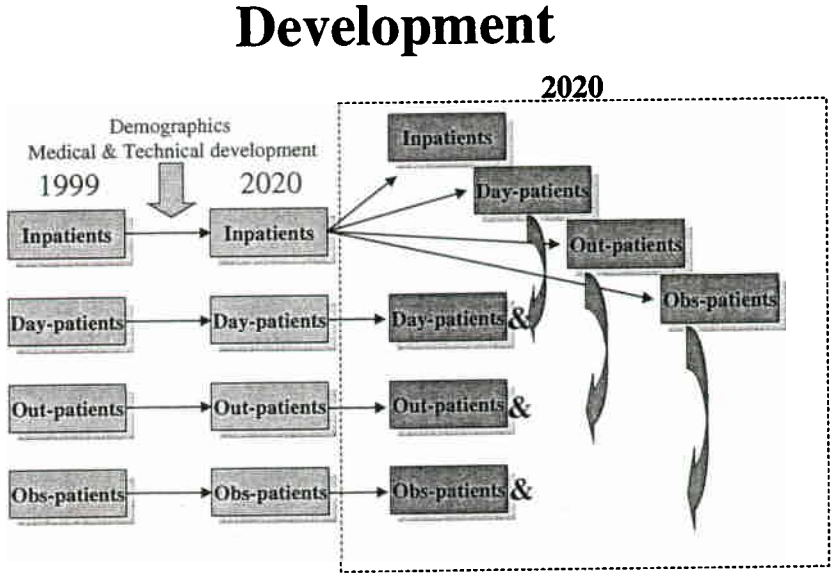
Physiotherapy and occupational therapy is therefore an integrated service and should be served mainly in the wards of the acute hospital and only in fewer cases in a central therapy.

In rehabilitation departments the physiotherapy can be performed in more centralized training departments, swimming pools etc.

# 4. Patient Profile and Volume

In this chapter we describe how the future patient profile and volume for Landspitali up to year 2020 is estimated.

The following illustration shows the extrapolation in two steps.




Step one is a simple extrapolation due to the demographic development. The fact that more and more citizens move into Reykjavik as well as the general population development has been taken into account (36% for somatic and 11% for psychiatry). Development as to a higher number of elderly people in the population has not been taken into account.

Step two is a more advanced extrapolation where the inpatients are moved to a lower grade of care (from bed to chair).

We base this recommendation on the trends that are seen in the Scandinavian hospitals – and other European hospitals – where patients are transferred from in-patient care to day care and/or outpatient care.

We also recommend that some of the long-term patients be moved out of the two buildings into other houses e.g. Kopavogur in order to let these buildings contain only acute functions.

In Appendix 1 and 2 of this report the updated version of both steps in the extrapolation is shown.

Some of the figures have been further qualified. The differences in the calculations is as follows:

- One inpatient now is converted into an average of 1,5 day patient + 1 out patient visit (previously 2 day pat. and one out pat.)
- An observation patients has a LOS of 1,5 bed days (previously 2 bed days).

We recommend that an observation unit as seen in both Hringbraut and Fossvogi today – also in the future will be used as a "gate keeper" function for the wards.

We recommend that this unit be enlarged in order to prevent a lager number of patients from being admitted to the traditional wards and to ensure a quicker diagnostic and treatment services.

In the following calculations we look at the collective patient volume in the two complexes Hringbraut (incl. Eriksgata and Torfinnsgata) and Fossvogur.

The suggested movements of specialties have also been taken into account. This means that we now refer to a total Hringbraut & Fossvogur

- Incl. acute neurology, dermatology, venerology, pulmonology, and allergic diseases
- Exc. rehabilitation and long-term beds and long-term geriatrics

## 4.1. Inpatients 2020

Ementor recommend increasing day and outpatient care, as well as observation care, and at the same time reducing number of in-patients in the different sub-specialties as follows

## 6.4. Total present space

In the following table the total of the two complexes are shown.

| | Fossvogur | | Hringbraut | | Landspitali | |
|---|---|---|---|---|---|---|
| | net $m^2$ | gross $m^2$ | net $m^2$ | gross $m^2$ | net $m^2$ | gross $m^2$ |
| Bedwards for Somatics | 2.969 | | 4.899 | | 7.868 | |
| Bedwards for Psychiatry | 557 | | 1.113 | | 1.670 | |
| Day care | 193 | | 544 | | 737 | |
| Outpatient clinic | 1.106 | | 2.207 | | 3.313 | |
| Emergency/acute reception | 339 | | 549 | | 888 | |
| Observation beds | 80 | | 154 | | 234 | |
| Delivery beds | 0 | | 205 | | 205 | |
| Part result | **5.243** | | **9.672** | | **14.915** | |
| Intensive care | 564 | | 283 | | 847 | |
| OP | 1.012 | | 654 | | 1.666 | |
| Recovery | 104 | | 248 | | 352 | |
| X-ray | 730 | | 546 | | 1.276 | |
| Lab | 868 | | 1.552 | | 2.420 | |
| Occ + physio | 359 | | 978 | | 1.337 | |
| Pharmacy | 215 | | 155 | | 369 | |
| Part result | **3.852** | | **4.416** | | **8.268** | |
| Offices + meeting rooms | 1.871 | | 6.959 | | 8.830 | |
| University & education | 123 | | 618 | | 742 | |
| Archives | 239 | | 185 | | 424 | |
| Wardrobes/canteen/sleeping quart. | 616 | | 968 | | 1.584 | |
| Patient service | 356 | | 1.001 | | 1.357 | |
| Supplies & maintenance [1] | 2.772 | | 2.301 | | 5.074 | |
| Part result | **5.978** | | **12.032** | | **18.010** | |
| New Floor/Childrens hospital | 616 | | 3.579 | | 4.195 | |
| Total area | **15.688** | **29.263** | **29.699** | **60.359** | **45.387** | **89.622** |
| Gross/Net factor | *1,87* | | *2,03* | | *1,97* | |

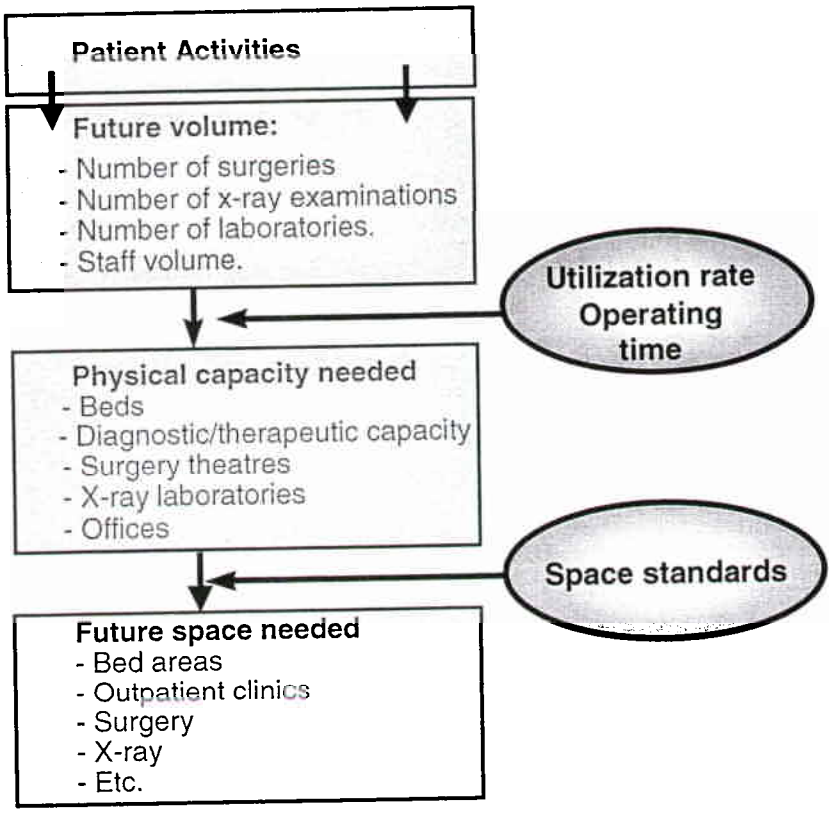
This shows a total net area for LSH of approx. 45.500 $m^2$. The total gross area for both locations is thus approx. 89.600 $m^2$.

# 7. Determination of Needed Space 2001 and 2020

## 7.1. Methodology

The future needs for space in the different departments is based on the estimated number of bed days, visits to the outpatient clinics, examinations etc. and the number of staff according to the previous chapters.

The calculation is also based upon a number of predefined coefficients of utilization and area standards for each function and/or specialty. The methodology for calculation of the future space is illustrated in the following figure.




All areas are calculated as ***Net areas in square meters***. Net areas are the total functional areas in a ward or department. The calculation adds up the inside measurements of each room. Thus the net areas are without walls, hallways, stairs, elevators, technical rooms for e.g. ventilation etc.

The gross areas are then all traffic areas, walls, hallways, elevators, stairs and technical areas

### 7.1.1. Utilization rate

The utilization rate represents the predefined percentages of occupancy per room or bed. The rate also shows the production time per visit, treatment or examination. In the following tables the suggested rates for LSH are shown.

| | Utilization days/year |
|---|---|
| **Beds** | |
| Normal somatic beds | 85% |
| Normal psychiatric beds | 85% |
| Intensive Care beds | 75% |
| Observation beds | 85% |

These suggestions have been chosen as a result of looking at the present ratios at LSH and comparing them to other resent hospital projects in Scandinavia.

In order to give an equal comparison of the different utilization rates chosen for this project we have listed some selected average rates below.

The table compares the present rates (where we have them) and the future suggested rates for LSH with some reference rates taken from the new region hospital in Trondheim, Norway, RIT 2000 and the new Østfoldsykehuset in Norway.

| Function | Present occupancy rate SHR | Occupancy rate future LSH | Hours per Day future LSH | Occupancy rate Østfold sykehuset | Hours per day Øst-foldsyke-huset | Occupancy rate RIT 2000 | Hours per day RIT 2000 |
|---|---|---|---|---|---|---|---|
| Somatic beds | 72% | 85% | | 85% | | 85% | |
| Psychiatric beds | 88% | 85% | | 85% | | | |
| Intensive care | 52% | 75% | | 75% | | 98% | |
| Observation | | 85% | 24 | 70% | 8/24 | 70% | |
| Day beds | | - | 6 | - | 6 | - | 6 |
| Outpatient clinic | | - | 7 | - | 6 | - | 6 |
| Radiology | | - | 8 | - | 7 | - | 6 |
| Surgery, theatres | | - | 8 | - | 7 | - | 6 |

The present rates are very different from department to department on the somatic beds. The above shown figures are an average of all departments. The present rate for observation, outpatients, radiology and surgery are not known as we need to know the exact number of beds / rooms used for each function to be able to calculate this. For intensive care 19 (11 + 8) beds have been used. As can be seen from the above stated figures we have chosen some very competitive rates for LSH.

In the table below the different rates for examinations and treatments in the various departments are shown. These figures are equally based on experience from resent projects in Norway, Østfold and RIT 2000.

**Utilization per function**

| | Days/year | Hours/day | | Min. pr. examination/treatment |
|---|---|---|---|---|
| **Daypatients** | | | | |
| Day beds | 230 | | 1) | 1 visit pr. day-patient |
| **Outpatient clinics** | | | | |
| Medicine | 230 | 7 | 1) | 45 |
| Surgery and Orthopeadics | 230 | 7 | 1) | 30 |
| Psychiatry | 230 | 7 | 1) | 75 |
| **Radiology and diag. imaging (planned)** | | | | |
| Radiology avarage | 230 | 8 | 1) | 25 |
| **Operations (planned) & Recovery** | | | | |
| Orthopedics | 230 | 7 | 1) | 180 |
| General surgery | 230 | 7 | 1) | 120 |
| Urology | 230 | 7 | 1) | 120 |
| ENT | 230 | 7 | 1) | 90 |
| Opthalmology | 230 | 7 | 1) | 60 |
| Plastic Surgery | 230 | 7 | 1) | 120 |
| Gyn/obs | 230 | 7 | 1) | 80 |
| Children | 230 | 7 | 1) | 100 |
| Thoracic surgery | 230 | 7 | 1) | 170 |
| Neurosurgery | 230 | 7 | 1) | 180 |
| Vascular surgery | 230 | 7 | 1) | 140 |
| Day surgery | 230 | 7 | 1) | 90 |
| Recovery beds (inpat.) | 230 | 7 | 1) | Average LOS 3 hours |
| **Emergency** | | | | |
| Acute Outpatient clinic | 365 | 8 | | 45 |
| Emergency | 365 | 8 | | 60 |

1) 230 = workdays (one year excl. weekends, holidays, etc.)

### 7.1.2. Space standards

The space standard refers to the primary rooms such as bed wards, examination and treatment rooms, office's, etc., and includes secondary rooms such as restrooms, storage's, tea-kitchens etc. See appendix 9.

All the standards, e.g. a standard for an outpatient room of 30 $m^2$, include both primary and secondary rooms. The standard represents an average, meaning that the exact size of each room and the number of secondary rooms can be varied during the later detailed planning of each department.

An example: For the outpatient room standard of 30 $m^2$, the first 20 $m^2$ is used for the primary examination and treatment room and the rest, the remaining 10 $m^2$, represents this room's part of patient areas, storage, room for cleaning service, staff areas, toilets etc.

In the following table a list of the suggested space standards for this project is shown.

| | Standard $m^2$ net. | Comments |
|---|---|---|
| **Clinical functions** | | |
| Beds (somatic) | 21 | See Specification |
| Cardiac monitoring beds & neonatology beds | 30 | Incl. part in secondary rooms - see appendix |
| Beds (psychiatry) | 31 | See Specification |
| Daybeds (somatic) | 15 | Incl. part in secondary rooms - see appendix |
| Daybeds (psychiatry) | 20 | Incl. part in secondary rooms - see appendix |
| Outpatient rooms | 30 | Incl. part in secondary rooms - see appendix |
| Special rooms for outpatients (somatic) | 40 | Incl. part in secondary rooms - see appendix |
| Special rooms for outpatients (psychiatry) | 30 | Incl. part in secondary rooms - see appendix |
| Observation beds | 21 | Incl. part in secondary rooms - see appendix |
| Delivery rooms | 70 | Incl. part in secondary rooms - see appendix |
| **Clinical service functions** | | |
| Intensive care beds | 40 | Incl. part in secondary rooms - see appendix |
| Emergency | 50 | Incl. part in secondary rooms - see appendix |
| Recovery | 15 | Incl. part in secondary rooms - see appendix |
| Operation | 120 | Incl. part in secondary rooms - see appendix |
| Radiology & Diag. Image. | 90 | Incl. part in secondary rooms - see appendix |
| **Service functions** | | |
| Offices management/head of depart. + adm. | 10 | Incl. Hardware room (printer, Xerox, fax etc.) |
| Offices other doctors and academic personnel | 8 | Incl. Hardware room (printer, Xerox, fax etc.) |
| Meeting rooms | 1,7 | Pr. seat (1/3 of staff during daytime) |
| Sleeping quarters/on call duty | 15 | Incl. toilet & bath and part of living room |
| Dress rooms | 1 | Pr. locker |
| Canteen | 2 | Pr. seat |

## 7.2. Needed space 2001 and 2020

The result of the future space is a manifestation of a theoretical calculation. And because in reality the departments and functions must fit into an existing frame of buildings the actual apportion between the departments and functions must be reviewed in a later state during the process of detailed programming.

Thus this calculation lays out a framework within which the proceeding work of rebuilding and reorganizing LSH can take place.

As mentioned in the previous chapters the estimations are based upon a number of predetermined standards and utilization rates. E.g. in this project the space standard for a somatic bed is predefined to be 21 $m^2$. This is based on the theory that the beds are located in bed pools of 25 beds each, sharing secondary facilities for patients, staff and supply. An example of a detailed calculation is shown in the table below.

| Somatic | |
|---|---|
| **Bed pool - 25 beds** | |
| 15 sqm pr. bed (average incl. bath/WC) *(1)* | 375 |
| Storage (medicine 4 sqm, clean 5 sqm, unclean 4 sqm, linen 4 sqm, equipment 8 sqm) | 25 |
| Disinfection room 10 sqm, cleaning 5 sqm. | 15 |
| 1 examination room 15 sqm, 1 conversation room 8 sqm | 23 |
| Staff room (tea-kitchen & day room 12 sqm, toilet 2 sqm ) | 14 |
| Expedition (head of dept. nurse 10 sqm, secretary and on call rooms 15 sqm) | 25 |
| Kitchen | 15 |
| Patients day room (1 sqm pr. patient incl tea-kitchen) | 25 |
| **Total** | **517** |
| **Net. sqm. pr. bed** | **21** |
| | |
| *(1)* e.g. 5 single-bedrooms of 15 sqm , 10 double bedrooms of 25 sqm | 325 |
| 10 Sanitary rooms of each 5 sqm. (one pr single room and one pr 2 double rooms) | 50 |

In the same way a calculation for psychiatric beds has been done, this is shown in the next table.

| Psychiatry | |
|---|---|
| **Bed pool - 25 beds** | |
| 18 sqm pr. bed (average incl. bath/WC) *(1)* | 450 |
| Storage (medicine 6 sqm, linen 6 sqm, equipment 10 sqm) | 22 |
| Activation, group therapy (4 sqm. pr. pat.) | 100 |
| Laundry for patients | 20 |
| 1 examination room 15 sqm, 2 conversation room 8 sqm | 31 |
| Staff room (tea-kitchen & day room 14 sqm, toilet 3 sqm ) | 17 |
| Expedition (head of dept. nurse 10 sqm, secretary and on call rooms 15 sqm) | 25 |
| Workstations (2 x 8sqm) | 14 |
| Kitchen | 20 |
| Patients day room (3 sqm pr. patient incl tea-kitchen) | 75 |
| **Total** | **774** |
| **Net. sqm. pr. bed** | **31** |
| | |
| *(1)* e.g. 25 single-bedrooms of 13 sqm | 325 |
| 25 Sanitary rooms of each 5 sqm. | 125 |

In the following table the calculated total future space is shown for all the main functions within the hospital. To preserve the overview, the functions are divided into four overall groups:

- Clinical functions
- Medical service functions
- Education and university functions
- Non-medical service functions

The total space is thus calculated for 2001 and 2020 due to the predefined assumptions given in the previous chapters.

## Total needed space for 2001

| | Units | Space needed sqm. net |
|---|---|---|
| **Clinical functions** | | |
| Somatic beds incl. car.monotoring, neonath. etc. | 478 | 13.062 |
| Psychiatric beds incl. shielded beds | 72 | 2.929 |
| Daybeds (somatic) | 94 | 1.410 |
| Daybeds (psychiatry) | 27 | 540 |
| Outpatient clinics som. (standard and special rooms) | 97 | 3.460 |
| Outpatient clinics psych. (standard and special rooms) | 6 | 180 |
| Emergency/acute reception | | 922 |
| Observation beds | 17 | 357 |
| Delivery rooms | 9 | 630 |
| **Part result** | | **23.490** |
| **Medical service functions** | | |
| Intensive care | 14 | 948 |
| Operation theatres | 18 | 2.160 |
| Recovery | 14 | 210 |
| Radiology and diagnostic imaging | 24 | 2.282 |
| Laboratory | | 4.030 |
| Occupational- and physiotherapy | | 951 |
| Pharmacy | | 586 |
| **Part result** | | **11.167** |
| **Education and University functions** | | |
| Education patients and personell | | 800 |
| Teaching med. students | | 600 |
| Research functions + libary | | 800 |
| Auditorium | | 120 |
| **Part result** | | **2.320** |
| **Non-medical service functions** | | |
| Administration & management | | 2.853 |
| Archives | | 300 |
| Wardrobes/Canteen/sleeping quarters | | 3.872 |
| Patient service | | 1.543 |
| Supplies & maintenance | | 7.608 |
| **Part result** | | **16.176** |
| **Hospital in total** | | |
| **Hospital** | | 53.153 |
| Primary Health Care | | 260 |
| **Total net area in square meters** | | **53.413** |

## Total space needed for 2020

| | Units | Space needed sqm. net |
|---|---|---|
| **Clinical functions** | | |
| Somatic beds incl. car.monotoring, neonath. etc. | 552 | 13.773 |
| Psychiatric beds incl. shielded beds | 58 | 2.680 |
| Daybeds (somatic) | 176 | 2.640 |
| Daybeds (psychiatry) | 43 | 860 |
| Outpatient clinics som. (standard and special rooms) | 122 | 4.210 |
| Outpatient clinics psych. (standard and special rooms) | 6 | 180 |
| Emergency/acute reception | | 1.056 |
| Observation beds | 47 | 987 |
| Delivery rooms | 9 | 630 |
| **Part result** | | **27.016** |
| **Medical service functions** | | |
| Intensive care | 18 | 1.132 |
| Operation theatres | 22 | 2.640 |
| Recovery | 14 | 210 |
| Radiology and diagnostic imaging | 32 | 3.045 |
| Laboratory | | 4.220 |
| Occupational- and physiotherapy | | 994 |
| Pharmacy | | 598 |
| **Part result** | | **12.839** |
| **Education and University functions** | | |
| Education patients and personell | | 800 |
| Teaching med. students | | 1.225 |
| Research functions + libary | | 2.620 |
| Auditorium | | 400 |
| **Part result** | | **5.045** |
| **Non-medical service functions** | | |
| Administration & management | | 2.703 |
| Archives | | 300 |
| Wardrobes/Canteen/sleeping quarters | | 3.929 |
| Patient service | | 1.648 |
| Supplies & maintenance | | 7.478 |
| **Part result** | | **16.058** |
| **Hospital in total** | | |
| **Hospital** | | 60.958 |
| Primary Health Care | | 260 |
| **Total net area in square meters** | | **61.218** |

All the details of the calculations are shown in Appendix 8.

| | 2001 needs | | 2020 needs | | Change from 2001 to 2020 | |
|---|---|---|---|---|---|---|
| | net $m^2$ | gross $m^2$ | net $m^2$ | gross $m^2$ | net $m^2$ | in % |
| Bedwards for somatics | 10.101 | | 10.513 | | 412 | 3,9% |
| Bedwards for psychiatry | 2.232 | | 1.798 | | -434 | -24,1% |
| Day care for somatics | 1.410 | | 2.640 | | 1.230 | 46,6% |
| Day care for psychiatry | 540 | | 860 | | 320 | 37,2% |
| Outpatient clinic | 3.640 | | 4.390 | | 750 | 17,1% |
| Emergency/acute reception | 640 | | 740 | | 100 | 13,5% |
| Observation beds | 357 | | 987 | | 630 | 63,8% |
| Delivery beds | 630 | | 630 | | 0 | 0,0% |
| Part result | **19.550** | | **22.558** | | **3.008** | **13,3%** |
| Intensive care | 560 | | 720 | | 160 | 22,2% |
| OP | 2.160 | | 2.640 | | 480 | 18,2% |
| Recovery | 210 | | 210 | | 0 | 0,0% |
| X-ray | 2.160 | | 2.880 | | 720 | 25,0% |
| Lab | 3.516 | | 3.706 | | 190 | 5,1% |
| Occ + physio | 800 | | 800 | | 0 | 0,0% |
| Pharmacy | 500 | | 500 | | 0 | 0,0% |
| Part result | **9.906** | | **11.456** | | **1.550** | **13,5%** |
| Offices + meeting rooms | 9.362 | | 9.722 | | 360 | 3,7% |
| University & education | 2.320 | | 5.045 | | 2.725 | 54,0% |
| Archives | 300 | | 300 | | 0 | 0,0% |
| Wardrobes/canteen/sleeping quart. | 3.872 | | 3.929 | | 57 | 1,4% |
| Patient service | 1.543 | | 1.648 | | 105 | 6,4% |
| Supplies & maintenance [1] | 6.300 | | 6.300 | | 0 | 0,0% |
| Part result | **23.697** | | **26.944** | | **3.247** | **12,0%** |
| Primary Healthcare | 260 | | 260 | | 0 | 0,0% |
| Total area | **53.413** | **105.470** | **61.218** | **120.881** | **7.805** | **12,7%** |
| Gross/Net factor | 1,97 | | 1,97 | | | |

The above table shows development from 2001 to 2020. The areas that will increase mostly are day-care, out patient areas, intensive care, operation, x-ray and university and education areas.

In the following chapters a more detailed description of the various functions will explain the preconditions for these calculations.

# 8. Clinical Functions

The number of beds for patient wards, day care unit, intensive care unit, etc. is based on a utilization rate of the bed as well as the future bed days as shown in the previous chapters.

## 8.1. Patient wards

We suggest that the beds could become a common resource for all specialties in the hospital. This means in more practical terms, that some beds are mainly dedicated to specialized surgical functions and some to medical, but that there is a rather broad overlapping zone between the departments, as it is known today with oncology and hematology at Fossvogur and nephrology and urology at Hringbraut. There will still be a need for specialized beds for psychiatry, children, obstetrics, monitored beds for cardiac patients etc.

To estimate the number of beds needed in the future, we have to decide a bed occupancy rate on utilization term of references.

- For the utilization % of beds: Ementor suggest 85 %, which is, as shown above, the "normal" efficiency goal for the use of hospital beds in Scandinavia.

Based on our suggestions for future in-patient activity, we estimate the future number of beds needed as follows:

- Internal Medicine, including all sub-specialties (Int. medicine I + Medicine II): 191 beds including 25 beds for cardiac monitoring. (today 192 beds)
- Surgery, including all sub-specialties: 158 beds (today 195 beds)
- Geriatrics 26 beds (today 25 beds)
- Women and Children 119 beds (today 140 beds)
- Psychiatry 58 beds (today 69 beds)

Besides the above we suggest increasing the number of beds for observation to 47 beds. These observation beds can be used up to max. 48 hours per patient.

The intensive care unit at Fossvogur is quite new with 11 beds. At Hringbraut there are 8-10 beds in the ICU. We suggest intensive care beds in the future LSH (18 beds) to be co-used with the recovery beds (16 beds), for cross-functional use of anesthetic and nursing staff. This could also include the cardiac intensive beds.

## 8.2. Day patient services

We suggest gathering all functions for day patients in three units to achieve the most efficient use of the day capacity.

This could mean – depending of the location of functions -

- One day hospital for all medical specialties
- One day hospital for all surgery
- One for obstetrics located together with other obstetric functions
- One for pediatrics located together with other pediatric functions
- One for psychiatry located together with other psychiatric functions

From the day hospital the patients will go to diagnostics and treatments in the special diagnostic functions (e.g. urology, gastrolaboratory, x-ray, surgery). This means that LSH could benefit from locating the day hospital and the outpatient clinics very close together.

Therefore Ementor recommend placing these units closely together in order to increase flexibility, also in the future, and to share patients, equipment and staff.

Based on the suggested future day activity we estimate the number of day-beds/chairs to be

- Internal medicine I +II: 66 beds/chairs
- Surgery, incl. gynecology: 48 beds/chairs
- Obstetrics: 44 beds/chairs
- Pediatrics: 19 beds/chairs
- Psychiatry: 43 beds/chairs

## 8.3. Out-patient services and specialized diagnostic services

Outpatient services can be organized in different ways:

- One area covering all out-patient functions with ordinary reception and waiting area for all specialties in the hospital
- Each specialty has its own out-patient clinic located close to the ward, and where the same staff moves between ward and out-patient clinic

But as mentioned above Ementor recommends to keep all the clinics together and to locate the clinics in connection with the entrance area for walking patients. The clinics should as mentioned be closely together with the day care unit and with easy access to Radiology and other special diagnostic service.

In LSH there are several specialized diagnostic functions serving in-patients, day patients and outpatients e.g.:

- Urology: urodynamic and cystoscopia
- Gastro laboratory: endoscopic services
- Clinical physiology: spirometry, cardiac testing etc.
- HBO - Hyper Baric Oxygen Treatment
- Neurophysiology examinations, e.g. EEG, EMG etc.
- Gynecology: Ultrasound, embryo diagnostics, IVF etc.
- Psychiatry: e.g. light therapy, ECT etc.

These functions could - if possible – to some extend be gathered in order to achieve synergy and cross-functional use of staff (nursing, administration) and space.

## 8.4. Offices and meeting rooms

The office area consists of offices for leading doctors, nurses and other leaders. Normally in Scandinavian hospitals an office location/desk is assigned to all doctors and other academically staff. Also all administrative staff needs an office location/desk. Meeting rooms are estimated from precondition that one third of all personnel working during daytime (70%) must be able to be in a meeting at the same time.

In this project we have calculated with two different room standards for offices:

- One space standard (10 m2 per office unit) is used for the executive staff and staff in the administration
- A lower space standard (8 m2 per office unit) for doctors, academic staff, secretaries etc.

The lower standard is based on a high rate of shared offices, e.g. as mobile offices in landscape.

In this calculation it has been necessary to include the office and meeting areas in the various departments as these figures in the gab analysis (chapter 12) has to be compared with the present space.

# 9. Clinical Service Functions

## 9.1. Emergency department

Only emergency patients and patients for acute admissions should come through emergency. All others such as elective admissions, outpatients and day-patients etc. will go directly to the relevant department.

The emergency department or departments receives the following patients:

- Trauma patients for emergency care and treatment, patients who thereafter are transferred to operational theatres, intensive care, cardiology unit etc.
- Emergency patients for out-patient-treatment who can leave the hospital after treatment
- Patients for acute admission preferably in the observations unit within the emergency department, alternatively transferred to intensive care, cardiology unit or wards

The emergency department has also special units for rape-victims and intoxicated patients.

Ementor suggests that the observation unit is strengthened in order to save a larger number of patients a traditional admission in the wards. Based on our estimations for the future activities, we suggest that a patient can stay in the observation unit up to 2 days, with an average LOS of 1,0, which gives a total of 47 observation beds.

The ambulance services are driven by the local fire department and the coast guard drives the helicopter service. The emergency department assigns a doctor to go out with the ambulance. All the ambulances and other vehicles and the necessary garages are placed in the fire department's building approx. 2 minutes away from both hospitals.

It is important only to have one area for the arriving ambulances per building.

## 9.2. Operational theatres

The operational theatres are presently located in both complexes on several different floors. The size of the individual theatres is very small compared to what is known as a reasonable size in a modern hospital. Some improvements seem mandatory to live up to the standards of today.

Some of the operational theatres must be placed with easy access from emergency and be located in close connection with intensive care and recovery. Some of the theatres should be reserved for elective operations in location close to the day units.

For some of the operational theatres that must serve both in-patient and day surgery the more simple and smaller size can still be reasonable. But as more and more complicated surgeries is possible as day surgery also this type of theatres requires more space. We have therefore in the future space for LSH calculated with an average standard for the theatres of 120 $m^2$ in order to give some flexibility in the further planning of the theatres.

The future surgical activity is a consequence of the patient related activity, and the suggestions made by Ementor regarding moving patients from in-patient stay to day care. We have extrapolated the number of surgeries with 36% and moved all the transferred inpatients for inpatient surgery to day surgery.

The total extrapolation is shown in the tables below:

## In patients

| Specialty | Operation 1999 Inpatient | Increase from simple extrappl. | Decrease due to transfer to daysur. [1] | Operation 2020 Inpatient |
|---|---|---|---|---|
| | | | | |
| General surgery/vascular | 1.891 | 672 | -980 | 1.583 |
| Urology | 1.346 | 479 | -374 | 1.451 |
| Neurosurgery | 632 | 225 | 0 | 857 |
| Ear, nose, throat | 1.025 | 364 | -290 | 1.099 |
| Orthopedics | 2.072 | 737 | -662 | 2.147 |
| Ophthalmology | 312 | 111 | -76 | 347 |
| Thorax | 306 | 109 | 0 | 415 |
| Plastic surgery | 611 | 217 | -82 | 746 |
| Pediatric | 738 | 262 | -409 | 592 |
| Gynecology | 884 | 314 | -354 | 844 |
| **In total** | **9.817** | **3.491** | **-3.228** | **10.080** |

## Day patients

| Specialty | Operation 1999 Day patient | Increase from simple extrappl. | Increase due to transfer to daysur. [1] | Operation 2020 Day patient |
|---|---|---|---|---|
| | | | | |
| General surgery/vascular | 112 | 40 | 980 | 1.132 |
| Urology | 170 | 60 | 374 | 604 |
| Neurosurgery | 2 | 1 | 0 | 3 |
| Ear, nose, throat | 292 | 104 | 290 | 686 |
| Orthopedics | 130 | 46 | 662 | 838 |
| Ophthalmology | 783 | 278 | 76 | 1.138 |
| Thorax | 0 | 0 | 0 | 0 |
| Plastic surgery | 0 | 0 | 82 | 82 |
| Pediatric | 0 | 0 | 409 | 409 |
| Gynecology | 2.738 | 974 | 354 | 4.066 |
| ***In total*** | ***4.227*** | ***1.503*** | ***3.228*** | ***8.958*** |

[1] Inpatients transferred to day surgery

Below a table shows the future number of operations and operational theatres. The number of theatres is conclusively 22 rooms, which are 3 rooms more than today (9 rooms in Fossvogur, 9 rooms in Hringbraut and 1 in Eriksgata).

| Specialty | Operations 1999 | Operations 2020 | Operations daytime 80%/100% | Operations pr. day | Minutes | OP Hours pr. day | Calculated number of theatres | Suggested number of theatres |
|---|---|---|---|---|---|---|---|---|
| General surgery/vascular | 1.891 | 1.583 | 1.266 | 5,51 | 120 | 11,01 | 1,38 | 2 |
| Urology | 1.346 | 1.451 | 1.161 | 5,05 | 120 | 10,09 | 1,26 | 2 |
| Neurosurgery | 632 | 857 | 685 | 2,98 | 90 | 4,47 | 0,56 | 1 |
| Ear, nose, throat | 1.025 | 1.099 | 879 | 3,82 | 90 | 5,74 | 0,72 | 1 |
| Orthopedics | 2.072 | 2.147 | 1.717 | 7,47 | 180 | 22,40 | 2,80 | 3 |
| Ophthalmology | 312 | 347 | 277 | 1,21 | 60 | 1,21 | 0,15 | 1 |
| Thorax | 306 | 415 | 332 | 1,44 | 170 | 4,09 | 0,51 | 1 |
| Plastic surgery | 611 | 746 | 597 | 2,60 | 120 | 5,19 | 0,65 | 1 |
| Pediatric | 738 | 592 | 473 | 2,06 | 100 | 3,43 | 0,43 | 1 |
| Gynecology | 884 | 844 | 675 | 2,94 | 80 | 3,92 | 0,49 | 1 |
| Day surgery | 4.227 | 8.958 | 8.958 | 38,95 | 90 | 58,42 | 7,30 | 8 |
| In total | 14.044 | 19.037 | 17.021 | 74 | 1220 | 130 | 16 | 22 |

## 9.3. Recovery, Intensive care and Anesthetics

At Fossvogur the intensive care has been renewed recently, the ward has 11 beds and will remain in close connection with recovery, which has 9 beds for adults and 4 for children. At Hringbraut there are 10 beds in the ICU on the same floor as recovery, with 11 beds, and the operation theatres.

With a simple extrapolation of the admitted patients in the ICUs with 36% and the same LOS as in 1999 2,8 days, the total number of beds in the ICU should be 18 in 2020. This means that there probably is an over-capacity in the ICUs at the present time. The table below shows the calculations for the ICU in 2020.

| Department | Patients in 1999 | Adm. days 1999 | LOS 1999 | Patients in 2020 | Adm. days 2020 | LOS 2020 | Calculated number of beds | Suggested number of beds |
|---|---|---|---|---|---|---|---|---|
| Intensive | 1311 | 3616 | 2,8 | 1783 | 4918 | 2,8 | 18,0 | 18 |

We suggest that in the future only inpatients will use the recovery beds as all day patients have their own day bed or chair. We assume that it will be possible to use these day beds as recovery from day surgery. The LOS for the inpatient in recovery is 3 hours. Thus the following calculation for the future need of recovery beds appears:

| | Operations pr day | Average LOS in recovery | Hours pr day on recovery | Calculated number of beds | Suggested number of beds |
|---|---|---|---|---|---|
| Recovery | 36,00 | 3 | 108,0 | 13,5 | 14,0 |

## 9.4. Radiology and diagnostic imaging

Radiology and diagnostic imaging is an important diagnostic tool. Generally we expect changes in the profile of services as follows

- More MR, CT, ultrasound diagnostics
- More intervention in diagnostic and treatment
- Less conventional X-ray examination

It is hard to know exactly how this development will go as far as 2020 therefore we have chosen to extrapolate the resulting number of all examinations with the 36% collectively. Thus we suggest a total of 32 labs at LSH. In order to get a higher efficiency some these should be restricted to the acute functions and some to the elective. The calculation is shown in the table below.

| Examination type | Examinations 2020 | -85% in daytime | Examinations pr. day | Minutes pr. exam. | Exam. hours pr. day | Calculated no. of labs | Suggested no. of labs [2] |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| Radiology | 163.734 | 139.174 | 605 | 25 | 252 | 31,5 | 32 |

## 9.5. Laboratory

LSH has a wide range of laboratory services within clinical biochemistry, microbiology, immunology, blood bank functions and pathology.

Laboratory service "on location" is an advantage for quick testing of in-patients and patients admitted through Emergency in a hospital. But we recommend that this will be done in a different way than today.

We suggest gathering all the laboratory functions in one place in order to get a more efficient use of equipment and staff etc. But at the same time we suggest building up smaller satellite stations for taking simple tests gathering samples etc. in order to provide a good service for all departments.

Order of tests and receiving results could be administrated and supported by e-mail or other information technology. The physical transportation of samples could be organized by having a dedicated shuttle bus between the satellite stations and the main laboratories with the necessary material.

## 9.6. Occupational and physiotherapy

Services like physio- and occupational therapy should be in close connection to the specialties using their services, like psychiatry, orthopedic, neurology, geriatrics etc. Therefore if possible Ementor suggest to integrate these service into the relevant wards or at least to locate their rooms very close by. This means transportation of staff instead of patients.

However, some functions will be centralized for all specialties (for instance some workout rooms).

## 9.7. Archives for Medical records and X-ray files

All hospitals are moving towards the electronic medical record and digital imaging (PACS).

However, we suggest assigning space for archiving, as this is not an issue at a present state. However, enlarging the archives will not encourage working more focused towards an electronic successor of the traditional records. We therefore suggest preserving records in some of the present rooms dedicated for this purpose and to move out records more than 3 years old to a remote archive in another location.

# 10. Education and university functions

At the new LSH the university and education functions has a high priority and therefore must be of some higher standard than today. In these functions there should be room for:

- Auditorium
- University functions for the medical students
- Research facilities
- Medical library

## 10.1. Auditorium

We suggest establishing one large auditorium for approx. 400 seats used for special occasions, seminars, staff meetings etc.

## 10.2. University functions for medical students

Regarding the medical students we assume the following figures:

- There are 40 new medical students per year
- The students have 3 years studies in the clinical part, i.e. 120 medical students in total in 40 weeks per year.
- We assume 30 education hours per student per week in average. Thus 120x30 = 3.600 student hours per week
  - 33 % of these hours are spent in a smaller auditorium (all 40 students)
  - 33 % of these hours are spent in smaller group rooms (of 10 students)
  - 33 % of these hours are spent in the hospital departments, labs etc

In the following the calculations for the $m^2$ is shown for the different units:

**Small auditorium**

1.200 student hours per week in "smaller auditoriums", with 40 students per group.

This gives 30 room hours per week, and requires one auditorium of 40 seats.

We calculate with 1,2 $m^2$ per seat = 48 $m^2$. In addition secondary rooms are needed (wardrobes, toilets, storage)

In total 70 $m^2$

**Group rooms**

1200 student hours per week in "group rooms", with 10 students per group.

This gives 120 room hours per week, i.e. 4 group rooms of each 10 seats (30 hours per room per week)

Each room is 20 m2, which gives 80 m2 in total for four rooms.

**Other facilities for medical students**

Other facilities are wardrobe (120 $m^2$), canteen (80 $m^2$), social rooms' (40 $m^2$) and reading rooms' (80 $m^2$). In total 320 $m^2$.

In total the net square area in total for the medical students will be 470 $m^2$.

## 10.3. Research

The most important factor for the research is the number of university employees. In Norwegian hospital there are approximately 0,7 FTE per student for teaching and research.

We have in total 120 student in the clinical part of the medical study, so if we assume that:

- 0,4 university employees per student, i.e. 48 FTE's
- The major part of theses university employees are academic staff, say 35 FTE's
- Each of these academic employees needs 10 $m^2$ of research area plus an office of 10 $m^2$, in total 20 $m^2$ per academic staff
- The rest of the university staff needs 10 $m^2$ per FTE.

This means that 700 $m^2$ is needed for the 35 academically personnel (research and offices) and 130 $m^2$ is needed for the rest of the universities staff (13 FTE). For research in total 830 $m^2$.

## 10.4. Medical Library

Furthermore there is a need for a medical library of approx. 300 $m^2$.

# 11. Service Functions

## 11.1. Kitchen

At LSH there are kitchens in various locations, at Hringbraut, Fossvogi, Landakot and Arnarholt.

Ementor suggest outsourcing the kitchen, e.g. to one of the units outside the two main complexes or even another third party in order. This is necessary in order to gain more room in the complex for other functions and in order to free the ground floor of the A wing, in Fossvogur which is very centrally placed in the house. In Hringbraut the kitchen and canteen areas are equally centrally placed in house 13, and this areas could preferably be used more efficiently.

## 11.2. Administration

Most of the joint administration for the two complexes is placed in Torfinnsgade. Only a few accounting and financial departments are still located at Fossvogi. We suggest gathering all top management functions and central administration in one location.

## 11.3. Patient service

We suggest establishing some patient services in connection with the central entrance areas such as cafeteria, newsstand etc. We also suggest considering other patient services such as information, patient's representative ("ombud"), library with Internet connection etc.

## 11.4. Staff service

Staff services are mainly cloakrooms and canteen. It is common standard today in a modern hospital that every employee without an office shall have his or her own locker and that all employees have access to a canteen.

## 11.5. Other service functions

Other services are mainly related to supply services and transportation:

- Storage, distribution, waste
- Cleaning, sterilization
- Pharmacy services

All these services are in the complexes today, and we recommend LSH to consider the possibility to outsource any of these functions.

# 12. Gap Analysis

In order to illustrate the problems of locating the future functions within the existing building frame a gab analysis has been made on the main functions of the hospital.

The present space has been calculated and divided according to the same model, as we have calculated the future space, please see chapter 6. The future space has been calculated as stated in the previous chapter and can be found in total in appendix 8.

The gap has been calculated in two steps:

- Gap 1 illustrates the gap between the present situations and the theoretical needed space in 2001.
- Gap 2 shows the gap between the present situations and the future needed space in 2020.

| | Total present space net $m^2$ | gross $m^2$ | 2001 needs net $m^2$ | gross $m^2$ | GAP 1 net $m^2$ | in % |
|---|---|---|---|---|---|---|
| Bedwards for somatics | 7.868 | | 10.101 | | -2.233 | -28,4% |
| Bedwards for psychiatry | 1.670 | | 2.232 | | -562 | -33,7% |
| Day care for somatics | 737 | | 1.410 | | -673 | -91,4% |
| Day care for psychiatry | 0 | | 540 | | -540 | -100,0% |
| Outpatient clinic | 3.313 | | 3.640 | | -327 | -9,9% |
| Emergency/acute reception | 888 | | 640 | | 248 | 27,9% |
| Observation beds | 234 | | 357 | | -123 | -52,4% |
| Delivery beds | 205 | | 630 | | -425 | -207,0% |
| Part result | **14.915** | | **19.550** | | **-4.635** | **-31,1%** |
| Intensive care | 847 | | 560 | | 287 | 33,9% |
| OP | 1.666 | | 2.160 | | -494 | -29,6% |
| Recovery | 352 | | 210 | | 142 | 40,4% |
| X-ray | 1.276 | | 2.160 | | -884 | -69,3% |
| Lab | 2.420 | | 3.516 | | -1.096 | -45,3% |
| Occ + physio | 1.337 | | 800 | | 537 | 40,2% |
| Pharmacy | 369 | | 500 | | -131 | -35,4% |
| Part result | **8.268** | | **9.906** | | **-1.638** | **-19,8%** |
| Offices + meeting rooms | 8.830 | | 9.362 | | -532 | -6,0% |
| University & education | 742 | | 2.320 | | -1.578 | -212,8% |
| Archives | 424 | | 300 | | 124 | 29,2% |
| Wardrobes/canteen/sleeping quart. | 1.584 | | 3.872 | | -2.288 | -144,5% |
| Patient service | 1.357 | | 1.543 | | -186 | -13,7% |
| Supplies & maintenance | 5.074 | | 6.300 | | -1.226 | -24,2% |
| Part result | **18.010** | | **23.697** | | **-5.688** | **-31,6%** |
| New buildings | 4.195 | | 260 | | 3.935 | 93,8% |
| Total area | **45.387** | 89.622 | **53.413** | 105.470 | **-8.026** | **-17,7%** |
| **Gross/Net factor** | | | | | | |

Gap 1 shows a total gab of approx. 8.000 $m^2$, mostly on the clinical functions and the non-medical service functions.

| | Total present space net $m^2$ | gross $m^2$ | 2020 needs net $m^2$ | gross $m^2$ | GAP 2 net $m^2$ | in % |
|---|---|---|---|---|---|---|
| Bedwards for somatics | 7.868 | | 10.513 | | -2.644 | -33,6% |
| Bedwards for psychiatry | 1.670 | | 1.798 | | -128 | -7,7% |
| Day care for somatics | 737 | | 2.640 | | -1.903 | -258,4% |
| Day care for psychiatry | 0 | | 860 | | -860 | -100,0% |
| Outpatient clinic | 3.313 | | 4.390 | | -1.077 | -32,5% |
| Emergency/acute reception | 888 | | 740 | | 148 | 16,7% |
| Observation beds | 234 | | 987 | | -753 | -321,3% |
| Delivery beds | 205 | | 630 | | -425 | -207,0% |
| Part result | **14.915** | | **22.558** | | **-7.643** | **-51,2%** |
| Intensive care | 847 | | 720 | | 127 | 15,0% |
| OP | 1.666 | | 2.640 | | -974 | -58,4% |
| Recovery | 352 | | 210 | | 142 | 40,4% |
| X-ray | 1.276 | | 2.880 | | -1.604 | -125,7% |
| Lab | 2.420 | | 3.706 | | -1.286 | -53,1% |
| Occ + physio | 1.337 | | 800 | | 537 | 40,2% |
| Pharmacy | 369 | | 500 | | -131 | -35,4% |
| Part result | **8.268** | | **11.456** | | **-3.188** | **-38,6%** |
| Offices + meeting rooms | 8.830 | | 9.722 | | -892 | -10,1% |
| University & education | 742 | | 5.045 | | -4.303 | -580,2% |
| Archives | 424 | | 300 | | 124 | 29,2% |
| Wardrobes/canteen/sleeping quart. | 1.584 | | 3.929 | | -2.345 | -148,1% |
| Patient service | 1.357 | | 1.648 | | -291 | -21,4% |
| Supplies & maintenance | 5.074 | | 6.300 | | -1.226 | -24,2% |
| Part result | **18.010** | | **26.944** | | **-8.934** | **-49,6%** |
| New buildings | 4.195 | | 260 | | 3.935 | 93,8% |
| Total area | **45.387** | 89.622 | **61.218** | 120.881 | **-15.831** | **-34,9%** |
| Gross/Net factor | | | | | | |

Gap 2 shows a total gab of approx. 16.000 $m^2$, and still mostly on the clinical functions and the non-medical service functions.

As can be seen from the above figures a direct and uncritical realization of the future space would require a significant enlargement of the existing building frame. Somewhere in the amount of approx. 16.000 * 2,0 $m^2$ = 31.000 $m^2$ keeping an approx. gross/net factor of 2,00 as the average of the two buildings.

# 13. Conclusions and recommendations

In this chapter we will summarize our findings and conclusions, on which base we will make our recommendations.

## 13.1. Overall strategic direction

The aim of this work is to point out a direction for the future functional and building development of the newly merged major hospitals of Reykjavik, in order to create the "university hospital of Iceland".
A university hospital is expected to live up to the country's demands for up-to-date hospital services, leading educational and research capabilities, and where major investments in new facilities will give a return of investments in more efficient operations and better services for patients.
The strategic direction is described as follows:

- Transfer patients from "bed to chair" which means that inpatients of today will be moved to day care and outpatient care
- Strengthen and increase observation care connected to Emergency in order to reduce number of traditional admissions in the wards (Gate keeper function)
- Have one emergency function only
- Improve facilities for patients and staff (for instance ward robes, offices etc.)
- Improve facilities for university functions (especially teaching rooms)
- Focus in the short-term on acute services in the central hospital buildings (Hringbraut and Fossvogur) and find good logistical solutions in Hringbraut (H) and Fossvogur (F)

## 13.2. Our findings

### 13.2.1. Patient development until 2020

Due to demographic development the population in the Reykjavik area will increase with approximately 36 %, until year 2020. This will require a corresponding increase in the inpatient activity unless you turn around the way of care. Together with the department leaders of Landspitali following transformations has been estimated as goals for the future:

- Change from inpatient care to day care, observation care and outpatient care:
  - Number of inpatients reduced with 24% in year 2020
  - Number of patients offered observation care in connection with acute admission increased with 67%
  - Number of patients diagnosed and treated as day patients increased with 46 %

### 13.2.2. Staffing development until 2020

Increased patient activity will require increased staffing from approximately 3200 to 4000 FTE's with present level of efficiency. However, the increase in staff can be reduced – or eventually eliminated - with the help of

- Better functionality and logistics of the hospital facilities
- Improvement and efficiency of the patient processes and working procedures
- Increased and better use of IT support in the clinical work.

### 13.2.3. Present space capacity

Generally there is a need for more space in the hospital with the present level of activity, and the need for more space increase over time.

The estimated space in Hringbraut and Fossvogur to day is approximately 90.000 gross square meters, where 60.000 m² are located in Hringbraut and 30.000 in Fossvogur.

The present gap (in year 2001) is about 16.000 gross square meters, which will increase to 31.000 in year 2020.

You find gaps in most of the hospital functions, but with the most severe gaps in:

- Bed wards, day care facilities, the operational theatres and X-ray department
- Staff functions (wardrobes, offices)
- University functions (teaching rooms, students facilities, research functions)

### 13.2.4. Present functionality and logistics

Today a number of functions are located in both Hringbraut and Fossvogur, which may reduce level of efficiency, among others:

- Clinical specialties: pediatrics, urology, orthopedics, general surgery, internal medicine, psychiatry, oncology, hematology
- Emergency, kitchen, laboratory

It is however decided by the management, that a number of above mentioned functions are merged – or is going to be merged – within the next year (see later).

The laboratories are spread over many locations (Fossvogur, Hringbraut, Armuli) and in a number of smaller buildings in Hringbraut. Also it seams if the laboratories have a rather poor efficiency compared to other laboratories in Scandinavia.

The present building structure and logistics of Landspitali can be summarized as follows:

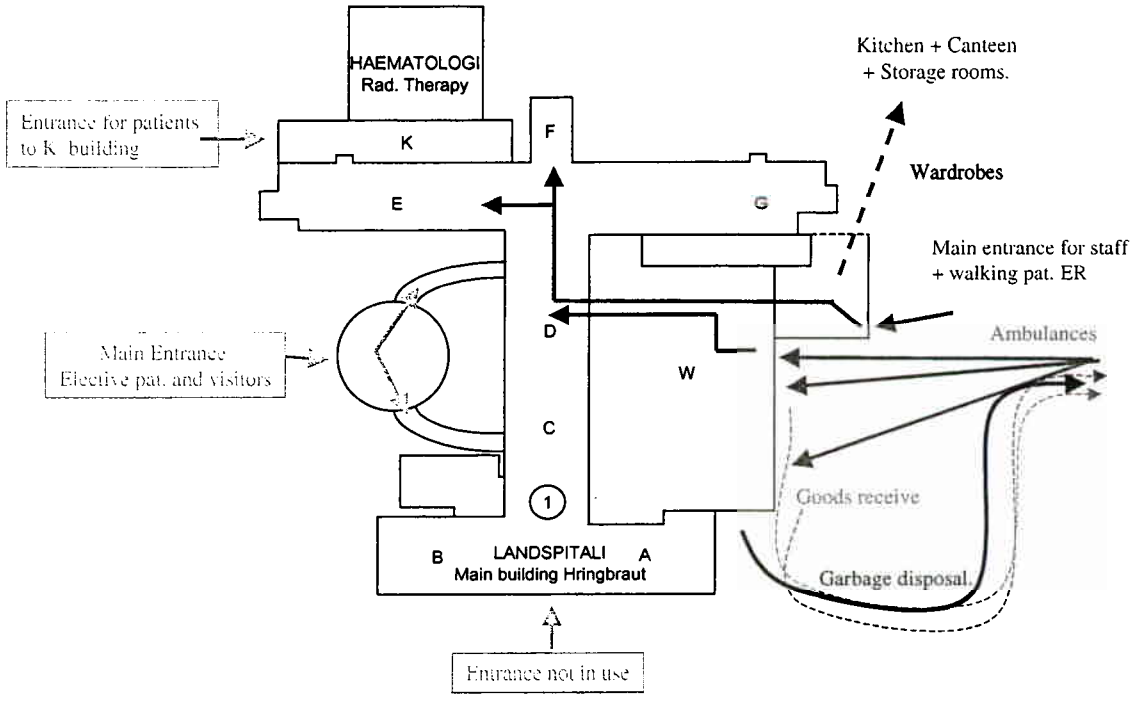
**Good things about Hringbraut:**

- A new Children's Hospital is being built close to gynecology and obstetrics. This building will be finished soon, and will improve the standards for children significantly.
- Psychiatry is located in a rather new building raised especially for psychiatric services. This building will satisfy the demands for a number of yeas ahead.
- Also oncology, radiotherapy and hematology are having good building facilities
- The university is quite next to the main building complexes, and the coming change of the main road will give more land for building activity

**Bad things about Hringbraut**

- There is one main building complex, but of a variable building quality, and with a number of additions also of variable quality (among others W-building)
- There is small stand-alone buildings of poor quality
- There is only little space for new building activity related to existing buildings
- Bad logistics for walking patients, there are too many entrances, it is difficult to find your way and emergency patients have entrance together with staff and supply
- Difficult and narrow access for cars to emergency, located together with supply and waste
- It is difficult to build without disturbing hospital operations

The logistical problems are illustrated on the figure below:



**Good things about Fossvogur**

- There is a new Intensive Care Unit and Recovery
- There is plenty of land for building activity, and you can build without disturbing the hospital operations
- Easy access by car to emergency
- There is one main building complex of acceptable quality with one addition (G-wing)

**Bad things about Fossvogur**

- G-wing is not optimal for patient activity
- Emergency, operational theatres and X-ray are not up-to-date
- There are too many entrances for patients
- The kitchen has a very central location

### 13.2.5. Building and functional bindings in the short-term

In order to develop solutions for the future, there are at least in the short-term some bindings to consider:

- Pediatric services and gynecology-obstetrics must stay in Hringbraut
- Psychiatry, oncology, radiotherapy and hematology must stay in Hringbraut
- Emergency in Fossvogur

## 13.3. Our recommendations

Our recommendations for future development of Landspitali first describe some general considerations to be taken, secondly our suggestions for short-term respectively long-term solutions.

### 13.3.1. In general

Short-term you need both Hringbraut and Fossvogur for acute hospital functions, as also stated above.

However, for the long-term we suggest gathering acute somatic functions in one location only. This location could be Hringbraut, Fossvogur or somewhere else (see later)

Some major short-term improvements is needed due to present space gap, but also due to the poor facilities of some functions (among others emergency and operational theatres)

Depending on what you decide for the long-term, you will give indications for the level of ambition for short-term improvements. Also the timeframe will depend on the chosen long-term solution. In any case the short-term implementation will be composed by a number of steps.

We suggest the following main principles to be taken into account when developing the short-term solution:

- Establish emergency in Fossvogur, with traumatology and the majority of acute surgery and medicine
- Merge the specialties and locate them in either Hringbraut or Fossvogur
- Move pulmonology in from Vifilstadir
- Keep children, women, oncology and psychiatry in Hringbraut
- Merge the laboratories and make them more efficient
- Have only one kitchen (in Hringbraut)

### 13.3.2. Long-term solutions

As mentioned above, a long-term solution has to be decided before you can identify actions to be taken in the short-term.

We see following possibilities in the long-term:

- Alternative A: one location for acute somatic hospital services: in Hringbraut or Fossvogur
- Alternative B: a new built hospital, for instance in Vifilsstadiror a less ambitious long-term solution:
- Alternative C: to continue the short-term development, use both Hringbraut and Fossvogur for acute somatic hospital services. (This alternative could also be considered as a step towards alternative A)

Below we try to summarize the advantages respectively disadvantages for the different alternatives.

**Long-term Alternative A: One hospital in Hringbraut or Fosvogur**

With this long-term alternative you gather all somatic hospital functions in one of the two locations where:Psychiatry will be established in the other location

- University functions will be established in both locations, as they have to be integrated in the clinical functions
- One laboratory in one of the two locations or eventually in a third location

In the following we will describe the consequences seen so far of the two possibilities for location of one somatic hospital.

The consequences will be described as advantages respectively disadvantages.

The consequences can be summarized as follows:

| Long-term alternative A | One hospital in Hringbraut (H) | One hospital in Fossvogur (F) |
|---|---|---|
| **Advantages** | Less space has to be new built, as H has most space today (60.000 gross sqm). But more space has to be re-built.<br><br>Neighbor to University | A good solution can be obtained, only few – or no – buildings have to be de-molished<br><br>Easy to implement during full hospital operations in both locations |
| **Disadvantages** | Difficult to integrate existing build-ings in a new solution, and probably not possible to achieve a logistical good solution.<br><br>Many buildings have to be demol-ished.<br><br>A number of preliminary buildings will be necessary<br><br>Building will disturb hospital opera-tions<br><br>You must probably move psychiatry to F | More new builds are necessary, as F has less space than H (total gross sqm in F amounts to 30.000). But less space has to be rebuilt.<br><br>You will have a longer distance to Uni-versity. |

## Long-term alternative B: A new hospital

A new hospital built in an "open land" has its obvious advantages, you can integrate all new trends, you can built after all modern principles and you can implement and build without dis-turbing present hospital activities.

However, higher investment costs are necessary, but you may find it easier to control invest-ments costs during the time of building compared to major rebuilds

Also a new hospital will give a longer distance to the present university unless you decide to demolish most buildings in Hringbraut and new build there.

## Long-term Alternative C: Continue with Hringbraut and Fossvogur

This alternative will not live up to our general suggestion for long-term solutions, to have acute somatic hospital function on one location only. It can however be a step towards the "Alterna-tive A", and with respect to consequences please see above.

### 13.3.3. Conclusions

If a new hospital is not an option we suggest:

- To chose Fossvogur as the location for the acute somatic hospital in the long-term

The reason for this recommendation is in principle mentioned above, but

- You will be able to achieve a good hospital
- You can implement without disturbing present hospital operations
- You will get "value for money", you can build new without demolishing a number of buildings
- You can reach this solution step by step, and integrate short-term improvements with the long-term solution.

We do not consider the distance to university (approx. 2 km) as a problem because all important clinical university functions will be integrated in the hospital.

The new Children's hospital located together with gynecology-obstetrics, and the good building quality of oncology, radiotherapy and hematology means that these services can remain in Hringbraut for many years, 10-25 years, or what the investment plan require.

Based on this we recommend, that the short-term solution should fit into this strategy. We suggest following short-term actions:

- Build a new emergency, operational theatres and X-ray in Fossvogur (eventually also a new recovery and ICU)
- Close the kitchen in Fossvogur, and rebuild kitchen for other services (for example outpatient or day care) together with a new main entrance
- Find a solution for the laboratories: first improve efficiency through process analysis and benchmarking and secondly build a new lab center or outsource services
- Use the G-wing for non-patient functions (offices and university functions)
- Gather over time the somatic specialties in Fossvogur, with first priority to the emergency related specialties
- Build in Fossvogur in steps according to the movement of specialties and investment plan

## 13.4. Actions to be taken

We suggest the management of Landspitali to do the following:

- Decide the direction for a long-term development, either
  - Focus on one of the two present locations
  - Go for a new hospital or
  - Run the hospital on both present locations
- Develop a detailed stepwise plan for short-term activities
  - Programme new and changed functions (rooms, size and location)
  - Analyze and take process view and IT support into consideration
  - Determine the consequences for staffing and organization
  - Time planning, investment planning

### 13.4.1. First steps in short-tem taken by the management

The management of Landspitali has recently decided a number of first step actions to be implemented during the coming year. These decisions are in overall in line with the recommendations presented previously. The actions are the following:

- Emergency will stay in Fossvogur, and a new observation unit with higher capacity will be established
- Acute admission for cardiology, pediatrics, obstetrics and psychiatry will take place in Hringbraut
- Clinical specialties are merged and located as follows:
  - In H: pediatrics, hematology, oncology, general surgery, urology, cardiology, psychiatry
    - Some pediatric beds in F for emergency, ENT and plastic surgery
    - Some cardiology beds in F to serve emergency
  - Merged and located in F: neurology, orthopedics
  - Internal medicine in H, with acute services in F
  - Others located in H: gynecology/obstetrics, thorac surgery, eye
  - Others located in F: pulmonology, plastic surgery, neurosurgery, vascular surgery, ENT
- Outside H & F: Dermatology and veneral diseases in Kopavogur
- Dialysis and diabetes clinic in Hringbraut
- Laboratories
  - The labs are merged on the management level.
  - Plan is developed for future location, incl. time and investment planning