

The National University Hospital of Iceland

The New Hospital Project

New facility: assessment of operational gains



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Content

1	Summary and conclusion	1
1.1	The main purpose of the new hospital project.....	1
1.2	The 2009 review of the new hospital project	1
1.3	The focus of this report	2
1.4	Conclusion	3
2	Background and scope	4
3	Methodology – a comparative approach	4
4	Present cost situation 2010.....	5
4.1	Core activities	5
4.2	Staffing.....	8
4.3	Facility management costs	8
4.3.1	<i>FM cost variables</i>	8
4.3.2	<i>The 2010-2011 status regarding number of m² occupied</i>	8
4.3.3	<i>The cost profile</i>	9
5	Future cost situation.....	10
5.1	Core activities	10
5.2	Benchmarking – Alternative 2.....	13
5.3	Benchmarking Landspitali with new hospital projects in Denmark and Norway	14
5.3.1	<i>Benchmarking clinical departments</i>	14
5.3.2	<i>Benchmarking clinical service departments, management and administration and service functions</i>	16
5.4	Possible savings	17
5.4.1	<i>Somatic patient activity 2025</i>	17
5.4.2	<i>Staff needed in Alternative 2</i>	18
5.4.3	<i>Staff needed in Alternative 0</i>	18
5.4.4	<i>Summary</i>	19
5.5	FM costs	19
5.5.1	<i>The cost profile 2025</i>	19
6	Total operational gains.....	20
6.1	Core activities	20
6.2	FM costs 2010 - 2025.....	20
6.3	Sum of cost gains	21
6.4	NPV-analysis	21
7	Uncertainty	22
8	Appendix 1. Present situation 2010	24
9	Appendix 2. Patient activity 2025	26

10	Appendix 3: Process	28
11	Appendix 4. Methodology	29
11.1	A comparative approach	29
11.2	Calculation of productivity figures	30
11.2.1	<i>Productivity figures for clinical departments</i>	30
11.2.2	<i>Productivity figures for clinical service departments</i>	31
11.2.3	<i>Productivity figures for management and administration and service departments</i>	31
12	Appendix 5. Norwegian and Danish benchmarking hospitals	31
12.1	Østfold Hospital	32
12.2	Stavanger University Hospital	32
12.3	Kolding Hospital	32
12.4	A general hospital, Denmark	33
13	Appendix 6. NPV-analysis	1

Table index

Table 1. Sum of estimated cost difference per year Alternative 0 vs. Alternative 2 in a 2025 perspective	3
Table 2. The 2009 cost savings estimates, Alternative 1 and 2 compared to Alternative 0	4
Table 3. Inpatient and outpatient activities 2010	6
Table 4. Actual beds in 2010	6
Table 5. Surgical procedures 2010	7
Table 6. Diagnostic imaging examinations 2010 in Radiology department	7
Table 7. Emergency 2010	7
Table 8. FTE's 2010	8
Table 9. Space usage 2011 and planned usage 2025 (Alternative 2 and Alternative 0)	9
Table 10. FM cost data 2010	10
Table 11. Population projection in Iceland by age 2011 to 2025	11
Table 12. Alternative 2. Estimated patient activity data for 2025, somatic functions	12
Table 13. Alternative 0. Estimated patient activity data for 2025, somatic functions	12
Table 14. Development of patient activity and number beds from 2010 to 2025 for Alternative 0 and Alternative 2, somatic functions	13
Table 15. Benchmarking. Clinical departments. Productivity figures for Norwegian/Danish hospitals compared to Landspítali	15
Table 16. Alternative 2. Estimated gain in Landspítali after benchmarking – 2010 level	15
Table 17. Alternative 2. Benchmarking clinical services and other service functions	16
Table 18. Alternative 2. Estimated gains in clinical services and other service functions at Landspítali 2010 level	17
Table 19. Alternative 2. Somatic patient activity in 2025	17
Table 20. Alternative 0. Somatic patient activity in 2025	18
Table 21. Alternative 2. Staff measured in FTE's 2010 - 2025	18
Table 22. Staff increase 2010-2025 in Alternative 0	19
Table 23. Comparison of alternatives	19
Table 24. Estimated FM costs 2010 and 2025	20
Table 25. Estimated cost savings 2025, Alternative 2, rental costs	20
Table 26. Estimated cost savings 2025, Alternative 2, transportation	21
Table 27. Total cost increase, FM, transportation and rental costs Alternative 2	21
Table 28. Sum of estimated cost difference per year in 2025 between Alternative 0 and Alternative 2	21
Table 29. NPV analysis in the 2009-project review	22
Table 30. NPV analyses 2011	22
Table 31. Uncertainty, FM costs	23
Table 32. Uncertainty, internal and external benchmarking	23

Figure index

Figure 1. Alternatives from the 2009 project review	1
Figure 2. Illustration Alternative 2 from 2009 review	2
Figure 3. Methodology for calculating cost savings by comparison of two alternatives	5
Figure 4. Population growth 2011-2025 per age group, and expected bed days per age group	11
Figure 5. Methodology for calculating cost savings by comparison of two alternatives	30

1 Summary and conclusion

1.1 The main purpose of the new hospital project

The main purpose of the new hospital project is to unite the two acute care facilities of Landspítali at Hringbraut and Fossvogur in one location at Hringbraut. In 2008 Landspítali carried out an analysis of the extra costs involved with operations in two separate sites. The majority of the savings was identified as excess labour costs in clinical areas, support service and inventory as well as quality and safety of care. However, there have been extensive changes in the operation of Landspítali during the last two years, with large cut downs in the budget. It has therefore been necessary to re-evaluate the gains. Landspítali therefore decided to conduct a new comprehensive assessment on the operational gains. To understand the background and the alternatives evaluated, a brief summary of elements from the 2009 review report is given below.

1.2 The 2009 review of the new hospital project

In a review of the project done in 2009, the alternatives were described as showed in the figure below:

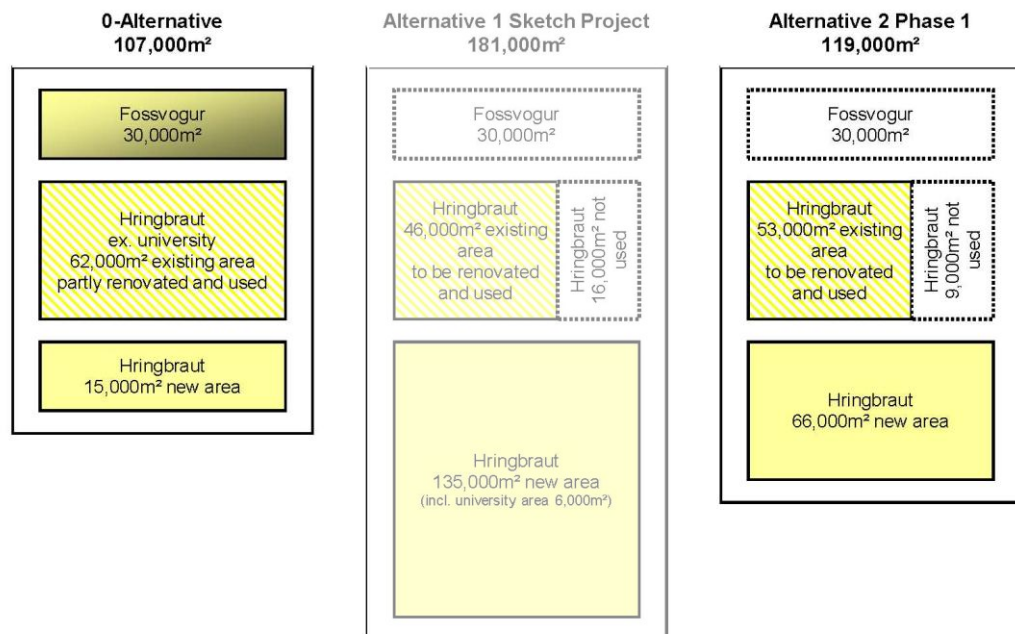


Figure 1. Alternatives from the 2009 project review¹

The 0-Alternative utilises the existing facilities at Fossvogur in their entirety, together with 62.000m² of the hospital's general building mass. The existing areas are upgraded in accordance with the definition of the 0-Alternative. 15.000m² of new buildings are provided to replace existing buildings of poor quality and to provide an absolutely necessary increase in capacity. The 0-Alternative does not simply consist of "doing nothing" – an option which is unrealistic both economically and in terms of qualitative considerations. Excess maintenance and new buildings were estimated at approximately 41 mrd ISK.

Alternative 1 is 135.000m² of new buildings inclusive of 6.000m² university area which is integrated with the clinical area. In addition, re-use of 46.000m² existing area, which is to be upgraded as in the 0-Alternative. Fossvogur and other general areas are either disposed of or utilised for hospital functions. Alternative 1 is not considered in this evaluation. Investments were estimated at approximately 100 mrd ISK.

¹ The space in this figure is not to be compared to the total space of Landspítali this figure only focuses on Fossvogur and Hringbraut

Alternative 2 is a first phase development of 75.000m² new buildings plus re-use of 53.000m² existing area upgraded in accordance with the 0-Alternative. The objective is to realise as much as possible of the economic advantages of a redevelopment. In addition, this alternative also includes a series of qualitative improvements, such as providing single rooms for approximately 180 beds, and creates a platform for further development in several alternative directions. Excess maintenance and new buildings were estimated at approximately 61 mrd ISK. Alternative 2 was in the 2009-review illustrated as shown below:

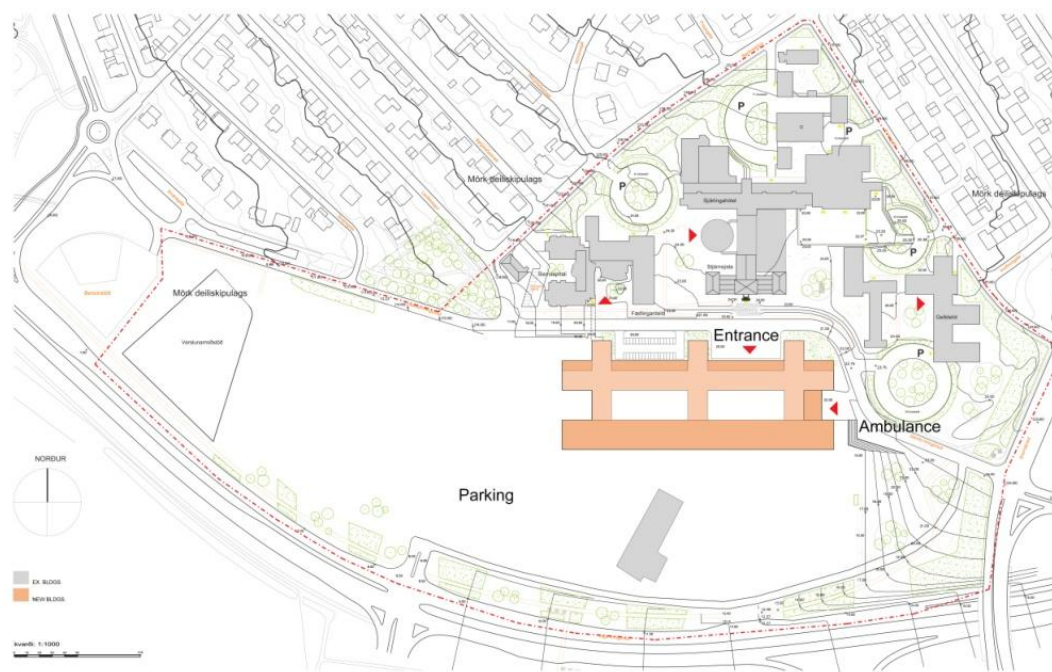


Figure 2. Illustration Alternative 2 from 2009 review

In 2009 it was concluded the Alternative 2 was the best choice compared to Alternative 1 and Alternative 0, given the recourse constraints on investments. The Alternative 1 is not a focus in this report since it is Alternative 2 which is now regarded as the relevant option.

1.3 The focus of this report

This new assessment of operational gains focuses on comparing Alternative 2 with Alternative 0, both in time perspective 2025:

1. Operating the hospital functions in the existing facilities in a 2025 perspective including the investments needed in the 0-alternative.
2. Operating the hospital functions in partly new facilities (75.000 m² of new facilities) in a 2025 perspective. Alternative 2.

The investment, excess maintenance and rebuild costs in the two compared alternatives are approximately 61 mrd ISK in Alternative 2 vs. 41 mrd ISK in Alternative 0. So there is no alternative in time perspective 2025 without investment costs or excess maintenance costs.

The new estimates identify a saving potential in annual operating costs for the core hospital functions of approximately 2.700 mill ISK in Alternative 2 compared to Alternative 0. Building 75.000 m² of new facilities allows a merging of functions which in existing facilities must be operated in various buildings on different sites.

However, the facility management (FM) costs will have a slight increase because of increased space in Alternative 2. The increase of space (including the new facilities) results in an up to date standard of services. The value of upgrading the standard is not easily measured in economical terms, but the costs of running the facility are measurable. The

² 66.000 m² in the 2009 report is later changed to 75.000 m².

excess FM costs given the Alternative 2 including 75.000 m² of new buildings, is approximately 90 mill ISK.

The gross annual economical gain in operating costs of a scenario including 75.000 m² of new buildings compared to operating in existing buildings is estimated at approximately 2.600 mill ISK. In this gain the increase in the standard of services is not measured. The expected annual gross gain is approximately the same level as estimated in 2009.

Estimating future operating costs and savings in 2025 also involves an evaluation of the level of uncertainty in these estimates. In this report the estimated operational gain related to the core activities is approximately 2.700 mill ISK, and has an uncertainty range from 2.200 mill ISK (- 20 %) to 3300 mill ISK (+ 20 %). The expected 2025 FM costs are, given the Alternative 2 including 75.000 m² of new buildings, 2.630 mill ISK with an uncertainty range from 2400 mill ISK (-10 %) to 2.900 mill ISK (+ 10 %). For further details, see chapter 7.

The table below shows the total estimated annual cost difference (approximately 2.600 mill ISK).

Table 1. Sum of estimated cost difference per year Alternative 0 vs. Alternative 2 in a 2025 perspective

Function	Cost difference per year, mill ISK
FM costs	88
Core activities	-2 719
Sum cost changes	-2 631

A NPV³ analysis of the two alternatives shows that the Alternative 2 gives a better result than Alternative 0. This result is consistent with the result of the NPV analysis in the 2009 project review.

1.4 Conclusion

When comparing Alternative 0 with Alternative 2, Alternative 0 has less investment costs, while Alternative 2, on the other hand, has a significant operational gain. The estimated operational gain in Alternative 2 compared to Alternative 0, FM cost changes included, is approximately 2.600 mill ISK per year. In a NPV-analysis this operational gain is more than weighing out the effect of the excess investment cost in Alternative 2. The operational gain is approximately at the same level as estimated in 2009.

³ Net Present Value: a method of weighing together long term operational gains (or costs) with investment costs. Formally: the discounted value of the differences over time between monetary costs and benefits in a defined time perspective.

2 Background and scope

The main purpose of the new hospital project is to unite the two acute care facilities of Landspítali at Hringbraut and Fossvogur in one location. The future location will be at Hringbraut. In 2008-2009⁴ Landspítali carried out an analysis on the extra costs involved with core operations in its two main locations. The majority of the savings if united in one location was identified as excess labour cost in clinical areas, support service and inventory as well as in quality and safety of care. There have been extensive changes in the operation of Landspítali during the past two years, with large cut downs in the budget.

Based on this development it was necessary to re-evaluate the gains, and Landspítali decided to conduct a new comprehensive assessment on the operational gains.

The 2009-estimates were defined in two alternatives as follows (mill ISK from the 2009 NPV-analysis):

Table 2. The 2009 cost savings estimates, Alternative 1 and 2 compared to Alternative 0

Area of annual cost saving, mill ISK	Alt 1	Alt 2
Clinical services	1.030	1.030
Support services	550	440
Infection control reinforcement	120	96
Reduced rental costs	120	0
Patient hotel and outpatient services	1.000	800
SUM	2.820	2.366

Alternative 1 had 135.000 m² of new facilities, and an estimated investment cost of 100 mrd. ISK. The Alternative 2 had 75.000 m² of new facilities, plus refurbishment and upgrading of some of the existing buildings, and the investment was estimated at approximately 61 mrd. ISK. These estimates together with estimated operational gains (see the table above) and sales value for property were applied as input to the NPV analysis in 2009.

In this report we compare the 0 Alternative, with Alternative 2. We do not compare with the Alternative 1, since the focus now is on the choice between Alternative 0 and Alternative 2.

The project's process is described in appendix 3.

3 Methodology – a comparative approach

We have used the standard methodology⁵ of Hospitalitet as for assessment on operational gains. The main principles are:

- The operational gains are the difference in estimated operating costs between two future cost situations.
- The present situation is the baseline, and based on 2010 data from existing hospital
- The future situation is the future hospital operational costs estimated in two alternative situations
 - Alternative 0: Existing facilities in a 2025 perspective including needed investments
 - Alternative 2: With new facilities (75.000 m²) in a 2025 perspective

⁴ This analysis was partly carried out in 2008, before the 2009 review was presented, and was used as an input in the NPV-analysis in the 2009 review.

⁵ A well grounded method Hospitalitet as has used for assessing the operating costs of future hospital services in alternative scenarios

A full description of the methodology is in appendix 4.

The present situation is described on basis of 2010 data from Hringbraut and Fossvogur, and the data is used as a reference point to calculate productivity figures like “number of activities per FTE” for the different functions of Landspítali, and these productivity figures describe the present situation.

The future situation of Alternative 0 and Alternative 2 is estimated based on projected patient activity in the future hospital.

For Alternative 2 we use productivity levels based on comparative data from other Nordic hospitals. We assume that the departments in a united Landspítali can be raised to a higher productivity level based on “Best-Practice” analysis. To perform benchmarking with different hospitals it is necessary to calculate productivity figures for relevant departments like “number of activities per FTE” for each hospital. Patient activities are different categories (inpatients, outpatients, day patients) and in order to summarise these different activities we use a weighing principle which in rough terms describes the complexity and scale of the activity. This is further described in appendix 4.

In the Alternative 2 the benchmarking is based on new buildings, new processes and technology.

For the Alternative 0 the patient activity is also projected to 2025, but with a lower grade of efficiency related to service mix. The staff needed in 2025 is based on the present productivity level of Landspítali. In this alternative Landspítali cannot be raised to a best-practice level based on benchmarking with new hospital projects.

The main principle is shown in the figure below:

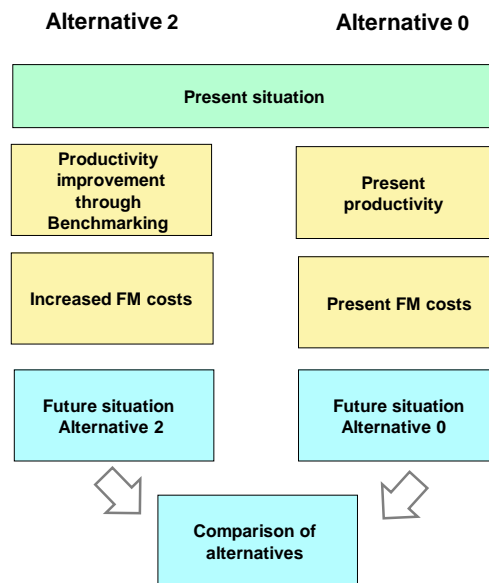


Figure 3. Methodology for calculating cost savings by comparison of two alternatives

All costs are calculated in mill 2010 ISK.

4 Present cost situation 2010

4.1 Core activities

Based on activity data of 2010 the inpatient and outpatient activity in the somatic specialties and mental health can be summarized as follows (details in appendix 1).

Table 3. Inpatient and outpatient activities 2010

Specialty	Location	Inpatients	Beddays	Normal beds (actual)	Observation patients	Hotel beddays patients	Outpatients doctors	Day visits	Outpatients nurses & others
Medicine in total HB	HB	4.552	26.197	81			53.052	26.240	
Medicine in total FV	FV	5.082	36.088	107			31.494	8.212	20.162
Geriatrics	LKOT	934	25.030	83			2.720	4.151	
Rehabilitation	GR	262	8.213	24			178	5.128	
Surgery in total HB	HB	3.728	16.147	54			20.469	7.129	
Surgery in total FV	FV	3.923	16.473	54			22.273	4.249	
Women and children in total HB	HB	7.897	19.885	87			40.339	7.102	10.581
Women and children in total FV	FV	0	0	0			0	165	
Hospice	KOP	270	3.646	12			47	407	
Somatic in total		26.648	151.679	502	3.172	9.598	170.572	62.783	30.743
Mental Health in total HB	HB	2.120	19.780	66			7.602	10.577	20.938
Mental health, rehabilitation	KL	365	15.136	43			2.603	1.047	4.862
Mental health, rehabilitation	LR	24	2.494	8				757	
Mental health	Sogn	9	1.759	7					
Mental health, children	DAL	212	3.589	17			1.729		4.135
Mental health	Skst							2.961	
Mental health	Hat							11.076	
Mental Health in total		2.730	42.758	141			11.934	26.418	29.935
Habilitation	KOP	14	4.966	14					
Landspítali in total		29.392	199.403	657	3.172	9.598	182.506	89.201	60.678

This table shows the basic patient activity in the hospital, and results in 27.000 somatic inpatients per year with 152.000 bed days, more than 200.000 outpatient visits including visits to nurses and others as well as 63.000 day patients. In mental health there are about 3.000 patients and 43.000 bed days, 42.000 outpatient visits and 26.000 day patients.

The present bed capacity is 502 somatic beds in total, including geriatrics, rehabilitation and hospice. Intensive care is not included. Mental health has 141 beds and there are 14 beds for habilitation. Furthermore there are 10 observation beds in the Fossvogur emergency and 41 hotel beds. The hotel beds are an average for the year 2010, with 50 beds in 7 months and 28 beds in 5 months. The hotel beds are mainly used by patients but relatives also use the hotel. The total number of beds can for 2010 be summarised as follows:

Table 4. Actual beds in 2010

Actual beds 2010	Normal beds	Obs beds	Hotel beds *)	Total beds
Hringbraut, somatic	222			
Fossvogur somatic	161	10		
Other locations, somatic	119			
Somatic in total	502	10	41	553
Hringbraut, mental health	66			
Other locations, mental health	75			
Mental Health in total	141			141
Other locations, habilitation	14			
Total	657	10	41	708

*) 50 hotel beds in 7 months and 28 beds in 5 months. In average 41

Furthermore patient related activities in the clinical service departments have to be quantified. These are surgical procedures, diagnostic imaging and emergency services, These activities are shown in the tables following.

Table 5. Surgical procedures 2010

Surgical procedures 2010	Location	Day surgery	Planned surgery inpatients	Acute surgery inpatients	Total
General surgery	HB	594	1.003	727	2.324
Urology	HB	430	402	92	924
Cardiothoratic surgery	HB	6	304	315	625
Ophthalmology *)	HB	3.311	138	103	3.552
Gynecology/obstetrics	HB	1.161	494	1.143	2.798
Pediatric surgery	HB	218	138	296	652
Surgery in total HB	HB	5.720	2.479	2.676	10.875
General surgery	FV	0	0	13	13
ENT	FV	538	342	230	1.110
Orthopedics	FV	801	550	1.295	2.646
Neurosurgery	FV	176	372	211	759
Plastic reconstructive surgery	FV	57	202	59	318
Vascular surgery	FV	49	106	81	236
Surgery in total FV	FV	1.621	1.572	1.889	5.082
Landspítali in total		7.341	4.051	4.565	15.957

*) Including 2.285 medical injections

In total there are about 16.000 surgical procedures per year, with approx. 8.500 procedures for inpatients and 7.300 for day patients.

Table 6. Diagnostic imaging examinations 2010 in Radiology department

Diagnostic imaging examinations 2010	Hringbraut	Fossvogur	Landspítali in total
X-ray	17.585	51.101	68.686
Angiography	25	987	1.012
Scintigraphy	1.364	346	1.710
Ultrasound	5.278	4.483	9.761
MRI	3.957	4.858	8.815
CT	10.010	15.253	25.263
PET			
Review of prev. Diagnostic images	1.224	1.451	2.675
Mammography			
Other	1.030	1.487	2.517
Total	40.473	79.966	120.439

In total there are performed approximately 120.000 imaging examinations in the Radiology department. These numbers do not include invasive cardiac procedures performed in the cardiology department which are accounted for in the clinical cardiology department.

Table 7. Emergency 2010

Emergency	Hringbraut	Fossvogur	Landspítali in total
Visits G2	3.632	41.515	45.147
There from admitted	884	5.937	6.821
There from in observation bed		3.172	3.172
There from calculated outpatient visits	2.748	32.406	35.154
Visits G3		23.649	23.649
Weighted activities *)	1.342	18.452	19.794

*) Admissions+patients in obs bed + outpatient visits/6

The various activities in emergency have a different case mix. We have therefore created a weighted index for activities which will be used in the benchmarking later.

4.2 Staffing

The staff measured in FTEs related to the activity in 2010 can be stated as follows (details shown in appendix 1).

Table 8. FTE's 2010

Staffing data 2010 (FTE)	Hringbraut			Fossvogur			Other locations			Landspítali in total		
	Doctors	Other	Total staff	Doctors	Other	Total staff	Doctors	Other	Total staff	Doctors	Other	Total staff
Somatic clinical departments in total	149	652	801	99	343	442	28	217	245	276	1.211	1.487
Mental health in total	31	160	191				17	208	225	48	368	415
Habilitation (KOP)								29	29		29	29
Clinical functions in total	180	812	992	99	343	442	45	453	498	324	1.608	1.931
Clinical services in total	58	501	559	60	387	447	5	160	164	123	1.048	1.171
Service functions in total	2	239	241	2	74	75	3	225	228	6	538	544
Total	240	1.552	1.792	160	804	964	52	838	890	452	3.194	3.646

These numbers do not include external staff in cleaning, canteen and maintenance.

4.3 Facility management costs

4.3.1 FM cost variables

The FM cost depends primarily on two factors:

- The number of m² occupied (owned or rented) by the hospital
- The cost profile of this connected to the facilities. The cost per m².

4.3.2 The 2010-2011 status regarding number of m² occupied

The 2011 space status is documented in the table below together with the 2025 plan (Alternative 2).

Table 9. Space usage 2011 and planned usage 2025 (Alternative 2 and Alternative 0)

Location	2011, m ²	2025, Alt 2, m ²	2025, Alt 0, m ²
Hringbraut	56 853	56 853	56 853
Hringbraut, new		75 000	15000
Armuli	3 862	0	3 862
Þorfinnsgata	1 340	1 340	1 340
Eiriksgata	760	760	760
Kleppur	9 902	9 902	9 902
Dalbraut	3 123	3 123	3 123
Laugarasvegur	403	403	403
Reynimelur	228	0	228
Kopavogur	8 991	8 991	8 991
Vífilsstaðir	9 320	9 320	9 320
Tunguhals	3 725	3 725	3 725
Fossvogur	28 574	0	28 574
Grensas	5 792	5 792	5 792
Landakot	9 543	9 543	9 543
Skólavordustigur	1 065	0	1 065
St. Jósefsspítali	3 714	0	3 714
Sommerhouses	924	924	924
Apartments	1 203	0	1 203
Baronstigur	342	0	342
Eiriksgata	3 402	3 402	3 402
Hatun	495	0	495
Snorrabraut	1 645	0	1 645
Skogarhlid	150	0	150
Vesturhlid	1 179	0	1 179
Total	156 535	189 078	171 535

4.3.3 The cost profile

Landsþítali has provided the following FM-cost data (2010).

Table 10. FM cost data 2010

Facility Management costs (FM costs)	Mill ISK
Administration	
Taxes	287.827
Insurance	20.324
Administration	38.589
Operating costs	
Basic operations	500.500
Cleaning	447.749
Energy	225.705
Water supply a	51.180
Waste	23.301
Security	121.248
Outdoors FM (Parking areas, parks, snow clearing)	60.200
Maintenance	
Planned maintenance	143.000
Ad hoc/ short notice maintenance	71.500
Outdoors	6.000
Rental costs	160.874
Service costs	
Inventory, relocations etc	20.000
Sum	2.177.997
Facility development costs	
Rebuilding and upgrading	323.000

The 2010 cost per m² according to this data is 13.914 ISK.

5 Future cost situation

5.1 Core activities

In order to evaluate the operational costs for 2025 we have estimated the patient activity for 2025 for both alternatives. The patient activity in 2025 is extrapolated from the 2010 activity in two steps:

- Demographic development
- Turnover and efficiency: Estimated transfer of inpatients to day care and observation beds as well as reduction of length of stay⁶.

The demographic development is based on the development of the population of Iceland from 2010 to 2025, which according to official statistics is shown in the table below.

⁶ Due to technical progress in medicine and enhanced preventive measures, as well as possibilities of new facilities

Table 11. Population projection in Iceland by age 2011 to 2025

Age groups	2011	2025	% change
0-9 years	44.790	46.146	3,0
10-19 years	45.053	48.074	6,7
20-29 years	46.780	45.138	-3,5
30-39 years	44.400	45.677	2,9
40-49 years	42.616	45.957	7,8
50-59 years	39.930	42.059	5,3
60-69 years	27.622	40.712	47,4
70-79 years	16.282	28.445	74,7
80-89 years	9.451	11.906	26,0
90-99 years	1.489	2.380	59,8
100 years and over	39	43	10,3
SUM	318.452	356.537	12,0

The total population increase is 12 %, but especially the older age groups (over 60 years old) have a higher growth rate (see also figure below). As these age groups in general use the hospital services more than the younger age groups, each age group is extrapolated individually.

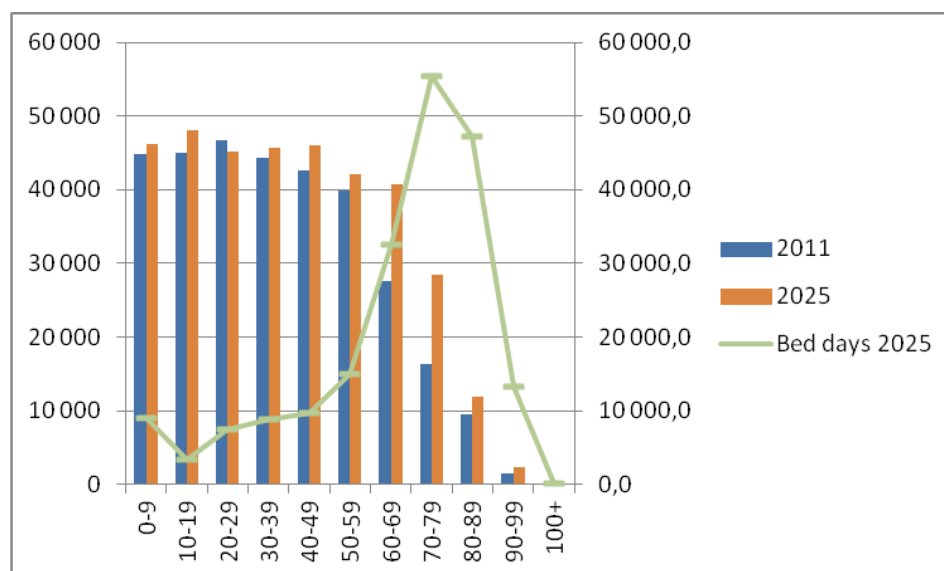


Figure 4. Population growth 2011-2025 per age group, and expected bed days per age group

The demographic profile of the Icelandic population in 2011 combined with number of inpatients and bed days gives indexes for inpatients/inhabitant and bed days/inhabitant. These indexes together with the projected population of Iceland in 2025 are used to calculate a demographic patient development of 2025. The indexes and development figures are shown in appendix 2.

For estimating patient turnover and efficiency of patient treatments in 2025 projections from the hospital projects in Østfold and Stavanger in Norway are used. Based on those and the following developments for Alternative 2 are predicted:

- 8 % of the somatic inpatients will have transferred to daycare (excl pediatric ICU and hospice as well as mental health)
 - Østfold 7,2 % and Stavanger 8,2%
- 10 % of the inpatients will have transferred to observation beds and will be discharged from there
 - Østfold 10 %, Stavanger 12 %
- Reduction of beddays due to transfer to daycare and observation is 1,3 days/patient (like Østfold & Stavanger)

- General reduction of bed days: 19 % for both somatic and mental health
 - Østfold: 25 %, Stavanger 16 %
- 6 % of the remaining bed days will have transferred to a patient hotel (excl. infectious diseases, geriatrics, pediatric ICU and mental health)
 - Various experiences from Norway are due to differences in patient hotel developments. Latest 5 % of the bed days have transferred to a patient hotel at Ullevål and Aker hospitals in Oslo.

Outpatient services delivered by nurses and other staff categories are not included in the projection to 2025, as these data are not available for the benchmarking hospitals.

For the Alternative 0 the patient turnover and efficiency of patient treatments will be lower due to older buildings, and the predicted figures for 2025 are therefore reduced to a lower level than Alternative 2. We have assumed a level of 70 % of Alternative 2.

For both alternatives we use the following occupancy rates, which corresponds to those used for the Norwegian hospitals:

- Occupancy rate for calculation of beds needed:
 - Somatic adults: 85 %
 - Pediatrics: 70 %
 - Observation beds: 85 %
 - Hotel beds: 70 %

Mental health and habilitation is kept unchanged.

These assumptions lead to the following patient activity in 2025, where only somatic specialties is shown, as mental health and habilitation are kept unchanged. (details in appendix 2)

Table 12. Alternative 2. Estimated patient activity data for 2025, somatic functions

Alternative 2 - patient activity 2025	Inpatients	Beddays	Obs patients	Hotel bed days	Outpatients doctors	Day visits
Internal medical services	9.783	62.229			105.658	43.620
Surgical services	7.770	31.511			53.690	14.849
Women & children services	8.861	19.641			50.698	2.900
Geriatrics	948	26.881			3.461	5.233
Rehabilitation	266	8.301			246	6.377
Hospice	270	3.646			47	
Somatic clinical departments in total	27.898	152.208	9.155	19.239	213.800	72.979

For Alternative 2 there is generally an increase in patient activity, especially in the day- and outpatient services. The increase in bed days is less than the increase in number of inpatients, indicating that the length of stay is expected to decrease. There is an increase in the number of bed days in observation beds and hotel beds.

Table 13. Alternative 0. Estimated patient activity data for 2025, somatic functions

Alternative 0 - patient activity 2025	Inpatients	Beddays	Obs patients	Hotel bed days	Outpatients doctors	Day visits
Internal medical services	10.428	68.255			105.371	43.334
Surgical services	8.281	34.927			53.463	14.621
Women & children services	9.108	21.584			50.504	2.857
Geriatrics	1.011	28.843			3.433	5.205
Rehabilitation	284	9.074			239	6.369
Hospice	334	4.874			47	0
Somatic clinical departments in total	29.445	167.556	7.654	17.695	213.057	72.387

As the transfer to day care and observation is lower in Alternative 0 compared to Alternative 2, we see a higher number of inpatients in Alternative 0. Also the number of bed days is higher due to lower reduction in length of stay. The total development in patient activity and number of beds from 2010 to 2025 in the two alternatives can be summarised in the table following:

Table 14. Development of patient activity and number beds from 2010 to 2025 for Alternative 0 and Alternative 2, somatic functions

Landspitali	2010	2025	2025
		alternative 0	alternative 2
Somatic			
Inpatients	26.648	29.445	27.898
Beddays	151.679	167.556	152.208
LOS	5,7	5,7	5,5
Beds *)	502	548	498
Observation patients	3.172	7.654	9.155
Observation beds *)	10	15	18
Hotelbeddays (patients)	9.598	17.695	19.239
Hotel beds *)	41	71	77
Outpatients	170.572	213.057	213.800
Day patients	62.783	72.387	72.979
Total somatic beds	553	633	592

*) Beds: 2010 numbers are actual beds. 2025 numbers are beds needed with occupancy 85 % for adults, 70 % for children and 70 % for hotel

In Alternative 2 the number of observation beds and hotel beds is increased, which is the reason for the increase in the total number of somatic beds from 533 to 592. In Alternative 0 the number of beds increases in all areas. This is due to the lower transfer of inpatients to day care and observation as well as the lower reduction of length of stay. In Alternative 0 is the total number of somatic beds 633, which is approximately 40 more than in Alternative 2.

5.2 Benchmarking – Alternative 2

With benchmarking Landspitali is compared to other new hospital projects in Norway and Denmark in order to identify a potential for gain related to the new development of Landspitali. We only use benchmarking for alternative 2 where Landspitali will have new buildings with corresponding technology and processes. The benchmarking hospitals from Norway and Denmark are hospitals which have all gone through a similar future prediction in connection with new constructions, and are all included in the Hospitalitet database.

- Landspitali: A fully integrated university hospital covering the total Icelandic population including all levels of specialised hospital services.
- Østfold Hospital, Norway: A general hospital covering all general hospital functions for a population of approximately 300.000 inhabitants. 2/3 of the hospital is going to be in new buildings in a 2015 perspective.
- Stavanger University Hospital, Norway: A university hospital in Norway with high specialised hospital functions, serving a population of approximately 400.000 inhabitants. A great part of the hospital is going to be in new buildings and renovated in a 2025 perspective.
- Kolding Hospital, Denmark: A general hospital covering all general hospital functions for a population of approximately 300.000 inhabitants. A great part of the hospital is going to be in new buildings in a 2020 perspective.
- A general hospital in Denmark: A general hospital covering all general hospital functions for a population of approximately 200.000 inhabitants. 1/3 of the hospital is going to be in a new building in a 2020 perspective.

A short description of the benchmarking hospitals in Norway and Denmark is shown in appendix 4.

Landspitali is a highly specialised university hospital with regional and national functions, and three of the Norwegian/Danish hospitals are general hospitals. This means that the hospitals have a different case mix. We take this fact into account as explained later. The benchmarking is performed for the following functions/services:

- Clinical departments: Medical, surgical, women & children services.
- Clinical service departments: Emergency, surgery and anaesthesiology incl. intensive care, diagnostic imaging and laboratories.
- Management and administration.
- Service functions: Kitchen, laundry, transportation, security.

The clinical departments exclude geriatrics, rehabilitation, hospice, mental health and habilitation because these departments are not influenced by the building development of Landspitali. The service functions exclude maintenance and cleaning, since these services are included in the FM costs.

Productivity figures are calculated for these hospitals where possible and compared to the similar figures for Landspitali based on patient activity and staffing in 2010.

5.3 Benchmarking Landspitali with new hospital projects in Denmark and Norway

5.3.1 Benchmarking clinical departments

The productivity figures are calculated for each department as described in part 3.1. Østfold and the Danish hospitals are general hospitals with no regional and university functions compared to Stavanger University Hospital and Landspitali, which both are university hospitals with specialised regional functions. These hospitals therefore have different patient case mix, characterised by the average DRG score per patient in the hospital. To take this fact into account we use a patient index for the Norwegian hospitals based on the national patient register SAMDATA. The patient index is based on a DRG case mix and covers inpatients, day patients and outpatients from the year 2009. From this register we find:

- Østfold Hospital: Patient index 0,20
- Stavanger University Hospital: Patient index 0,21
- St. Olavs Hospital, Trondheim: Patient index 0,22

The above figures show a difference between St. Olavs and Østfold of 10 % and between St. Olavs and Stavanger of 5 %. Landspitali is in this report considered to have a case mix similar to St. Olavs Hospital, as Landspitali is a highly specialised hospital with among others transplantations. The figures are used in the following way:

- Østfold Hospital, Kolding Hospital and general hospital in Denmark: productivity figures are reduced with 10 % compared to Landspitali
- Stavanger University Hospital: productivity figures are reduced with 5 % compared to Landspitali

Tabell 15. Benchmarking. Clinical departments. Productivity figures for Norwegian/Danish hospitals compared to Landspitali

Benchmarking	Wght patients	Wght beddays	Doctors	Other	Total staff	Wght patients per doctor	Wght beddays per other
Landspitali 2010 (case mix 1)							
Internal medical services	28.164	173.462	127	510	637	222	340
Surgical services	16.063	83.091	100	262	362	160	317
Women & children service	13.626	54.259	50	248	298	272	219
Østfold Hospital, Norway 2020 (case mix 0,9)							
Internal medical services	40.582	188.133	157	605	761	233	280
Surgical services	25.084	129.725	105	388	492	216	301
Women & children service	12.346	42.897	51	213	264	218	181
Stavanger University Hospital, Norway 2025 (case mix 0,95)							
Internal medical services	44.667	259.004	173	909	1.082	245	271
Surgical services	31.457	178.432	241	640	880	124	265
Women & children service	23.110	86.710	80	404	484	274	204
Kolding Hospital, Denmark 2020 (case mix 0,9)							
Internal medical services (incl. Emergency)	21.603	91.406	112	511	622	174	161
Surgical services (inkl. emergency & surgery)	26.582	102.472	133	610	743	180	151
Women & children service	17.234	54.700	70	343	413	221	144
A general hospital, Denmark 2020 (case mix 0,9)							
Internal medical services	28.453	127.857	84	405	489	305	284
Surgical services	17.938	88.181	80	248	328	202	320
Women & children service	9.811	32.319	31	105	136	287	276

*) Medical and surgical doctors include emergency doctors. Divided 50/50 for benchmarking purpose only

Best-Practice is marked with blue. Among these hospitals Landspitali performs best with respect to other staff in medical services. Østfold performs best with respect to surgical doctors. The general hospital in Denmark performs best with respect to doctors in medical services, other staff in surgical services and for all staff in women & children services.

Following the methodology Landspitali should be raised to best-practice level. However, there is an uncertainty in benchmarking where you compare overall productivity figures not knowing what is underlying these figures. Where the difference is high we therefore suggest reducing the productivity target. For instance medical doctors in the above table: Landspitali has a productivity figure of 222 weighted inpatients per doctor and best-practice (the general hospital in Denmark) has 305 weighted inpatients per doctor. We consider this difference to be too high to be directly comparable, and to modify (reduce uncertainty) we use a target for Landspitali which is in the middle between the two figures: $(222 + 305)/2 = 263$. For medical doctors we use 263 weighted inpatients/doctor as a target for Landspitali. This method is used in all cases marked with bold in the above table: Medical doctors, surgical doctors and other staff for women & children service. In all other cases Landspitali is raised to Best-Practice level. Using these principles the total staff in Landspitali after benchmarking is as follows:

Table 16. Alternative 2. Estimated gain in Landspitali after benchmarking – 2010 level

Benchmarking	Doctors needed after BM	Others needed after BM	Total staff needed after BM	Gain doctors	Gain others
Landspitali 2010 (case mix 1)					
Total	240	989	1.229	38	31

The total gain is 38 doctors and 31 others based on the 2010 patient activity level. This gain is however only relevant with new hospital buildings, technology and processes.

5.3.2 Benchmarking clinical service departments, management and administration and service functions

Next step is to compare productivity key figures for clinical service departments, management and administration and service functions. The methodology is same as for clinical departments. These services are:

- Clinical service:
 - Emergency, including observation beds
 - Surgery and anaesthesiology including intensive care
 - Diagnostic imaging, which includes the central department for diagnostic imaging and not decentralised functions in cardiology and others
 - Laboratories: All laboratories
- Management and administration: Hospital management including chief doctor and chief nurse, and staff functions like financial services, human resource (HR) and IT
- Service functions like kitchen including canteen, laundry services and transportation and security.

The service functions maintenance and cleaning are not included as the services are included in the FM costs. The benchmarking data is shown in the table below.

Table 17. Alternative 2. Benchmarking clinical services and other service functions

Benchmarking	Activities	Doctors	Other	Total staff	Activities per doctor	Activities per other	Activities per total staff	Definition of activity
Landspitali 2010 (case mix 1)								
Emergency *)	19.794		152	152		130		Weighted activities
Surgery & anaesthesiology (incl. ICU)	15.957	40	255	295	400	63		Surgical procedures
Diagnostic imaging	120.439	21	77	99	5.646	1.556		Examinations
Laboratories	368.875	32	260	292	11.609	1.419		Weighted bed days somatic
Management, administration & service (kitchen, laundry, transportation, security)	439.205	3	422	424			1.035	Weighted bed days somatic & mental health
Østfold Hospital, Norway 2020 (case mix 0,9)								
Emergency	34.138		150	150		205		Weighted activities
Surgery & anaesthesiology	21.317	30	287	317	636	67		Surgical procedures
Diagnostic imaging	152.000	41	122	163	3.338	1.117		Examinations
Laboratories	386.266	15	154	169	23.975	2.256		Weighted bed days somatic
Management, administration & service (kitchen, laundry, transportation, security)	400.124		365	365			987	Weighted bed days somatic & mental health
Stavanger University Hospital, Norway 2025 (case mix 0,95)								
Management, administration & service (kitchen, laundry, transportation, security)	819.832		587	587			1.327	Weighted bed days somatic & mental health
Kolding Hospital, Denmark 2020 (case mix 0,9)								
Diagnostic imaging	155.709	27	87	114	5.159	1.617		Examinations

*) Emergency doctors are moved to medical and surgical services for benchmarking purpose only

Best-Practice is marked with blue.

The type of activity as base for the productivity figures is described in the last column of the table. In the case of Stavanger and Kolding only a limited range of data has been available. The general hospital in Denmark is not included here, as data for the service departments is not available. Østfold Hospital has most Best-Practices.

There is a rather significant difference between Landspitali and Østfold with respect to some functions, like emergency, surgery and anaesthesiology (incl. ICU) and laboratories. This can be explained by the geographical spread of functions in the old buildings of

Landspitali compared to Østfold, where the data is a result of efficiency after centralizing all functions in one new location. Taking these rather great differences into account, Landspitali is raised to a level corresponding to the average between Landspitali and the benchmarking hospital as described in the previous part. These cases are marked with **Bold** in the table and are the following:

- Emergency
- Surgery and anaesthesiology doctors (i.e. anaesthesiology doctors)
- Laboratories

In other cases related to clinical service functions Landspitali is raised to best-practise level. For management, administration and service functions Stavanger shows the best-practice, and Landspitali is raised to that level. Landspitali is raised to a higher productivity level based on these assumptions, which leads to the following calculated gain:

Table 18. Alternative 2. Estimated gains in clinical services and other service functions at Landspitali 2010 level

Benchmarking	Doctors needed after BM	Others needed after BM	Total staff needed after BM	Gain doctors	Gain others
Landspitali 2010 (case mix 1)					
Total	73	963	1.036	20	206

There is an estimated gain in clinical services, management, administration and other service functions on 226 FTE's based on benchmarking. This gain is only relevant with new hospital buildings, technology and processes.

5.4 Possible savings

5.4.1 Somatic patient activity 2025

In part 5.1 the patient activity in Landspitali 2025 was estimated for the two alternatives based on demographic development and expected further efficiency developments like transfer to day care and reduction in length of stay. The compared patient activity in 2025 for the two alternatives is summarized in the tables below, where the weighted activities also are shown. Only somatic patient activities in medical, surgical and women & children services are shown here, as only these services are affected by the building changes.

Table 19. Alternative 2. Somatic patient activity in 2025

Alternative 2 - patient activity 2025	Inpatients	Beddays	Obs patients	Hotel bed days	Outpatients doctors	Day visits	Wght inpatients	Wght bed days
Internal medical services	9.783	62.229			105.658	43.620	33.765	206.116
Surgical services	7.770	31.511			53.690	14.849	19.008	98.942
Women & children services	8.861	19.641			50.698	2.900	14.574	53.919
Somatic clinical departments	26.414	113.380	9.155	19.239	210.046	61.369	67.347	358.978

Somatic clinical departments

2010	25.182	114.790	3.172	9.598	167.627	53.097	57.907	311.142
Change in %	4,9%	-1,2%	188,6%	100,4%	25,3%	15,6%	16,3%	15,4%

For Alternative 2 the increase in "weighted activities" is approximately 16 %. On the next page is the corresponding table for Alternative 0:

Table 20. Alternative 0. Somatic patient activity in 2025

Alternative 0 - patient activity 2025	Inpatients	Beddays	Obs patients	Hotel bed days	Outpatients doctors	Day visits	Wght inpatients	Wght bed days
Internal medical services	10.428	68.255			105.371	43.334	34.099	210.281
Surgical services	8.281	34.927			53.463	14.621	19.273	100.880
Women & children services	9.108	21.584			50.504	2.857	14.634	54.741
Somatic clinical departments	27.817	124.765	7.654	17.695	209.338	60.813	68.006	365.902
Somatic clinical departments 2010	25.182	114.790	3.172	9.598	167.627	53.097	57.907	311.142
Change in %	10,5%	8,7%	141,3%	84,4%	24,9%	14,5%	17,4%	17,6%

In Alternative 0 the increase in weighted activities is approximately 18 %.

These patient activity data is used to estimate the staff needed in the two alternatives.

5.4.2 Staff needed in Alternative 2

In Alternative 2 – with new hospital buildings, technology and processes we use the results from the benchmarking in order to estimate the staff needed to serve the projected patient activity in 2025. The benchmarking for Landspítali is based on 2010 patient activity and staffing and must be transferred to 2025 patient activity. Using the benchmarking results with respect to productivity figures and the 2025 patient activity the staff needed in 2025 is calculated. This staff does not include the clinical departments of geriatrics, rehabilitation, hospice, mental health and habilitation as these departments are not influenced by the new buildings. Also maintenance and cleaning are excluded as these functions are covered by FM costs.

Table 21. Alternative 2. Staff measured in FTE's 2010 - 2025

Staffing	2010 staffing			Savings after benchmarking - 2010 patient activity			2025 staffing according to benchmarking & 2025 patient activity		
	Doctors	Other	Total staff	Doctors	Other	Total staff	Doctors	Other	Total staff
Somatic clinical departments *)	249	1.020	1.269	38	31	68	262	1.133	1.396
Clinical services	123	1.048	1.171	20	112	133	88	1.028	1.116
Adm & Service **)	6	450	456		93	93	4	450	453
Total	378	2.518	2.896	58	236	294	354	2.611	2.965

*) Medical services, surgical services, women & children services

**) Excl. maintenance & cleaning 2010: 88 FTE's

Total staff in 2010 for the relevant functions was 2.896 FTE's, of which 294 can be reduced according to benchmarking based on 2010 patient activity and new buildings, technology and processes. 2010 staff can in theory be reduced to 2.602 (= 2.896 – 294). When the benchmarking results are transferred to the 2025 patient activity as described earlier in part 5.1, the corresponding staff needed increases to 2.965 in 2025. This staff can service approximately 16 % more patients (increase in weighted activities) but require new buildings, technology and processes.

5.4.3 Staff needed in Alternative 0

In Alternative 0 where the hospital operates in old buildings, spread locations etc. there cannot be expected a raise of productivity according to benchmarking. With the previous estimated 2025 patient activity for alternative 0, and with the 2010 productivity factors of Landspítali we get the following:

Table 22. Staff increase 2010-2025 in Alternative 0

Staffing	2010 staffing			2025 staffing according to present productivity & 2025 patient activity for alt 0		
	Doctors	Other	Total staff	Doctors	Other	Total staff
Somatic clinical departments *)	249	1.020	1.269	328	1.186	1.514
Clinical services	123	1.048	1.171	112	1161	1.273
Adm & Service **)	6	450	456	4	567	571
Total	378	2.518	2.896	443	2.914	3.357

*) Medical services, surgical services, women & children services

***) Excl. maintenance & cleaning 2010: 88 FTE's

In Alternative 0 the staff needed increases to 3.357 FTE's in 2025, which is almost 400 FTE's more than in Alternative 2.

5.4.4 Summary

The development in Landspitali in Alternative 2 is a synthesis of increased patient activity and more efficient patient treatment due to more observation, day- and outpatient care and use of a patient hotel as well as a higher productivity level due to modern and up to date facilities. All these actions lead to a more effective hospital compared to Alternative 0, where Landspitali continues with the present old buildings and is spread out in many locations. The staff calculated in the two alternatives only includes the functions relevant to the planned new buildings:

- Clinical functions: Internal medical services, surgical services, women & children services.
- Clinical service functions.
- Management and administration.
- Service functions excluding maintenance and cleaning.

Geriatrics, rehabilitation, hospice, mental health and habilitation are not included as these services are not affected by the new hospital. Maintenance and cleaning are included in the FM costs. Comparison of the two alternatives is summarized in the table below:

Table 23. Comparison of alternatives

Comparison of alternatives	FTE's	Mill ISK
2010 staffing	2.896	
2025 staffing - alternative 0	3.357	
2025 staffing - alternative 2	2.965	
Total annual gain	393	2.719

The above 2025 estimates for the alternatives give a difference of 393 FTE's, which can be considered as the annual gain which can be earned by building new facilities. The cost estimates are based on the average yearly wage cost per FTE of approximately 7 mill. ISK, which gives a calculated gain of approx. 2.700 mill ISK due to new buildings, technology and processes.

5.5 FM costs

5.5.1 The cost profile 2025

The expected space usage in 2025 (Alternative 2) is shown in table 9 (approximately 189.000 m²). The cost profile per m² in 2025 is assumed to be approximately the same as in 2010 with regard to facilities owned by Landspitali.

There is an increase in the proportion of new buildings. A first approach would be to expect reduced FM costs in a new facility compared to an old facility. However, there is

weak evidence supporting the hypothesis that new buildings are less costly to run in terms of FM costs compared to old buildings. New technology and more sophisticated ventilation systems, more specialized rooms with demanding regulations connected to technical infrastructure, security and back-up systems imply increased costs. Energy saving building constructions will on the other hand reduce energy costs. Given the information available on the FM cost profile of the new hospital facility, we assume the 2025 cost per m² will be approximately the same compared with the 2010 cost profile per m². This conclusion is based on two different paths of change:

- New facilities will be more cost effective in terms of heating and cleaning.
- New facilities will be more costly in terms of more ventilation (which is energy consuming) and more technical infrastructure which is both energy consuming and demands maintenance.

The investment costs (facility development) are not included (we include only operating costs).

6 Total operational gains

6.1 Core activities

It is estimated that Alternative 0, operating Landspítali in 2025 perspective continuing the 2010 practice (present buildings, processes etc.) including the increased patient activity and staffing, results in approximately 3.300 FTEs. Based on best practice estimates the staff level can be reduced to approximately 2.900 FTEs in alternative 2. The estimated gain is approximately 2.700 mill ISK, see table 23. The cost estimates are based on the average yearly wage costs 7 mill ISK⁷.

6.2 FM costs 2010 - 2025

The FM costs will increase from 2010 to 2025 due to an increase in the expected space usage with approximately 15.000 m² compared to Alternative 0. The estimated cost increase adds up to approximately 240 mill ISK per year.

Table 24. Estimated FM costs 2010 and 2025

Increased FM costs	Mill ISK
FM costs 2010, existing facilities	2 178
FM costs, new facilities Alt 0	209
FM costs 2025, Alt 0	2 387
FM costs 2025, Alt 2	2 631
Increased FM costs	244

Specification of rental costs.

Table 25. Estimated cost savings 2025, Alternative 2, rental costs

Rental cost savings	Mill ISK
Snorrabraut 60	49,0
Skogarhlid	1,2
Vesturhlid	17,4
Hatun	5,2
Total	72,8

⁷ From year 2010

Specification of transportation costs.

Table 26. Estimated cost savings 2025, Alternative 2, transportation

Transportation cost savings	Mill ISK
Food, goods, post, linen, blood	27,6
Taxi shuttle, patients	23,0
Ambulance, patient transport	32,8
Total	83,4

The total cost picture for FM costs, rental costs and transportation costs is documented in the table below.

Table 27. Total cost increase, FM, transportation and rental costs Alternative 2

Total cost picture FM cost, transportation and rental costs	Mill ISK
Increased FM costs ex transportation	244,1
Cost savings rental costs	-72,8
Cost savings transportation costs	-83,4
Total cost increase	87,9

6.3 Sum of cost gains

The sum of estimated cost changes are shown in the table below, and the estimates add up to approximately 2.600 mill ISK.

Table 28. Sum of estimated cost difference per year in 2025 between Alternative 0 and Alternative 2

Function	Cost difference per year, mill ISK
FM costs	88
Core activities	-2 719
Sum cost changes	-2 631

This scale of cost saving is comparable to the estimates in the 2009-report, based on 2008-data (Alternative two 2.366 mill ISK in 2008 price level).

6.4 NPV-analysis⁸

In the 2009 review of the project a NPV analysis for the three alternatives was presented. A NPV-analysis is useful to combine the investment costs and operational cost savings (gains) over a defined time perspective, to assess the results for different alternatives when investment costs and operating costs are weighed together. The NPV result of the 2009 economic analysis is summarized in the table below, expressed in mill ISK:

⁸ NPV = Net Present Value

Table 29. NPV analysis in the 2009-project review

Net present values	Alt 0	Alt 1	Alt 2
NPV 6%, mill ISK	-16.493	-37.833	-7.871
NPV 4%, mill ISK	-20.348	-33.490	-1.144
NPV 3%, mill kr ISK	-22.829	-28.850	4.363

The same approach has now been applied based on the operational gains estimated in this report. The results for Alternative 0 and Alternative 2 are shown in the table below.

Table 30. NPV analyses 2011

Net present values	Alt 0	Alt 2
NPV 6%, mill ISK	-18 519	-11 650
NPV 4%, mill ISK	-22 697	-4 015
NPV 3%, mill kr ISK	-25 340	2 308

The results in the 2009 project review and the 2011 estimates on operational gains are close to identical both for Alternative 0 for Alternative 2. Alternative 2 still has a better result than Alternative 0 in a 40 year perspective when investment costs and operational effects are taken into account in a NPV-approach. So, in the long run the NPV-analysis indicates that Alternative 2 is a better choice than Alternative 0.

In the table above the NPV's are illustrated with three different levels of annual discount rates, 6 %, 4 % and 3 %. With a 6 % discount rate the weight of the future gains compared to the investment costs in the coming years is lower compared to applying a 3 % discount rate. This explains the situation where Alternative 2, including the highest investments in the close future, and the largest operational gains in the long run, has a better result with a lower discount rate. In Alternative 0 there is a long run upgrading cost with regard to existing facilities, thus the better result with the higher discount rate. The basic assumptions in the NPV-analysis:

- Alternative 0 investment cost 41 mrd ISK
- Alternative 2 investment cost 61 mrd ISK
- Life span of analysis: 40 years;
- Life span of investment: 40 years;
- Rest value 2050: New buildings 8/40 for Alternative 2 and 10/40 for Alternative 0.
- Discount rates 3, 4 and 6%;
- Sale value of existing facilities, Alternative 2: 8.475 million ISK;
- Gains in operating costs due to new facilities: 2630 mill ISK in Alternative 2 compared to Alternative 0.

Details are shown in appendix 6.

7 Uncertainty

Cost saving estimates in a 15 year perspective will by nature have a significant degree of uncertainty. Regarding the FM costs there is uncertainty related to a number of perspectives:

- The actual space used in 2025. 189 000 m² is an estimate, and the actual space operated in 2025 can be typically within a range +/- 10% (approximately 170.000 – 208.000 m²). This range (-10 to +10 %) measured in monetary terms accounts for approximately 500 mill ISK.
- The FM cost estimate per m², ref chapter 4.3.3. Future energy cost is one of the key uncertainty factors in most countries, however probably less significant in Icel-

and compared to most other countries. A +/- 10% range accounts for approximately 500 mill ISK.

Table 31. Uncertainty, FM costs

Uncertainty FM costs Alt 2	m2/mill ISK	-10%	10%
Actual space (m2) 2025	189 078	170 170	207 986
Cost variation	2 631	2 368	2 894
FM cost per m2 2025	0,013914	0,012523	0,015305
Cost variation 2025	2 631	2 368	2 894

Regarding the core activity costs there is uncertainty related to a number of perspectives:

- Benchmarking of core activities compares productivity as measured with productivity indicators, and in this case, between hospitals from different countries. The productivity indicators may have shortfalls like not taking case mix variation sufficiently into account, and here the tradition and structure of the hospital sector may feed extra uncertainty into the estimates. There may also be variations in quality of services between countries, which is not covered in this approach. +/- 20% accounts for approximately +/- 550 mill ISK (range approximately 1100 mill ISK).

Table 32. Uncertainty, internal and external benchmarking

Uncertainty gain core activities	Mill ISK	-20%	20%
Benchmarking	2.719	2.175	3.263

There is uncertainty related to both alternatives. In Alternative 0 there may well be higher operational cost compared to these estimates if the efficiency gain is lower than the 70% compared to Alternative 2. The comparable 2025 operating costs in Alternative 0 is an example on an uncertainty factor in favor of Alternative 2.

Uncertainty also includes opportunities. Thus there may also be potential for increasing the cost savings above the estimates in this report.

8 Appendix 1. Present situation 2010

The 2010 activity for Landspítali. The table shows the actual data (inpatients, bed days, outpatients etc.) as well as the weighted patients and weighted bed days which are used in the benchmarking.

Specialty	Location	Inpatients	Beddays	LOS	Normal beds (actual)	Occupancy rate	Observation patients	Hotel beddays patients	Outpatients doctors	Day visits	Weighted patients	Weighted beddays	Outpatients nurses & others
Medicine in total HB	HB	4.552	26.197	5,8	81	88,6%			53.052	26.240	17.720	105.203	
General medicine	FV	1.129	3.359	3,0	15	61,4%					1.129	3.359	
Pulmonology (**)	FV	1.027	7.286	7,1	20	99,8%			10.152	627	2.082	13.616	
Allergy	FV								5.000		417	2.500	
Infectious diseases	FV	1.134	7.666	6,8	21	100,0%			1.307		1.243	8.320	
Neurology	FV	689	5.487	8,0	18	83,5%			3.114	2.488	1.778	12.020	
Rheumatology	FV	637	4.770	7,5	12	108,9%			3.675	5.097	2.642	16.802	1.944
Geriatrics	FV	466	7.520	16,1	21	98,1%					466	7.520	
Skin	FV								837		70	419	11.241
Sex. Transm. Dis.	FV								2.959		247	1.480	5.142
Diabetes	FV								3.331		278	1.666	1.835
Endocrinology	FV								1.119		93	560	
Medicine in total FV	FV	5.082	36.088	7,1	107	92,4%			31.494	8.212	10.444	68.259	20.162
Geriatrics	LKOT	934	25.030	26,8	83	82,6%			2.720	4.151		34.692	
Rehabilitation	GR	262	8.213	31,3	24	93,8%			178	5.128		18.558	
General surgery	HB	1.094	4.928	4,5	18	75,0%			8.017		1.762	8.937	
General surgery & urology	HB	1.514	6.332	4,2	18	96,4%			5.205		1.948	8.935	
Cardiothoratic surgery & Ophthalm	HB	1.120	4.887	4,4	18	74,4%			230		1.139	5.002	
Ophthalmology	HB								7.017	2.982	1.579	9.473	
Daysurgery	HB									4.147	1.382	8.294	
Surgery in total HB	HB	3.728	16.147	4,3	54	81,9%			20.469	7.129	7.810	40.640	
ENT & vascular surgery & plastic surgery	FV	1.453	5.414	3,7	18	82,4%			10.535		2.331	10.682	
Orthopedics	FV	1.197	5.944	5,0	18	90,5%			9.509		1.989	10.699	
Neurosurgery & ortopedics	FV	1.273	5.115	4,0	18	77,9%			1.981		1.438	6.106	
Cardiothoratic	FV								248		21	124	
Endoscopy	FV									632	211	1.264	
Daysurgery & observation	FV						3.172			3.617	2.263	13.578	
Surgery in total FV	FV	3.923	16.473	4,2	54	83,6%	3.172		22.273	4.249	8.253	42.452	
Pediatrics	HB	1.697	5.218	3,1	26	55,0%			21.848	1.297	3.950	18.736	2.540
Pediatrics, newborn ICU	HB	416	4.806	11,6	22	59,9%				399	549	5.604	
Delivery/maternity *)	HB	4.349	7.747	1,8	29	73,2%			12.142	3.344	6.476	20.506	8.041
Gynecology	HB	1.435	2.114	1,5	10	57,9%			6.349	2.062	2.651	9.413	
Women and children in total HB	HB	7.897	19.885	2,5	87	62,6%			40.339	7.102	13.626	54.259	10.581
Pediatrics FV	FV									165	55	330	
Women and children in total FV	FV	0	0		0	0			0	165	55	330	
Hospice	KOP	270	3.646	13,5	12	83,2%			47	407		4.484	
Somatic in total		26.648	151.679	5,7	502	82,8%	3.172	9.598	170.572	62.783	57.907	368.875	30.743
Mental health	HB	1.545	15.247	9,9	51	81,9%			6.364	6.575		25.004	14.443
Mental health, addiction	HB	575	4.533	7,9	15	82,8%			1.238	4.002		9.154	6.495
Mental Health in total HB	HB	2.120	19.780	9,3	66	82,1%			7.602	10.577		34.158	20.938
Mental health, rehabilitation (**)	KL	365	15.136	41,5	43	96,4%			2.603	1.047		17.485	4.862
Mental health, rehabilitation	LR	24	2.494	103,9	8	85,4%				757		3.251	
Mental health	Sogn	9	1.759	195,4	7	68,8%						1.759	
Mental health, children (**)	DAL	212	3.589	16,9	17	57,8%			1.729			4.454	4.135
Mental health	Skst									2.961		2.961	
Mental health	Hat									11.076		11.076	
Mental Health in total		2.730	42.758	15,7	141	83,1%			11.934	26.418		75.143	29.935
Habilitation	KOP	14	4.966	354,7	14	97,2%						4.966	
Landspítali in total		29.392	199.403	6,8	657	83,2%	3.172	9.598	182.506	89.201		448.984	60.678

*) Maternity/delivery: 929 patients (2204-1275) admitted during pregnancy plus 3420 births = 4349 in patients

**) Incl. Homenursing: pulmonology: 1170, Mental Health KL: 1100, Mental health DAL: 318

The following table shows the total staff for Landspítali:

Staffing data 2010 (FTE1)	Hringbraut			Fossvogur			Other locations			Landspítali in total		
	Doctors	Nursing & other	Total staff	Doctors	Nursing & other	Total staff	Doctors	Nursing & other	Total staff	Doctors	Nursing & other	Total staff
Internal medical services (incl. adm & med secr)	60	264	324	52	231	283	1	15	16	113	510	623
Surgical services (incl clin adm & med secr)	39	143	182	47	112	159		6,5	7	86	262	348
Women & children services (incl clin adm & med secr & emergency)	50	245	295					3	3	50	248	298
Geriatrics (LKOT) incl med secr.							19	130	149	19	130	149
Rehabilitation (GR)							6	34	40	6	34	40
Hospice (KOP)							2	28	30	2	28	30
Somatic clinical departments in total	149	652	801	99	343	442	28	217	245	276	1.211	1.487
Mental health HB	31	160	191					2	2	31	161	192
Mental health, rehabilitation KL							7	99	106	7	99	106
Mental health, rehabilitation LR							0	15	15	0	15	15
Mental health Sogn							2	31	33	2	31	33
Mental health, children DAL							7	51	58	7	51	58
Mental health Skst							1	4	5	1	4	5
Mental health hat							0	6	6	0	6	6
Mental health in total	31	160	191				17	208	225	48	368	415
Habilitation (KOP)								29	29		29	29
Clinical functions in total	180	812	992	99	343	442	45	453	498	324	1.608	1.931
Emergency				28	148	176		5	5	28	152	181
Surgery (excl anaesthesia)		67	67		38	38			0	0	105	105
Anaesthesia (doctors serve surgery and ICU)	22,7	29	52	17,2	18	35				40	46	86
Sterilisation		2	2		1	1		16	16	0	19	19
Intensive care & recovery		55	55		49	49			0	0	104	104
Occupational/physio therapy		36	36		31	31		45	45	0	111	111
Dietetics , speech therapy, home nursing, social counselling, med record								30	30	0	30	30
Psychology & social counselling (mental health)		92	92							0	92	92
Imaging	9	30	39	12	48	60				21	77	99
Laboratories & inf control	25	154	179	2	45	47	2	20	22	29	219	248
Bloodbank							3	41	44	3	41	44
Pharmacy	1	37	38		11	11				1	48	49
Patient hotel							0	3,55	4	0	4	4
Clinical services in total	58	501	559	60	387	447	5	160	164	123	1.048	1.171
Chief executive office	1	1	2	0	0	0	0	23	23	1	24	24
Chief medical executive = IT		27	27	0	12	12	0	24	24	0	64	64
Chief nursing executive					13	13	0	0	0	0	13	13
Facilities and operational services, management & adm							0	5	5	0	5	5
Finance & information							2	67	69	2	67	69
HR							1	38	38	1	38	38
Research & education	1	12	13	1	12	13	1	2	3	4	26	30
Patientservice (school)		2	2			0				0	2	2
Cleaning **)		32	32		2	2		7	7	0	41	41
Kitchen **)		80	80		2	2		3	3	0	84	84
Laundry								42	42	0	42	42
Maintenance **)		26	26		7	7		9	9	0	42	42
Transportation and Security		59	59		26	26		6	6	0	91	91
Service functions in total	2	239	241	2	74	75	3	225	228	6	538	544
Total	240	1.552	1.792	160	804	964	52	838	890	452	3.194	3.646

Exclusive 3 FTE for "No location"

**) Exclusive external staff

Number of doctors are corrected and anaesthesia is extracted accordingly to numbers Bryndis

Emergency other locations are secretaries

9 Appendix 2. Patient activity 2025

Estimation of the patient activity in 2025 is based on the demographic development and a number of efficiency factors.

The demographic age grouping of Iceland 2010 is linked to the patient activity in all specialties, and this factor is used to calculate inpatients and bed days in 2025 for each age group.

Development of somatic inpatients and bed days for each age group from 2010 to 2025

Age groups	2010/2011					2025			Change 2010 - 2025	
	Total population of Iceland 2011	Inpatients 2010	Inpatients per inhabitant	Beddays 2010	Beddays per inhabitant	Total population of Iceland 2025	Calculated inpatients 2025	Calculated beddays 2025	Inpatients	Beddays
0-9 years	44.790	1.483	0,03	8.664	0,19	46.146	1.528	8.926	3,0%	3,0%
10-19 years	45.053	1.060	0,02	3.085	0,07	48.074	1.131	3.292	6,7%	6,7%
20-29 years	46.780	3.201	0,07	7.759	0,17	45.138	3.089	7.487	-3,5%	-3,5%
30-39 years	44.400	3.326	0,07	8.492	0,19	45.677	3.422	8.736	2,9%	2,9%
40-49 years	42.616	1.971	0,05	8.897	0,21	45.957	2.126	9.595	7,8%	7,8%
50-59 years	39.930	2.773	0,07	14.199	0,36	42.059	2.921	14.956	5,3%	5,3%
60-69 years	27.622	3.351	0,12	22.091	0,80	40.712	4.939	32.560	47,4%	47,4%
70-79 years	16.282	3.623	0,22	31.734	1,95	28.445	6.329	55.440	74,7%	74,7%
80-89 years	9.451	3.106	0,33	37.487	3,97	11.906	3.913	47.225	26,0%	26,0%
90-99 years	1.489	542	0,36	8.268	5,55	2.380	866	13.215	59,8%	59,8%
100 years and over	39	10	0,26	109	2,79	43	11	120	10,3%	10,3%
SUM	318.452	24.446	0,08	150.785	0,47	356.537	30.274	201.552	23,8%	33,7%

Based on these calculations the change in % from 2010 to 2025 is calculated for the age groups. The total/average for all age groups is used as base for the demographic estimate of 2025 patient activity for somatic specialties:

- 23,8 % increase from 2010 to 2025 for inpatient, outpatients and day patients
- 33,7 % increase from 2010 to 2025 for bed days

Mental health and habilitation is kept at present level. Below is the estimated number of patients in 2025 in Alternative 2:

Specialty	Location	Inpatients	Beddays	LOS (normal beds)	Beds needed (normal)	Obs patients	Obs beds needed 85 %	Hotel beddays	Hotel beds needed 70%	Outpatients doctors	Day visits
Cardiology	HB	2.354	10.098	4,3	33	459				37.118	1.535
Gastroenterology & nephrology	HB	1.043	7.142	6,8	23	203				4.383	10.985
Oncology (incl. Radiotherapy)	HB	684	4.376	6,4	14	134				24.597	14.624
Haematology	HB	541	4.042	7,5	13	106				53	53
Endocrinology	HB	0	0		0	0				0	0
Endoscopy	HB	0	0		0	0				0	5.750
Medicine in total HB	HB	4.623	25.658	5,6	83	902	0			66.151	32.947
General medicine	FV	1.147	3.170	2,8	10	224				112	112
Pulmonology	FV	1.043	7.189	6,9	23	203				12.674	878
Allergy	FV	0	0		0	0				6.192	0
Infectious diseases	FV	1.152	8.034	7,0	26	225				1.731	112
Neurology	FV	700	5.432	7,8	18	137				3.925	3.149
Rheumatology	FV	647	4.714	7,3	15	126				4.614	6.375
Geriatrics	FV	473	8.033	17,0	26	92				46	46
Skin	FV	0	0		0	0				1.037	0
Sex. Transm. Dis.	FV	0	0		0	0				3.664	0
Diabetes	FV	0	0		0	0				4.125	0
Endocrinology	FV	0	0		0	0				1.386	0
Medicine in total FV	FV	5.161	36.571	7,1	118	1.007	0			39.506	10.673
Geriatrics	LKOT	948	26.881	28,3	87	185				3.461	5.233
Rehabilitation	GR	266	8.301	31,2	27	52				246	6.377
General surgery	HB	1.111	4.774	4,3	15	217				10.037	108
General surgery & urology	HB	1.537	6.110	4,0	20	300				6.596	150
Cardiothoracic surgery & Ophtalm	HB	1.137	4.727	4,2	15	222				396	111
Ophtalmology	HB	0	0		0	0				8.690	3.693
Daysurgery	HB	0	0		0	0				0	5.136
Surgery in total HB	HB	3.786	15.611	4,1	50	739	0			25.718	9.198
ENT & vascular surgery & plastic surgery	FV	1.476	5.190	3,5	17	288				13.191	144
Orthopedics	FV	1.216	5.785	4,8	19	237				11.895	119
Neurosurgery & ortopedics	FV	1.293	4.925	3,8	16	252				2.579	126
Cardiothoracic	FV	0	0		0	0				307	0
Endoscopy	FV	0	0		0	0				0	783
Daysurgery & observation	FV	0	0		0	3.928				0	4.479
Surgery in total FV	FV	3.984	15.900	4,0	51	4.706	0			27.972	5.651
Pediatrics	HB	1.933	5.144	2,7	20	336				27.225	0
Pediatrics, newborn ICU	HB	515	5.204	10,1	20	82				0	0
Delivery/maternity	HB	4.955	7.458	1,5	24	862				15.468	0
Gynecology	HB	1.457	1.835	1,3	6	284				8.005	2.696
Women and children in total	HB	8.861	19.641	2,2	70	1.565	0			50.698	2.696
Pediatrics FV	FV	0	0		0	0				0	204
Women and children in total	FV	0	0		0	0	0			0	204
Hospice	KOP	270	3.646	13,5	12	0				47	0
Somatic in total		27.898	152.208	5,5	498	9.155	18	19.239	77	213.800	72.979
Mental health	HB	1.545	15.247	9,9	46					6.364	6.575
Mental health, addiction	HB	575	4.533	7,9	14					1.238	4.002
Mental Health in total HB	HB	2.120	19.780	9,3	60					7.602	10.577
Mental health, rehabilitation	KL	365	15.136	41,5	46					2.603	1.047
Mental health, rehabilitation	LR	24	2.494	103,9	8					0	757
Mental health	Sogn	9	1.759	195,4	5					0	0
Mental health, children	DAL	212	3.589	16,9	11					1.729	0
Mental health	Skst	0	0		0					0	2.961
Mental health	Hat	0	0		0					0	11.076
Mental Health in total		2.730	42.758	15,7	130	0	0	0	0	11.934	26.418
Habilitation (unchanged)	KOP	14	4.966	354,7	15					0	0
Landspitali in total		30.642	199.932	6,5	643	9.155	18	19.239	77	225.734	99.397

For Alternative 0 there is a lower efficiency compared to Alternative 2, and the patient activity in 2025 is as follows:

Specialty	Location	Inpatients	Beddays	LOS (normal beds)	Beds needed (normal)	Obs patients	Obs beds needed 85 %	Hotel beddays	Hotel beds needed 70%	Outpatie nts doctors	Day visits
Cardiology	HB	2.509	11.182	4,5	36	322				37.049	1.466
Gastroenterology & nephrology	HB	1.112	7.865	7,1	25	142				4.352	10.954
Oncology (incl. Radiotherapy)	HB	730	4.823	6,6	16	93				24.577	14.604
Haematology	HB	577	4.448	7,7	14	74				37	37
Endocrinology	HB	0	0		0	0				0	0
Endoscopy	HB	0	0		0	0				0	5.750
Medicine in total HB	HB	4.927	28.318	5,7	91	631				66.016	32.812
General medicine	FV	1.222	3.539	2,9	11	157				78	78
Pulmonology	FV	1.112	7.916	7,1	26	142				12.644	848
Allergy	FV	0	0		0	0				6.192	0
Infectious diseases	FV	1.227	8.685	7,1	28	157				1.697	79
Neurology	FV	746	5.976	8,0	19	96				3.904	3.129
Rheumatology	FV	689	5.188	7,5	17	88				4.595	6.356
Geriatrics	FV	504	8.633	17,1	28	65				32	32
Skin	FV	0	0		0	0				1.037	0
Sex. Transm. Dis.	FV	0	0		0	0				3.664	0
Diabetes	FV	0	0		0	0				4.125	0
Endocrinology	FV	0	0		0	0				1.386	0
Medicine in total FV	FV	5.501	39.937	7,3	129	705				39.355	10.522
Geriatrics	LKOT	1.011	28.843	28,5	93	130				3.433	5.205
Rehabilitation	GR	284	9.074	32,0	29	36				239	6.369
General surgery	HB	1.184	5.287	4,5	17	152				10.004	76
General surgery & urology	HB	1.639	6.775	4,1	22	210				6.551	105
Cardiothoracic surgery & Ophtalm	HB	1.212	5.237	4,3	17	155				363	78
Ophtalmology	HB	0	0		0	0				8.690	3.693
Daysurgery	HB	0	0		0	0				0	5.136
Surgery in total HB	HB	4.035	17.299	4,3	56	517				25.608	9.087
ENT & vascular surgery & plastic surgery	FV	1.573	5.766	3,7	19	202				13.147	101
Orthopedics	FV	1.296	6.398	4,9	21	166				11.859	83
Neurosurgery & ortopedics	FV	1.378	5.464	4,0	18	177				2.542	88
Cardiothoracic	FV	0	0		0	0				307	0
Endoscopy	FV	0	0		0	0				0	783
Daysurgery & observation	FV	0	0		0	3.928				0	4.479
Surgery in total FV	FV	4.246	17.628	4,2	57	4.472				27.855	5.534
Pediatrics	HB	1.984	5.666	2,9	22	235				27.175	0
Pediatrics, newborn ICU	HB	486	5.537	11,4	22	58				29	0
Delivery/maternity	HB	5.084	8.275	1,6	27	603				15.338	0
Gynecology	HB	1.553	2.105	1,4	7	199				7.962	2.653
Women and children in total HB	HB	9.108	21.584	2,4	77	1.095				50.504	2.653
Pediatrics FV	FV	0	0		0	0				0	204
Women and children in total FV	FV	0	0		0	0				0	204
Hospice	KOP	334	4.874	14,6	16	67				47	0
Somatic in total		29.445	167.556	5,7	548	7.654	15	17.695	71	213.057	72.387
Mental health	HB	1.545	15.247	9,9	51					6.364	6.575
Mental health, addiction	HB	575	4.533	7,9	15					1.238	4.002
Mental Health in total HB	HB	2.120	19.780	9,3	66					7.602	10.577
Mental health, rehabilitation	KL	365	15.136	41,5	43					2.603	1.047
Mental health, rehabilitation	LR	24	2.494	103,9	8					0	757
Mental health	Sogn	9	1.759	195,4	7					0	0
Mental health, children	DAL	212	3.589	16,9	17					1.729	0
Mental health	Skst	0	0		0					0	2.961
Mental health	Hat	0	0		0					0	11.076
Mental Health in total		2.730	42.758	15,7	141	0	0	0	0	11.934	26.418
Habilitation (unchanged)	KOP	14	4.966	354,7	15					0	0
Landspitali in total		32.189	215.280	6,7	704	7.654	15	17.695	71	224.991	98.805

10 Appendix 3: Process

In order for a thorough review an information exchange process with the hospital project team was carried out, and meetings held with relevant staff and management personnel to qualify authors understanding of the data. Step 1 was the information exchange process.

The meeting sequence was:

Meeting 1 (May):

- To qualify authors understanding of the changes carried out after 2009.
- To supplement information already received before the first meeting
- To collect and review data.

- To qualify the structure and scope of the report

Meeting 2 (July):

- The draft report was distributed to the hospital project team before the meeting, and discussed at the meeting. After the meeting the report was updated before meeting 3.

Meeting 3 (29.08, telephone meeting):

- The report was distributed to the hospital project team before the meeting, and discussed at the meeting.

Meeting 4 (15.09, telephone meeting):

The report was distributed to the hospital project team before the meeting, and discussed at the meeting.

Meeting 5 (29.09, telephone meeting):

- The report was distributed to the hospital project team before the meeting, and discussed at the meeting..

Meeting 6 (12.10, telephone meeting):

- The report was distributed to the hospital project team before the meeting, and discussed at the meeting..

Meeting 7 (18.10, telephone meeting):

- The report was distributed to the hospital project team before the meeting, and discussed at the meeting. After the meeting the report was updated and submitted.

11 Appendix 4. Methodology

11.1 A comparative approach

We have used our standard methodology for assessment on operational gains. The main principles are:

- The operational gains are the difference in estimated operating costs between two future cost situations.
- The present situation is the baseline, and based on 2010 data from existing hospital
- The future situation is the future hospital operational costs estimated in two alternative situations
 - Alternative 0: Existing facilities in a 2025 perspective including needed investments
 - Alternative 2: With new facilities (75.000 m²) in a 2025 perspective

The present situation is described on basis of 2010 data from Hringbraut and Fossvogur. The main data is:

- Patient activity data: in-patients, number of day- and outpatient visits from all clinical departments, as well as activity data from surgery, diagnostic imaging and emergency
- Staff data – gross data in fulltime equivalents (FTE) from all departments, clinical as well as non clinical
- Average wage costs per FTE
- Size of hospital measured in square meters (m²)
- Facility management (FM) cost data

The data is used as a reference point to calculate productivity figures like “number of activities per FTE” for the different functions of Landspítali, and these productivity figures describe the present situation. .

The future situation of Alternative 2 is estimated based on projected patient activity in the future hospital and productivity levels based on comparative data from other Nordic hospitals. We assume that the departments in a united Landspitali can be raised to a productivity level based on "Best-Practice" analysis. The assessment of the future situation in Alternative 2 contains the following steps:

- Estimation of patient activity in 2025 with a more efficient service mix (transfer of inpatients to daycare, reduction in length of stay)
- Estimation of staff needed in 2025 based on an increased productivity level in Landspitali after benchmarking with new hospital projects in Norway and Denmark, i.e. the new hospitals in Østfold, the university hospital in Stavanger, Kolding hospital and a general hospital in Denmark.
- Assessment of FM costs for the new hospital buildings

In the Alternative 2 the benchmarking is based on new buildings, new processes and technology. For the Alternative 0 the patient activity is also projected to 2025, but with a lower grade of efficiency related to service mix. The staff needed is based on the present productivity level of Landspitali. In this alternative Landspitali cannot be raised to a best-practice level based on benchmarking with new hospital projects. The main principle is shown in the figure below:

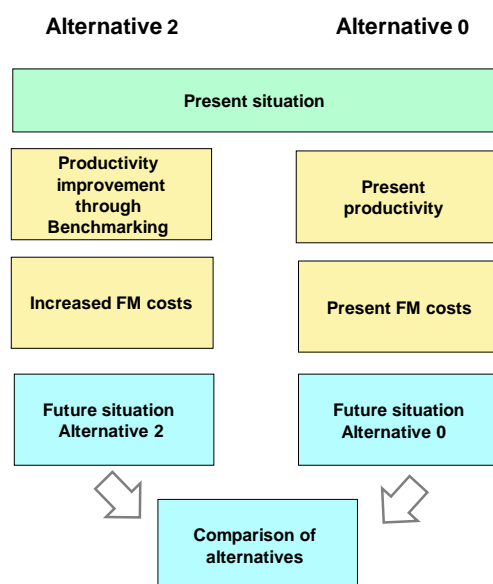


Figure 5. Methodology for calculating cost savings by comparison of two alternatives

All costs are calculated in mill 2010 ISK. The calculation of operational gains performed earlier by Landspitali has served as a base for the analysis, and is compared to the new assessment described here.

11.2 Calculation of productivity figures

To perform benchmarking it is necessary to calculate productivity figures for relevant departments like "number of activities per FTE" for the hospitals to be benchmarked.

11.2.1 Productivity figures for clinical departments

Productivity figures for the clinical departments are patient activities per staff (FTE). There are however different categories of patient activities:

- Inpatients
- Bed days
- Day visits
- Outpatients
- Observation patients (emergency)

In order to summarise these patient activities we use a weighing principle which in rough terms describes the complexity and scale of the activity. Weighted patient activities are calculated as follows:

- Weighted inpatients = inpatients + outpatients/12 + day visits/3 + observation patient/3
- Weighted bed days = bed days + outpatient/2 + day visits x 2 + observation patients x 2

The doctor activities are generally more related to the patient turnover than the length of stay, which is the opposite for nurses and other staff. We therefore calculate the productivity figures for clinical departments covering medical, surgical, women & children services as follows:

- Weighted inpatients per doctor (FTE)
- Weighted bed days per nurses and other staff (FTE)

11.2.2 Productivity figures for clinical service departments

For the clinical service departments we apply key productivity figures like

- Activities per doctor (FTE)
- Activities per nurses & other staff (FTE)

The activities depend on the type of service:

- Emergency: weighted activities = number of admissions + observation patients + outpatients/6
- Surgery & anaesthesiology: Surgical procedures
- Diagnostic Imaging: Examinations
- Laboratories: Weighted somatic bed days.

11.2.3 Productivity figures for management and administration and service departments

Management and administration and the service departments serve the total patient population in the hospital, which means both somatic and mental health services. We apply key productivity figures like

- Weighted bed days for all somatic and mental health services per total staff (FTE)

For Mental Health, geriatrics, rehabilitation, hospice and habilitation we calculate weighted bed days like this:

- Geriatrics, rehabilitation, hospice: Weighted bed days = bed days + outpatient/2 + day visits x 2
- Mental health, habilitation: Weighted bed days = bed days + outpatient/2 + day visits

12 Appendix 5. Norwegian and Danish benchmarking hospitals

In this appendix is a short description of the Norwegian and Danish hospitals which are benchmarked with Lanspitali:

- Østfold Hospital
- Stavanger university hospital
- Kolding Hospital
- A general hospital in Denmark.

12.1 Østfold Hospital

Østfold Hospital is located in the Helse Sør-Øst region in Norway and is a general hospital where the major part of the hospital is going to be rebuilt.

2020 planning figures which are described below.

Bed capacity:

- 443 normal beds in somatic specialties
- 67 observation/short time beds in emergency
- 108 beds for mental health.

The planned patient activity in 2020:

Østfold Hospital	Inpatients	Bed days	Obs patients	Day visits	Outpatients
Internal medicine	8.474	27.003	10.098	17.800	29.736
Cardiology - pulmonology	9.683	31.298	3.234	1.479	24.602
Rheumatology	546	3.203	33	2.690	10.849
Neurology	3.274	14.999	1.843	221	8.476
Surgery	7.133	26.492	6.604	3.816	27.826
Ortopedics	3.805	19.145	1.875	2.892	29.474
ENT	268	979	214	2.015	12.072
Eye	64	226	36	3.258	13.555
Gynekology	1.046	2.261	408	1.825	26.146
Obstetrics	4.125	8.240			
Pediatrics	3.314	9.226		521	9.176
Somatic in total	41.732	143.072	24.346	36.518	191.912
Mental health		37.449			3.840

12.2 Stavanger University Hospital

Stavanger University Hospital is located in the Helse Vest region and is a university hospital where the great part of the hospital is going to be rebuilt.

2025 planning figures are described below:

Bed capacity:

- 704 normal beds in somatic specialties
- 68 observation beds in emergency
- 329 beds in mental health.

The patient activity 2025:

Stavanger university hospital	Inpatients	Bed days	Obs patients	Day visits	Outpatients
Surgical services	11.754	63.032	5.129	8.372	61.911
Medical services	15.127	80.662	11.379	16.287	49.354
Specialised medical services	4.578	21.834	1.323	21.010	96.765
Blood and cancer	2.749	20.410	424	7.390	9.710
Rehabilitation	1.330	17.424	0	63	8.215
Women	13.573	31.485	730	3.907	39.109
Children	2.320	11.924	861	1.912	17.854
Somatic total					
Somatic total ex rehab	51.432	246.771	19.845	58.941	282.918
Mental health	4.230	106.625	0	3.187	161.029

12.3 Kolding Hospital

Kolding Hospital is located in the Region South Denmark and is a general hospital where the great part of the hospital is going to be rebuilt.

2020 planning figures are described below:

Bed capacity:

- 316 normal beds in somatic specialties
- 57 observation beds in emergency.

The patient activity 2020:

Kolding Hospital	Inpatients	Bed days	LOS	Day visits	Outpatients
Internal medicine	11.835	36.461	3,1	82	61.372
Neurology	2.966	14.130	4,8	28	19.820
Surgery	6.374	15.994	2,5	1.120	16.491
Ortopedics	4.515	13.446	3,0	2.042	41.042
ENT	1.243	1.824	1,5	2.076	13.615
Vascular surgery	1.471	4.969	3,4	309	7.188
Urology	2.999	6.368	2,1	1.078	14.910
Gynekology/obstetrics	5.196	10.423	2,0	2.394	42.364
Pediatrics	6.306	9.890	1,6	2	16.829
Somatic in total	42.906	113.503	2,6	9.130	233.630

12.4 A general hospital, Denmark

This Hospital is located in Sealand and is a general hospital where the great part of the hospital is going to be rebuilt.

2020 planning figures are described below:

Kolding Hospital	Inpatients	Bed days	Day visits	Outpatients
Internal medicine	11.835	36.461	82	61.372
Neurology	2.966	14.130	28	19.820
Surgery	6.374	15.994	1.120	16.491
Ortopedics	4.515	13.446	2.042	41.042
ENT	1.243	1.824	2.076	13.615
Vascular surgery	1.471	4.969	309	7.188
Urology	2.999	6.368	1.078	14.910
Gynekology/obstetrics	5.196	10.423	2.394	42.364
Pediatrics	6.306	9.890	2	16.829
Somatic in total	42.906	113.503	9.130	233.630

Bed capacity:

- 402 normal beds in somatic specialties
- 50 observation beds in emergency.

The patient activity 2020:

General hospital	Inpatients	Bed days	Obs patients	Outpatients
Internal medicine	11.101	39.245	7.671	51.983
Neurology	4.565	14.597	1.100	10.605
Onkology-hematology	1.452	6.422	0	26.200
Reumatology	375	1.829	112	7.209
Geriatrici	1.094	14.376	482	2.082
Surgery	4.008	17.874	2.316	19.097
Ortopedics	2.561	12.294	1.716	22.080
ENT				7.252
Eye				10.249
Urology	2.979	7.677	819	22.591
Gynekology/obstetrics	3.374	5.448	1.537	28.169
Pediatrics	2.786	4.968	0	9.487
Somatic in total	34.295	124.730	15.753	217.005

