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The future development of Landspítali's services

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Table of contents

Disclaimer

This report is aimed at assessing system level trends, changes, and interventions. At no point is the report intended to provide direct medical advice or give medical input to care pathways. Although numerous clinicians were involved in this work, the primary purpose here is not to provide medical or treatment advice.

1 Introduction

In 2019, the Icelandic parliament approved the 2030 health policy, which, among other things, defines a clear strategic directive to enable the healthcare system to provide the right services in the right care setting. Furthermore, through the Landspítali expansion project (the Hringbraut project), the healthcare system aims to increase Landspítali's capacity and modernize its services.

To complement and future-proof the current fact base and strategy, the government also needs to develop a clearer view on the longer-term development of healthcare demand and decide which strategic issues regarding Landspítali will need to be tackled from a long-term perspective. Thus, this report has been commissioned to address two key questions:

1. Is Landspítali's role within the healthcare system sufficiently clear?
2. Is Landspítali sufficiently equipped to handle upcoming demographic shifts and the subsequent increase in healthcare demand?

In this report, we first outline the current state of the healthcare system and Landspítali's current role within this system. Building on the current state, a bottom-up baseline forecasting model is developed to identify the system's needs in the next 20 years, based on the best available demographic, medical, and technological forecasts. This baseline tries to extrapolate a 'no-change' scenario where no major initiatives or strategies are adopted.

Building on the baseline forecast, different potential changes to the healthcare system are explored, and their potential impact is quantified. These changes include six key strategic choices facing the Icelandic healthcare system that directly impact the direction of the system, and subsequently, the resource needs and preferred role of Landspítali. While this set of choices is not exhaustive, experts within the Icelandic healthcare system agree that the choices explored here are the key choices that the system faces and capture the largest potential shifts in the system. Finally, to enable a robust view of the main 2040 scenario for healthcare demand in Iceland, the future development of operational improvement and prevention measures within the system are also explored in relation to the baseline forecast to provide decision makers with an understanding of the significance of these factors and the impact of successfully driving them.

The overarching goal of this effort is to provide a likely 2040 scenario of the demands on Landspítali and its role, through a comprehensive strategic review and forecasting. Although each modelling element is based on a solid fact base presented in this report, long-term forecasts are uncertain by nature. In some cases, differing opinions exist among experts. As such, the report closes by providing plausible alternative future scenarios for the choices and improvement measures used for the main 2040 scenario and forecasts the impact of those alternatives on Landspítali.

2 Summary

Overview of overarching findings

The overarching findings of this report are that healthcare demand is expected to rise by ~1% p.a. for outpatient visits and ~1.2% p.a. for inpatient stays, driven mainly by shifts in demographics. If no major actions are undertaken by Landspítali and the broader healthcare system, the workforce need and costs are forecasted to increase by ~36% and ~90% respectively. Notably, need for beds at Landspítali is expected to increase by ~80% by 2040, resulting in ~50% more beds than the current 2026 planned capacity once Hringbraut has opened.

However, certain key actions outlined in this report can offset this increased resource need for Landspítali. Around half of the increase of inpatient bed needs and outpatient visits can be absorbed by shifting long-term and primary care, currently provided at Landspítali to a more adequate healthcare setting, lowering costs for the healthcare system and likely improving quality of care. This would require creating the equivalent of ~240 bed capacity in e.g., home based, elderly and rehabilitation care, as well as a structured effort shifting this care and primary care to care settings outside Landspítali.

Furthermore, achieving benchmark levels (~1.3% p.a.) of efficiency gains through operational improvements and digitization could likely absorb an additional ~23% of the bed demand growth, and ~33% of the expected cost growth at Landspítali until 2040. Achieving these efficiency gains, along with the shift of long-term care patients, would bring the net bed capacity need to ~760 in 2040, only slightly above the ~730 beds planned for in 2026.[1]

Below, a summary of the findings for each section of the report is presented, and in the following sections a more extensive discussion of the role of Landspítali and the quantitative modelling underlying these findings are presented.

Background: University tertiary care facility with high bed occupancy rates and average productivity

Landspítali is the only tertiary and university hospital in Iceland and has ~25,000 inpatient stays and ~407,000 outpatient visits per year. In 2019 the hospital spent ~78 ISK billion and provided 624 beds, 21 operating rooms and ~4,500 Full Time Equivalents (FTSs) of staff.

The current productivity levels of the hospital are comparable to other Nordic hospitals for physicians (both as measured by DRG-points and outpatient equivalents) and for nurses (5.9 nurse hours per patient day). Nurse and physician density to population is also comparable with other Nordic countries (15.7 and 3.9 per 1,000 inhabitants respectively).

The current bed occupancy load is high, with a rate of 97%, and in many wards over 100%, indicating load levels significantly above benchmarks (in 85 to 90% range). Operating room utilization is ~56%, which is on the lower end, likely with substantial opportunities to increase utilization.

Currently, Landspítali faces several challenges, e.g., outflow issues and consistently high occupancy rates. In addition to the official responsibility of serving patients, training clinical staff and conducting medical research, the hospital takes on additional tasks typically outside

[1] The ~760 bed capacity needs includes the smaller effect from improving shift to day surgery, which could reduce need by 6 beds by 2040.

the scope of a university hospital (e.g, serving stable elderly patients), as the healthcare system looks to Landspítali to fill gaps found elsewhere in the system. In recent years, Landspítali has also been diverging from parts of their core responsibilities, e.g., with decreased focus on conducting medical research. As demands on the healthcare system continue to grow, there is a need to clarify Landspítali's role to enable the hospital to solve its challenges and meet increased demand for care.

Base case: ~2% annual demand growth resulting in ~80% increase in bed needs by 2040 indicating significant gap in current facilities and staff if no actions taken

In a 'no change' scenario, Landspítali would face significant increase in demand for its services and resource needs in coming decades. By 2040, outpatient visits are expected to increase by ~23%, need for beds by 80%, workforce by 45%, and costs by a proportionally significant ~90% driven by staff-intensive care with high inpatient numbers and high real wage growth of staff. This would entail a need for 1,120 beds by 2040, far above the planned capacity of ~730 beds once Hringbraut has opened.

The increase in healthcare demand is driven mostly by expected demographic shifts until 2040 – with the population of 85+ year olds growing fastest (108%), the average age increasing by 9%, and the total population increasing by 18%. Non-demographic changes also lead to a changing burden of diseases, with e.g., diabetes and kidney diseases, enteric infections, and neurological disorders expected to increase in incidence and prevalence significantly. For beds, a government target to reduce utilization to 85% further increases the need. The impact on Landspítali would differ significantly by division, with aging and rehabilitation services seeing the largest increased demand of ~90%. The demographic challenge will be compounded by the currently relatively high share of elderly patients in long-term care at different wards of the hospital (17 to 26% of total bed days), which also disproportionately impacts aging and rehabilitation services.

A 'no change' scenario indicates a trajectory that could require significant capacity expansions. However, several potential initiatives have been identified that might increase quality of care while decreasing load on Landspitali by shifting patients to better healthcare settings.

Strategic choices: By shifting long-term and primary care to more adequate care settings, ~50% of the increased need for beds and ~65% of outpatient growth by 2040 could be absorbed outside Landspítali

Landspítali currently provides significant long-term care (38,000 to 51,000 bed days in 2019) for elderly care patients who could be treated in a more cost effective and appropriate care setting. This is due to capacity constraints in the healthcare system, resulting in an inability to shift these patients outside the hospital. Solving the constraint could conservatively decrease need for beds by 21% (~240 beds), workforce need by 5%, and result in ~ISK 9 billion in cost savings for Landspítali by 2040. Cost savings for the healthcare system from this initiative would likely exceed 1 to 2 ISK billion.

In addition, Landspítali is serving a significant number of patients who would more appropriately be served by primary care facilities. A benchmark against Swedish healthcare regions indicated that Landspítali spends ~4% of total resources on primary care services. If structured initiatives are implemented to identify and shift these patients to primary care facilities, a reduction of ~12% in outpatient visits, ~2% in workforce need, and ~3% cost savings could be achieved for Landspítali, compared to the 2040 base forecast.

Operational and digitalization improvements: A further ~24% of expected bed increase could be absorbed, bringing 2040 demand close to planned capacity levels once Hringbraut has opened

Existing research and benchmarks suggest that healthcare systems should expect between ~1 to 2.5% annual productivity gains in coming decades, by implementing operational best practices and both adopting current and developing digital healthcare solutions. To achieve these gains, Landspítali and the healthcare system will need to continuously identify and drive concrete operational and digitization initiatives and track results transparently. If the conservative end of this range (~1.3% per year) is achieved, Landspítali would decrease the need for beds by ~13% and costs by ~25% compared to the 2040 base forecast.

In addition, if Landspítali can maintain its successful shift towards day surgery and reach current best practice day surgery rates, Landspítali would reduce the need for beds, workforce and costs ~0.5% further by 2040.

Finally, this report identifies a number of other conclusions and choices that could benefit the healthcare system and Landspítali if addressed

Privatization in the healthcare system: Compared to neighbouring countries, Iceland's private specialist sector is relatively unregulated. Many physicians split time between the public and private sectors, self-referrals are allowed, and there is high freedom of establishment and mostly uncapped volumes. In addition, majority of contracts with private specialist providers have expired, which in Iceland enables private providers to charge top-up co-pays, which in 2019 accounted for ~25% of total private funding.

Out-of-country treatments: Treatments are outsourced abroad due to patient request, clinical necessity (e.g., expertise lacking in Iceland), or too long waiting times. Number of treatments outsourced abroad due to clinical necessity is assumed to remain at similar levels going forward, but outsourcing due to waiting times is expected to be significantly reduced in line with stated aims of Iceland's 2030 health policy. Ensuring capacity at Landspítali to enable insourcing of these volumes is likely beneficial, resulting in cost savings for the system. Impact on bed needs, costs and workforce at Landspítali would be small (less than 0.5% across metrics by 2040). More importantly, a formalized structure and process for referring patients abroad is lacking - potentially resulting in sub-optimal decisions which may be impacting quality of care and hindering the formation of longer-term strategies for outsourcing out-of-country. Developing a structured approach for shifting care both within and out-of-country could be highly beneficial for the healthcare system.

Funding and focus on research and education: Landspítali's spend on medical education per student is in line with benchmarks, while spend on medical research is significantly lower than other Nordic and US university hospitals, 1.3% as share of total costs, versus 3%+ for other compared countries. The 2030 health policy states that research in Iceland should be of comparable quality and volume as abroad and investments would be needed to achieve this. In addition, enhanced funding for research at Landspítali would likely result in tangible benefits in retaining and attracting clinical staff to the institution. Finally, the funding process for education and research to Landspítali could benefit from thorough review and adoption of certain elements from funding processes elsewhere - earmarked funding for these activities should be considered.

Coordination role of Landspítali: Currently, the procurement of medical supplies and equipment in Iceland is not centralized, and a significant part is done through Landspítali.

The typical spend on these items makes up ~30 to 40% of total expenditure, and significant savings can be realized by implementing procurement related improvements such as standardizing products across units, harmonizing prices, consolidating volumes, optimizing product choices, and optimizing procurement administration. A more centralized structure could also improve national stockpile control and national quality standards. There are several options for how to set up this type of function – e.g. via a new separate body or by giving Landspítali a national mandate and creating a governance structure and system around this. These options should be considered and could impact the role of Landspítali.

In conclusion, the demographic challenge is manageable, but significant decisions must be made on where care is provided and how to enable operational improvements

While findings in this report indicate that initiatives primarily concerning operational improvements, digitalization and shifting healthcare production outside the university hospital setting would result in a manageable growth for Landspítali, these initiatives would need to be pursued with some focus already in the short-term to achieve this.

In the main scenario, the need for beds is expected to grow significantly, primarily driven by the ambition to move from the current bed occupancy rate of 97% to a target of 85%. When Hringbraut opens, the planned bed capacity is ~730 beds. To handle demand with this planned capacity and reach the bed occupancy rate target, ~55% of the potential impact from shifting out long-term care would need to have been realized by 2026. This would result in a total need for 729 beds by 2026 – a growth of ~17% from the 2019 starting point of 624 beds.

The scenario described above would also be dependent on operational and digitalization productivity gains of ~1.3% per annum being achieved from the start. While it should be achievable and realistic, it does require significant focus, strong management and transparent follow-up, and tracking of productivity initiatives.

If the initiatives described above were not to be pursued, alternative strategies centred around expanding the capacity of Landspitali further would need to be considered, if the system aims to serve demand on the same level as currently.

3 Landspítali's starting point

Landspítali's starting point is studied in two sections: 1) the role of Landspítali today, and 2) current healthcare production, capacity, capabilities, and costs. The first section serves to understand Landspítali's role in the context of the Icelandic healthcare system and what key questions to answer regarding the role going forward. The second section establishes the starting point of the forecast.

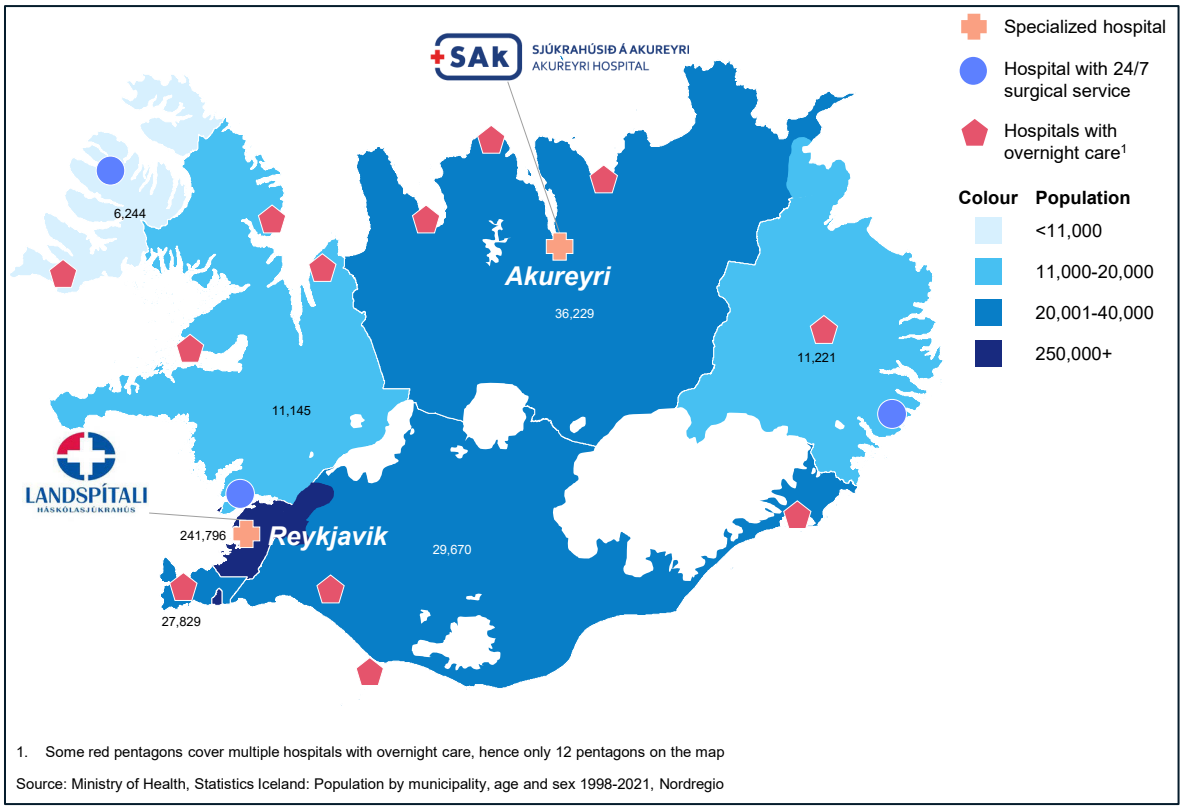
3.1 The role of Landspítali today

This section details the role of Landspítali to understand Landspítali's current mandate and what unclear aspects exist today. Firstly, Landspítali is described in the context of the Icelandic healthcare system. Secondly, the official responsibilities of Landspítali are detailed. Lastly, unclear aspects of Landspítali's role, which will be studied in this report, are listed.

3.1.1 Landspítali in the Icelandic healthcare system

Iceland has two specialized hospitals, Landspítali and Akureyri (SAK), three additional hospitals with 24/7 surgical services, and 18 more hospitals with overnight care. Icelandic healthcare spending was ~8.5% of GDP in 2019, of which 82% was publicly funded.[2] In the Icelandic healthcare system, Landspítali is the largest entity, representing close to one-third of total healthcare spending in Iceland and being the only university hospital.[3]

Exhibit 1. Overview of the Icelandic healthcare system per region.



1. Some red pentagons cover multiple hospitals with overnight care, hence only 12 pentagons on the map

Source: Ministry of Health, Statistics Iceland: Population by municipality, age and sex 1998-2021, Nordregio

[2] OECD, 'Health spending', 2019, data.oecd.org.

[3] Landspítali, 'Landspítali financial report', 2019, landspitali.is; Statistics Iceland, 'Current health expenditure by healthcare functions and financing schemes 2003–2020', 1 November 2021, statice.is.

Landspítali was founded in 1930, originally built on the idea of creating one hospital that should serve the entirety of Iceland. Throughout the 20th century, Landspítali mainly acted as a hospital for the Capital Region of Iceland and steadily grew in size. In 2000, it merged with Reykjavík City Hospital (Sjúkrahús Reykjavíkur) to form Landspítali – the National University Hospital of Iceland.[4] Since then, the size and responsibilities of Landspítali have continued to grow, making Landspítali the largest employer in Iceland with ~4,500 full-time employees (FTEs). Today, Landspítali is a cornerstone of the Icelandic healthcare system and the leading provider of advanced secondary and tertiary care and healthcare education in Iceland.

3.1.2 Official responsibilities of Landspítali

The official role defined in the Icelandic 2030 health policy[5] is threefold: 1) serving patients, 2) teaching and training clinical staff, and 3) conducting scientific research.

Serving patients: In addition to serving the ~230,000 inhabitants of the Capital Region of Iceland, Landspítali plays a vital role in the entire Icelandic healthcare system as being the main hospital able to provide advanced secondary and tertiary care, with ~20% of Landspítali patients coming from areas outside the Capital Region. Additionally, Landspítali is responsible for providing emergency medical services to all aviation and marine traffic in the Northern Atlantic, from the South of the Faroe Islands to Canada.[6] Currently, various medical specialties are offered at Landspítali, ranging from basic secondary care procedures to advanced tertiary care, with more than ~15,000 surgeries conducted annually.[7] For highly advanced and unique treatments that Landspítali cannot provide itself, Landspítali collaborates with hospitals in other countries by referring patients abroad to ensure the quality of care is maintained. In the coming years, the development and growth of Landspítali's capabilities and capacity are expected to continue, with significant expansion plans through the Hringbraut project – which entails adding a new major hospital building, a laboratory building, and a hotel for patients.

Teaching and training clinical staff: Landspítali's second area of responsibility includes acting as an educating body for healthcare expertise in Iceland – educating most of the medical staff for the Icelandic healthcare system through cooperation with the University of Iceland. Currently, Landspítali educates a broad range of medical staff, including postgraduate and undergraduate physicians, midwives, and nurses. For physicians, Landspítali provides education across medical specialties and draws upon medical education centres abroad for certain highly specialized practices they cannot offer.

Conducting scientific research: The third area of responsibility includes conducting medical research for Iceland. Landspítali is one of the most significant medical research contributors in Iceland[8] – conducting research mainly within biochemistry, genetics, molecular biology, and medicine.

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[4] Landspítali.is, 'About Landspítali', 01 November 2021; 'Ágrip af sögu Landspítalans 1930–1998'. Landspítalinn, 25 March 2017.

[5] Ministry of Health, 'Health Policy: A policy for Iceland's health services until 2030', Government of Iceland, 2019.

[6] European Nurse Directors Association, https://enda-europe.com, 15 November 2021.

[7] Hospital statistics and accounts Landspítali 2019.

[8] Other medical research institutions include the University of Iceland, deCODE genetics, the Icelandic Heart Association, and more.

3.1.3 Unclear aspects of Landspítali's role

In addition to its official responsibilities, Landspítali currently plays a broader role in the Icelandic healthcare system – taking on responsibilities that ideally should not belong to a university hospital. For instance, previous reports have highlighted that primary and nursing home care is provided at Landspítali,[9] which is typically outside the scope of a university hospital focused on complex secondary and tertiary care. At the same time, Landspítali has been straying away from parts of the official core responsibilities of a university hospital, e.g., through a potentially decreased focus on conducting scientific research.[10] These 'unofficial' changes to Landspítali's responsibilities create questions and unclarities of the actual role of Landspítali. In addition to this, the need for efficient collaboration with a growing private healthcare sector[10] and potential coordination roles on a system level – e.g., centralized procurement – puts increased pressure on defining the role of Landspítali.

Currently, Landspítali faces several challenges, e.g., outflow issues, higher average length of stay (ALOS) than benchmarks, and high occupancy rates. At the same time, improvement work is potentially hindered by the current unclarities of Landspítali's role in the healthcare system. On top of this, the size of Landspítali is growing, medical practices are becoming more complex, and healthcare demand is expected to increase significantly.

To tackle the challenges Landspítali faces and adapt to the increasing scale and complexity of the healthcare system, Landspítali's role in the healthcare system needs to be clear. The following key questions and topics need to be clarified:

- **Given Landspítali's role in serving patients from a wide range of regions and geographies, is the current concentration of complex care at Landspítali adequate on a system level, or should it be further centralized or decentralized in the system?**
- **Should Landspítali stop providing primary and long-term care and instead devote more resources to complex secondary and tertiary care?**
- **What role should Landspítali have in contrast to the private specialist sector?**
- **To what degree should Landspítali continue to collaborate with international partners to outsource treatments?**
- **Is Landspítali's official responsibility of conducting scientific medical research well supported in the system through adequate funding and structure?**
- **Should Landspítali expand its' broad role in the system to act as a centralized coordinating body for specific functions – e.g., procurement?**

With the growing demand on the healthcare system, increased complexity of medical practices, and challenges Landspítali faces today, the need to properly define the role of Landspítali is evident and essential for Iceland to achieve its long-term goals. In the following chapters, the report aims to assist in defining Landspítali's role by answering the above key questions.

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[9] Ministry of Health, 'Increasing productivity and quality through new reimbursement model and benchmarking', Government of Iceland, 2020; M. Heimisdóttir, 'Unlocking the full potential of Landspítali University Hospital: Icelandic healthcare at a crossroads', *The Icelandic Medical Journal,* 2016, https://doi.org/10.17992/lbl.2016.10.99; Ministry of Health, 'Health Policy: A policy for Iceland's health services until 2030', Government of Iceland, 2019.

[10] Ministry of Health, 'Health Policy: A policy for Iceland's health services until 2030', Government of Iceland, 2019.

3.2 The current healthcare production, capacity, capabilities, and costs of Landspítali

3.2.1 Introduction

This section serves to understand Landspítali's starting point to establish the baseline of the forecast. Firstly, key considerations for establishing the baseline are explained. Secondly, the starting point is studied regarding current; 1) healthcare production, 2) bed capacity, 3) operating room capacity, 4) workforce composition and capabilities, and 5) cost. Lastly, the key findings are summarized.

3.2.2 Key considerations for establishing the baseline

This report focuses on establishing the baseline regarding the key data for understanding Landspítali's future needs. To start, healthcare production is studied to understand the current healthcare demand, focusing on physical visits since it is the predominant driver of hospital needs in terms of working hours and space. In contrast, remote visits have a significantly smaller impact. Then, the data connected to what is needed to enable this production is covered, focusing on bed capacity, operating room capacity, workforce composition and capabilities, and costs.

In the coming decades, strategic decisions and policy changes – other than those discussed in this report – will affect, e.g., the structure of Landspítali's divisions and workforce composition across roles. For example, if the Icelandic healthcare system decides there is a need to invest in improving access to psychiatric care, the capacity, capability, and cost needs of that division would increase from forecasts made in this report. Similarly, if Landspítali were to decide that a significant increase in medical secretaries is needed to optimize task allocation for clinical staff, it would not be captured in this report.[11] Unless decisions were already made or deemed key strategic choices by experts in the Icelandic healthcare system to, explore at the time of writing this report, they are not reflected in the forecast.

Throughout the report, data is used from 2019 to establish the baseline for the forecast. This is due to the impact of Covid-19 on 2020 and 2021 data, which strongly affected Landspítali's demand and provision of healthcare services.

3.2.3 Landspítali's current healthcare production

In 2019, Landspítali had 24,912 inpatient episodes and 406,672 physical outpatient visits.[12] In addition, there were also a total of 107,612 outpatient visits conducted remotely via phone calls and emails. For inpatients, the women's and children's services division had the most episodes (8,213), and for outpatients, the medical and emergency services division had the most visits (154,449). For psychiatric services, there are indicators that elderly patients needing psychiatric care are spread across other divisions, since there is no geriatrics department for psychiatric services.[13] The forecast uses the existing production data and

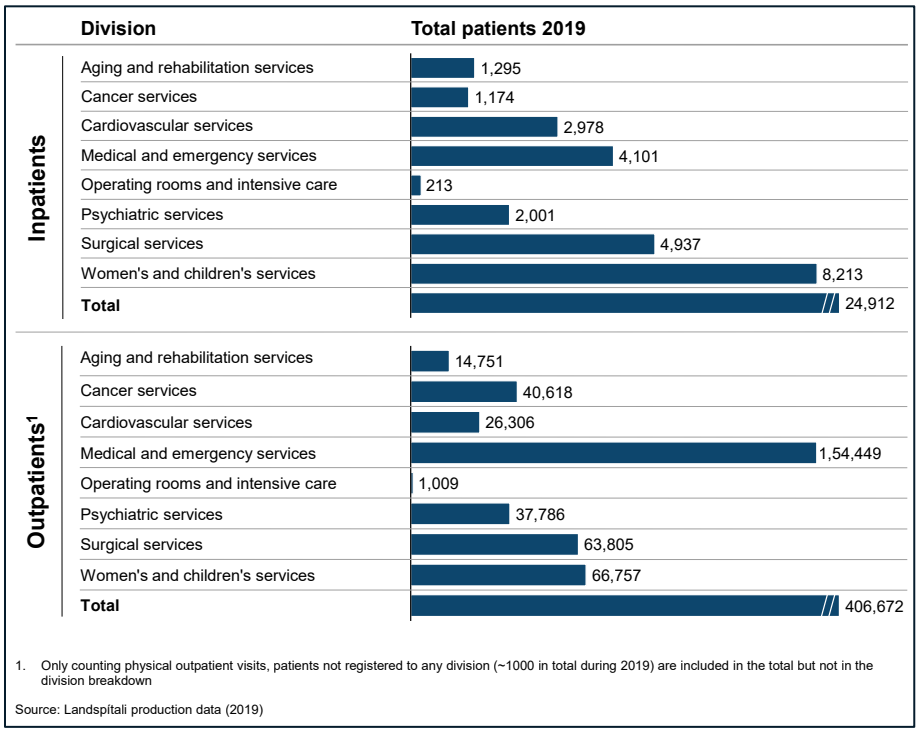
[11] The forecast is this report assumes no changes to distribution of staff across roles, apart from the effects due to shifts in demographics, incidence and prevalence rates of diseases, and effects from the strategic choices and operational improvement and prevention measures discussed in this report.

[12] Production data from Landspítali.

[13] Interviews with Landspítali.

does not make adjustments for this, but it is noted that parts of the demand for psychiatric services may currently be served in other divisions, hence the demand for psychiatric services being larger than reflected in the data.

Exhibit 2. Inpatient and outpatient visits per division in 2019.



1. Only counting physical outpatient visits, patients not registered to any division (~1000 in total during 2019) are included in the total but not in the division breakdown

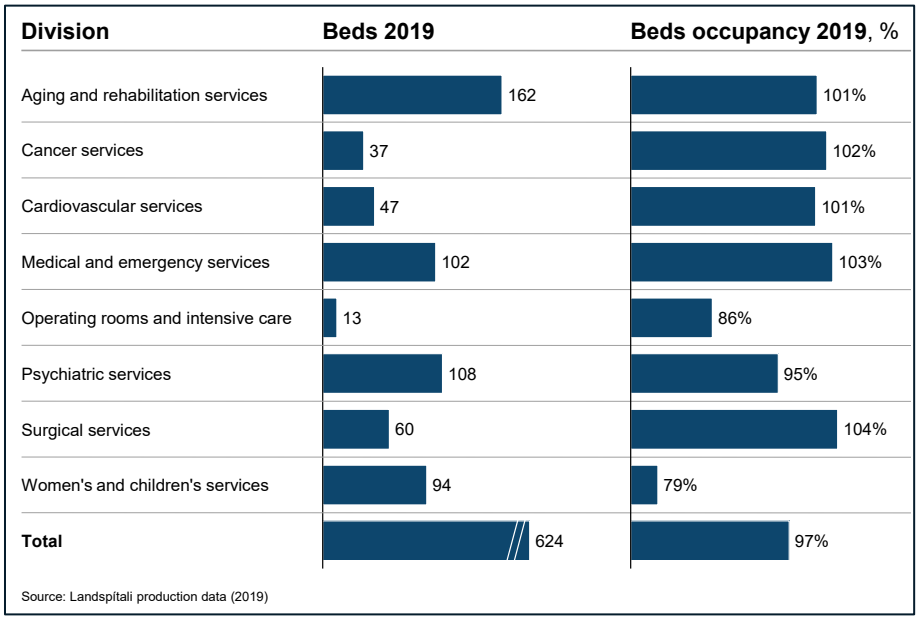
Source: Landspítali production data (2019)

3.2.4 Landspítali's current bed capacity

During 2019, Landspítali had an average of 624 operational beds with an average bed occupancy rate of 97%, which can be compared to occupancy rate best practices in the 85 to 90% range.[14] The division with the most beds is aging and rehabilitation services, and the bed occupancy rates were slightly above 100% in all divisions in 2019 except for psychiatric services (95%), surgery and intensive care (86%), and women's and children's services (79%). Above 100% occupancy rate occurs when beds classified as closed or when beds not classified as proper beds are used, e.g., due to being in corridors. Bed occupancy is measured through a manual count of patients in every ward at 6:00 am every morning.

[14] National Guideline Centre, 'Bed occupancy', *National Institute for Health and Care Excellence,* NICE guideline 94, 2018.

Exhibit 3. The number of beds and bed occupancy rates per division in 2019.



In addition to the current beds, there is the possibility of opening ~40 more beds currently closed, and plans exist for an additional 15 beds in Landakot.[15] With the new hospital building Hringbraut, there are plans to increase the capacity by ~50 more beds as the transition is made to the new building.[16] In total, this would signify a capacity of ~730 beds after Hringbraut has opened.

3.2.5 Landspítali's current operating room capacity

Regarding operating room capacity, in 2019, Landspítali had 21 operating rooms that were used for a total of ~20,400 hours with a utilization rate of 56%. The utilization rate is calculated assuming that all operating rooms are open eight hours a day, five days a week, except for Fv. Stofa 3 and Hb. Stofa 3 which are considered to be open 12 hours a day, seven days a week, since they would be where acute cases are handled outside of daytime hours. This utilization rate is counted excluding the summer months June to August – when utilization is lower due to vacation time[17] – and excluding Kv. Stofa 24 is used for acute caesarean sections. Studying the utilization time of the operating rooms, the surgery ratio of the operation time – i.e. the share of utilization time, which was knife time – was 56% of the total time, meaning that the remaining 44% of the utilization time went to non-active surgery activities like preparation and cleaning. In addition to the current operating rooms, when transitioning to the new hospital building Hringbraut, the plan is to increase the total number of operating rooms to 24.[18]

[15] Interviews with Landspítali.

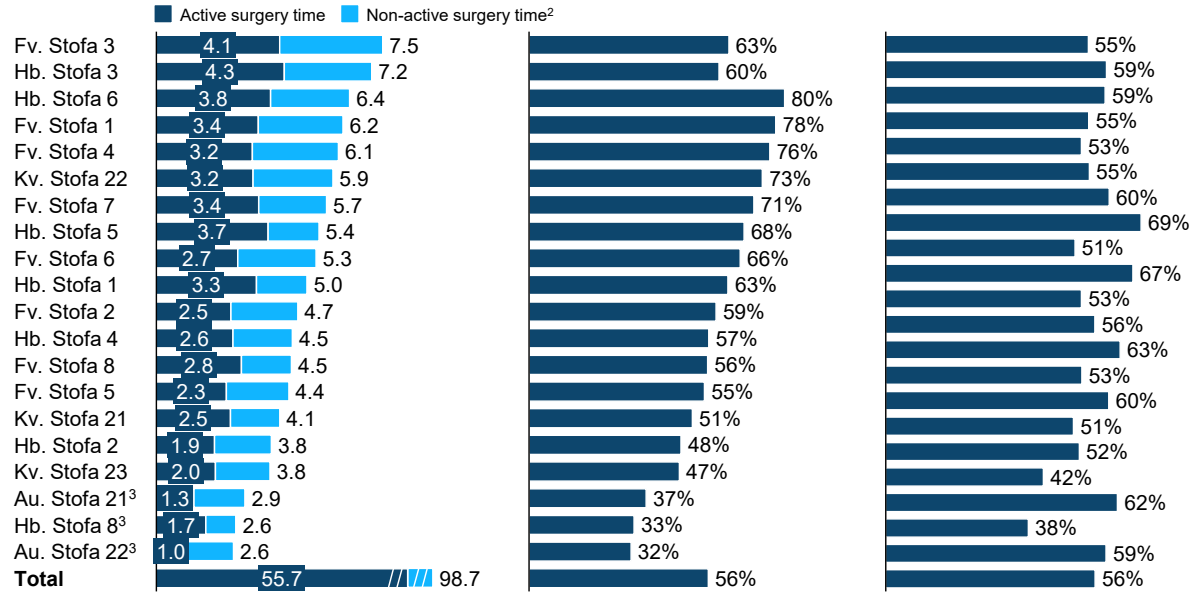
[16] Interviews with Landspítali.

[17] When measuring utilization rate of operating rooms to compare to benchmarks and best practices, vacation time is typically not excluded. However, due to a clear and prolonged decrease in utilization during summer months at Landspítali, this is done here to ensure comparability.

[18] Interviews with Landspítali.

Exhibit 4. Landspítali's use of operating rooms in 2019.

Utilization of Landspítali operating rooms[1], 2019 (excl. summer months June-Aug)



Counting all operating rooms as being open 8 hours a day 5 days a week, except Fv. Stofa 3 and Hb. Stofa 3 counted as open 12 hours a day 7 days a week

1. Excluding Kv. Stofa 24 used for caesarean section
2. E.g. preparation and cleaning of operating rooms
3. Special purpose operating room primarily for eye surgery, explaining low utilization rate

Source: Landspítali surgery data (2019)

3.2.6 Landspítali's current workforce composition and capabilities

In 2019, Landspítali had a total of 4,500 FTEs. In the forecast, these are split into the following seven different role categories; physicians, junior physicians, registered nurses & midwives, nurse assistants, management / administration, other care / rehab / social, and other remaining staff.

Since 2019, the new Better Working Hours agreement has come into effect, which introduced structural changes on how FTEs are defined.[19] To ensure that the forecast reflects the 2021 workforce definition, the 2019 workforce numbers are scaled up in two ways. The scaled workforce required for 2019 amounts to 4,801 FTEs. Firstly, the number of FTEs for shift workers increases by 15% as their workweek decreases from 40 hours to an average of 34 hours. Secondly, total salary costs for shift workers is increased by 8%, primarily due to the increase in FTEs.[20] For daytime workers, it is a precondition of the Better Working Hours agreement that it does not affect total production, i.e., the same number of employees should still be able to achieve the same output.[21] Daytime workers are therefore not adjusted, although their working hours may decrease from 40 to 36 hours per week. This is assumed to be offset by: 1) increased productivity during worked hours and 2) non-work

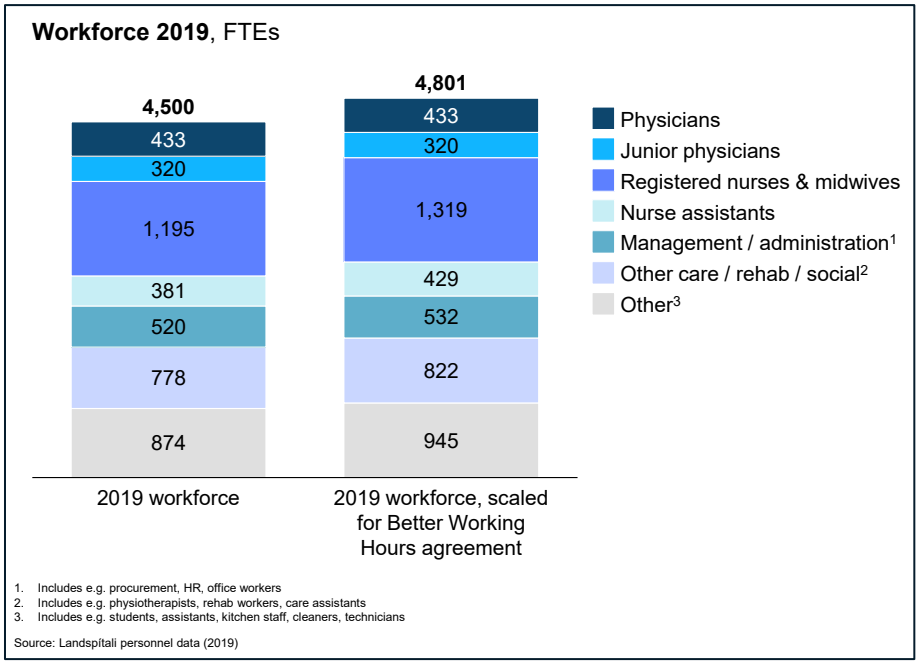
[19] 'Better Working Hours', 2021 Betrivinnutimi.is.

[20] Discussions with Landspítali data department on impact of Better Working Hours agreement since implementation during Spring 2021.

[21] The agreement is dynamic and the results from the implementation are periodically reviewed, so that if production would be shown to be impacted, the hourly decrease is adjusted to ensure that production is not impacted.

hours that were previously logged as work (e.g., coffee breaks) are no longer to be logged as work hours. By the end of 2021, estimates are that ~100 of the additional ~300 FTEs required due to the structural changes in the Better Working Hours agreement have been filled.[22] This means that there is a need for an additional ~200 FTEs to fill this gap.

Exhibit 5. Landspítali's workforce in 2019.[23]



3.2.7 Landspítali's current financials

During 2019, Landspítali had total costs of ISK 77.8 billion, of which ISK 57.6 billion were salary costs, ISK 11.1 billion product costs, ISK 6.2 billion services and rental costs, ISK 1.8 billion other operating costs, and ISK 1.1 billion depreciation costs.[24] Compared to the total income of ISK 75.4 billion, this equates to a deficit of ISK 2.4 billion. Since the forecast serves to understand the future costs of Landspítali, only the costs are considered, and not the previous income or budget deficits.

Historically, Landspítali has been in a budget deficit – accruing debt annually. At the end of 2020, Landspítali had accrued ~ISK 3 billion in debt. To deal with this, agreements between the Ministry of Health, Ministry of Finance, and Landspítali were made, where Landspítali's total debt will be paid in full by the Ministry of Health if Landspítali stays within budget for three years. Even if Landspítali fails to meet their end of the agreement and is required to pay the debt back in full, that would be considered a one-time expense that does not impact Landspítali's long-term costs. As the model looks at the hospital's ongoing expenses, the potential effect from this will be excluded in the 2040 forecast.

[22] Interviews with Landspítali.

[23] The workforce data was presented to and reviewed by Landspítali's economics department in a number of sessions. However, questions have been raised about potential errors or misreporting in the data logged by the hospital, specifically around the number of Junior physician FTEs, by the department of Postgraduate Medical Education. This may be partly explained by that department using headcount, while here FTEs are used, including shift hours. For the purposes of this review, the data has been assumed to be correct, but in cases where this is called into question, changes to and clarifications of Landspítali's reporting procedures should be undertaken.

[24] Landspítali, 'Landspítali financial report', May 2020, Landspítali.is.

It should be noted that the 2026 transition to the new hospital building Hringbraut will likely impact the costs – partly in terms of treatment costs if efficiencies are realized, but also the depreciation costs. In a previous report by the Institute of Economics at the University of Iceland examining the costs of the new Landspítali, it is described that estimates in Norway on potential operating savings connected to new hospital buildings range between 5 and 7%. However, these are only based on forecasts.[25] Another study on financial gains from a new modern hospital building in Bolton, United Kingdom, estimates a 2% cost reduction potential.[26] A similar survey for St Helier, United Kingdom, estimates a 10% cost reduction potential.[27] On the other hand, benchmarks indicate that costs more commonly increase when moving to a new hospital building, e.g., due to more expensive equipment, increased floor space, and higher depreciation costs.[28] Due to the deviating views on this, the forecast does not quantify potential cost savings or increases from the transition to Hringbraut since it would introduce significant uncertainties into the forecast. However, it is noted that costs should be monitored closely throughout the transition process to understand how they develop compared to the costs forecast in this report, which is based on the baseline costs in current buildings.

3.2.8 Summary of Landspítali's healthcare production, capacity, capabilities and costs

The starting point of Landspítali has now been studied to understand the current healthcare production, bed capacity, operating room capacity, workforce and capabilities, and costs. In coming chapters, this will serve as the baseline for forecasting Landspítali's healthcare demand and needs until 2040.

To summarize, in 2019, Landspítali treated 24,912 inpatients and 406,672 outpatients. To handle the inpatients, 624 beds were open on average with a high occupancy rate of 97%, significantly above best practices of 85 to 90%. Additionally, Landspítali had 21 operating rooms with an average utilization rate of 56% and a surgery ratio of operation time of 56%. To enable this, Landspítali had 4,500 FTEs, scaled up to 4,801 FTEs due to the structural changes in the Better Working Hours agreement. The total cost of all of this was ISK 77.8 billion, of which the largest expense was salaries, representing ISK 57.6 billion.

[25] Hagfræðistofnun Háskóla Íslands, 'Kostnaður og ábati af smíði nýs Landspítala', 2014.

[26] National Health Service, 'Strategic Outline Case: New Hospital Programme "For a Better Bolton"', NHS Foundation Trust Bolton, 2021,

[27] National Health Service, 'Strategic outline case for investment in our hospitals 2020–2030', NHS Trust Epsom and St Helier University Hospitals, 2017.

[28] Expert interviews.

4 Baseline forecasting of Landspítali's healthcare demand and needs until 2040

This chapter serves to establish the base case forecast of Landspítali's healthcare demand and needs until 2040 in a do-nothing scenario where Landspítali continues its operations without any changes. The first section details how gaps in healthcare services are identified and adjusted for, the second section describes the approach to create the forecast, and the last section presents the results of the base case forecast.

4.1 Identifying and adjusting for current gaps in healthcare services

In this section, potential gaps in healthcare services are studied. Firstly, it is detailed why and how gaps in healthcare services are adjusted for in the forecast baseline. Secondly, potential gaps are analysed regarding 1) healthcare production, 2) beds, 3) operating rooms, and 4) workforce. Lastly, conclusions on current gaps are summarized.

4.1.1 Adjusting the forecast baseline for gaps in healthcare services

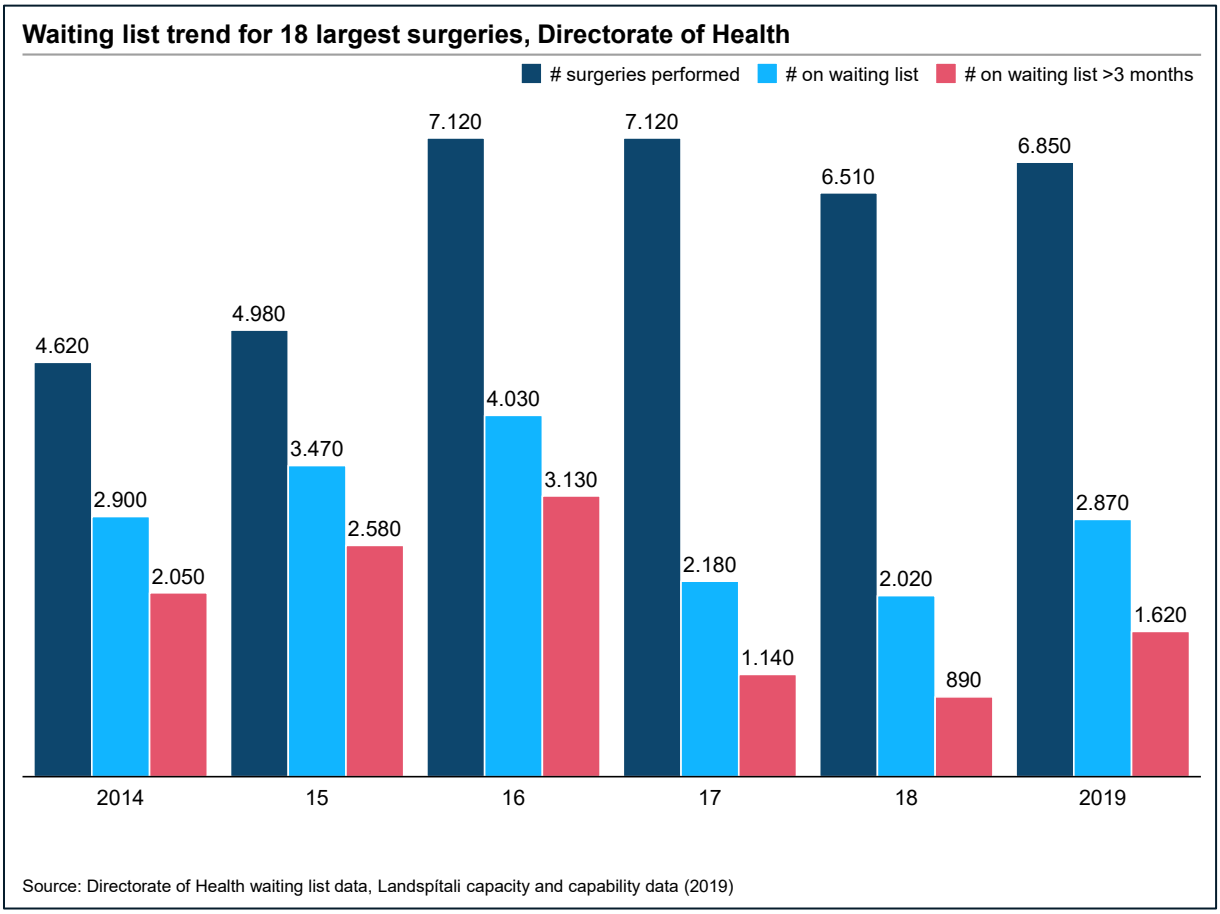
To ensure that the baseline used for the forecast accurately depicts a structurally desired state for Landspítali, it is adjusted to accommodate gaps in healthcare demand, capacity, capabilities, and costs. For example, if there is a shortage of beds, accounting for this by adjusting the baseline reduces the risk of projecting the current gap forward.

4.1.2 Analysis of potential gaps in healthcare production

To estimate any current gaps in healthcare production, i.e., the demand being higher than the supply of care, waiting list trends are studied. The Directorate of Health tracks waiting lists for the 18 most prominent surgical procedures analysed over the 2014 to 2019 period.[29] The analysis shows that the waiting list sizes did not consistently grow over the period, as would have been the case if there was an undersupply of care for the selected surgical procedures. Please note that the usage of waiting lists changed in 2016, so the data is only fully comparable from 2017 onwards. If, when studying the 2017 to 2019 period, we see a growth in waiting list sizes, this is not considered robust enough to quantify a structural gap in healthcare production due to the short period and the fact that waiting lists shrank between 2017 to 2018. Waiting list trends for these surgeries should nonetheless be monitored closely over the coming years to ensure that the healthcare supply meets demand.

[29] Download data on waiting lists from 2014–2019, on the Icelandic Directorate of Health's website.

Exhibit 6. Waiting list data for the 18 largest surgeries from the Directorate of Health.



Comparing the waiting list data to the Icelandic target of all patients receiving care within three months[30] shows that in 2019 this was met for roughly 43% of patients at Landspítali for the studied surgical procedures.[31] If assuming the waiting list sizes are constant, meeting this goal would require a one-off action to reduce waiting times on current waiting lists and would not by itself signify that more healthcare production is needed constantly going forward. Therefore, the baseline forecasting model does not consider this a gap in healthcare production.

4.1.3 Analysis of potential current gaps in beds

The bed occupancy rate is studied and compared to target levels to estimate gaps in bed capacity. In 2019, Landspítali had an average bed occupancy rate of 97%,[32] while best-practice targets are 85 to 90%.[33] The lower end of 85% is the main target in the modelling. This, since Landspítali is the only Icelandic hospital that provides more complex care. As such, it is not possible to refer patients to other nearby hospitals if the capacity is reached – as would be the case for most hospitals in other parts of the world. This would indicate the need for redundancy to handle demand peaks, mainly in the acute flow. However, setting the target occupancy rate is something where there is a clear choice based on the tolerance for

[30] Icelandic Directorate of Health, 'Waiting for health care', 2021, https://www.landlaeknir.is/.

[31] Download data on waiting lists from 2014–2019, on the Icelandic Directorate of Health's website.

[32] Measured through a manual count of number of patients in every ward at 6:00 am every morning.

[33] National Guideline Centre, 'Bed occupancy', *National Institute for Health and Care Excellence*, NICE guideline 94, 2018.

risk of the capacity deficit during peaks.[34] This approach quantifies a current bed gap of 88 additional beds at an 85% bed occupancy target and 49 extra beds at a 90% target. Closing this gap is factored into the forecasting model.

In addition, a bed gap is quantified based on the emergency room (ER) currently having long-term patients who would be inpatients if moved to inpatients wards in line with existing targets. All patients staying in the ER longer than 24 hours are considered long-term ER patients. This translates into bed needs by calculating how many hours they would have been in inpatient wards if moved after being in the ER for six hours. The target of six hours maximum length of stay in the ER is selected since this is widely used in research and best practices.[35, 36, 37] The inpatient hours calculated as currently being spent in the ER is then translated to the number of bed days and the number of beds needed. In total, this amounts to a current gap of 23 beds, which is factored into the forecasting model.

Note that no increase in healthcare production, workforce, or cost is modelled as a direct effect of increasing the number of beds to account for this gap. This is so as opening additional beds aims to reduce overall bed occupancy rates and have more empty beds available for handling demand peaks. Therefore, the number of patients is not expected to change as a direct effect of this. Naturally, there will be some costs, e.g., equipment, associated with opening new beds, but this is unaccounted for, due to two primary reasons. Firstly, parts of the bed increase could be accounted for by using currently closed beds. Secondly, as most of the costs would be salary-related, they would not increase as the number of patients remains the same, meaning that other costs would only have a marginal impact on the overall forecast.

4.1.4 Analysis of potential current gaps in operating rooms

When considering the utilization potential of operating rooms to understand any current gaps, two main levers are studied. Firstly, the utilization rate during all the hours the operating rooms are open (as defined in the 'Landspítali's current operating room capacity' section). Secondly, what the surgery ratio of operation time is, i.e., what percentage of the time the operating room was used for active surgery (examples of non-active surgery time are preparation and cleaning). In 2019, operating rooms had a utilization rate of 56% and a surgery ratio of operation time of 56%. Best practices are typically between 75 to 90% utilization and 60 to 70% for surgery ratio of operation time.[38, 39, 40] Since both the current utilization rate and active surgery ratio are below best-practice rates, there should be

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[34] A reason for setting a target for 90% would be how bed occupancy rates are measured. Since Landspítali measures bed occupancy rates once per day at 6:00 am in the morning, which is when the bed occupancy is generally the highest, Landspítali will due to the measurement method have a higher occupancy rate than other hospitals that for example measures three times a day.

[35] P.L. Henneman, et al., 'Emergency Department Patients Who Stay More Than 6 Hours Contribute to Crowding', *Administration of Emergency Medicine,* 2009, Volume 39, Issue 1, pp. 105–112, https://doi.org/10.1016/j.jemermed.2008.08.018.

[36] Expert interviews.

[37] Note that this is slightly different from Landspítali's current target of six hours maximum length of stay in the ER after a decision has been made that the patient should be moved to an inpatient ward, i.e., the six-hour countdown not beginning when the patient arrives at the ER but rather when a decision to move the patient has been made.

[38] National Health Service, 'Acute sector: Operating theatres', NHS Benchmarking Network Study, 2021, nhsbenchmarking.nhs.uk .

[39] National Health Service, 'Planned Care, Outpatients and Theatres', NHS Benchmarking Network, 2017, nhsbenchmarking.nhs.uk.

[40] Expert interviews on best-practice rates in the United Kingdom and United States, 2021.

significant potential to increase the utilization of existing rooms; hence no gap is accounted for in the forecast.

4.1.5 Analysis of potential current gaps in the workforce

To analyse potential gaps in the workforce, i.e., current staff shortages, three primary approaches are evaluated. Firstly, overtime ratios – how much of the total working time is logged as worked and paid overtime – are compared with targets to understand if the staff needs to work too many hours to meet demand. Secondly, productivity metrics per physician and nurses are benchmarked with Swedish hospitals to determine if the workload is too high during the worked hours. Thirdly, the number of physicians and nurses per capita are benchmarked with other Nordic countries to understand the situation at a healthcare system level.

Overtime ratios for daytime workers vary between 0.5 to 3.4% across roles – 0.5% for physicians and 2.2% for registered nurses & midwives.[41] This figure is well below the Landspítali target of a 3.4% overall overtime ratio.[42] For shift workers, the overtime ratio varies between 4.9 and 5.9% across roles, being 5.1% for registered nurses & midwives and 5.9% for nurse assistants. According to the Better Working Hours agreement of 5%, this is slightly above the target, but not significantly. Some deviations are seen when studying this per hospital division, e.g., registered nurses & midwives have a 7.4% overtime ratio within medical and emergency services and a 7.3% overtime ratio within psychiatry. These ratios indicate that although Landspítali overall is close to being in line with targets, select divisions are above them.

Productivity metrics show that Landspítali is below Swedish peers for physicians regarding diagnosis-related group (DRG) points per physician,[43] which is the most appropriate metric to compare since it considers the varying complexity levels of treated patients.[44] When studying outpatient equivalents, an average across hospitals is used to convert inpatients to outpatient equivalents; here, Landspítali is in line with Swedish hospitals. Further dividing productivity per inpatients and outpatients shows that Landspítali is below Swedish comparables for inpatient stays but above for outpatient visits. The outpatient visits could be explained by Landspítali's relatively high volume of less complex outpatients, as indicated by comparatively low average outpatient DRG-points. Regarding nurse productivity, Landspítali is comparable to the Swedish average on nurse hours spent per patient day, but slightly above the best performing of the three Swedish hospitals. The benchmark indicates that Landspítali staff currently has a somewhat lower or comparable workload to Swedish hospitals.

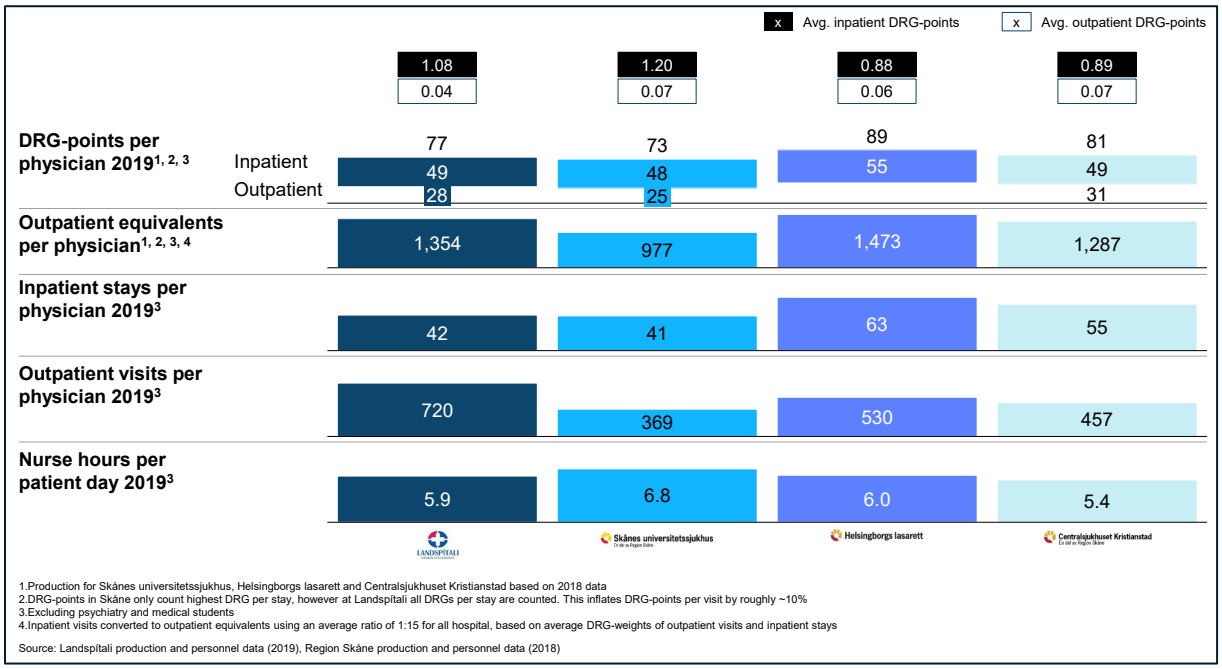
[41] Overtime ratio calculated as worked overtime divided by total worktime to be in line with international standards, noting that it slightly deviates from Landspítali's commonly used calculation that uses the formula (worked overtime divided by total worktime, excluding overtime).

[42] Dialogue with Landspítali employees.

[43] Ministry of Health, 'Increasing productivity and quality through new reimbursement model and benchmarking', Government of Iceland, 2020.

[44] DRGs are by definition not exact metrics, but based on averages of varying quality. However, on a yearly basis, accuracy would be sufficient to give an indication of productivity.

Exhibit 7. Benchmark of Landspítali productivity per physicians and nurses compared to Swedish hospitals in 2019.



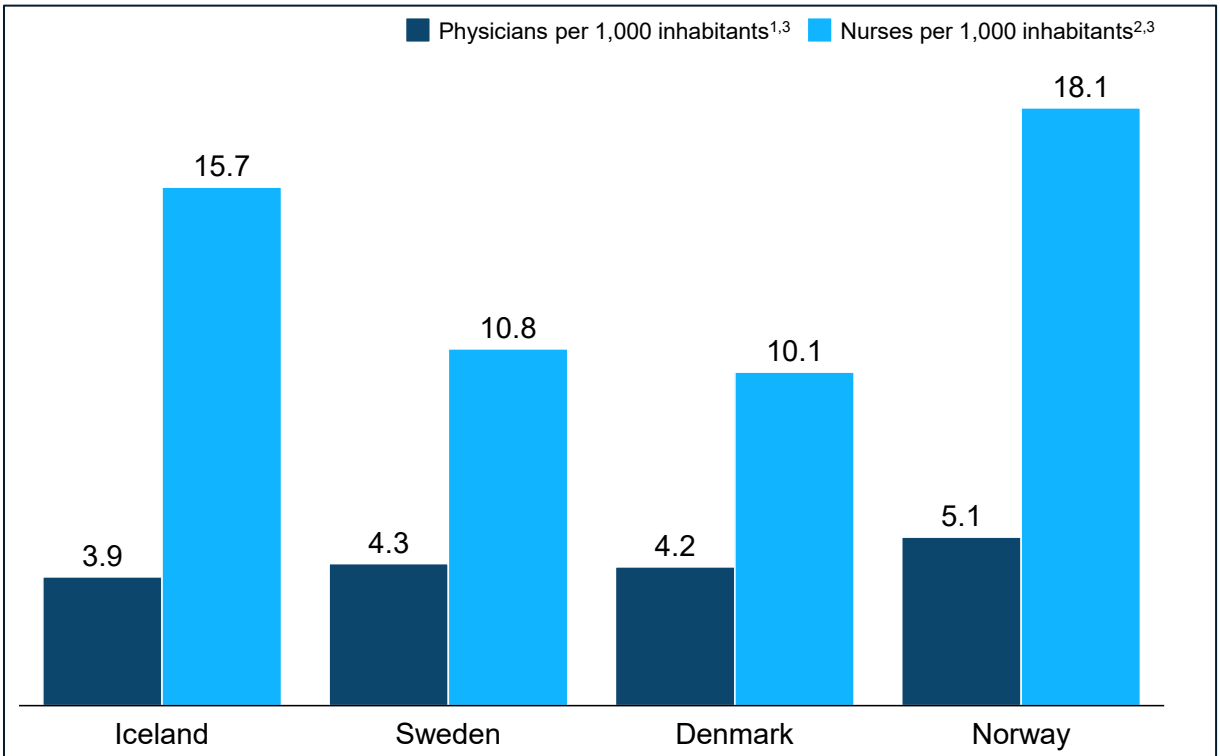
1.Production for Skånes universitetssjukhus, Helsingborgs lasarett and Centralsjukhuset Kristianstad based on 2018 data
2.DRG-points in Skåne only count highest DRG per stay, however at Landspítali all DRGs per stay are counted. This inflates DRG-points per visit by roughly ~10%
3.Excluding psychiatry and medical students
4.Inpatient visits converted to outpatient equivalents using an average ratio of 1:15 for all hospital, based on average DRG-weights of outpatient visits and inpatient stays

Source: Landspítali production and personnel data (2019), Region Skåne production and personnel data (2018)

An Organisation for Economic Co-operation and Development (OECD) benchmark on physicians and nurses per capita in Nordic countries shows that Iceland is slightly below Sweden and Denmark for physicians, having approximately 10% fewer physicians per capita while being further below Norway. The benchmark shows that Iceland has roughly 50% more nurses per capita than Sweden and Denmark while being below Norway.[45] Note that this is for the whole healthcare system of Iceland, i.e., not just Landspítali. Altogether, the benchmark highlights that, in comparison, Iceland has slightly fewer physicians but more nurses per capita.

[45] In a report from the Icelandic Association of Nurses (Félag Íslenskra Hjúkrunarfræðinga) from 2017, it is claimed that the OECD data on nurses per capita in Iceland is overestimated due to including nursing assistants and that the true value is closer to nine nurses per 1,000 inhabitants, which OECD claims on their website is not the case.

Exhibit 8. OECD benchmark on physicians and nurses per 1,000 inhabitants in Nordic countries.



1. Defined as "practising" physicians providing direct care to patients (incl. generalists and specialists), per OECD
2. Defined as "practising" nurses (excl. nurse aides) providing direct health services to patients, per OECD
3. Latest available year for each country in OECD data as of 2021-11-26, 2020 for Iceland and Norway, 2018 for Denmark and Sweden

Source: OECD

In addition to analysing overtime ratios, productivity metrics, and benchmarks per capita, it should be noted that an ongoing study by Landspítali, based on the RAFAELA system, regarding nurses' workload, in particular, shows signs that it is higher than preferable.[46] This has also been indicated in interviews with several experts within the Icelandic healthcare system. Determining potential gaps in capabilities contains many uncertainties, but since the overall analysis of Landspítali data does not indicate a significant current gap, the forecast does not account for one. However, this should be closely monitored going forward, especially as a gap could quickly emerge if the education pipeline does not keep up with demand growth. It should also be noted that the Better Working Hours agreement is expected to impact this and that the forecast accounts for an additional ~300 FTEs (shift workers), of which ~100 FTEs will be filled by the end of 2021[47] due to the structural changes the agreement implements.

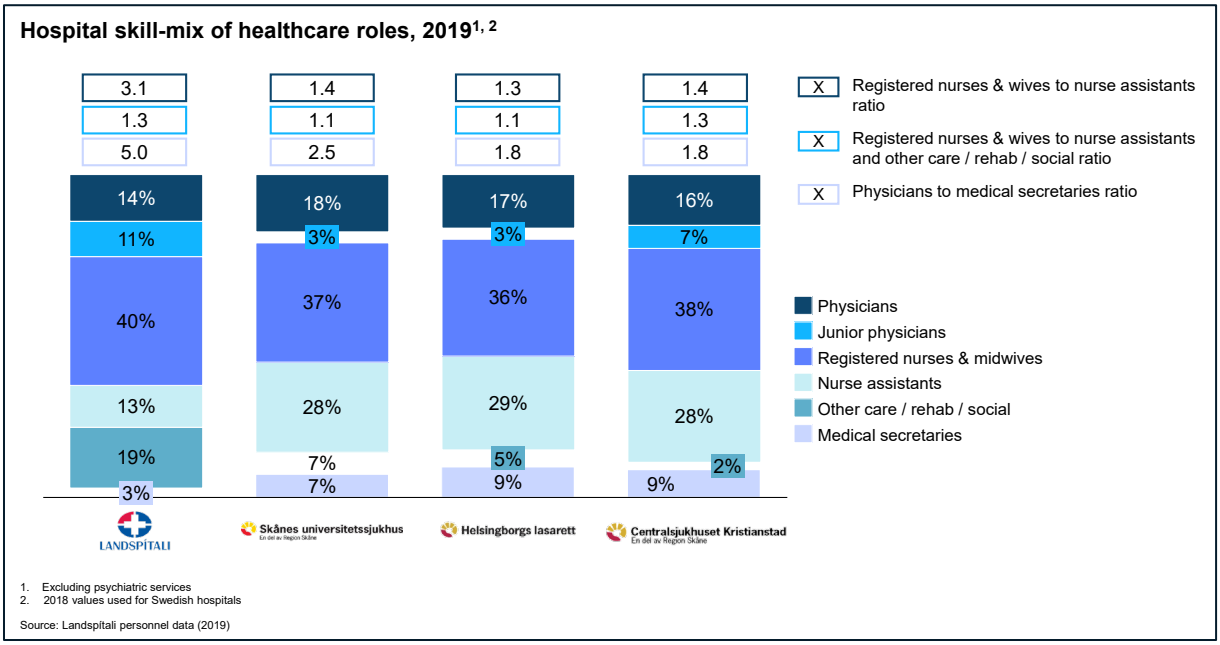
To further understand Landspítali's workforce composition, a skill-mix benchmark of healthcare roles is studied. The benchmark shows that, compared to Swedish hospitals, Landspítali stands out in its ratio of registered nurses & midwives and physicians compared to other care workers. Firstly, the ratio of registered nurses & midwives to nurse assistants is much higher at 3.1 while being between 1.3 and 1.4 for Swedish hospitals. When including other care / rehab / social workers in the ratio in addition to nurse assistants, it is slightly higher at 1.3 while it is between 1.1 and 1.3 for Swedish hospitals. Secondly, the ratio of physicians to medical secretaries is much higher at 5.0, while it is between 1.8 and 2.5 for

[46] Discussions with Landspítali representatives of RAFAELA study.

[47] Interviews with Landspítali.

Swedish hospitals. This indicates that registered nurses & midwives, and physicians at Landspítali perform a wider array of tasks, which nurse assistants or medical secretaries would support in other hospitals. While a different task allocation does not indicate a gap, it should be studied closely to ensure optimal task allocation, which could alleviate and create a more skill-appropriate workload for registered nurses & midwives, and physicians.

Exhibit 9. Benchmark of Landspítali skill mix of healthcare roles compared to Swedish hospitals in 2019.[48]



4.1.6 Summary of potential current gaps in healthcare services

To summarize, the forecast accounts for current gaps in healthcare services to adjust the baseline to define desired starting point of Landspítali, which is then used for the forecast. Gaps are accounted for regarding bed capacity to shift from the current 97% occupancy rate to the 85% target and to enable moving long-term patients from the ER to inpatient wards. For healthcare production, studying waiting list trends did not conclusively show a gap, partly due to the short time period, so no gap is accounted for. Regarding operating rooms, there is significant potential to increase utilization, so no gap is accounted for. For the workforce, overtime ratios and productivity metrics are generally in line with targets and benchmarks, and hence no gap is accounted for. It is, however, noted that there are indicators in an ongoing RAFAELA study and interviews that workload may be higher than preferable, thus this should be closely monitored going forward.

4.2 Description of the approach for creating the base case forecast

In this section, the forecasting approach to creating the base case forecast is described. Firstly, the forecast's models are detailed; 1) healthcare demand, 2) capacity, 3) capabilities, and 4) financials. Secondly, the key demand drivers of demographic and non-demographic changes, inflation, and real wage growth are explained. Lastly, the approach to consider the impact of immigration and tourism in the forecast is described.

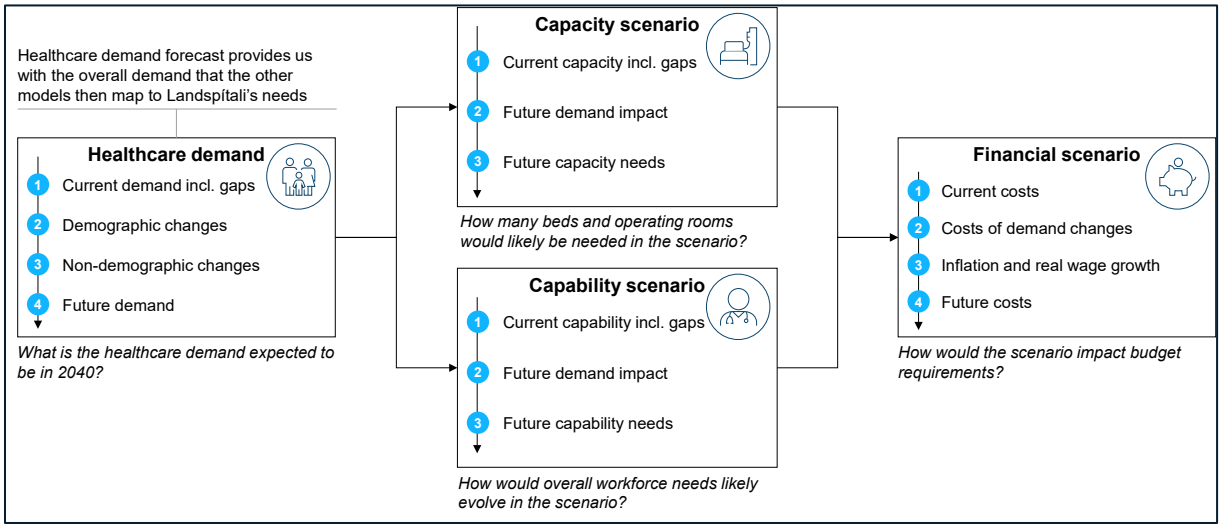
[48] Ministry of Health, 'Increasing productivity and quality through new reimbursement model and benchmarking benchmarking', Government of Iceland, 2020.

4.2.1 Overview of forecasting approach

The forecast consists of four different models to determine 1) healthcare demand, 2) capacity needs, 3) staffing and capability needs, and 4) financial needs. Healthcare demand is forecasted at DRG granularity, by age group (five-year intervals), and by gender. For each possible combination of these, a forecast is made. An example of such a combination could be males between 25 and 29 years old that were treated for DRG 080, 'Respiratory infections and inflammations without complications, age >18'.

The forecast begins from the current healthcare demand in 2019 for each of these DRGs, age bucket, and gender combinations. It then applies demographic and non-demographic forecasts to arrive at the expected future demand. This forecast across all combinations of DRGs, age buckets, and genders can then be aggregated, e.g., across divisions, cost centres, and medical specialties, and mapped to capacity, capability, and financial needs.

Exhibit 10. Overview of the healthcare forecasting model.



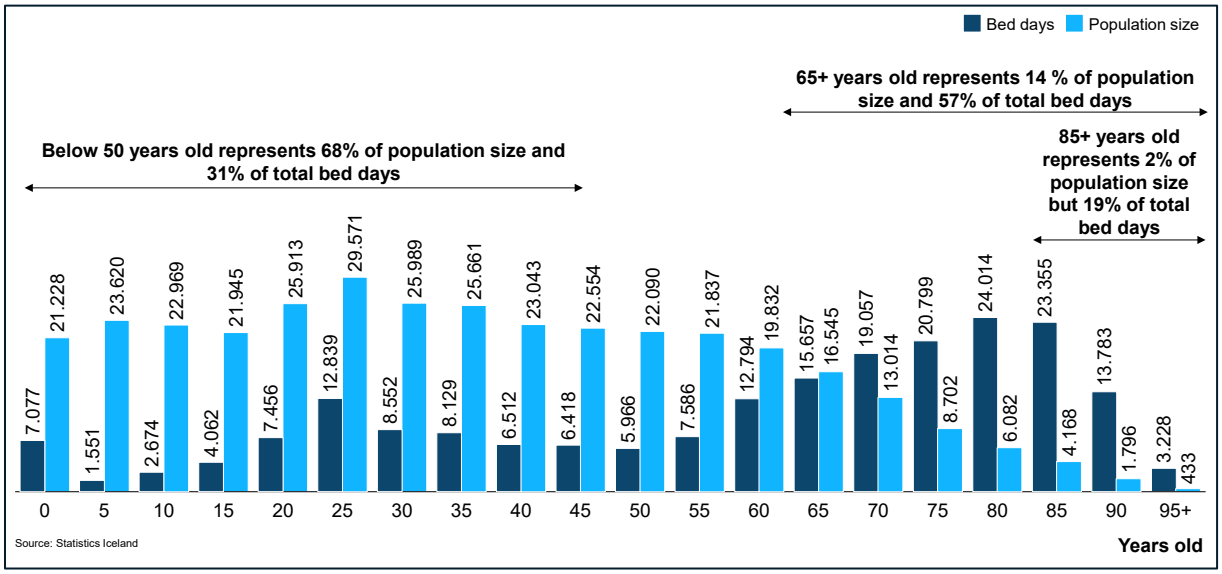
4.2.2 Approach to forecasting the impact of demographic changes

Demographic changes are the first main demand driver for which the impact is forecasted. This is important to consider since it affects the size and composition of the underlying population that requires healthcare services. Additionally, there is also a clear link between healthcare needs and age. This is evident when studying data from 2019, which shows that people below 50 years of age represented 68% of the population but only 31% of total bed days, while people above 65 years of age represented 14% of the population but 57% of total bed days, and people above 85 years of age represented 2% of the population but 19% of total bed days.[49], [50]

[49] Statistics Iceland, Population Data, 24 August 2021, statice.is.

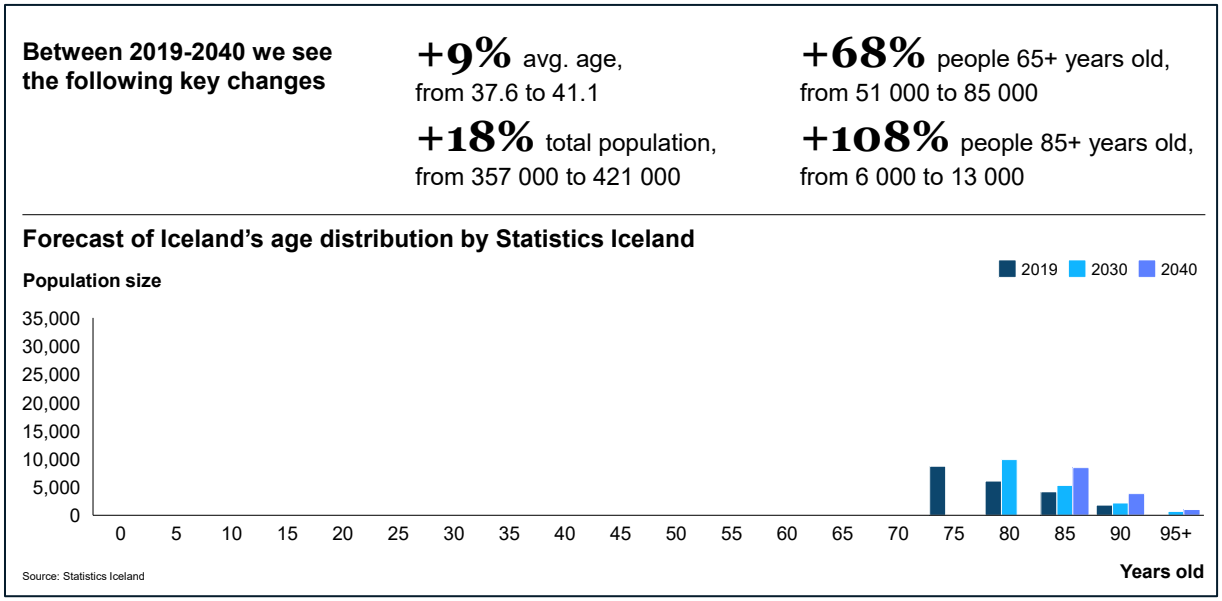
[50] Landspítali production data, 2019.

Exhibit 11. Total bed days at Landspítali and population size per age group in 2019.



To understand expected demographic changes, the most recent Statistics Iceland population projection is used.[51] The projection describes that between 2019 and 2040, the average age is expected to increase by 9% from 37.6 to 41.1, and the total population will increase by 18% from 357,000 to 421,000. Regarding age distribution, the shift is the largest for older people, with the number of people above 65 years of age being expected to increase by 68% from 51,000 to 85,000, and those above 85 years of age to increase by 108% from 6,000 to 13,000. Since, as seen in the previous paragraph, older people represent a disproportionately large share of healthcare demand, the shift towards a more aging population will significantly impact healthcare demand.

Exhibit 12. Population projection of Statistics Iceland.



[51] Statistics Iceland, Population Projections, 24 August 2021, statice.is.

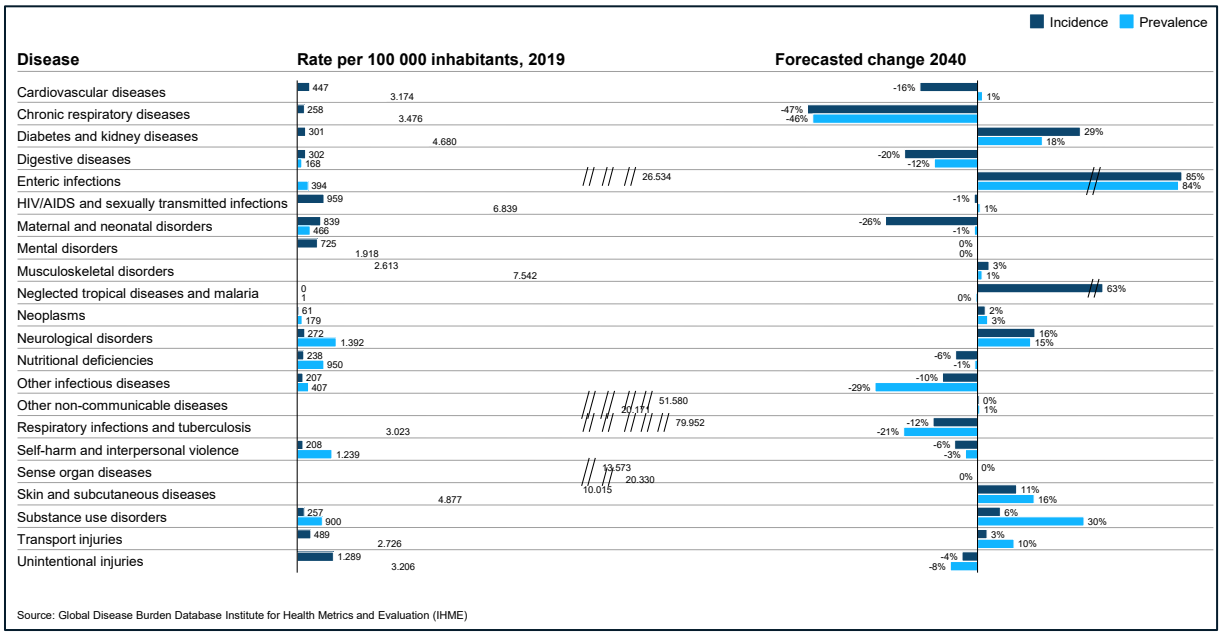
4.2.3 Approach to forecasting the impact of non-demographic changes

The second main demand driver of the forecast is non-demographic changes, i.e., how the incidence and prevalence rates of diseases are expected to shift. Non-demographic changes are dependent on how the population's health evolves, e.g., if obesity is expected to increase, so would obesity-related diseases. The Institute of Health Metrics and Evaluation's (IHME) Global Disease Burden study is used to incorporate this into the forecast.[52] This forecast was launched in 2010 and is updated annually in collaboration with the World Health Organization (WHO). The study contains, among other things, forecasts on a national level for incidence and prevalence rates for 354 different diseases per gender and age group. For Iceland, mapping is used to translate the forecast from IHME's disease classification from ICD-10 to DRGs. This is then applied to each combination of DRG, age bucket, and gender that the forecast is made for.

Since incidence rate measures how many people were infected by a disease over the year, and prevalence rate measures how many people had a disease at a single point in time. It varies between diseases whether the incidence or prevalence rate is the appropriate determinant of the healthcare demand. For short-term diseases, e.g., diarrhoea, the incidence rate would be the more appropriate determinant. For long-term diseases, e.g., diabetes, the prevalence rate would be more appropriate. A weighted average of the incidence and prevalence forecasts accounts for this in the model, with the total rate being used as the weight.[53]

The exhibit below displays the forecast on incidence and prevalence rates aggregated to IHME's level-2 diseases. It varies significantly between different diseases, e.g., the prevalence of chronic respiratory diseases is expected to decrease in prevalence by 46%. Diabetes and kidney diseases are expected to increase in prevalence by 18%. Note that the forecast is used at a more detailed level in the model.

Exhibit 13. IHME disease incidence and prevalence rate forecast for Iceland (excluding demographic impact).



[52] IHME, Global Burden of Disease (GBD), 2019, healthdata.org.

[53] For example, if a disease has an incidence rate of 10 000 per year, and a prevalence of 100, the incidence forecast would be weighted by 10,000/10,100 = ~99%, and the prevalence forecast would be weighted by 100/10,100 = ~1%.

4.2.4 Approach to forecasting the impact of inflation and real wage growth

In the financial model, a third significant driver of increased costs is the effect of inflation and real wage growth. Inflation is a measure of how much prices are expected to increase in society, and real wage growth measures how much wages are expected to increase in addition to inflation. To determine the inflation and real wage growth, forecasts from Statistics Iceland are used.[54] The forecasts run until 2026, so for the 2027 to 2040 period, the forecasted value for 2026 is used as the expected long-term value. This is considered a sufficient approximation since the forecasts from Statistics Iceland are steady for inflation throughout 2024 to 2026 and only varies by 0.1% between 2024 and 2026 for real wage growth. For inflation, this provides a long-term value of 2.5%, and for real wage growth, a long-term value of 1.7%.

Exhibit 14. Statistics Iceland forecasts on inflation and real wage growth, extrapolated for 2027 onwards.[55]

Year	2020	2021	2022	2023	2024	2025	2026	2027 2040
Inflation, %	2.8%	3.2%	2.4%	2.4%	2.5%	2.5%	2.5%	2.5%
Real wage growth, %	3.4%	3.8%	2.9%	1.8%	1.7%	1.6%	1.7%	1.7%

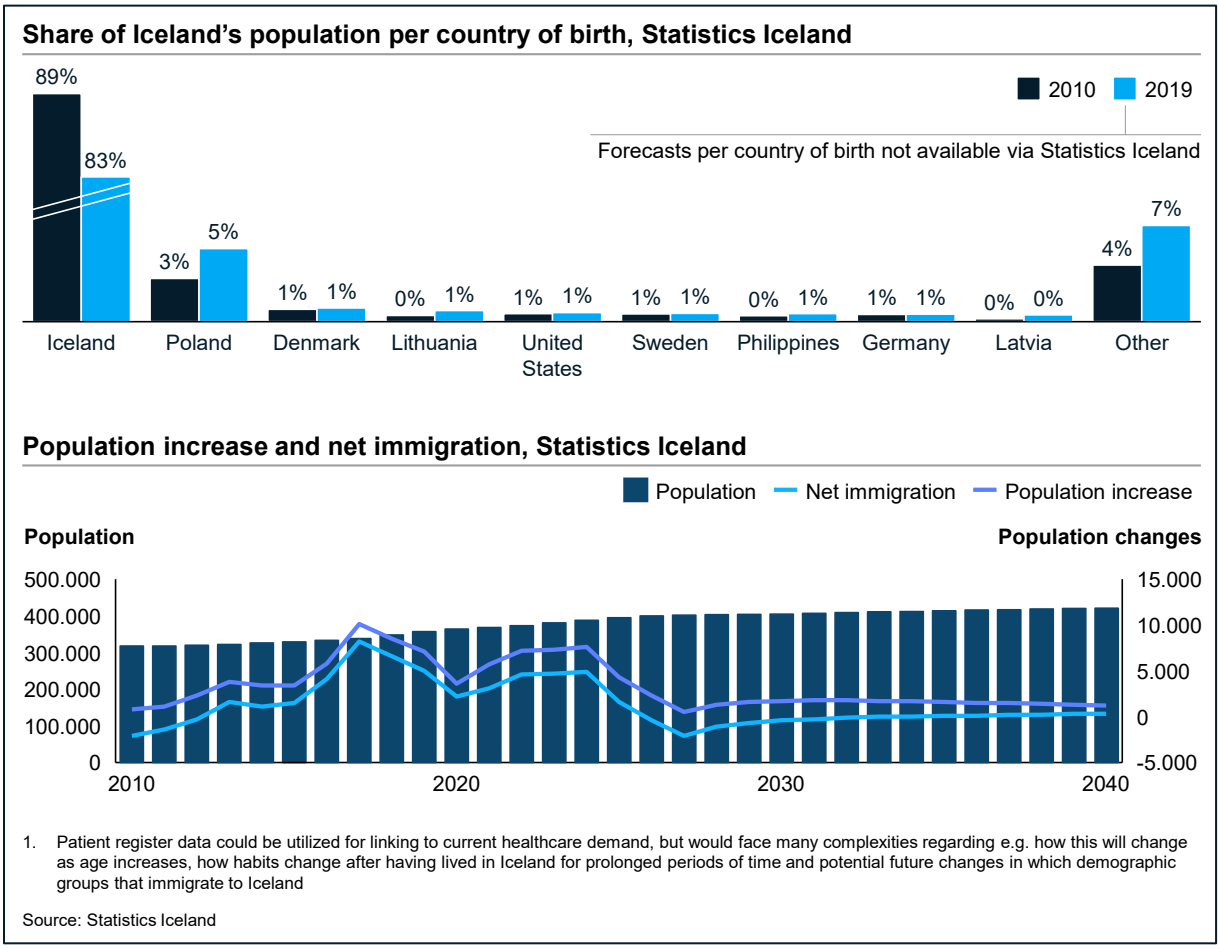
4.2.5 Approach to consider the impact of immigration

Studying the historical growth of immigration, in 2010, 89% of Iceland's population was born in Iceland, and in 2019 this had decreased to 83%. Since healthcare data from 2019 is used to establish the baseline, the impact of increased immigration to having 17% of the population being born in countries other than Iceland is already included in the starting point of the forecast. Meanwhile, Statistics Iceland's forecasts on immigration going forward show that net immigration has already peaked and is expected to flatten after 2025 and be negative between 2026 to 2032. This indicates that the impact of immigration on healthcare demands is unlikely to increase significantly compared to the 2019 baseline.

[54] Statistics Iceland, Economic Forecast, 20 October 2021, statice.is.

[55] ibid.

Exhibit 15. Share of Iceland's population per country of birth and immigration forecasts.[56]



1. Patient register data could be utilized for linking to current healthcare demand, but would face many complexities regarding e.g. how this will change as age increases, how habits change after having lived in Iceland for prolonged periods of time and potential future changes in which demographic groups that immigrate to Iceland

Source: Statistics Iceland

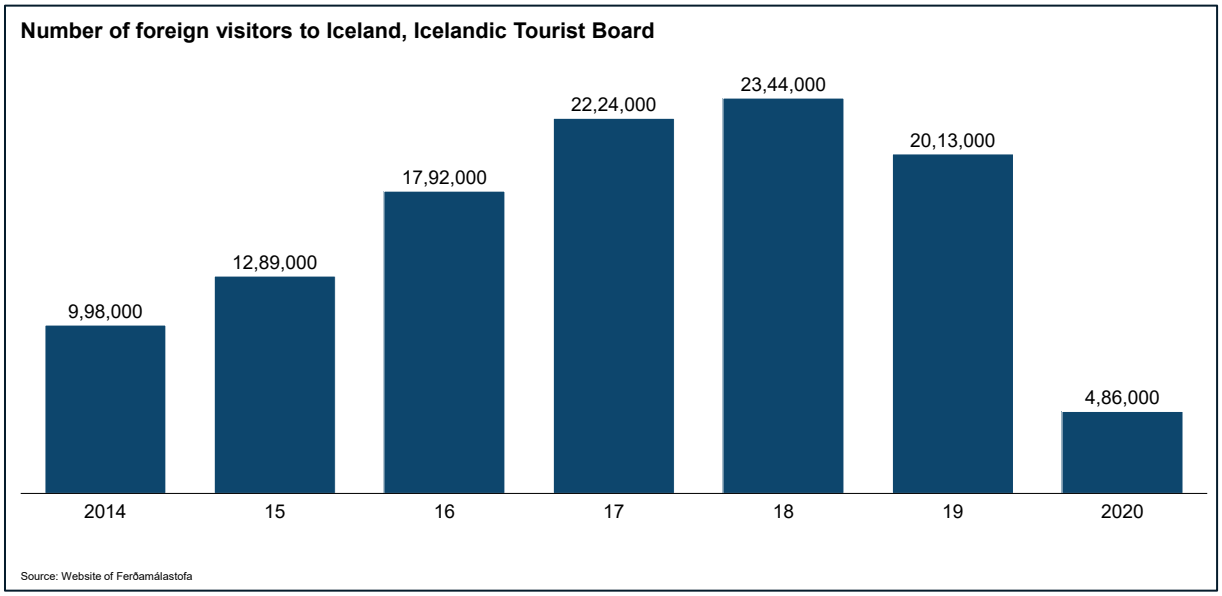
Attempting to further account for the impact of immigration would also risk introducing many uncertainties into the forecast. Firstly, no official population forecast exists per country of birth. Secondly, the diverse immigration from many different countries results in too small sample sizes to accurately quantify the current healthcare effects. For example, Denmark is the country of birth with the third most inhabitants in Iceland, but this still only amounts to ~3,500 people. Thirdly, it would also require assumptions on linking country of birth to future healthcare demands, e.g., how healthcare demands may shift as immigrants have lived in Iceland for a prolonged period and grow older. Due to these uncertainties, and since the 2019 baseline already largely captures the healthcare impact of immigration, the forecast does not account for immigration further.

4.2.6 Approach to consider the impact of tourism

Since a significant number of tourists visit Iceland, this has an impact on healthcare services. The number of foreign visitors to Iceland has also grown considerably from approximately 998,000 visitors in 2014 to 2,224,000 in 2017. In 2018, visitor growth slowed down and then declined in 2019. Note that 2019 is still before Covid-19, which started having an impact in 2020. Since the growth of tourism plateaued before Covid-19 and even began shrinking slightly, the forecast accounts for the impact of tourism implicitly by using 2019 data as the baseline, when a large number of tourists already required healthcare services.

[56] Statistics Iceland, Population by Country of Birth and Immigration Forecasts, 2021, statice.is.

Exhibit 16. Number of foreign visitors to Iceland.[57]



4.3 Results of the base case forecast for Landspítali's healthcare demand and needs until 2040

This section describes the results of the base case forecast for Landspítali's healthcare demand and needs until 2040. Firstly, a description of what is meant by the base case forecast is provided. Secondly, the base case forecast results are detailed for the four models regarding; 1) healthcare production, 2) capacity, 3) capabilities, and 4) financials. Lastly, the key results of the base case forecast are summarized.

4.3.1 Description of base case forecast

In the base case forecast, the expected forecast in a do-nothing scenario where Landspítali continues its operations without changes is modelled. This means that no changes are made regarding the care provided at Landspítali or elsewhere in the system, that today's research and education spend is maintained, and that current productivity remains unchanged. The base case forecast should not be seen as the expected scenario but rather serves to understand what is expected if Landspítali remains unchanged and is exposed to demographic, non-demographic, and economic changes in society. In the ensuing chapters, it will then be detailed what the forecasted impact of various strategic decisions and different operations improvements and preventions could be to form a conceivable scenario for 2040.

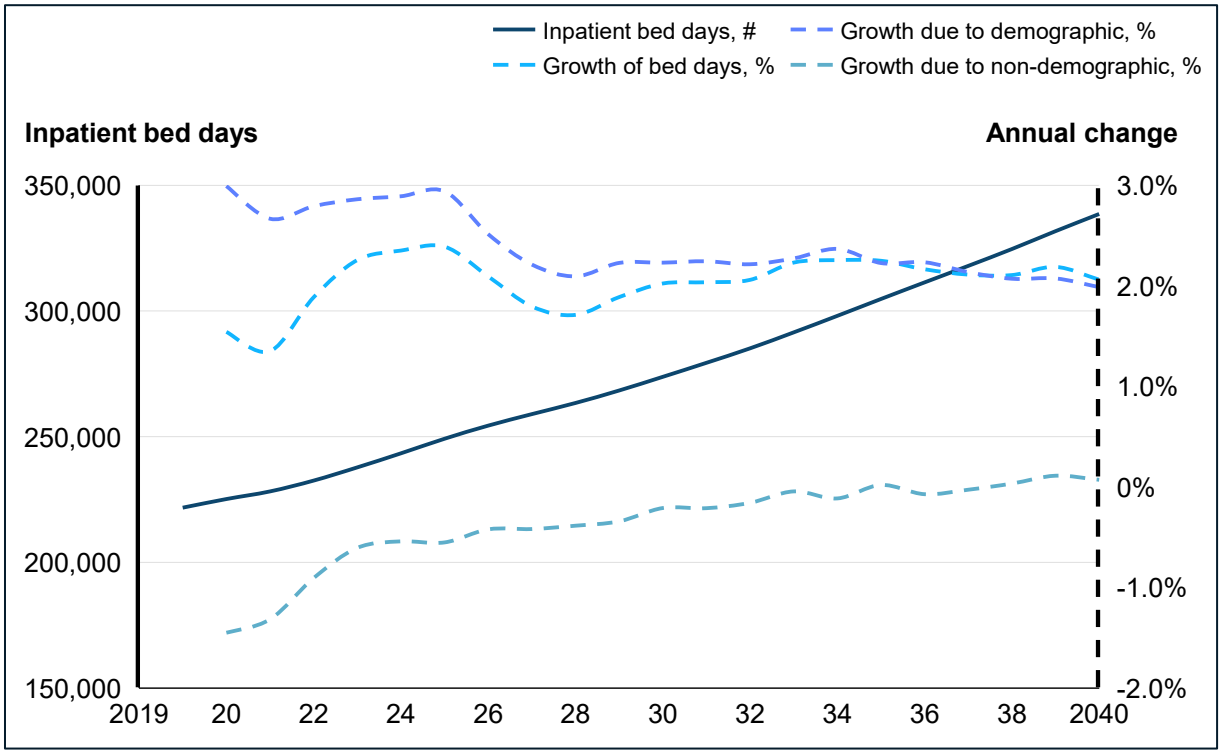
4.3.2 Results of the base case for healthcare production forecast

As a proxy for total healthcare production, the number of bed days is initially studied since this accounts for the varying complexities of treating different patients. The base case forecast shows that bed days are expected to increase by 53%, from ~222,000 in 2019 to ~339,000 in 2040, with a CAGR of ~2%. Splitting this into the two demand drivers of demographic and non-demographic changes shows that demographic changes are initially expected to increase demand the most, at close to +3% annually and flatten out to around

[57] Icelandic Tourist Board, Number of Foreign Visitors, 2021, ferdamalastofa.is.

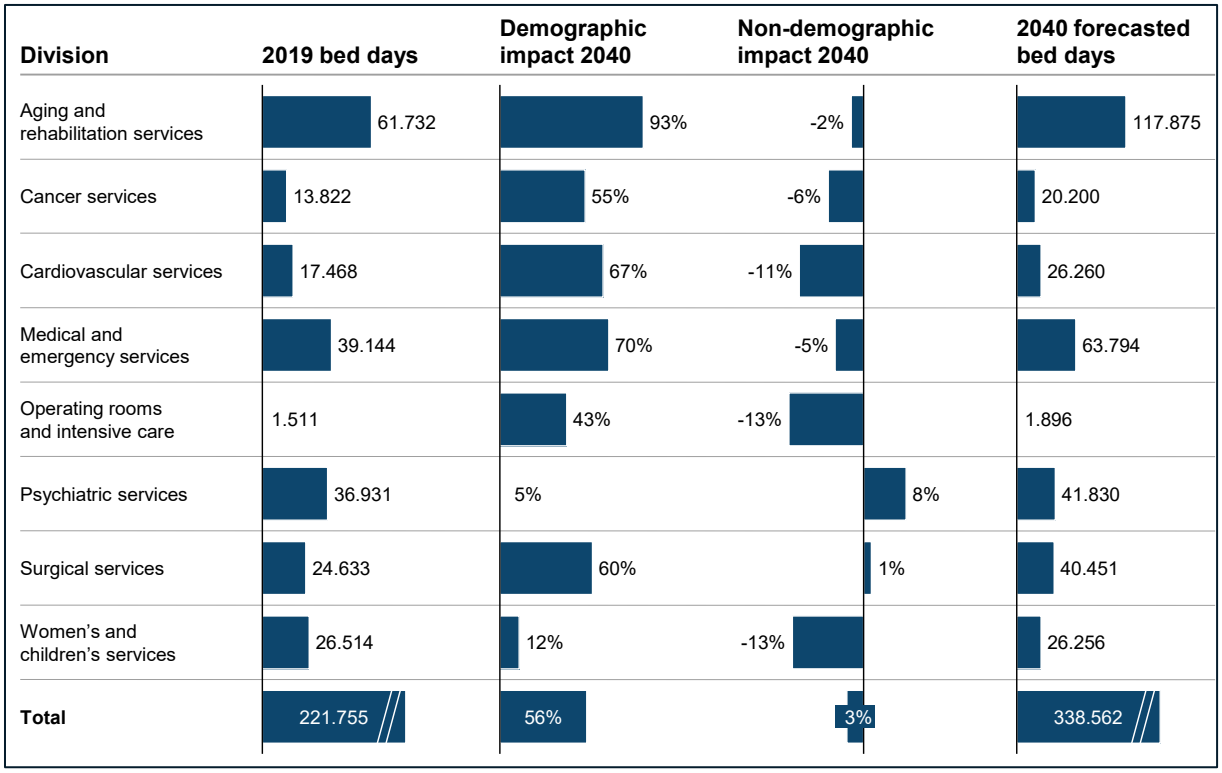
+2% from 2030 onwards. Non-demographic changes are initially expected to decrease demand by close to –1.5% annually and flatten out towards 0% in 2040.

Exhibit 17. Base case forecast on annual growth of bed days.



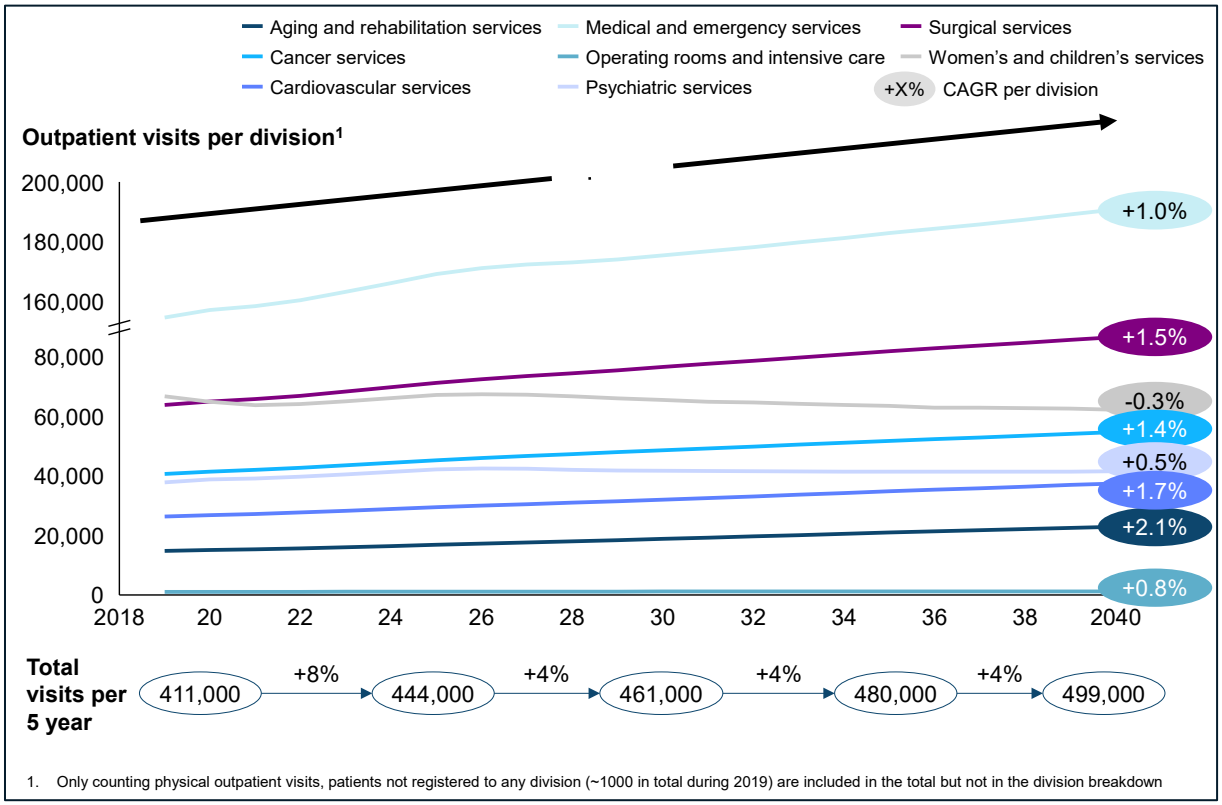
Across Landspítali's divisions, the forecasted demographic and non-demographic impact varies greatly. The demographic impact increases healthcare demand across all divisions by a total of 56%. As the population ages, the most significant shift is expected in the aging and rehabilitation services division (+93%), while the women's and children's services division would, in comparison, only be marginally impacted (+12%) primarily driven by decreasing fertility rates. The non-demographic impact is expected to decrease demand by 3% in total, and is negative across most divisions except for in psychiatric services (+7%) and surgery (+1%). Total inpatient visits are expected to increase by 29%, from ~25,000 annually in 2019 to 32,000 in 2040. When comparing this to the forecasted increase in bed days of 53%, it is evident that bed days are forecasted to grow quicker. This is due to the expected increase in demand being larger for patients with longer ALOS, predominantly driven by the high growth of the aging and rehabilitation services division that currently has the longest ALOS of all divisions (~48 days compared to the Landspítali average of ~9 days).

Exhibit 18. Base case forecast on growth of bed days per division.



For outpatient visits, counting only physical visits, the expected increase is 23%, from ~407,000 annually in 2019, to ~499,000 in 2040, with a CAGR of +1.0%. This increase is driven by demographic impact (+27%) while being decreased by non-demographic impact (–4%). Across divisions, the most significant expected increase is in aging and rehabilitation services (+2.1% CAGR) and cardiovascular services (+1.7% CAGR), while women's and children's services are expected to decrease (–0.3% CAGR). Note that an increase in digital healthcare could lead to a more rapid decrease in physical visits; however, digital visits would also be expected to increase the demand and consumption of healthcare. Additionally, there are large uncertainties related to digital healthcare in the next 20 years. Thus, physical outpatient visits are in focus since these would also be the primary demand driver of workforce hours and space needs. In contrast, digital visits would have a significantly smaller impact.

Exhibit 19. Physical outpatient visits per division.

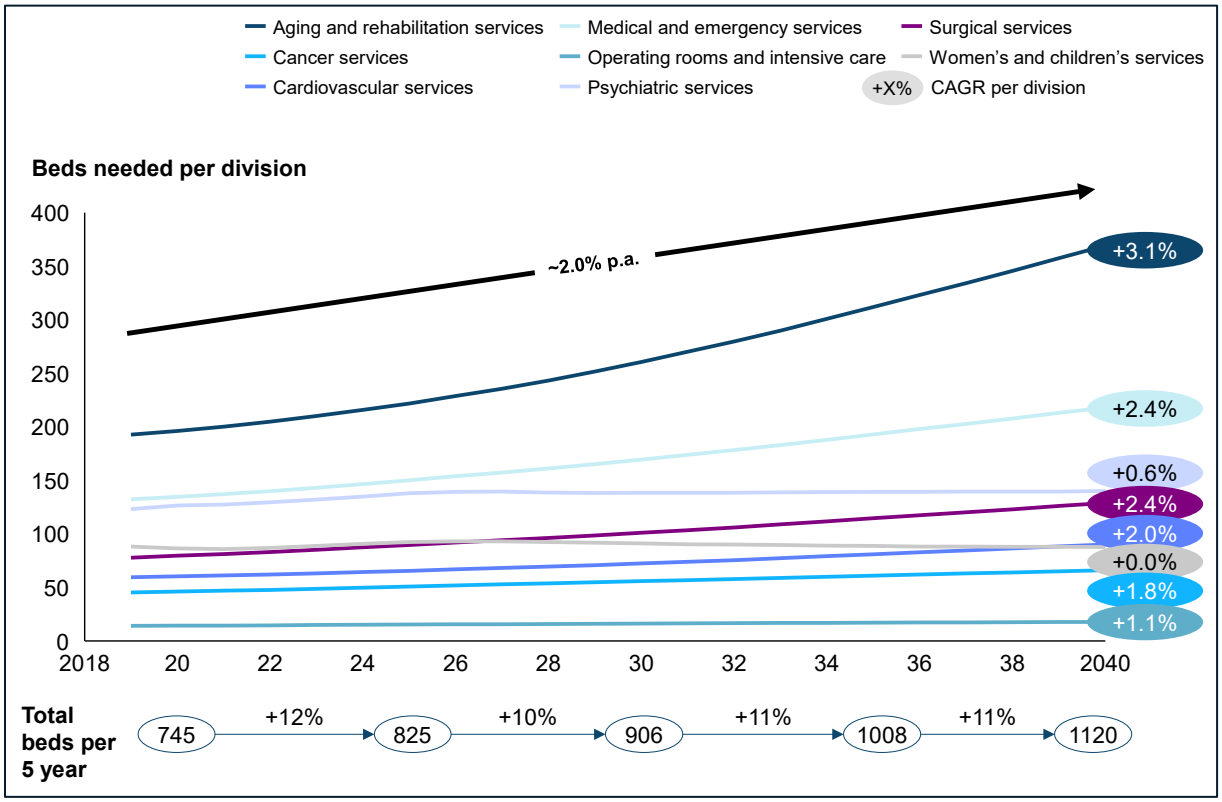


1. Only counting physical outpatient visits, patients not registered to any division (~1000 in total during 2019) are included in the total but not in the division breakdown

4.3.3 Results of the base case for the capacity forecast

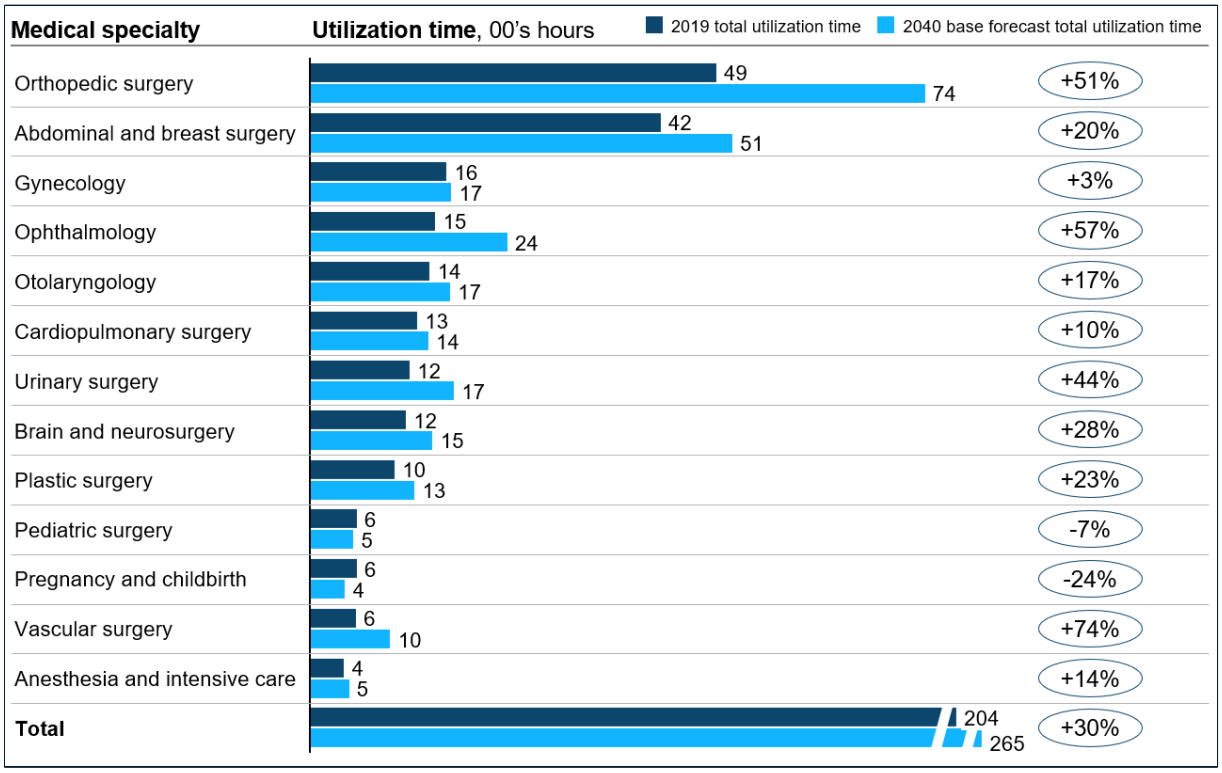
In the base case forecast, the number of beds needed is expected to increase by 79%, from 624 to 1,120. This increase is attributed to a current gap in beds (+110 beds), demographic impact (+407 beds), and non-demographic impact (–21 beds). It would be far above the currently planned capacity of ~730 beds after the new hospital building Hringbraut has opened. Year over the year, steady growth is expected from 2019 to 2040 with a CAGR of +2.0%, but with large variations between divisions. The most significant increase with a CAGR of +3.1% is expected in aging and rehabilitation services and the lowest in women's and children's services (+0.0%) and psychiatric services (+0.6%).

Exhibit 20. Base case forecast for beds needed per division, with the starting point adjusted for current gaps.



Operating room utilization time is expected to increase by 29%, from ~20,400 hours in 2019 to 26,400 hours in 2040. This varies significantly across medical specialties, with the largest percentual increases forecasted for vascular surgery (+74%), ophthalmology (+57%), and orthopaedic surgery (+51%). In comparison, a decrease is expected for pregnancy and childbirth (–24%) and paediatric surgery (–7%).

Exhibit 21. Base case forecast for operating room utilization time per medical specialty.

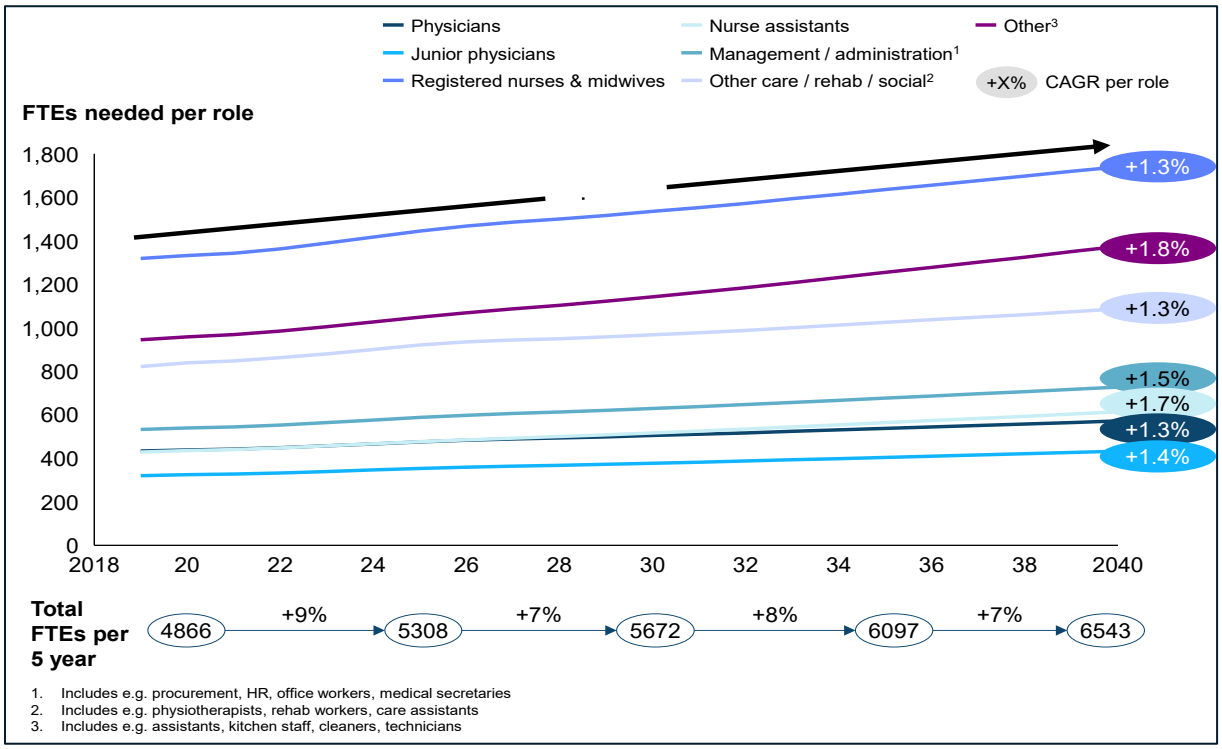


4.3.4 Results of the base case for capability forecast

In the base case, workforce need is forecasted to increase by 36%, from 4,801 in 2019 to 6,543 in 2040, with a CAGR of +1.5%.[58] Over the years, there will be a small spike in growth between 2020 and 2025, followed by a continued steady growth rate. Across roles, the growth rates have some variations but are relatively similar overall, with all being in the range of 1.3 to 1.8% CAGR.

[58] If not adjusting the starting point for Better Working Hours agreement, the increase is +45% from 4,500, with a CAGR of +1.8%.

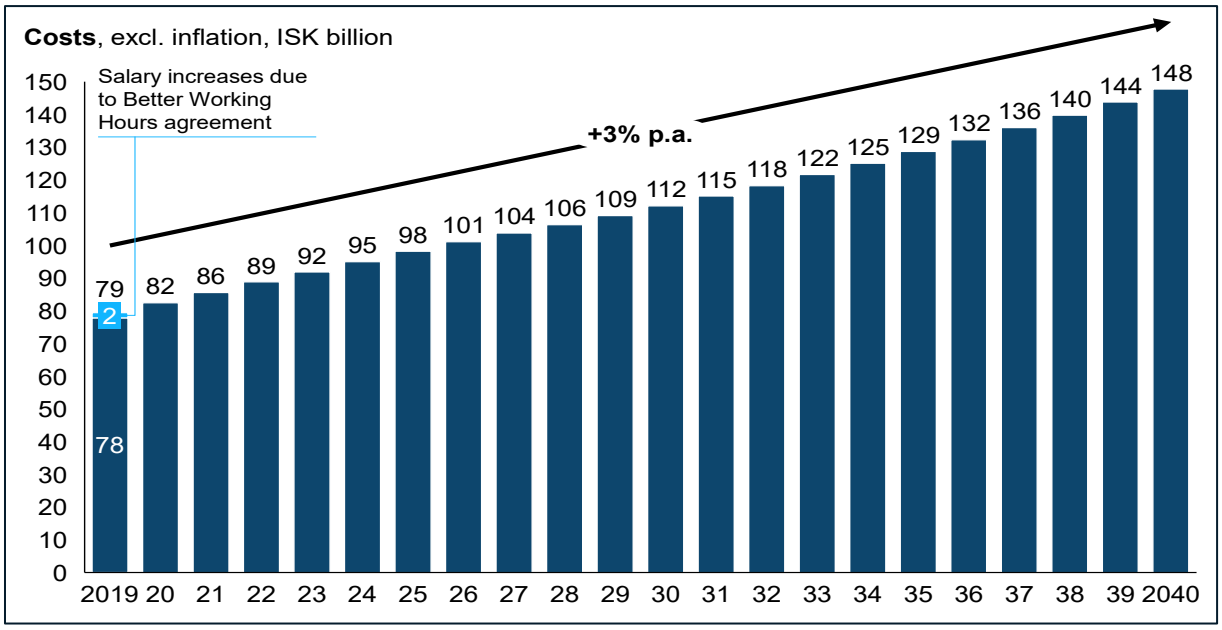
Exhibit 22. Base case forecast for workforce need per role, with starting point adjusted for the Better Working Hours agreement.



4.3.5 Results of the base case for financial forecast

In the base case, costs are expected to increase by 90%, from ~ISK 78 billion to ~ISK 148 billion, with a CAGR of +3%, excluding inflation. Of this increase, ISK 2 billion is due to increased salaries for shift workers following the Better Working Hours agreement, +ISK 33 billion due to demographic changes, –ISK 4 billion due to non-demographic changes, and +ISK 39 billion due to real wage growth. If inflation is included, the total costs by 2040 would be ~ISK 250 billion.

Exhibit 23. Base case forecast for Landspítali's costs, excluding inflation.



4.3.6 Summary of results of the base case forecast for Landspítali's healthcare demand and needs until 2040

The base case forecast has been established for Landspítali's healthcare demand and needs until 2040 to understand the expected forecast in a do-nothing scenario, where Landspítali continues operations without changes.

In summary, healthcare production is forecasted to grow in terms of bed days by 53% until 2040 with a CAGR of +2%, driven primarily by demographic changes as the population increases in size and becomes older. This would signify a 29% increase in inpatient visits and a 23% increase in physical outpatient visits. Beds needed are expected to increase by 79%, from 624 today to 1,120 in 2040, which would be far above the planned bed capacity potential of ~730 after Hringbraut has opened. On the other hand, operating room demand is expected to be fully absorbed by the currently planned capacity if utilization can be improved towards best-practice rates. Workforce need is forecasted to increase by 36% to a total of 6,543 FTEs in 2040, with a CAGR of +1.5%. Financial costs are expected to increase by 90% to ISK 148 billion in 2040, with a CAGR of +3%, largely driven by the real wage growth.

The base case forecast indicates that the current growth trajectory will be difficult, especially for the needed bed capacity. However, this do-nothing scenario is not expected, since the forecast will also be affected by key strategic choices and potential operational improvements and preventions. In the coming chapters, these are described, and their impact is quantified to understand the key levers and initiatives that can make the growth trajectory manageable.

5 Key strategic choices facing the Icelandic healthcare system

5.1 Introduction to strategic choices

The previous chapter provided a view on the development of healthcare demand in the upcoming ~20 years and its consequent impact on Landspítali's resource needs, assuming *no* significant policy changes or efficiency initiatives are implemented. It showed significant growth in healthcare demand, e.g., an ~80% increase in bed requirements, ~35% increase in staffing need, and ~85% increase in funding. This is primarily driven by demographic changes towards an older population.

There are three options for how this shift can play out for Landspítali: 1) Landspítali's capacity can be expanded as healthcare demand grows, 2) strategic choices on Landspítali's role could offset some of these shifts, and 3) operational improvement and prevention measures can be driven to offset some of the growth. In this chapter, we specifically focus on the second option, to understand what choices could be considered. Later in this report, there is a specific chapter exploring the third area surrounding operational improvement and prevention measures.

To approach the strategic choices facing the healthcare system today, these choices were defined and explored with the key stakeholders of the Icelandic healthcare system and international experts. This resulted in the identification of six primary choices deemed to be the most pressing and potentially impactful for Landspítali in the coming years. These six strategic choices all directly impact the capacity and capabilities of Landspítali, and would subsequently be important in defining what Landspítali's role could be through this period of demographic change.

This chapter provides an overview of these six strategic choices, a fact base for how they relate to Landspítali, and modelling of the potential impact these decisions might have on beds, staff, and finances, shown at the end of each section. In a subsequent chapter, a full scenario will be defined and expanded upon based on the discussions in expert groups during the course of this work.

The six strategic choices analysed are as follows:

- **Centralization and decentralization of complex care.** Deciding where in a healthcare system to provide different levels of secondary and tertiary care can impact the quality of and access to care, as well as financial outcomes. This section explores whether centralization or decentralization of certain types of care could benefit the Icelandic healthcare system, and quantifies the impact of potential future shifts in specialist care.
- **Shifting primary care and long-term care.** Providing primary and long-term care in an advanced university hospital can be costly and hinder focus and specialization. This section quantifies how much of this care is currently provided at Landspítali and estimates the impact of shifting this volume to more effective and efficient care settings.
- **Privatization in the healthcare system.** Different choices regarding the role of the private sector can have a significant impact on how the healthcare sector operates and therefore on Landspítali's role, for instance. In this section, the current role and volume of the private sector is established and the quantitative impact on Landspítali from increasing or decreasing this role is presented.

- **Out-of-country treatments.** In a system like Iceland's, different ways of approaching outsourcing of treatments might have a significant impact on healthcare supply. This section explores how this currently functions for Landspítali and the likely direction and quantitative impact of change from this factor.
- **Funding and focus on research and education.** Different roles and ambition levels around research and education have a significant impact on staffing and funding needs at a university hospital. In this section, the fact base around current activities is laid out and the directionality and impact of potential shifts in strategy around this is quantified.
- **Coordination role of Landspítali.** This section provides an overview of four key functions that could potentially be centrally coordinated within the Icelandic healthcare system (procurement, centre of excellence, digital infrastructure and guidelines, and placement of care). Furthermore, the benefits of coordinating these functions from Landspítali compared to other entities are discussed.

5.2 Centralization and decentralization of complex care

Disclaimer for the discussion on centralization and decentralization of complex care:

- *Volume versus quality evidence is difficult to apply on a generic level, e.g., how to consider total volumes for hospital versus volume per surgeon – evidence needs to be considered in context.*
- *Quality differences can also be driven more on an individual level, although systematically there is evidence for volume thresholds.*
- *In addition to direct volume per individual effects in terms of procedure quality, there are typically other positive intra-profession effects relating to information exchange, research, etc.*
- *Complex care in this chapter refers to secondary and tertiary hospital care, and thus excludes all other healthcare, e.g., primary care and long-term care – even though healthcare provided for these patients can of course also be complex in nature.*

5.2.1 Introduction

To be able to provide a view on Landspítali's future resource needs, there is a need to identify which secondary or tertiary care may or may not be provided at the hospital in the coming years. This chapter explores the topic of centralization and decentralization of complex care, depending on the type of care, within the context of the Icelandic healthcare system, and is divided into four sections. First, the chapter tackles why centralization and decentralization are important considerations for healthcare systems. Second, the current centralized situation of highly complex care in Iceland is explored. Third, the potential and benefits of decentralization of simpler secondary care away from Landspítali are examined. Finally, a structured framework for deciding placement of care within the system is introduced.

The chapter closes by providing a rationale for how strategic choices surrounding centralization and decentralization of complex care will be handled in the forecasting for 2040.

5.2.2 The importance of optimal placement of hospital care

Where specific care takes place within a healthcare system can have a significant impact on the quality of care provided, accessibility for patients, and financial outcomes. To safeguard a high degree of patient safety, clinicians need to provide complex healthcare treatments in sufficiently high volumes to ensure their skill levels are maintained. Conversely, centralizing most secondary and tertiary care into one or a few hospitals may come at the expense of patient accessibility and optimized financial outcomes, as simpler care is being provided in too costly a care setting.

5.2.2.1 Financials

From a financial standpoint, equipment and technology require investments and operating costs. With low patient volumes, investments in such technologies become expensive per treated patient, making larger volumes beneficial in terms of cost – this is a strong argument for why specialized and expensive equipment should be concentrated in a limited number of facilities. In addition, many complex and rare healthcare services also require more specialized staff, who are typically more costly and scarce.

At the same time, care facilities equipped to handle more complex care (e.g., a university hospital) tend to have higher costs for staffing, equipment, and corresponding resources. Thus, providing less complex care in a too-advanced care setting tends to result in higher overall costs for a healthcare system.

5.2.2.2 Access to care

Access to care is a key metric of any healthcare system; this can be broadly defined as a patient's ability to seek the care they require and have it provided within a reasonable period of time. Generally, centralizing care and resources at one or a few hospitals may decrease time to treatment due to scale benefits and higher capacity of more dedicated units.

However, having care provided close to the patient is generally considered as an improvement in access to care, as travelling large distances may hinder some from seeking the care they need. A highly decentralized system has the benefit of ensuring that most required types of care are offered in proximity to patients, which is especially important in systems where travel may be inaccessible to shares of the population.

5.2.2.3 Quality of care

From a quality standpoint, a number of research studies[59, 60, 61] indicate that patient mortality, morbidity, and post-surgery complication rates are often significantly reduced as patient volumes go up, as surgeons better maintain their skill levels and expertise, which reduces mistakes. The same applies for non-surgical conditions, where an experienced physician is key to correctly diagnosing the patient quickly. In scientific literature, this volume relationship to patient safety is generally referred to as minimum clinical volume threshold, which is the

[59] M. M. Chowdhury et al., 'A systematic review of the impact of volume of surgery and specialization on patient outcome', *The British Journal of Surgery,* 2007, Volume 94, Number 2, pp. 145–161, https://doi.org/10.1002/bjs.5714.

[60] Y.-L. Nguyen et al., 'The volume–outcome relationship in critical care: A systematic review and meta-analysis', *Chest*, 2015, Volume 148, Number 1, pp. 79–92, https://doi.org/10.1378/chest.14-2195.

[61] H. Kaneko et al., 'Impact of hospital volume on clinical outcomes of hospitalized heart failure patients: Analysis of a nationwide database including 447,818 patients with heart failure', *BMC Cardiovascular Disorders*, 2021, Volume 21, Number 49, https://doi.org/10.1186/s12872-021-01863-4.

annual minimum volume of patients for a specific treatment that a physician or unit requires to avoid a higher average of adverse patient outcomes.

When analysing healthcare systems and placement of complex care, these clinical volume thresholds are often translated into a minimum population threshold, which is the population in a unit's uptake area required to meet the minimum clinical volume threshold. Minimum population threshold is calculated as the minimum clinical volume divided by the probability of one person needing that treatment in a year.

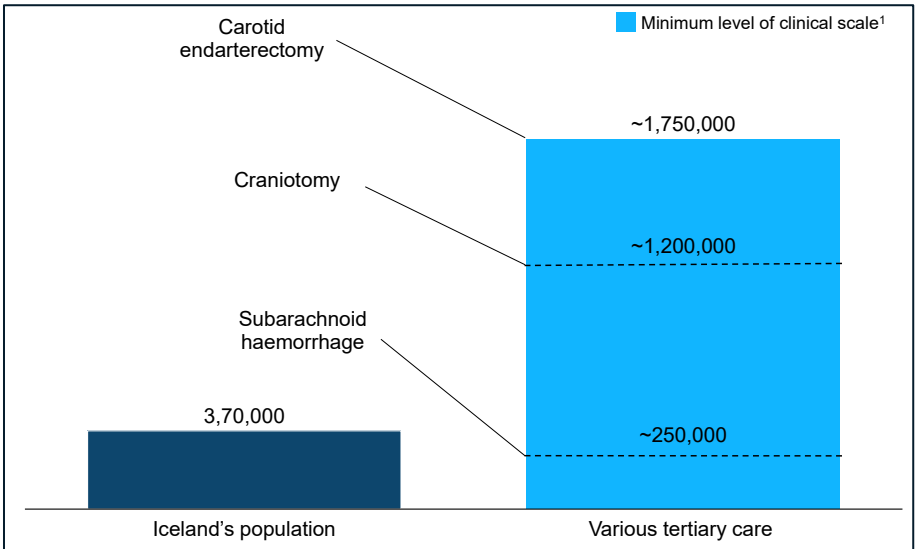
Generally, offering complex treatments within a population uptake area lower than the minimum threshold observed in scientific studies reduces patient safety. Thus, in healthcare systems with a small population, centralizing more complex care is typically advisable.

5.2.3 Centralization of complex secondary and tertiary care

The Icelandic healthcare system is already centralized to a large degree when it comes to complex secondary and tertiary care. Most of the more complex care is only provided at Landspítali, as smaller hospitals around Iceland outsource this care to the capital's hospital. With the potential increased risk to patient safety when minimum population thresholds are not met for complex treatments, and considering Iceland's small population (~370,000) and its concentration in the Capital Region (~240,000), this high degree of centralization in Iceland is vital – in most cases, likely outweighing optimization of access to care.

Iceland has inherently subscale volumes regarding some tertiary care and complex secondary care specialties, which can be seen in Exhibit 24 and Exhibit 25. Even Landspítali, with its population uptake area of ~300,000, is technically unable to meet some of the minimum population thresholds presented in the research, as seen, for example, for paediatrics and trauma. This does not mean that Iceland should not have paediatrics or trauma units; instead, it highlights the importance for the Icelandic healthcare system to be intently aware of the quality implications of not centralizing certain care types in the first place, since patient safety may be at risk at lower volumes. It is also important to note that the 'subscale' of Landspítali for certain specialties can be, and in many cases is, safeguarded against by sending the specialist physicians abroad to increase their experience and thus maintain their skill level in the complex treatments they conduct.

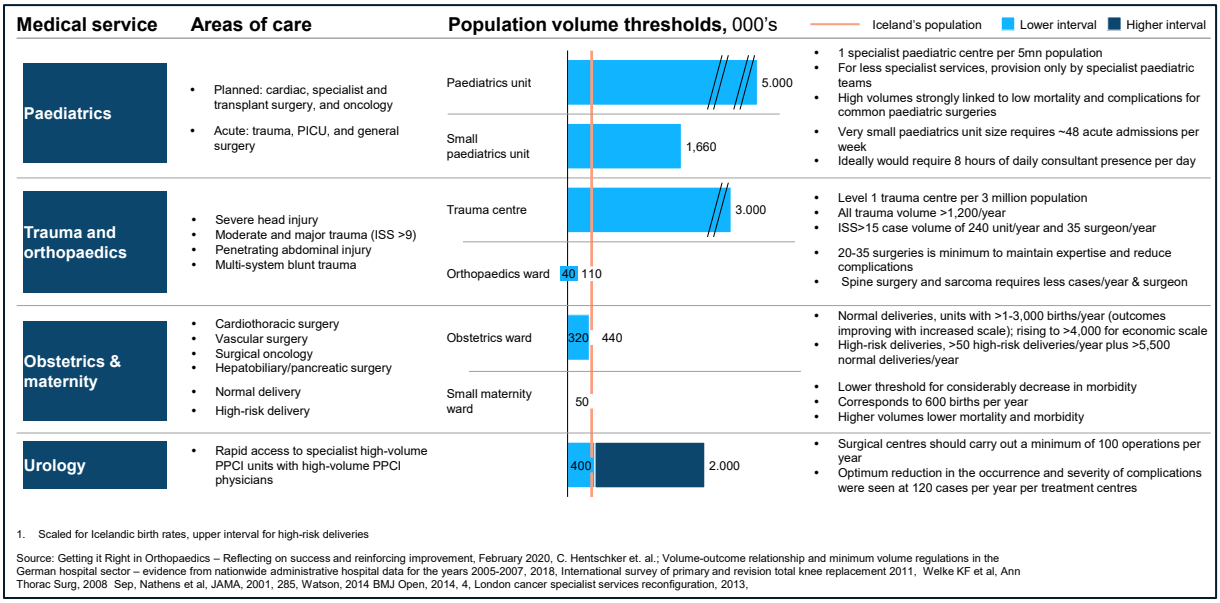
Exhibit 24. Assessment of population volumes to achieve acceptable quality in volume per clinician and number of clinicians for examples of tertiary care procedures (non-exhaustive).



1. From a patient safety point of view

Source: A.Singh, et. al., A comprehensive break even analysis of MRI and CT unit of a tertiary care hospital in Sikkim, 2020, Davies JM et al, Neurosurg Clin N Am, 2015, A. Bernard, C. Jonathan, A. Mariet, & C. Quantin – "Is an activity volume threshold really realistic for lung cancer resection?" 2018, A. Johal et al, Changing patterns of Carotid Endarterectomy between 2011 and 2017 in England, 2019, K. R. Fingar et al, Most frequent operating room procedures performed in U.S. hospitals, 2003-2012,2014, Expert interviews

Exhibit 25. Further assessment of population volumes to achieve acceptable quality in volume per clinician or unit, including more complex secondary and tertiary care (non-exhaustive).



1. Scaled for Icelandic birth rates, upper interval for high-risk deliveries

Source: Getting it Right in Orthopaedics – Reflecting on success and reinforcing improvement, February 2020, C. Hentschker et. al.; Volume-outcome relationship and minimum volume regulations in the German hospital sector – evidence from nationwide administrative hospital data for the years 2005-2007, 2018, International survey of primary and revision total knee replacement 2011, Welke KF et al, Ann Thorac Surg, 2008 Sep, Nathens et al, JAMA, 2001, 285, Watson, 2014 BMJ Open, 2014, 4, London cancer specialist services reconfiguration, 2013,

Local hospitals in Iceland are keenly aware[62] of patient risk associated with low volumes, and transfer patients regarded minimally at risk to Landspítali, and in some cases, to SAK. Although this does reduce access to complex care close to patients in rural Iceland, the reduction of patient risk on a system level is, and should most likely continue to be, considered more crucial. There are some limited examples of local hospitals in Iceland providing complex non-acute surgeries (e.g., various neck and nose surgeries at Heilbrigðisstofnun Vestfjarða), which are performed by visiting physicians from Landspítali or abroad. Local hospitals do offer certain *acute* care (e.g., within trauma), which, due to their

[62] Based on interviews with management from different local hospitals in Iceland.

small population uptake area, would be considered below minimum population thresholds. However, in the case of these acute services, being able to ensure short times from incident to care often outweighs the potential risk from lower volumes.

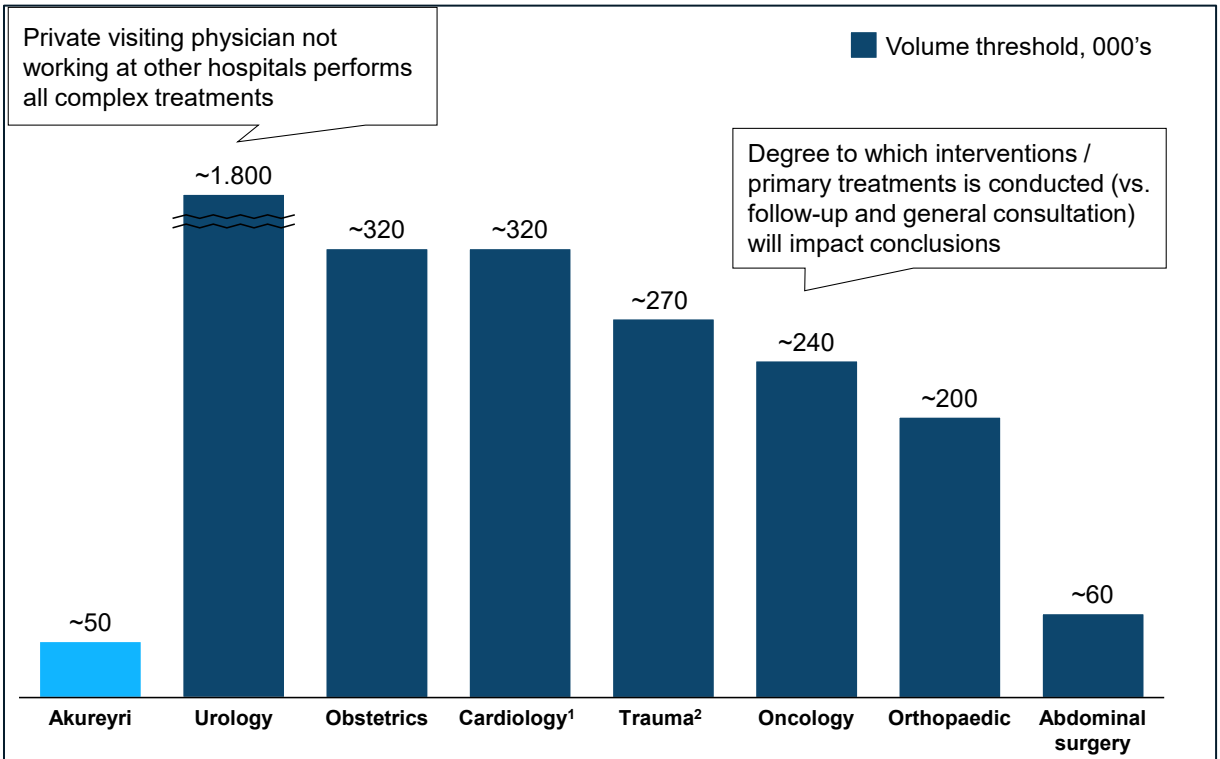
SAK only has a population uptake area of ~50,000, but as seen in Exhibit 26, does provide specialty care and treatments that are below suggested minimum population thresholds.[63] However, this fact alone does not mean that SAK is providing a lower quality of care or that all of these services and treatments should be centralized at Landspítali. SAK is aware of the minimum clinical volume thresholds and its own limitations on the volumes alone needed to maintain clinical skill levels. Thus, just like the local hospitals, SAK employs two key tactics to combat the low volumes. First, visiting physicians from Landspítali (or abroad) are used to perform some complex care or are consulted virtually (e.g., in oncology). Second, SAK periodically sends its physicians abroad to enable them to increase their volumes in certain complex treatments (e.g., in trauma). Finally, in orthopaedics, SAK is likely close to or meeting the minimum clinical volume threshold; this is because many orthopaedic surgeries are outsourced to SAK from hospitals around Iceland (even from the Capital Region), as SAK is a key centre for this specialty in Iceland.[64]

SAK uses this to safeguard against the potential increase in patient risk associated with being below minimum clinical volumes for most treatments. However, there are currently a few treatments provided at SAK that may still benefit from being centralized at Landspítali, from a volume and quality perspective – e.g., kidney and urinary tract neoplasms and reticuloendothelial disorders. These are examples of non-acute treatments with researched correlations between volume and patient safety, which may be candidates for centralization at Landspítali. Other specific treatments likely exist at SAK that may benefit the system if they were centralized, from a quality-of-care perspective. However, an exhaustive review of which few treatments may benefit from this is difficult currently, as a structured and holistic framework for evaluating placement of care within the Icelandic healthcare system that takes into account the trade-offs between access and quality of care, for instance, does not exist today. This is discussed further after the next subchapter.

[63] Based on production data and corroborated through interviews with experts and SAK.

[64] Based on interviews with management from different local hospitals in Iceland.

Exhibit 26. Akureyri's population and suggested population thresholds for the care SAK provides.



1.Mostly medical treatments with few invasive procedures and stroke treatments
2.Corresponding to level 3 trauma centre

Source: National cancer institute, London Cancer Specialist Services Reconfiguration: A case for change in specialist cancer services, 2013, WHO, Bauer H. et. al., Minimum volume standards in surgery – are we there yet, 2017, Journal of the American College of Surgeons, Ophthalmology suffers in Iceland from insufficient government funding, 2013, Expert interviews

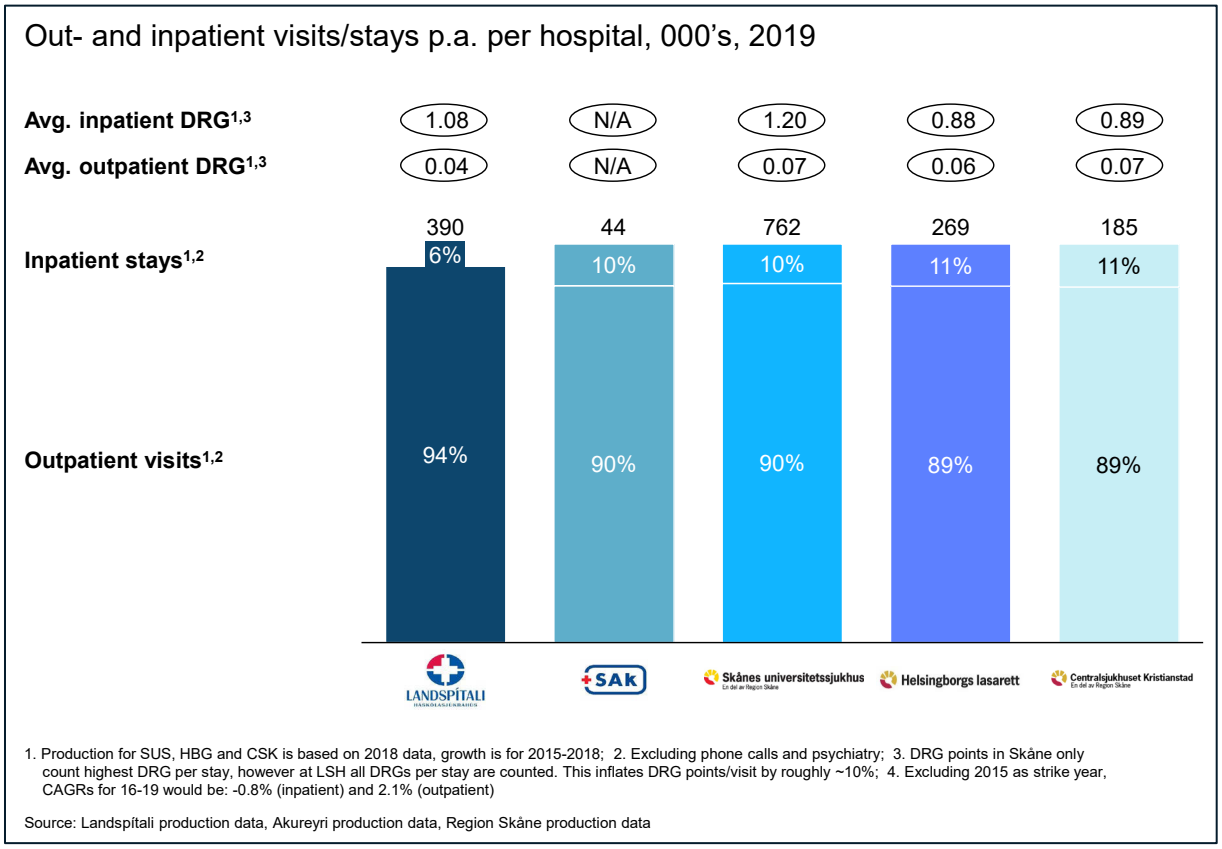
5.2.4 Decentralization of simpler secondary care

There may be opportunities for decentralization in Iceland, i.e., shifting some less-complex secondary care from Landspítali. Landspítali has a higher share of outpatient visits with lower average complexity (as measured by average DRG weight)[65] than is generally seen at comparable hospitals, as shown in Exhibit 27.[66] This high share of outpatient visits at Landspítali cannot only be explained by the higher share of ER or acute outpatients at the hospital, as shown in Exhibit 29. Partly, this high share of outpatients (and low average DRG weight) at the hospital may be an indication of some primary care being provided at the hospital. However, it is likely also an indication of simpler secondary outpatient care being highly centralized in Iceland – i.e., mostly offered at Landspítali rather than at neighbouring local hospitals, for instance.

[65] Questions have been raised about potential errors or misreporting in logging of production DRG data. For the purposes of this review, the data has been assumed to be correct, but in cases where this has been called into question, changes to and clarification of Landspítali's reporting procedures should be undertaken. This is likely to improve when DRG-based funding is adopted (planned for 2022).

[66] Landspítali has this high share of outpatient visits despite the fact that private specialist providers in the Capital Region of Iceland are taking on ~500,000 outpatient visits per year.

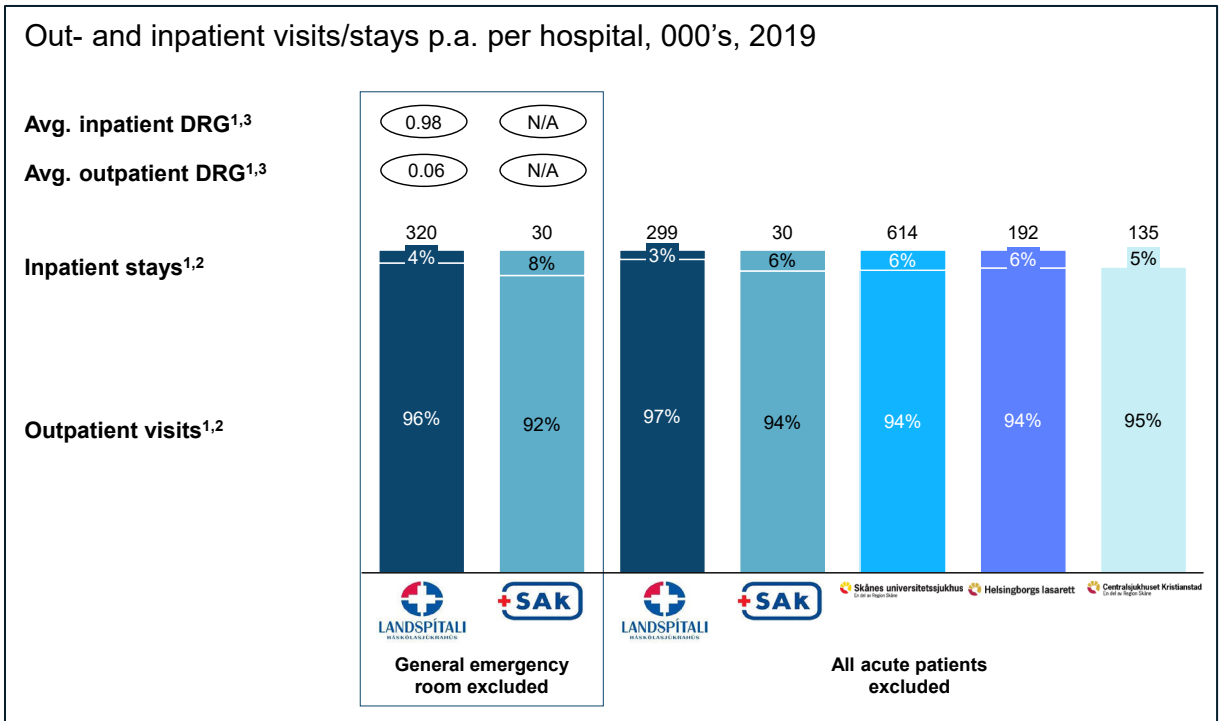
Exhibit 28. Outpatient and inpatient visits or stays per hospital in 2019.



1. Production for SUS, HBG and CSK is based on 2018 data, growth is for 2015-2018; 2. Excluding phone calls and psychiatry; 3. DRG points in Skåne only count highest DRG per stay, however at LSH all DRGs per stay are counted. This inflates DRG points/visit by roughly ~10%; 4. Excluding 2015 as strike year, CAGRs for 16-19 would be: -0.8% (inpatient) and 2.1% (outpatient)

Source: Landspítali production data, Akureyri production data, Region Skåne production data

Exhibit 29. Outpatient and inpatient visits or stays per hospital in 2019, excluding ER or acute patients.



1. Production for SUS, HBG and CSK is based on 2018 data, growth is for 2015-2018; 2. Excluding phone calls and psychiatry; 3. DRG points in Skåne only count highest DRG per stay, however at LSH all DRGs per stay are counted. This inflates DRG points/visit by roughly ~10%; 4. Excluding 2015 as strike year, CAGRs for 16-19 would be: -3.5% (inpatient excl. ER), 2.9% (outpatient excl. ER), -4.9% (inpatient excl. acute) and 3.9% (outpatient excl. acute)

Source: Landspítali production and emergency room data, Akureyri production and emergency room data, Region Skåne production and emergency room data

Decentralizing some of this simpler outpatient care from Landspítali could bring benefits. Care should generally be provided in the most adequate care setting, due to the costs associated with different care settings. Landspítali, as a university hospital, is generally a more complex care setting with higher costs for staffing and other resources. Moving less-complex care services to other care settings may free up resources at Landspítali, which could be used for more complex care while saving costs on a system level. As healthcare demand continues to grow, and consequently, Landspítali's services, exploring decentralization as an option may be beneficial to reduce the burden on Landspítali and enable it to focus on its core mandate of offering advanced specialist care.

However, if decentralization of simpler secondary care from Landspítali were to be explored further, the system would need to decide where to direct these services. Furthermore, as mentioned above, a holistic and structured framework would ideally be in place for evaluating trade-offs of placement of certain types of care within the system.

5.2.4.1 Potential choices for shifting simple secondary care from Landspítali

In a scenario where decentralization of some simpler secondary care away from Landspítali has been analysed as beneficial to the hospital, patients, and the broader system – there are three key potential options that could be explored to achieve this:

1. Splitting Landspítali into a university hospital responsible for more complex secondary and tertiary care, and a local hospital entity responsible for simpler secondary care
2. Shifting some or most simpler secondary care to other nearby hospitals (e.g., Selfoss)
3. Defining an internal boundary more clearly within Landspítali between where and how simpler secondary care is served versus where and how more complex secondary and tertiary care is served

Each of these options has its challenges and benefits, and would, to a varying degree, likely enable Landspítali to focus more on its core university hospital mandate of advanced specialist care, research, and education.

The option of splitting Landspítali into a university hospital and local hospital entities would provide the benefit of strongly focusing the university hospital on core services, which may lead to increased efficiency and cost savings. Additionally, the local hospital entity would potentially save further overall costs, as it could enable provision of care within a simpler, less-costly care setting. However, this option would bring significant challenges. First, redistribution of clinical staff between the two entities would likely be hard, as most of the same Landspítali clinical staff are currently providing care across the spectrum of secondary and tertiary care. Second, Landspítali is already a comparatively small university hospital, and would likely experience a loss of scale benefits on utilization of staff, beds, infrastructure, and more. Third, splitting acute flows between the two new entities could be challenging. Lastly, this would be a highly complicated and costly effort, which would be difficult to reverse if it were unsuccessful in bringing overall benefits.

The second option of shifting some simpler secondary care to nearby hospitals likely brings the same benefits as the prior option, and potentially with fewer challenges. The potential challenge of acute flows is eliminated. This option also enables more flexibility in terms of which simpler care to outsource, likely reducing the loss of scale benefits. This shift can also be reversed more simply – making it more feasible with fewer operational risks. However, the nearest hospitals to Landspítali are still 40 to 60 minutes away. Thus, shifting certain types of

simpler secondary care completely away from Landspítali may be challenging from a patient satisfaction and transport standpoint.

The third option of defining clearer internal boundaries at Landspítali between simpler and more complex care can bring the same benefits as the other two options, while eliminating most challenges. By creating robust processes and structures, and even physical boundaries, Landspítali might be able to create simpler care settings internally, where some simpler care could be shifted. This could potentially bring efficiency gains and cost savings while allowing the hospital and its staff to focus their efforts on complex services, research, and education in other parts of the institution. However, this has been tried at other university hospitals around the world with varying degrees of success. Successfully creating simpler care settings within advanced tertiary care facilities and allocating staff among these two settings is difficult, and in many cases fails to bring the benefits aimed for the Icelandic healthcare system to decide whether decentralization of some simpler care services would be beneficial overall, and to then decide how to shift those services – an holistic and structured framework for shifting care is needed. Such an overarching framework for shifting care does not exist today.

5.2.4.2 Framework for shifting care

A structured and holistic framework is needed when determining whether to shift patients from one healthcare facility to another – e.g., when centralizing or decentralizing care. As is further discussed in the 'Placement of care' subchapter in the 'Coordination role of Landspítali' chapter, a coordinated and structured approach to patient placement within the Icelandic healthcare system is currently lacking. Below, a high-level framework used by other healthcare systems is presented.[67]

Outlined in Exhibit 30 is a framework that describes four key evaluation criteria that should be considered when distributing patients. Not all criteria need to be fulfilled for a shift to be reasonable – but the implications of each criterion need to be considered. Additionally, as this is a framework used by other healthcare systems, it should be adapted to fit the Icelandic context – e.g., to adhere to the relatively small scale of the system compared to other healthcare systems.

Quality of care. This relates to the above clinical volume threshold discussion, and includes patient outcome, e.g., complication rates, days as an inpatient, morbidity, and more, as well as the care being effective, timely, and patient-centred. If a patient can receive better and safer care with reduced risks, at a centralized healthcare centre, then shifting the patient should be strongly considered. If the quality of care is reduced, then the patient shift should likely not be considered (even if other criteria indicate the opposite).

Resources. Availability of, and impact on, resources (including beds, equipment, and staff) should be considered next – from both a short- and long-term perspective. Short term, the amount of resources and capacity must be enough to handle the increased demand on the parts of the system that will receive additional patients. At the same time, the resources that are freed up need to be able to be utilized effectively elsewhere. Long term, the impact on expertise retention and capabilities needs to be considered, as volumes will decrease at the location where the patients are distributed from. Additionally, capabilities need to be sustainably scaled up in the parts of the system that will have increased, long-term patient

[67] The 'shifting of care' framework, developed and used by McKinsey for other healthcare system restructuring projects.

demand. This criterion could be considered a prerequisite for the last two criteria – if a patient shift is feasible given the current and potential longer-term resources (assuming shifting is plausible), then a shift could be considered.

Access to care. High accessibility to care for patients needs to be maintained – both in terms of travel time and waiting time for urgent care, but also in terms of access to a broad range of specialists. The impact on increased travel time for patients and the overall patient experience needs to be weighed against increased access to specialists, reduced waiting time, and potentially higher quality of care.

Financials. On a system level, overall increased capital expenditures need to be considered, as well as the change in cost distribution of operating expenditures, salaries, transport, overhead, and more.

Exhibit 30. Key evaluation criteria for a successful shift of complex care in healthcare systems.

*This framework has been used by other nations, but **needs to be adapted to fit the Icelandic context** – e.g., incorporating climate impact due to having to transport patients by plane*

Criteria	Quality of care	Resources	Access to care	Financials
Description	Impact to the **effectiveness**, **quality** and **safety** of the care the patient receives, as well as the overall **patient experience**	**Availability of, and impact on resources**, incl. beds, equipment and staff	Accessibility of the care for patients, including **travel time**, as well as **access to urgent care** and **waiting time for specialists**	Change in total costs and cost distribution, with regard to **CAPEX**, **salaries**, **transportation**, and **overhead**, etc.
Example questions to answer	*Will this shift reduce / increase risks?* *How will this shift impact the overall patient experience?*	*Is centralization possible in terms of available personnel and beds at each hospital?* *Will we enhance efficiency of staff?* *Will we negatively impact jobs in local communities?*	*Will this increase the necessary travel for a patient too much?* *Will time to treatment reduce?* *Will it be easier to access specialists?*	*Does it make financial sense to provide same medical specialty at multiple locations?* *How will staff efficiency change by centralizing specialist care?*

1. E.g., tertiary, complex secondary, simple secondary, etc.

Source: The 'shifting of care' framework, developed and used by McKinsey for other healthcare system restructuring projects

The framework in Exhibit 30 can be used as a basis for creating a structured and holistic approach for the Icelandic healthcare system to analyse potential beneficial shifts of care within the system. However, each of the evaluation criteria mentioned above would need to be further detailed out to enable fact-based decision making and account for an Iceland-specific context. Apart from the four key evaluation criteria presented, other factors are likely to play a role in a successful analysis of ideal patient placement and shifting of care.

It is vital to create clear definitions of which treatments should fall under which complexity level, and use this as a basis for what can, and should, be more centralized or decentralized. For instance, within a specific specialty (e.g., oncology), it must be determined which treatments (e.g., chemotherapy, radiation therapy, stem cell transplants) should belong to each complexity level, and from there, determine at what level of the healthcare system

these treatments should be provided. A coordinating body may also be needed for determining where in the healthcare system patients should be placed, e.g., which patients should be transferred, and to what care setting. This is further discussed in the 'Coordination role of Landspítali' chapter.

Finally, it is important to note that there have been past centralization projects in Iceland (e.g., Kragaverkefnið), which failed partly due to how the shifts were attempted – some treatments were centralized at Landspítali from rural hospitals, while no less complex treatments were outsourced from Landspítali to rural hospitals. This would have resulted in lost jobs and lost scale, leading to discontent and political inertia, even though strong arguments supported the attempts. It is likely important to ensure that Landspítali can guarantee some simpler care services being outsourced in exchange for complex care being insourced, to counteract potential large shifts in jobs within those communities.

5.2.5 Conclusions and impact on Landspítali

5.2.5.1 Key conclusions

The placement of care is an important system choice, affecting quality, accessibility, and costs of the healthcare system. The Icelandic healthcare system is already highly centralized, as local hospitals distribute almost all more-complex care to Landspítali. Considering Iceland's small population and its uneven population distribution, this high degree of centralization could be considered essential to ensuring quality of care.

At the same time, Landspítali also provides considerable care on the less complex end of the spectrum, which may not imply optimal utilization of resources on a system level. This could indicate that there is a potential to shift less complex care from Landspítali to other care facilities, e.g., local hospitals or private clinics.

Determining which care should be centralized and decentralized is challenging and depends on several factors. Without a structured approach and process, this may result in care practices being suboptimally utilized and subsequently, patient volumes below critical thresholds, as well as long waiting times, higher costs, and more.

The Icelandic healthcare system currently lacks such a framework – making the process for determining how (and where) to allocate care services complicated. Thus, formalizing a framework covering key criteria related to this, e.g., quality of care, resources, access to care, and financials, could bring significant benefits to Landspítali and the system.

5.2.5.2 Main 2040 scenario – no changes to current degree of centralization

Although decentralization of less complex secondary care could bring benefits to the system and Landspítali, this would entail a large shift from past trends in Iceland, and likely require capacity and resource additions elsewhere in the healthcare system. Additionally, as the Icelandic healthcare system currently lacks an established process or framework for how to ideally distribute care in the system, properly estimating further centralization or decentralization of care in the system is challenging. As such, no change to the current situation is modelled in the main 2040 scenario.

If and when a framework or structured process is implemented, an evaluation of the current concentration of care at Landspítali and the potential for further centralization or decentralization may be advisable.

5.2.5.3 The potential range of impact on Landspítali

The healthcare demand at Landspítali in 2040 could either increase or decrease due to centralization or decentralization of care. Further centralization of complex care to Landspítali would increase demand – e.g., complex treatments being shifted from both SAK and other hospitals to Landspítali. Decentralization of simpler care away from Landspítali would result in the opposite, decreased demand, e.g., by moving simpler secondary care from Landspítali to neighbouring hospitals.

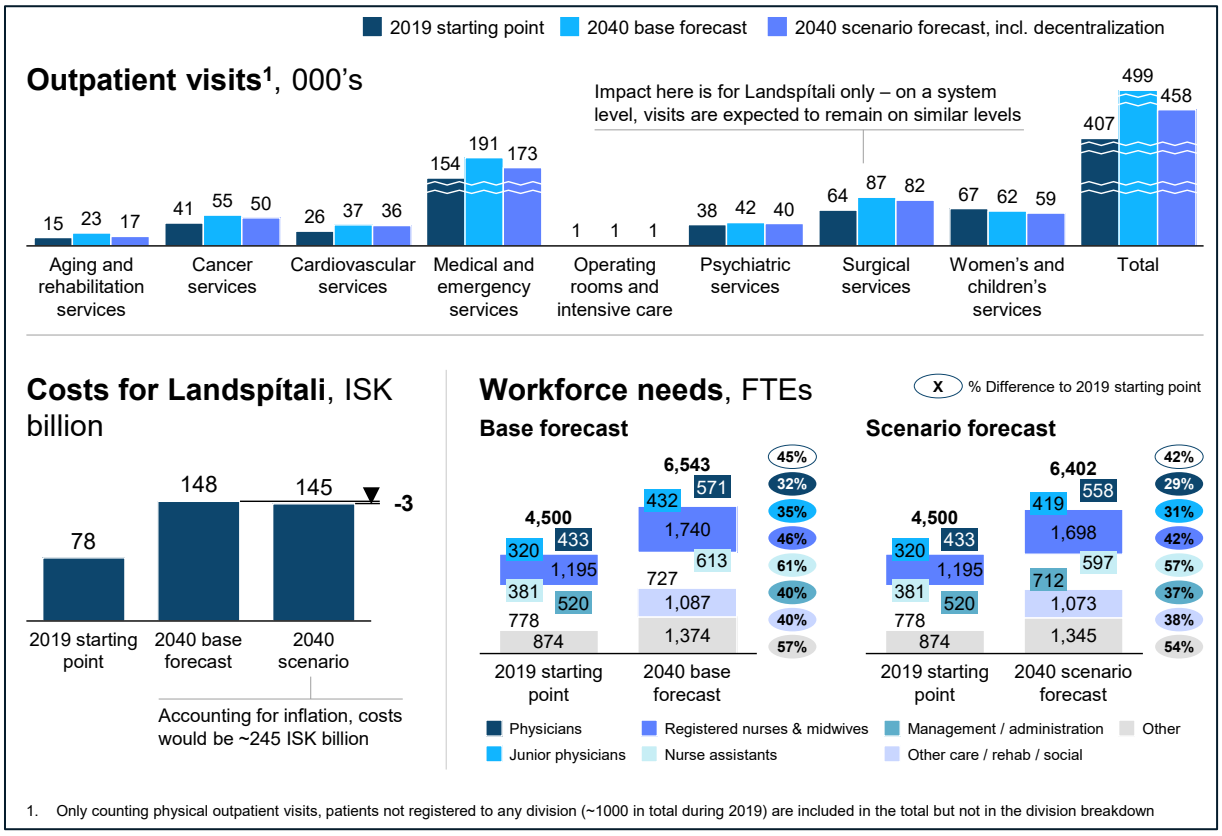
Increased centralization in the Icelandic healthcare system is unlikely – apart from limited potential cases at SAK, most treatments that require high volumes to ensure patient safety are already centralized at Landspítali. Thus, further centralization would have a negligible impact at most on Landspítali's future resource needs and is therefore excluded from the modelling.

Conversely, decentralization of simpler secondary care is more likely to have an impact on Landspítali's resource needs. This action may result in cost savings on a healthcare system level, while allowing Landspítali to more effectively focus on its core services – i.e., providing complex care, conducting medical research, and educating medical staff. As outlined previously, decentralization would likely stem from simpler outpatient services being moved out of Landspítali to other parts of the healthcare system.

To highlight the potential impact of this, a scenario where simple secondary care outpatients are moved out of Landspítali is modelled and displayed in this chapter. A list of all specialties currently provided outside of Landspítali at neighbouring hospitals (e.g., Selfoss) is first compiled. Then, 10% of current outpatient numbers along with 50% of the future growth of outpatient numbers currently treated at Landspítali (within the specialties provided at neighbouring hospitals) are modelled to be moved out of Landspítali. The impact is then measured and displayed in this section. This scenario should not be viewed as a recommendation, but only as a numerical exercise to display the range of potential impact that a decentralization from Landspítali would have.

The impact of the potential decentralization following this scenario is visualised in Exhibit 31.The impact of the estimated decentralization would be an ~8% decrease in outpatient visits, ~ISK 3 billion cost reduction, and ~140 FTE reduction for Landspítali. The decentralization initiative would shift the resource need to other parts of the healthcare system. On a division level, the largest percentual reduction in outpatient visits, 26%, would be realized in aging and rehabilitation services. Shifting out inpatients will be extensively discussed in the next chapter.

Exhibit 31. Impact of the strategic choice of pushing out simpler secondary care on the 2040 forecast for Landspítali.



1. Only counting physical outpatient visits, patients not registered to any division (~1000 in total during 2019) are included in the total but not in the division breakdown

5.3 Shifting out primary care and long-term care

5.3.1 Introduction

One of the critical elements with potential for improvement for any healthcare provider is ensuring that the right level of care is provided in the best setting. This chapter will discuss the potential to achieve significant cost savings and productivity gains by shifting the treatment of primary care patients and patients in need of long-term care out of the university hospital setting.

This chapter is divided into three sections. It first outlines the different types of care in Iceland at a high level, focusing on primary and long-term care. Second, it provides an overview and a fact base on whether primary and long-term care are provided at Landspítali, and to what extent. Finally, the potential impact of shifting these types of care away from Landspítali is quantified.

5.3.2 Types of care in Iceland

Before detailing the improvement potential around shifting care to more adequate care settings, the different types of care provided in Iceland's healthcare system are first defined. In Iceland, the total spend on healthcare consists of 1) specialized care, 2) primary and long-

term care, and 3) other costs (including other care[68] and other healthcare-related costs[69]). Exhibit 32 displays the breakdown of costs.

1. **Specialized care** consists *mainly* of secondary and tertiary care. Specialized care is typically provided in hospitals and specialist clinics, and often requires special skills and advanced technology.
2. **Primary care and long-term care**
    a. **Primary care** consists mainly of outpatient care and is often provided by healthcare centres (i.e., outside of a hospital environment). It includes simpler forms of care, such as routine physical exams, prescription of necessary medications, or treatment of minor illnesses and injuries. Primary care centres are both publicly and privately owned. In the Capital Region of Iceland, the publicly funded primary care facilities are operated by the Heilsugæsla höfuðborgarsvæðisins organization and include 15 primary care centres. The Capital Region also has four private primary care centres.
    b. **Long-term care** includes services to patients who require help to live their lives as independently as possible over a long period of time. Long-term care includes:
        › Nursing home care, which includes both live-in facilities and day care that is usually close to the patient's home. Day care includes temporary stays in social centres where patients can exercise, socialize, rest, get assistance with personal hygiene, etc. Transport to and from the patient's home is included. Nursing home care accounts for most of the long-term care spend (~62%) and covers both elderly and non-elderly patients.
        › Home-based care includes short- and long-term care for elderly and non-elderly patients in their homes. Home-based care services provide support that allows patients to live their lives as normally as possible. These services include home nursing (care during illness or in the wake of illness or an accident) and social domestic services (helping with daily housework, personal hygiene, bedside attendance during illness, and social work). Home-based care makes up ~8% of long-term care spend.
        › Other long-term care includes types of long-term care for patients in circumstances other than those described above. This makes up ~30% of long-term care spend.
3. **Other forms of costs** include other types of care, i.e., curative dental care, preventive care, and rehabilitative care,[70] and other healthcare-related costs, e.g., ancillary services, medical goods, governance and health systems, and financing administration.[71]

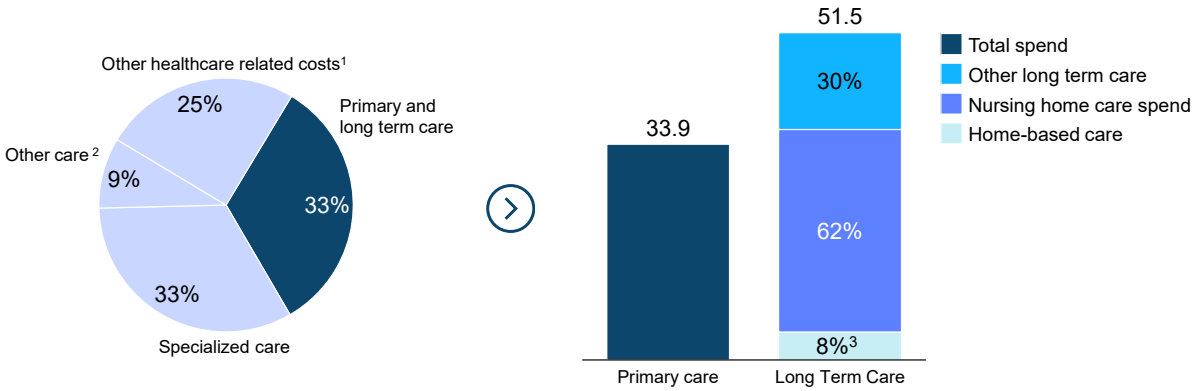
[68] Includes curative dental care, preventive care, and rehabilitative care.

[69] Includes ancillary services to healthcare (laboratory services, imaging services, patient transport), medical goods (pharmaceuticals and other medical non-durables, and therapeutic appliances and other medical durables), governance and health systems, and financing administration.

[70] Rehabilitative care is excluded from the primary care and specialist care categories, as the data is not detailed enough to be accurately distributed in these categories.

[71] The full list comprises ancillary services to healthcare (laboratory services, imaging services, patient transport), medical goods (pharmaceuticals and other medical non-durables, and therapeutic appliances and other medical durables), governance and health systems, and financing administration.

Exhibit 32. Total healthcare spend distribution versus primary and long-term care distribution.



1. Includes: Ancillary services to healthcare (laboratory services, imaging services, patient transport), medical goods (pharmaceuticals and other medical non-durables and therapeutic appliances and other medical durables), governance and health system and financing administration
2. Includes: Dental curative care, preventative care and rehabilitative care. Rehabilitative care is excluded from categories primary care and specialist care as data is not granular enough to be accurately distributed to these categories
3. Includes "Home-based curative care" that is not considered long-term care. ~80% of home-based care is considered 'long-term' and ~20% is not

Source: Icelandic Health Services Act, no. 40/2007; Statistics Iceland; Iceland Elderly Care Budget 2019

5.3.3 Primary and long-term care at Landspítali

A university hospital is typically a very high-cost care setting with a highly specialized operating model and the ability to treat the most complex of health issues. Nevertheless, treating a patient with low-complexity long-term needs in the most specialized hospital with an expensive operating model often does not increase the quality of healthcare provided – but it dramatically increases the costs. The same holds true for simpler primary care needs that could be more efficiently treated in a much lighter and less resource-intensive environment. There are indications that significant amounts of both primary care and less complex long-term care are being provided at Landspítali, potentially resulting in one of the most significant improvement initiatives for Landspítali's role in the Icelandic healthcare system identified throughout this report.

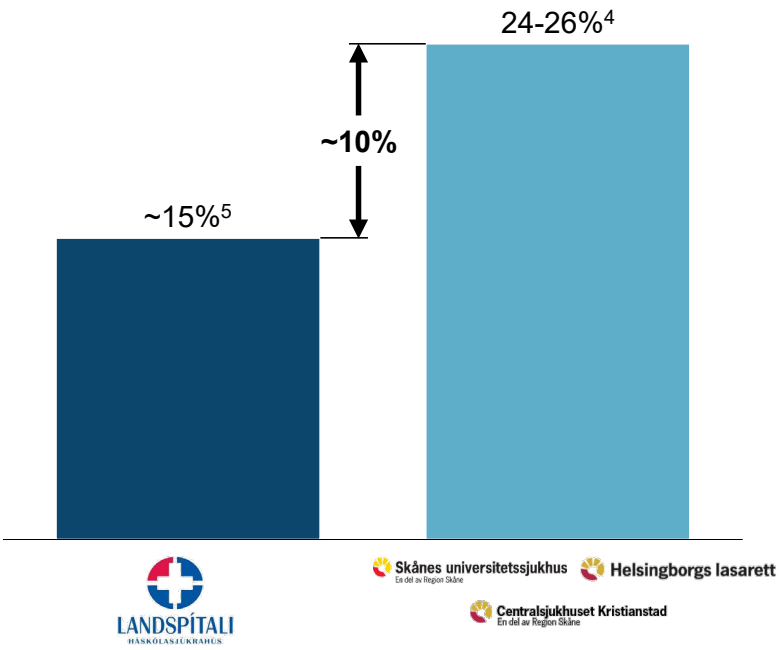
5.3.3.1 Primary care at Landspítali

Landspítali does not currently log or track its provision of primary care, and thus, direct statistics on this cannot be obtained easily. However, when comparing Landspítali's ER admittance rate against a selection of Swedish hospitals in Skåne County – Skåne University Hospital (SUS), Helsingborgs lasarett, and Centralsjukhuset Kristianstad – we see that Landspítali's is significantly lower (as shown in Exhibit 33). This clearly indicates that Landspítali treats fewer complex patients in the ER than its benchmarked peers, which may mean that primary care patients are in fact treated at Landspítali. This finding is supported by interviews carried out with Landspítali staff, and is an issue that the hospital is aware of.

'The ER at Landspítali has received patients who really should be using primary care. This may affect the large number of outpatients recorded at Landspítali.'

—HR staff member at Landspítali

Exhibit 33. The admittance rate of acute patients at Landspítali and a sample of Swedish hospitals (SUS, Helsingborgs lasarett, and Centralsjukhuset Kristianstad).



1. All acute patients included regardless of if registered at the general emergency ward or emergency admitted directly to other wards; 2. December 2019 has been extrapolated in the Skåne data by calculating December's share of total 2018; 3. Patients from evening- and weekend wards (primary care and nurse only wards) are excluded from Skåne data since they are not registered as acute; 4. Includes three hospitals in Skåne, Sweden: Skånes Universitetssjukhus, Helsingborgs lasarett and Centralsjukhuset Kristianstad; 5. Landspítali admittance rate might seem lower due to overfull capacity – some patients at the ER would be admitted if the hospital had additional capacity, but due to a lack of beds the patient is instead treated in the ER directly despite being 'equally complex' as some admitted patients; 6 Using data not impacted by the COVID-19 pandemic

Source: Landspítali emergency room data, Akureyri emergency room data and Region Skåne emergency room data; Prislista för utomlänsvård samt för EU/EES och Schweiz 2021

In 2019, a study compared the Capital Region of Iceland's spending on primary care with a selection of Swedish regions with similar populations, demographics, and size (Jönköping, Norrbotten, and Östergötland). In this comparison, it was found that the Capital Region has significantly lower recorded primary care spend levels, indicating some primary care might be classified as secondary care and performed at Landspítali.

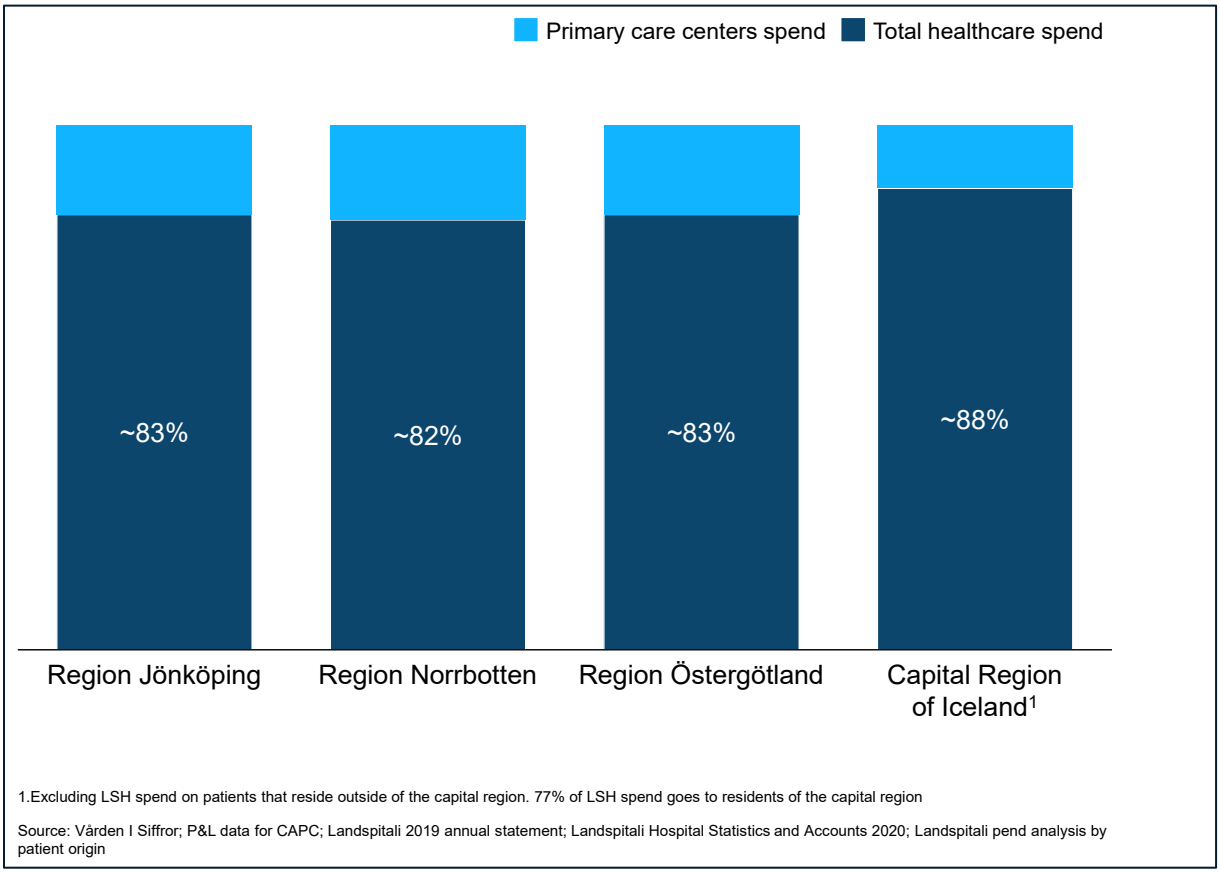
For the Swedish sample regions, it was found that on average, between 17 and 18% of total healthcare spending goes towards primary care centres that cover all the region's primary care needs. In the Capital Region of Iceland, however, only about 12% of total healthcare spend goes towards primary care centres. The rest is likely attributable to primary care performed at Landspítali for patients living in the Capital Region. This finding is apparent even when adjusting for the inflow of rural patients.[72] If the primary care needs of the Swedish sample regions are similar to those of the Capital Region of Iceland, Landspítali could be assumed to spend ~5% of its spend that's dedicated to Capital Region inhabitants[73] on primary care.[74]

[72] Excluding Landspítali spend on patients who reside outside of the Capital Region of Iceland. 77% of all Landspítali spend goes towards serving patients who are residents of the Capital Region, based on Landspítali Hospital Statistics and Accounts 2020.

[73] Landspítali spend dedicated to Capital Region inhabitants entails the share of Landspítali's total spend on patients who reside within the Capital Region of Iceland, i.e., excluding spend on patients travelling to Landspítali from other regions.

[74] Average primary care spend of Swedish benchmarked regions is 17.1%, compared to 12.3% for the Capital Region of Iceland; the difference is 4.8%, which constitutes 5.4% of Landspítali's total budget dedicated to inhabitants of the Capital Region.

Exhibit 34. Primary care spend as a share of total healthcare spend.



Generally, it is advisable to treat primary care patients at primary care facilities and outside of a hospital environment where possible, while focusing hospital resources on specialist care. This is primarily because treatments provided in a hospital designed to focus on secondary and tertiary care, such as Landspítali, are more expensive than the same treatment provided in a primary care setting.[75]

In Sweden, the cost per visit at a primary care centre is ~50% lower than an outpatient visit at a hospital.[76] Using this as an indication of how much less it costs to provide care at a primary care centre compared to a hospital, the estimated savings generated on a system level by moving primary care from Landspítali to dedicated primary care centres would be ~ISK 1.5 billion to 2 billion per year.[77] And this is a conservative estimation of the potential savings. The difference in cost between Icelandic primary care visits and outpatient visits at Landspítali would yield even more savings – ~60 to 70% cost reduction per visit.

In addition to the economic benefit, resources at hospitals are limited, and when spent on care more appropriate for other care settings, these resources are taken away from the care they are needed for. As healthcare demand grows in the future, there will be a clear choice on whether to provide a larger share of primary care in other settings to free up resources for growing secondary care.

[75] Based on benchmarks to Sweden, where the average treatment cost at an outpatient care facility compared to a primary care visit is around two times as expensive: Sveriges Kommuner och Landsting: Vården i siffror, KPP-grunder, 2018.

[76] Sveriges Kommuner och Landsting: Vården i siffror, KPP-grunder, 2018.

[77] Based on a conservative top-down estimation of savings on a system level.

While there are indications that primary care patients *were* being treated at Landspítali prior to 2019, this has been partly addressed from 2020 onwards through initiatives launched in late 2019. These initiatives aimed to increase collaboration between Landspítali and nearby primary care facilities, in order to proactively shift patients before they end up in a suboptimal care setting. According to senior stakeholders in the Icelandic healthcare system,[78] these initiatives have been successful to an extent, reducing the amount of primary care at Landspítali. However, these same stakeholders agree that the issue is not fully resolved. Currently, Landspítali's ER is viewed as the default healthcare setting for any type of acute care for many Icelandic citizens, when in many cases, the more appropriate option would be to receive care at a primary care facility.

Two actions could potentially be undertaken to improve patient distribution between Landspítali and other healthcare clinics and ensure patients are treated in the optimal setting:

1. Reducing the number of patients seeking care at the Landspítali ER through long-term, continuous efforts that aim to change the mindset of Icelandic citizens regarding where to ideally seek acute care – similar to the initiatives launched in late 2019. Models to get a better structural definition in acute care have been implemented, with relatively high success, in both Denmark and Norway. These are building on principles such as doctor approval before allowing emergency visits, implementing triage decision guides, and having a single point of contact for emergency help.[79]
2. Formalizing and improving collaboration related to patient referral and distribution between specialist departments at Landspítali and primary care clinics – enabling patients to be efficiently distributed within the healthcare system and resulting in more patients being treated in an optimal setting. Currently, this type of collaboration works very well for some specialties but less well for others. An example of where it works well is between the cardiology department and primary care – where patients who need to undergo surgery preparations, such as losing weight, are being treated by primary care facilities in close collaboration with Landspítali.

Due to the Covid-19 pandemic, the analysis conducted in this subchapter cannot use data from 2020 or 2021, as a temporary influx of funds in primary care would skew the comparison. A similar analysis conducted post-Covid-19 should analyse how effective the late-2019 initiatives were, and the degree to which this opportunity has already been captured.

5.3.3.2 Long-term care at Landspítali

In addition to a significant amount of primary care being provided at Landspítali, there are also indications that Landspítali provides significant amounts of long-term care, which can also be argued to be an inefficient use of high-cost capacity for the same reasons as providing primary care in this setting. Two approaches were used to estimate the amount of long-term care being provided at Landspítali and which could or should be shifted out of Landspítali to another care setting:

1. **The 'comparison approach'.** The ALOS ratio of elderly inpatients (aged 75 and older)[80] to all patients at Landspítali was first calculated. It was found that elderly patients have,

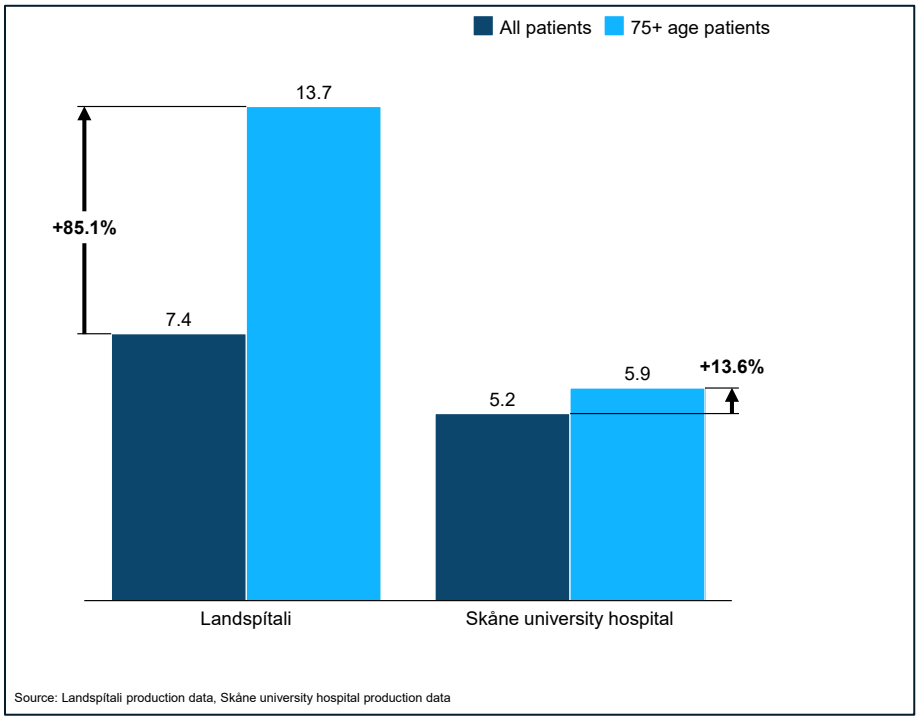
[78] Based on interviews with senior stakeholders in the Icelandic healthcare system.

[79] P.A. Berlac, 'Integrated Emergency Health Care: The Copenhagen Model', Emergency Medical Services Copenhagen, 2018, www.franciscus.nl.

[80] Excluding psychiatry patients.

on average, an ~85% higher ALOS compared to all inpatients at Landspítali. The same ALOS ratio was then calculated at SUS in Sweden. It was found that elderly patients at SUS have an ~13.6% higher ALOS than across all inpatients. An assumption was made that the ALOS ratios w*ould* be similar between Landspítali and SUS if Landspítali did not have the outflow issue for elderly patients. Enough patients aged 75 and older with the longest ALOSs were assumed to be moved out of Landspítali and treated in a simpler care setting until the ALOS ratio matched the ratio at SUS (~13.6%). This resulted in all patients who stayed for longer than 11 days are assumed to be moved out of Landspítali. While some of these patients may need hospital care for more than 11 days, this is likely compensated in large part by patients who could have been transferred earlier. From this, it was found that ~41,000 bed days could be freed up at Landspítali annually if these elderly long-term care patients could be treated in a different care setting – providing the higher range in the estimate displayed in Exhibit 36.

Exhibit 35. The 'comparison approach' – comparing the ALOS between all patients and elderly patients aged 75 and up at Landspítali and SUS.



Source: Landspítali production data, Skåne university hospital production data

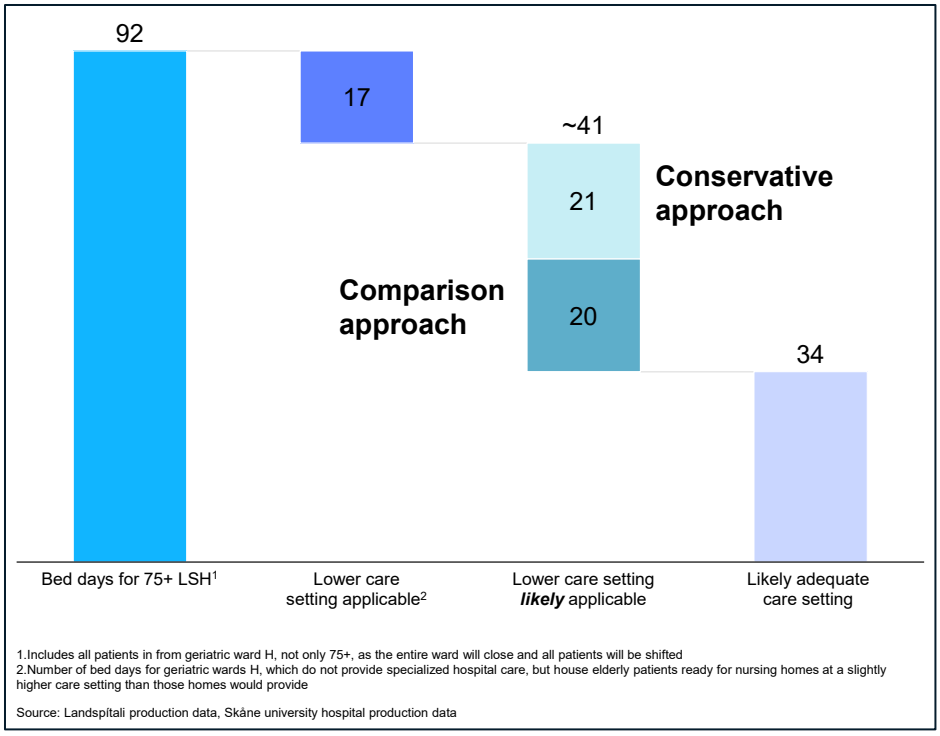
2. **The 'conservative approach'.** This approach is simpler. It assumes that all inpatients aged 75 and up[81] staying more than a month have been treated and are all waiting to be shifted to a more suitable care setting (e.g., nursing home). While some of these patients may need hospital care for more than a month, this is likely compensated by patients who could have been transferred earlier. By shifting elderly patients (aged 75 and up) who stay more than one month at Landspítali to a simpler care setting, there could be potential to free up ~21,000 bed days at Landspítali annually, providing the low end of the estimate displayed in Exhibit 36.

In addition to these estimations, an additional ~17,000 bed days can likely be freed up since they are currently in Geriatric Ward H, which does not provide specialized hospital care but houses patients ready for nursing homes in a slightly higher care setting than nursing homes would provide. In total, between 38,000 to 58,000 bed days could thus potentially be freed up

[81] Excluding psychiatry patients.

per year at Landspítali, if relevant and stable long-term care patients were shifted to a simpler care setting. Freeing up these resources for other patients would result in annual cost savings.

Exhibit 36. Bed day transfer potential for elderly long-term care patients at Landspítali.



1.Includes all patients in from geriatric ward H, not only 75+, as the entire ward will close and all patients will be shifted
2.Number of bed days for geriatric wards H, which do not provide specialized hospital care, but house elderly patients ready for nursing homes at a slightly higher care setting than those homes would provide

Source: Landspítali production data, Skåne university hospital production data

5.3.4 Potential to move long-term care patients from Landspítali

Estimating the potential financial impact of the above by comparing the costs of providing long-term care at Landspítali versus in an elderly care setting highlights potential savings for the Icelandic healthcare system of between ISK 1 billion to 2 billion[82] per year, and the potential for Landspítali to free up 21%[83] of their total number of beds and reduce their healthcare workforce need by 5%.[84] These cost-saving calculations take the conservative assumption that patients are only being moved from the geriatric ward at Landspítali, which has a low cost per bed day compared to the average ward at Landspítali. In reality, elderly care inpatients would be moved from multiple other wards as well, not only geriatrics. Thus, the actual savings could be significantly higher.

Despite the potential benefits, moving long-term care patients out of Landspítali has significant challenges – specifically, capacity-related challenges for nursing homes and home-based care. The capacity problem of long-term care is not new and has been reported on in several previous healthcare reports in Iceland. In 2017, ~67 people were waiting for nursing homes at any given time.[85] In 2016, there were reports of a lack of nursing home beds in the Capital Region of Iceland.[86] Furthermore, given the demographic trends pointing

[82] Top-down estimations on a system level based on the difference in cost between an average nursing home bed and hospital bed in Sweden (31%), and assuming this discrepancy is the same in Iceland multiplied by the number of beds freed up.

[83] Based on modelling output.

[84] Based on modelling output.

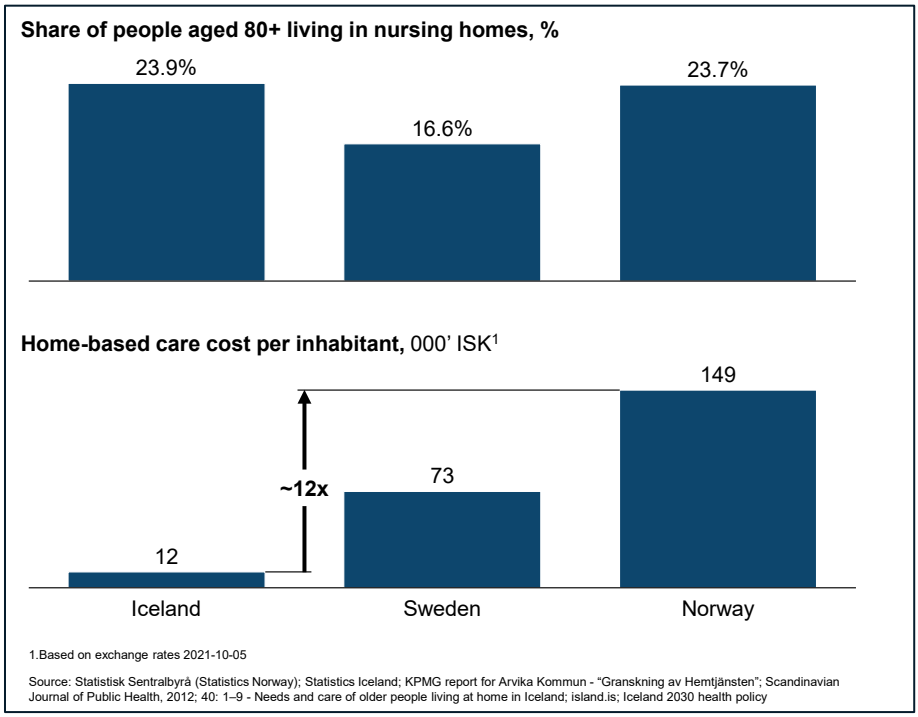
[85] Iceland 2030 health policy.

[86] Ministry of Welfare, 'Unlocking the full potential of Landspítali University Hospital: Icelandic healthcare at a crossroads', 2016, http://hdl.handle.net/10802/28261.

towards a growing elderly population, this capacity problem is only expected to increase going forward.

To solve the capacity issue and overcome some challenges related to moving long-term care patients out of Landspítali, it is likely necessary to expand spending on other care pathways for these patients, e.g., nursing homes and home-based care services. Currently, home-based care spending in Iceland is significantly less per capita than in Sweden and Norway – indicating that it might be an underutilized capacity resource for long-term care. Sweden spends approximately six times more per capita on home-based care, and Norway about 12 times more. At the same time, however, Iceland utilizes nursing homes significantly more than or at similar levels as its Nordic neighbours for people over 80 years of age – 23.9% of people over 80 years of age reside in nursing homes in Iceland compared to 23.7% in Norway, 16.6% in Sweden, and 14% in Denmark.

Exhibit 37. Share of people aged 80 and up living in nursing homes and home-based care cost per capita in Sweden, Norway, and Iceland.



Given the high number of nursing home patients and low spend on home-based care, moving stable long-term care patients out of Landspítali to home-based care services will likely be a significant part of the solution to the long-term-care capacity issue. Home-based care services may be less expensive than nursing homes, so the total cost savings for the healthcare system resulting from shifting capacity from Landspítali to home-based care could exceed the ISK 1 billion to 2 billion previously mentioned.

Between 2019 and 2021, initiatives have been launched to address the outflow issue of long-term care patients at Landspítali – opening new rehabilitation wards, increasing spend on home-based care, and more.[87] These initiatives have partly been successful, and a share of the long-term care patients have been moved out of Landspítali. However, this initial success might partly be due to the impact of Covid-19, because many patients delay seeking care, as

[87] Government of Iceland, 'Álagi létt af Landspítala – fjölgun legurýma og 30 ný rými á Landakoti,' 18 October 2021, https://www.stjornarradid.is/efst-a-baugi/frettir/stok-frett/2021/10/18/Alagi-lett-af-Landspitala-30-ny-rymi-i-vaendum-a-Landakoti/.

experienced in other European healthcare systems. Furthermore, due to the pandemic, the analysis conducted in this subchapter cannot be re-conducted using data from 2020 or 2021, as the patient data was temporarily skewed. A similar analysis done post-Covid-19 should analyse how effective these initiatives were, and the degree to which this opportunity has already been captured.

5.3.5 Conclusions and impact on Landspítali

5.3.5.1 Key conclusions

An important area for improvement potential for any healthcare provider is ensuring that the right level of care is provided in the optimal setting. This chapter discussed the potential to achieve significant cost savings and productivity gains by shifting the treatment of both primary care patients and patients in need of long-term care out of the university hospital setting at Landspítali.

It was found that Landspítali likely does serve primary care patients to a significant extent, and while initiatives targeted towards reducing this have been launched, the issue likely persists. There is the potential to realize significant cost savings by shifting these patients to more adequate care settings, as treating patients in a university hospital setting is more expensive compared to treating them in a primary care setting. The savings potential on a system level likely exceeds ~ISK 1.5 billon to 2 billion per year from this shift alone.

In addition, it was found that 38,000 to 58,000 bed days are currently allocated to long-term care patients who could be treated in a more cost efficient and adequate care setting. If these patients were to be moved out of Landspítali, this would also result in significant benefits in terms of reduced number of beds, a reduced workforce need, and cost savings of ~ISK 1 billion to 2 billion or more for both Landspítali and the Icelandic healthcare system. The root cause behind why long-term care patients are not being shifted out of Landspítali is capacity constraints in nursing homes and home-based care settings. An analysis revealed that Iceland currently has very low spending on home-based care compared to its peer countries. Dedicating additional funding to this area is likely a key solution to solving the capacity issue and alleviating the pressure on Landspítali.

5.3.5.2 Main 2040 scenario – quantitative impact on Landspítali

If the Icelandic healthcare system decides to act upon the strategic choices discussed throughout this chapter and actively shift both nursing home and primary care patients from Landspítali to more adequate care settings, there would likely be significant benefits for Landspítali. This subchapter quantifies and highlights the benefits of these shifts according to the most realistic scenario.

In terms of primary care, the main 2040 scenario reflects the impact all of the *identified* primary care volume at Landspítali, following a benchmark of Swedish hospitals. While it is very difficult to remove all primary care patients from a university hospital environment, the benchmark between Landspítali and select Swedish hospitals reveals that Landspítali likely spends ~5% more of its total Capital Region spend[88] on primary care patients than the

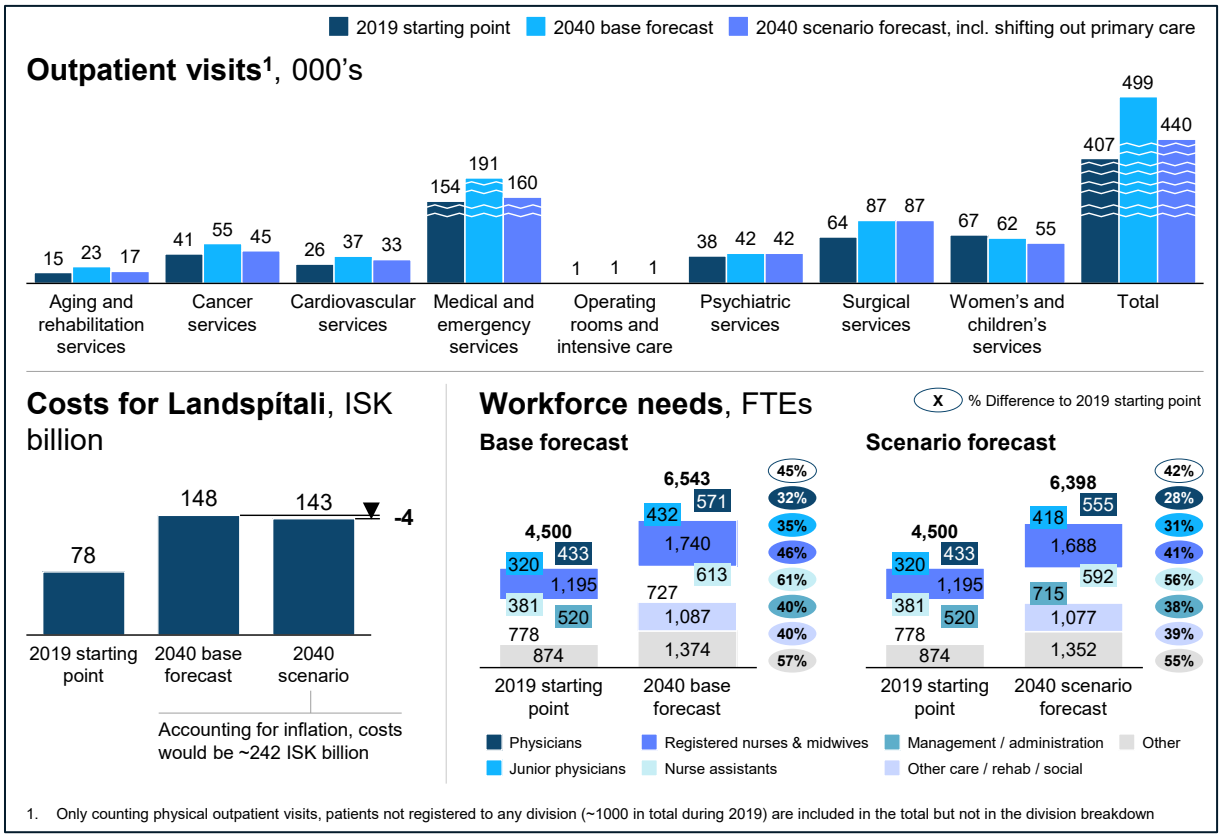
[88] Entails the share of Landspítali's total spend that is dedicated to inhabitants of the Capital Region of Iceland, i.e., excluding spend on patients travelling to Landspítali from other regions. 77% of all Landspítali spend goes towards serving patients who are residents of the Capital Region, based on Landspítali Hospital Statistics and Accounts 2020.

benchmarked hospitals. Landspítali is assumed to be able to reach the same amount of primary care patients as the benchmarks – entailing a ~5% reduction of spend on primary care out of total Capital Region spend.[88] This is according to the calculations made in the 'Primary care at Landspítali' subchapter. This ~5% is compared against total outpatient costs to determine what share of all outpatients are currently primary care patients. These primary care patients are then modelled to be shifted out of Landspítali.

Any potential impact from the initiatives launched in late 2019 that aimed to reduce the number of primary care patients being treated at Landspítali is not assumed to have been realized until 2020 onwards. Since the forecast uses data from 2019, the impact from changes affecting 2020 and beyond still need to be accounted for in the model. However, a post-Covid-19 analysis should be done to analyse in detail how effective the late-2019 initiatives were, and the degree to which this opportunity has already been captured to determine whether additional initiatives will be required.

The impact from shifting primary care patients out of Landspítali is highlighted in Exhibit 38, and would entail an ~12% reduction in outpatient visits, an ~2% reduction in workforce need, and ~3% cost savings. This would entail a significant cost reduction of ISK ~4 billion that could be realized at Landspítali.[89] This shift would significantly reduce the number of outpatient visits at Landspítali across divisions – most notably in medical and emergency services, as most primary care patients at Landspítali enter through the ER.

Exhibit 38. Impact on the 2040 forecast of the strategic choice of shifting primary care out of Landspítali.



1. Only counting physical outpatient visits, patients not registered to any division (~1000 in total during 2019) are included in the total but not in the division breakdown

In addition to shifting out primary care, the main forecasting scenario also includes the impact of shifting long-term elderly care patients out of Landspítali to a more suitable healthcare setting. The chapter discussed two approaches for estimating the volume range

[89] Savings will be realized on a system level, and care will be provided in a more cost-efficient setting.

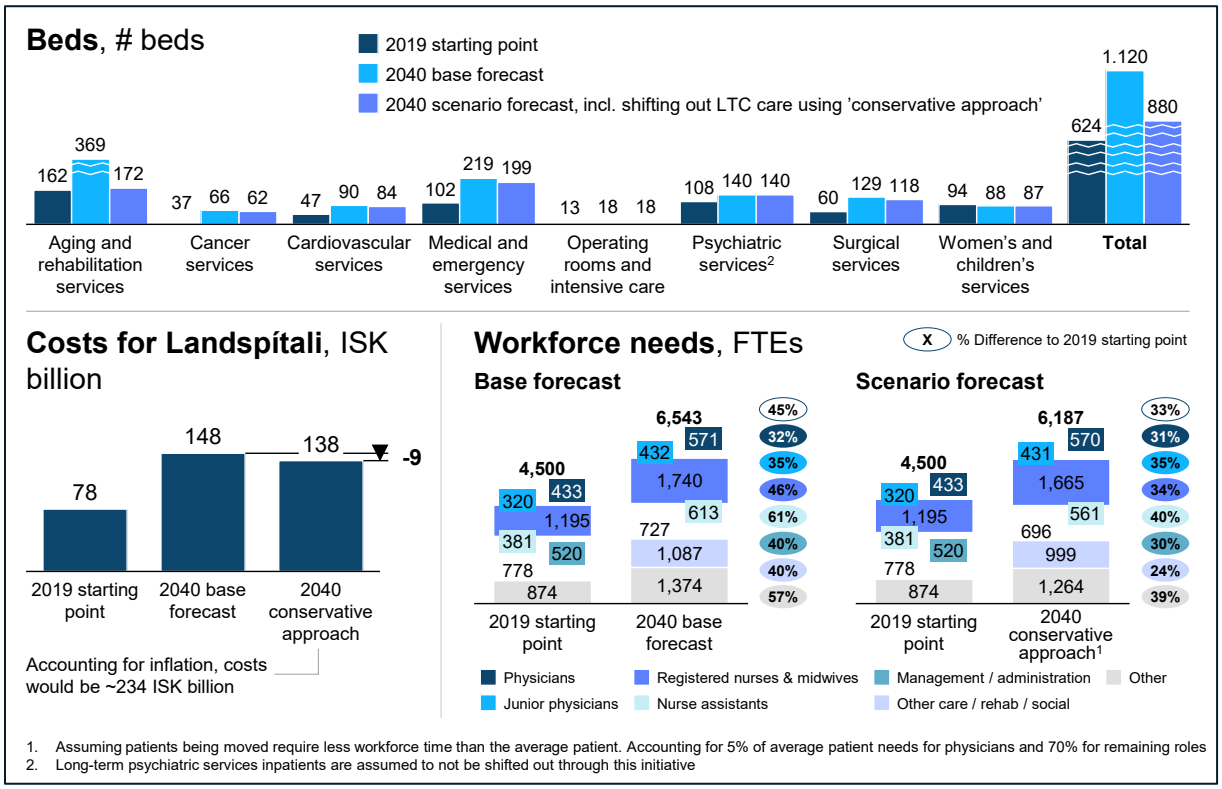
of long-term elderly care patients who could potentially be shifted from Landspítali – the 'conservative approach' to estimate the lower end of this range, and the 'comparison approach' for the upper end. If the Icelandic healthcare system decides to focus its efforts and investments on solving the long-term care capacity shortage (e.g., through expanding home-based care), it is likely that the realized impact on Landspítali would lie in between the conservative and comparison approaches. The conservative approach would entail a significant structural shift for the healthcare system, and is the estimate included in the main 2040 scenario. Readers should however be aware that this would represent the lower bound of impact from this choice.

The conservative approach estimates the amount of bed days that can be freed up by assuming that all inpatients aged 75 and up staying for more than one month at Landspítali have been treated and will be shifted to a more adequate care setting (e.g., home-based care or nursing homes). Patients currently in Geriatric Ward H are also planned to be shifted out of Landspítali and are accounted for in the modelling output. Geriatric Ward H does not provide specialized care and is instead a temporary ward that houses patients ready for nursing homes in a *slightly* higher care setting than nursing homes would provide. The calculated volume is further detailed out in Exhibit 36.

A long-term care patient typically requires a lower level of attention and care, and subsequently, a lower workload from staff, when compared to an average inpatient. The forecast accounts for this by assuming that the long-term days that are being shifted out would only impact physician and junior physician needs by 5% rather than 100% (as physician attention would typically be needed at the beginning of the stay), and the needs of other roles by 70% rather than 100%. Depending on how successful Landspítali is at reducing the workload for staff following this initiative, these numbers might be higher or lower.

The modelled impact on Landspítali in 2040 from shifting out long-term elderly care patients following this approach is highlighted in Exhibit 39, and would entail an ~21% decrease in bed needs, an ~5% reduction in workforce need, and ~ISK 9 billion in potential cost savings. Some of the cost savings at Landspítali would transfer to other parts of the healthcare system, but overall system cost savings are likely (potentially more than ISK 1 billion to 2 billion, as described in the previous section), as the care setting receiving the patients would likely be less costly. The impact on Landspítali would primarily be concentrated in aging and rehabilitation services, as those are the divisions where most current long-term care patients are being treated. A small effect will also be realized in other divisions. As described, these estimations are conservative – if the Icelandic healthcare system decides to further focus its efforts and investments on solving the long-term care capacity issues, greater impact can likely be realized. The higher range for this potential is also modelled in a subsequent chapter.

Exhibit 39. Modelling output of shifting out long-term care following the 'conservative approach', included in the main 2040 scenario.



1. Assuming patients being moved require less workforce time than the average patient. Accounting for 5% of average patient needs for physicians and 70% for remaining roles
2. Long-term psychiatric services inpatients are assumed to not be shifted out through this initiative

The potential impact from shifting out primary care and long-term elderly care patients from Landspítali accounts for the single largest impact on Landspítali and the Icelandic healthcare system identified in this report.

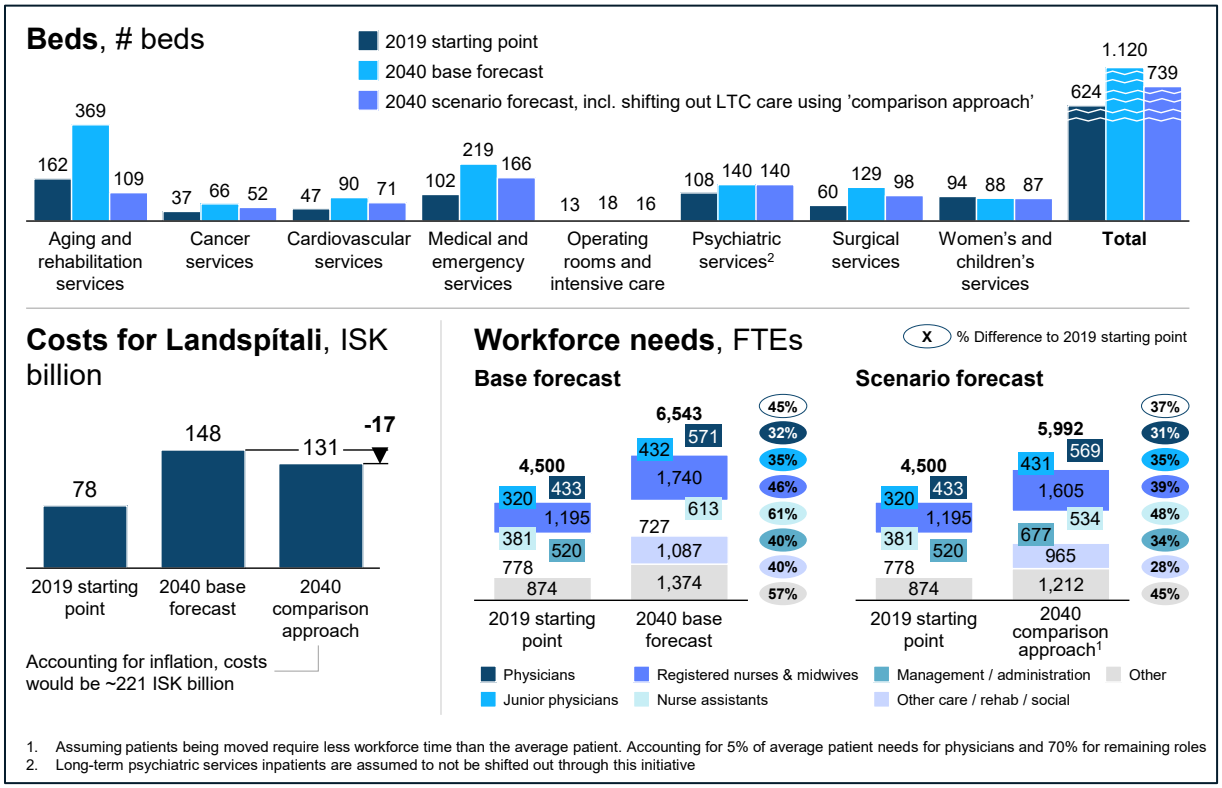
5.3.5.3 The potential range of impact on Landspítali

The above impact modelling for Landspítali for shifting out long-term care took a 'conservative' approach. To show the full potential range of impact from shifting out long-term care at Landspítali, the impact of what was referred to as the 'comparison' approach was also modelled and presented in this chapter. The potential benefits that can be realized if Landspítali and the healthcare system dedicate enough focus and resources towards shifting out as many long-term care patients as possible is highlighted.

As described and shown in Exhibit 36, the comparison approach benchmarks the ALOS difference of elderly care patients versus all patients at Landspítali against a comparable Swedish university hospital, and assumes the ALOS difference would be similar for these two hospitals if Landspítali were not faced with an outflow issue.

The impact of this scenario is highlighted in Exhibit 40, and would entail benefits in addition to the main 2040 scenario – resulting in a reduction of ~34% in bed needs, an ~8% reduction in workforce need, and 11% cost savings.

Exhibit 40. Modelling output for 2040 of shifting out long-term care following the comparison approach.



1. Assuming patients being moved require less workforce time than the average patient. Accounting for 5% of average patient needs for physicians and 70% for remaining roles
2. Long-term psychiatric services inpatients are assumed to not be shifted out through this initiative

5.4 Privatization in the healthcare system

5.4.1 Introduction

One of the strategic choices for a healthcare system is whether to enable private healthcare provision, and if so, to what degree, and how to do so. Increasing the amount of private care provision would reduce the amount of healthcare supply required from the public system, e.g., from Landspítali, and vice versa. There are also significant secondary effects to consider, such as potential skewing of demand and effects on incentives for doctors, for instance. This chapter aims to lay out the fact base around current private healthcare provision in Iceland and how it compares to other similar geographies. Additionally, the potential impact on Landspítali from an increase or decrease in the volume of private provision is specifically modelled to give a sense of the magnitude of effect that potential policy changes would have on the role of Landspítali.

This chapter is divided into three sections:

1. The current situation of the Icelandic private healthcare sector, its background, and what care types are provided in the private sector compared to at Landspítali
2. A comparison between the Icelandic private healthcare system and a selection of peers, to provide an overarching fact base for understanding potential future shifts and models
3. An estimate of the impact on Landspítali from increasing or decreasing the level of private provision in the system

5.4.2 The private healthcare sector in Iceland – background on its current state

Today, the private healthcare sector operates in a majority of the care areas in the Icelandic healthcare system – e.g., primary care, specialist care, nursing home care, dentistry. The scope of this report will focus mainly on the private sector's role in primary, specialist, and nursing home care, since these areas have a large direct or indirect effect on Landspítali's operations.[90] Specialist care here refers to secondary and tertiary care, which is typically provided in hospitals and specialist clinics, often requiring specialized physicians**.** The private healthcare sector in Iceland includes privately owned care providers that receive either public or private funding, or both. Unlike public care providers, private sector practitioners are usually for profit. The private healthcare sector in Iceland was legalized in stages – with significant steps taken in 2007 following the Health Service Act.[91] The 2007 Health Service Act opened the door for the private sector to provide all care services, with the main reason being to promote efficiency and economic viability of health services and maximize quality through complete freedom of establishment. The idea was that patients will choose the healthcare provider offering the best quality, with the government capping reimbursements, creating incentives for providers to provide treatment of the best quality possible for the funds available. In 2017**,** reimbursement for primary care was changed from a block-funded system (fixed reimbursement, decided centrally with no direct link to patients or care volumes) to a capitation-based system,[92] i.e., care providers get reimbursed based on the number of people enrolled at their facility. This resulted in 'making the money follow the patient', i.e., care providers' reimbursement is now based on where the patients choose to get care, instead of the other way around, i.e., patients choose their care provider based on the resources the different providers have available.

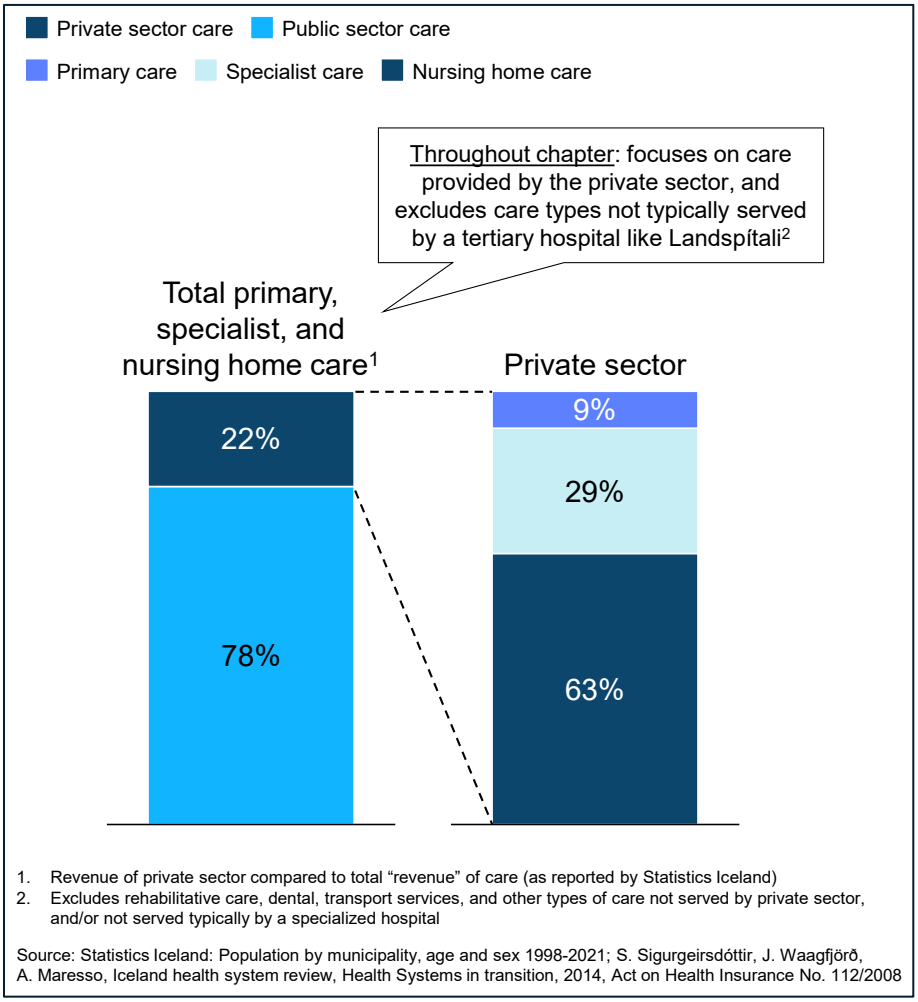
The private sector in the Icelandic healthcare system is heavily centred around the Capital Region – most of the private healthcare centres and private clinics, and some private nursing homes, are in close proximity to Reykjavík. In the Capital Region, four out of 19 primary healthcare centres are run by private actors. Furthermore, out of 79 publicly financed nursing homes in Iceland, 28 are run by private actors. Exhibit 41 demonstrates the relative size of the private sector's revenue compared to the total turnover for primary, specialist, and nursing home care in Iceland. In total, the private sector accounts for 22% of primary, specialist, and nursing home care in Iceland. Nursing home care accounts for the highest share of total private sector revenue, and private nursing home care accounts for the majority of total nursing home care.

[90] Physiotherapy and rehabilitative care are offered both at Landspítali and by the private sector. However, data for this care is very limited in the private sector, and is thus excluded from the comparison.

[91] Health Service Act, No. 40/2007, Icelandic Ministry of Health.

[92] IHI, 'Breytt fjármögnun heilsugæslunnar á höfuðborgarsvæðinu', 23 March 2017.

Exhibit 41. Icelandic private sector revenue share of total primary, specialist, and nursing home care revenue in 2019.



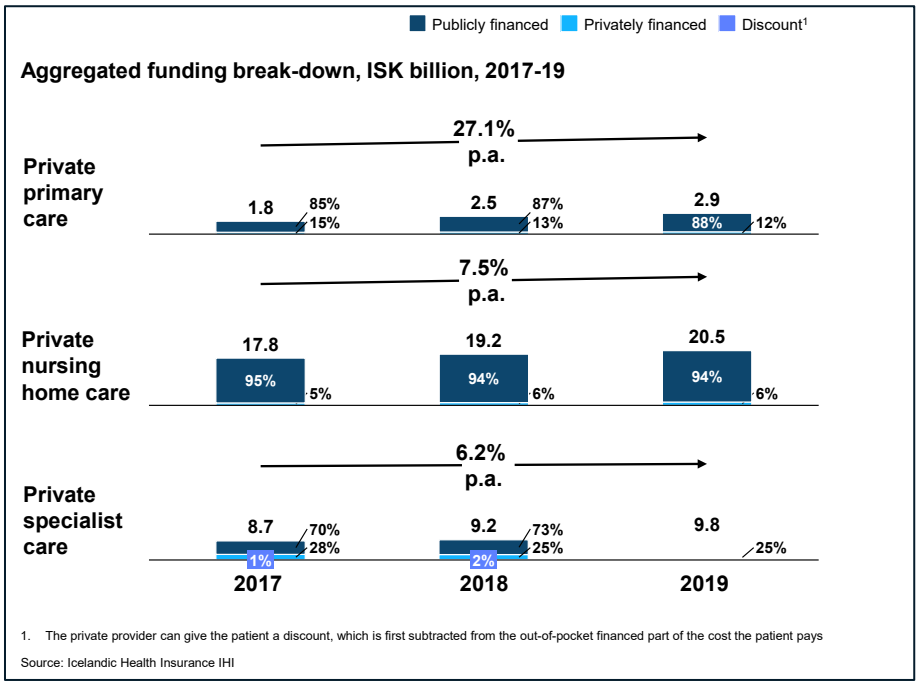
1. Revenue of private sector compared to total "revenue" of care (as reported by Statistics Iceland)
2. Excludes rehabilitative care, dental, transport services, and other types of care not served by private sector, and/or not served typically by a specialized hospital

Source: Statistics Iceland: Population by municipality, age and sex 1998-2021; S. Sigurgeirsdóttir, J. Waagfjörð, A. Maresso, Iceland health system review, Health Systems in transition, 2014, Act on Health Insurance No. 112/2008

As described above, private sector care is both privately and publicly funded – with public funding constituting a majority of the total funding. The amount of private funding as a share of total funding differs between care type. This is highlighted in Exhibit 42, which also shows the funding scheme for private sector primary, specialist, and nursing home care. Specialist care is characterized by the largest share of private funding,[93] making up ~25% of total funding. On the opposite end of the spectrum, nursing home care has the lowest share of private funding, at ~5%. The total costs of the Icelandic healthcare system grew by ~8% per year between 2017 and 2019; private specialist care and private nursing home care grew a bit slower, at ~6.2% and ~7.6% per year, respectively, in the same time period. However, private primary care grew at ~27% per year, outpacing the growth of total healthcare costs. Of this 27% growth, public funding grew by ~29% per year, and private funding by ~14%.

[93] Private funding constitutes individual top-up co-pays, either out-of-pocket or through private insurance.

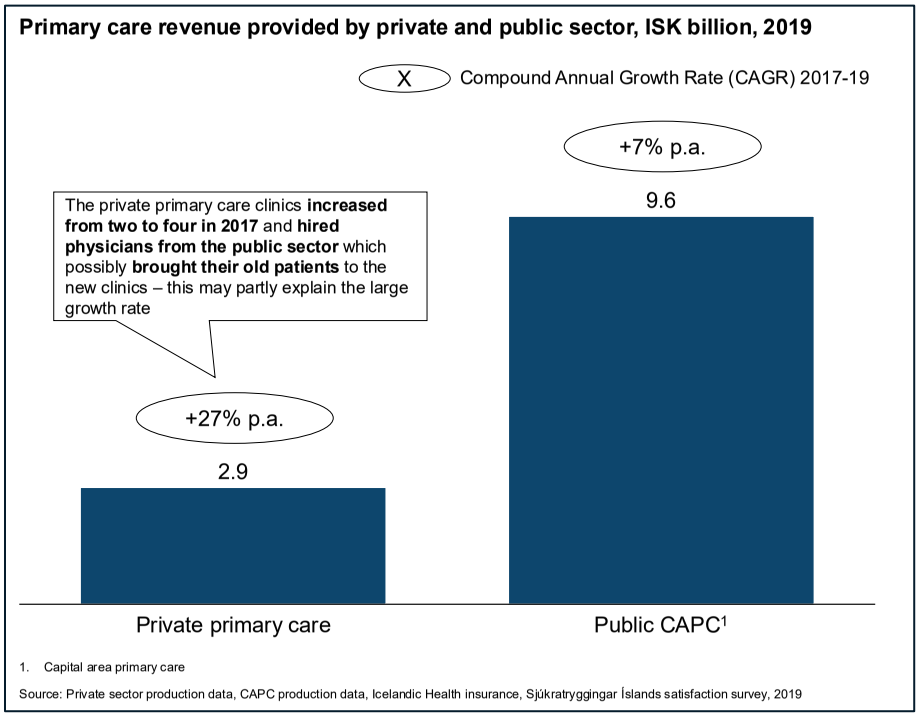
Exhibit 42. Aggregated funding breakdown of private primary, nursing home, and specialist care from 2017 to 2019.



5.4.2.1 Private primary care

As described previously, all privately run primary care facilities in Iceland are concentrated in the Capital Region. Private primary care grew considerably with the introduction of the capitation-based funding scheme and the opening of two new private healthcare centres in early 2017, explaining the rapid growth of 27% per year from 2017 to 2019. The newly opened private healthcare centres hired physicians from the public sector, and some patients likely followed the physicians to the new clinics. Furthermore, private healthcare centres scored higher than public healthcare centres in a patient satisfaction study, with all four private healthcare centres being in the top five out of the total 19. Although these results were only marginally in favour of the private care centres, it might be an indicator that patients are more satisfied at private sector clinics. Thus, in addition to the opening of two private healthcare centres, the rapid growth can likely further be explained by patients actively seeking care at private healthcare centres that are highly rated. Despite the higher growth rate of privately run primary healthcare clinics, public primary care in the Capital Region is still around three times as large in terms of revenue – as highlighted in Exhibit 43.

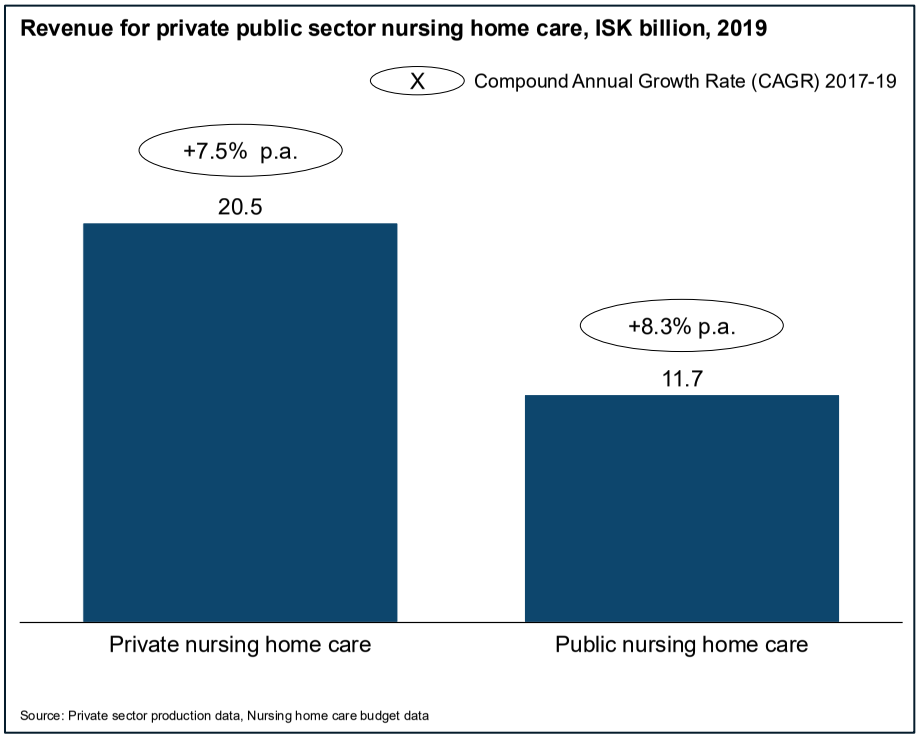
Exhibit 43. Primary care revenue from the private and public sectors.



5.4.2.2 Private nursing home care

Private nursing home care is provided by 28 private nursing homes, out of a total of 79 nursing homes in Iceland. In contrast to both capital area primary care and specialist care, private sector nursing home care generates more revenue than public sector nursing home care, as seen in Exhibit 44. Private sector nursing home care is ~80% larger in revenue than public nursing home care, and both are growing at roughly the same pace of ~7.5% per year, slightly below Iceland's total healthcare costs. Nursing home care is partly financed through patient out-of-pocket payments, based on the patient's wealth and income. The rest, ~94%, is publicly financed.

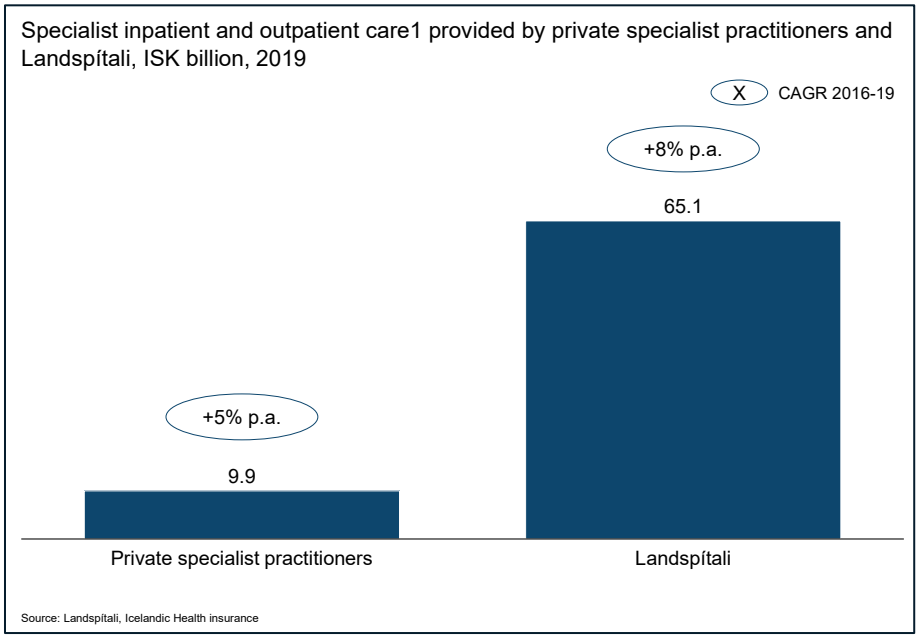
Exhibit 44. Revenue from private and public nursing home care.



5.4.2.3 Private specialist care

As with primary care, private specialist care is almost exclusively provided in the Capital Region in private specialist clinics. Private specialist care is provided by private specialist practitioners in different care categories, which are not always comparable to public specialist care categories due to differences in complexity level and the type of care provided. Exhibit 45 shows private specialist care by category compared to the specialist care provided at Landspítali. The care mix within each category differs substantially between private specialist practitioners and Landspítali; e.g., for cancer services, the private sector almost exclusively provides long-term follow-up treatments, whereas Landspítali provides all services, e.g., surgeries and chemotherapy**.** As shown in Exhibit 45, Landspítali's specialist care is ~6.5 times larger in terms of cost, and is growing in line with Iceland's total healthcare costs (~8%), whereas private specialist care is lagging, growing at only ~5% per year. For both private specialist practitioners and Landspítali, medical and rehabilitation services are among the fastest-growing segments. Cancer care, on the other hand, is also growing the fastest for Landspítali, but is shrinking the fastest for private specialist practitioners.

Exhibit 45. Specialist care by cost provided by private providers and Landspítali.



5.4.3 Private healthcare sector regulation compared to peer countries

5.4.3.1 Monitoring of the private sector and potential issues in Iceland today

In most healthcare systems where the private sector gets public financing, the private sector is also regulated. The same is true for the Icelandic healthcare system, where the Directorate of Health is the regulatory body, responsible for overseeing and monitoring healthcare providers and approving new private care providers. New private care providers must apply to the Directorate of Health for approval. The application must include what types of care will be provided, certifications of personnel, proof of sufficient equipment, etc. Icelandic Health Insurance (IHI) will monitor private sector practitioners to ensure they provide the services as described in their contracts, and the Directorate of Health is responsible for ensuring good practices are adhered to throughout the private healthcare sector. However, the Directorate of Health may be under-resourced (e.g., in terms of tools and staff) – making it difficult to monitor all providers effectively. The Directorate of Health employs 17 people in its Supervision and Quality of Healthcare Department, which equals ~46 employees per million inhabitants. For comparison, the Swedish Health and Social Inspectorate employs 770 people, corresponding to 74 employees per million inhabitants.

Once the application has been approved, a contract of five years, on average, is set in place that regulates reimbursements for provided care, and in a few cases, volumes. Once a contract has expired, the contractor can start charging top-up co-pays from patients while still receiving public reimbursement for their services. This, in combination with free volumes and the ability to both self-refer[94] and split time between the private and public sectors, can create adverse incentives[95] and outcomes in several ways. First, since waiting times for certain types of care might be long, this could enable people to buy access to care, reducing

[94] Physicians are allowed to work at both public and private practices, and those who do can refer public patients to their own private practices; this is called self-referral.

[95] Adverse incentives are when care providers' incentives are not coherent with the ones of the healthcare sector, indicating that their practices may not benefit, or may even counteract, the healthcare system.

social equity in the healthcare system. Second, many private specialist practitioners are working at both public and private practices ('split time'), and can self-refer, which can result in practitioners referring select patients to their own clinics while leaving other groups of patients to be treated within the public system.

A majority of private specialist contracts are expired today, and have been since the end of 2018. To reduce the risk of inequity and high top-up co-pays because of expired contracts, a clear process for enforcing the renewal of contracts with private specialist practitioners could be considered. Today, there are no incentives for private specialist practitioners to renew their contracts, which has resulted in a majority of current private specialist practitioners' contracts remaining expired.[96]

Finally, it is important to note that a core driver behind expanding the private sector through the 2007 Health Service Act was to 'promote efficiency and economic viability of health services'. However, based on interviews with key stakeholders in the healthcare system, there seem to be certain levels of 'coalitions' formed, which potentially limit desired competition, including when negotiating reimbursement levels.

5.4.3.2 Regulation of the private healthcare sector compared to other countries

The regulation of the private healthcare sector in Iceland differs compared to regulation in the United Kingdom, Sweden, and Denmark. Exhibit 46 provides an overview of the degree of regulation in the different countries discussed in this subchapter.

In Sweden, the private healthcare sector provides primary, secondary, and nursing home care. Primary care and most secondary care is close to 100% publicly financed, apart from certain specialist clinics, which are 100% financed through volumes linked to private health insurances. The private funding constitutes out-of-pocket payments from patients, representing a small co-pay fee that is capped to not exceed a certain amount each year. The reimbursement for primary and specialist care is a mix of procedure-based reimbursement, capitation, and fee-for-service, but with limited or no top-up co-pays allowed. There are two policies that define the role of the private sector in the Swedish healthcare system: the public procurement act (LOU) and the law on 'freedom of choice system' (LOV). The public procurement act limits volumes and freedom of establishment, with the purpose of creating competition on price. The law on freedom of choice system does not limit volume and has complete freedom of establishment, with capitation-based reimbursements, which create competition in terms of quality and attracting of patients. These policies mitigate the risk of adverse incentives for care providers, as providers need to act in favour of the system to succeed, either by providing fixed care at the lowest cost or the most high-quality care at a fixed cost.

In the United Kingdom, the private healthcare sector provides primary, secondary, nursing home, and some tertiary care. Around 10% of the population has private health insurance, which covers care on most levels in private sector clinics and hospitals, but does not generally cover primary and acute care, and accounts for a majority of the private financing in the healthcare system. Private health insurance in the United Kingdom functions as a complementary system to the public national healthcare system, and offers shorter waiting times and alternative treatments. There are some referrals between publicly and privately financed facilities, where each instance is reimbursed based on the specific services

[96] Based on interviews with key stakeholders at IHI, Landspítali, and the Ministry of Health.

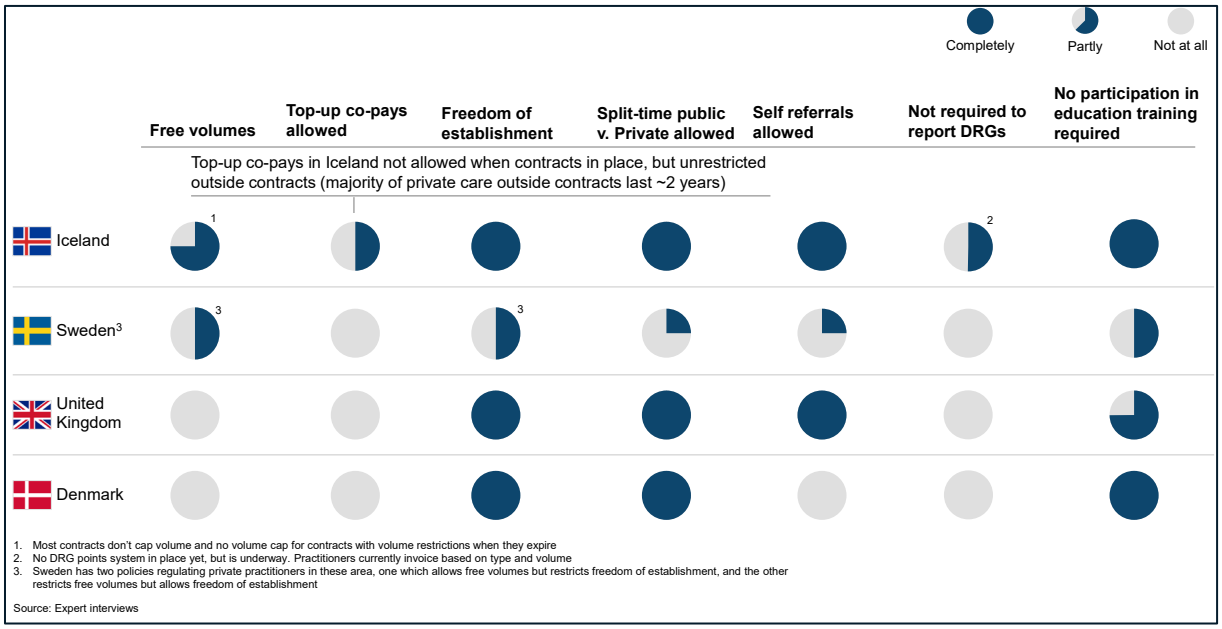
provided. The majority of primary care is provided by the private sector, as well as significant parts of secondary care. The UK system differs from other countries by having private hospitals which provide some tertiary care, which are both publicly and privately financed. However, adverse incentives can also occur in the UK system, as there are low barriers in place to hinder this – e.g., both self-referrals and split time between public and private healthcare sector are allowed. However, due to restricted volumes, these incentives are limited to an extent.

In Denmark, the private healthcare sector provides, primary, secondary, and nursing home care. There are two public insurance options – one where the majority of all care is publicly funded, which is what most people enrol in, and one where top-up co-pays are allowed but patients do not need a referral to see a specialist, and waiting times are often shorter. Overall, top-up co-pays are common, but are usually covered completely by private health insurance – resulting in few out-of-pocket payments. Unlike the other countries, all primary care is provided by the private sector, which is 100% publicly financed in the first insurance option, whereas only some secondary care is privately provided in the first insurance option. For the second insurance option, most primary and secondary care providers are privately run. Additionally, Denmark does not allow self-referrals and has predefined volumes, which helps hamper adverse incentives.

Based on the comparison in Exhibit 46, Iceland has a relatively unregulated private healthcare system. Furthermore, most public funding in comparable countries covers the costs fully, or the public funding is co-financed by private health insurance and not by out-of-pocket financing. The Icelandic private healthcare system currently has the following characteristics:

1. There is freedom of establishment.
2. Volumes are mostly free.
3. Physicians are allowed to split time between the public and private sectors.
4. Self-referrals are allowed.
5. Most private sector specialists can charge top-up co-pays since contracts are expired.

Exhibit 46. An overview of how regulated publicly financed private care is in different areas in Iceland and neighbouring countries.[97]



5.4.4 Conclusions and impact on Landspítali

5.4.4.1 Key conclusions

Enabling the private sector to provide care can bring cost efficiencies and quality improvements. However, it is important to ensure that potential benefits are indeed realized, and it is especially critical to ensure that the healthcare system as a whole is not negatively impacted. This chapter discussed the role of the private sector in the Icelandic healthcare system, focusing on the potential issues caused by private specialist practitioners being able to act on adverse incentives that may not benefit the overall healthcare system or be in line with the purpose outlined in the 2007 Health Service Act.

The analysis found that contracts with most private specialist practitioners have expired – making it possible for private specialist practitioners to charge top-up co-pays, potentially creating inequities for patients with lower incomes. Currently, ~25% of specialist private care is being financed by individuals through top-up co-pays. Furthermore, free volumes and establishment, coupled with freedom of self-referral and splitting time between the public and private sectors, may be enabling adverse incentives, where private practitioners are able to choose less complex patients to serve – leaving the more complex and costly patients for Landspítali.

5.4.4.2 Main 2040 scenario – no changes to current regulations

The impact on Landspítali from the private sector will primarily be through potential regulatory changes on how the private specialist sector is operated. Depending on what regulatory changes may be implemented, the impact on Landspítali will differ – with healthcare demand at Landspítali potentially increasing or decreasing. Determining the most

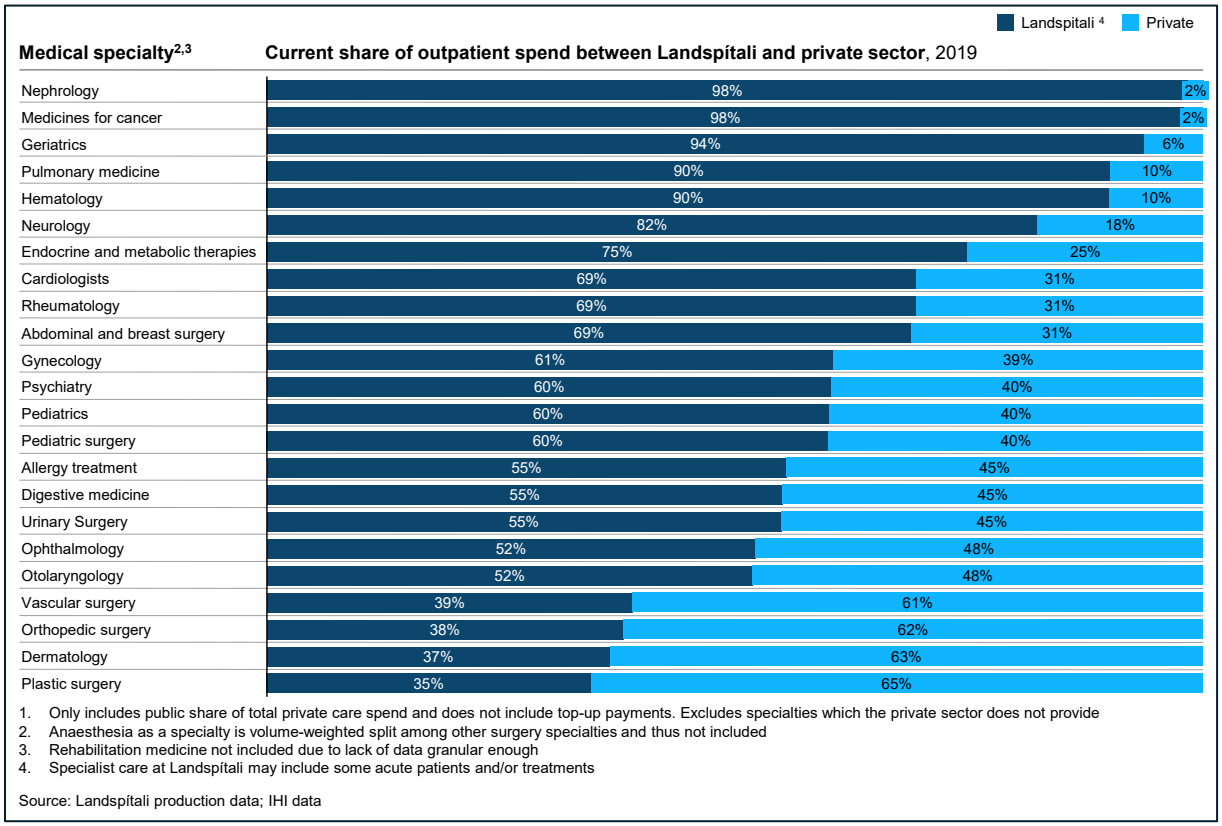
[97] The sixth column in Exhibit 46 describes requirements to report DRG points, which is set to be implemented for private specialist practitioners in Iceland. Currently, private specialist providers need to report activity to IHI, but not through DRGs.

'realistic' scenario regarding future regulatory policies on the private healthcare sector and the subsequent impact on Landspítali is challenging and would be highly speculative. Hence, modelling for the main 2040 scenario is based on the historic starting point, i.e. the role of the private sector is kept similar.

5.4.4.3 The potential range of impact on Landspítali

In this section, hypothetical scenarios of significantly increasing or decreasing the size of the private specialist sector are modelled and displayed in Exhibit 47 to capture and highlight the range of potential impact on Landspítali. More specifically, two scenarios are modelled, where the private sector would be assumed to either grow or shrink by 20% of its current share of care in each specialty. As an example, the private sector for psychiatry currently constitutes ~40% of total spend in the Capital Region of Iceland; in the model, this would either increase to ~48% or decrease to ~32%. The current share of outpatient spend between Landspítali and the private sector is shown in Exhibit 47.

Exhibit 47. Share of outpatient spend for Landspítali and the private specialist sector across specialties in 2019.



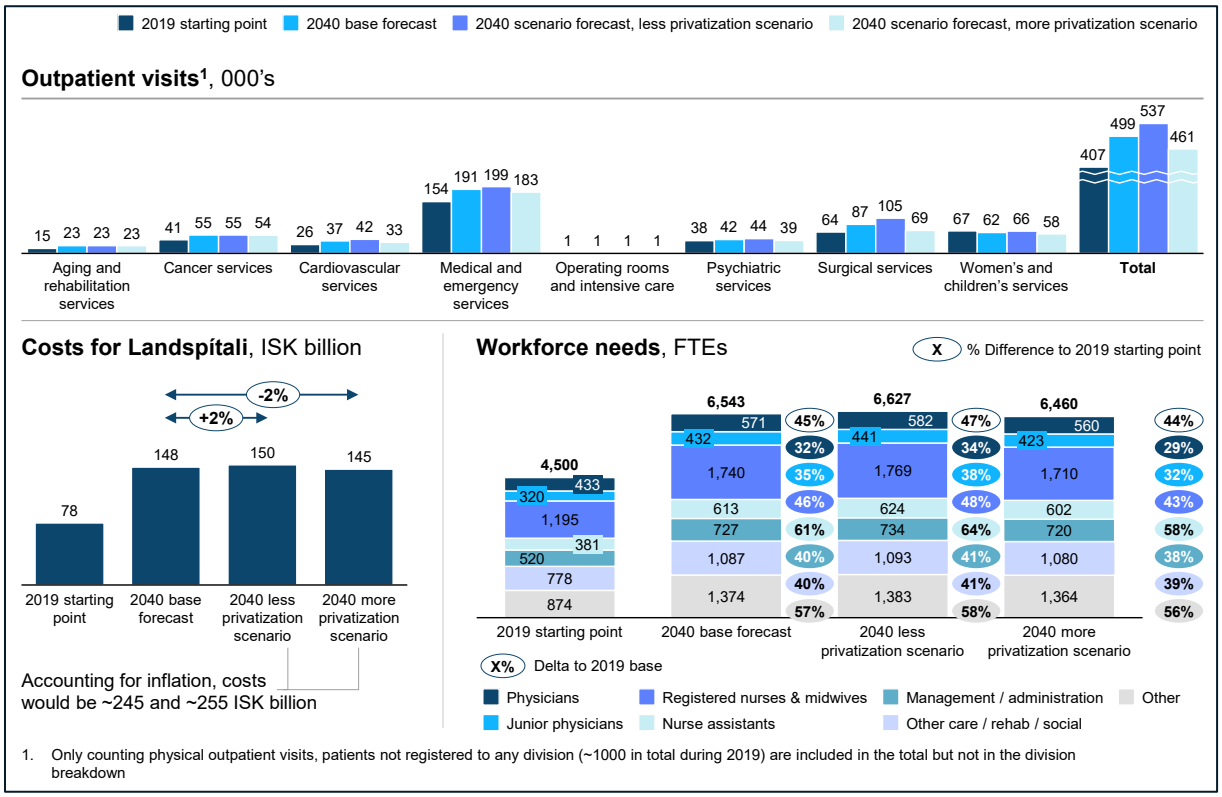
1. Only includes public share of total private care spend and does not include top-up payments. Excludes specialties which the private sector does not provide
2. Anaesthesia as a specialty is volume-weighted split among other surgery specialties and thus not included
3. Rehabilitation medicine not included due to lack of data granular enough
4. Specialist care at Landspítali may include some acute patients and/or treatments

Source: Landspítali production data; IHI data

Depending on the type of new policies enacted, a 20% increase or decrease could be considered significant and potentially unrealistic. However, this range should not be seen as a forecast value, but rather an example to help policymakers understand the impact of potential decisions on Landspítali.

The impact of a 20% increase or decrease in share of care by the private sector is highlighted in Exhibit 48. This would entail an increase or decrease of ~7.6% in outpatient visits, ~2% in costs, and ~1% in FTE need, respectively.

Exhibit 48. Impact of the strategic choice of increasing or decreasing the size of private specialist practitioners on the 2040 forecast for Landspítali.



1. Only counting physical outpatient visits, patients not registered to any division (~1000 in total during 2019) are included in the total but not in the division breakdown

5.5 Out-of-country treatments

5.5.1 Introduction

The Icelandic healthcare system is relatively small in scale, and as such, collaboration with international partners for out-of-country treatments is necessary. Landspítali currently outsources patients due to different reasons – ranging from a lack of clinical capabilities for highly unique treatments, to pre-established cross-border directives. This chapter provides an overview of which treatments are outsourced and why, and discusses the current process for out-of-country treatment decisions.

This chapter is divided into four sections:

- First, it outlines the three categories[98] of out-of-country treatments, highlights some factors that can impact patient decisions within these categories, and discusses what Iceland could consider going forward.
- Second, for each of the three treatment categories, it briefly describes current decision-making processes regarding which patients to send out of the country for treatment, and some potential issues that might arise because of this process.
- Third, it outlines a framework for out-of-country treatment decisions by evaluating four key criteria.

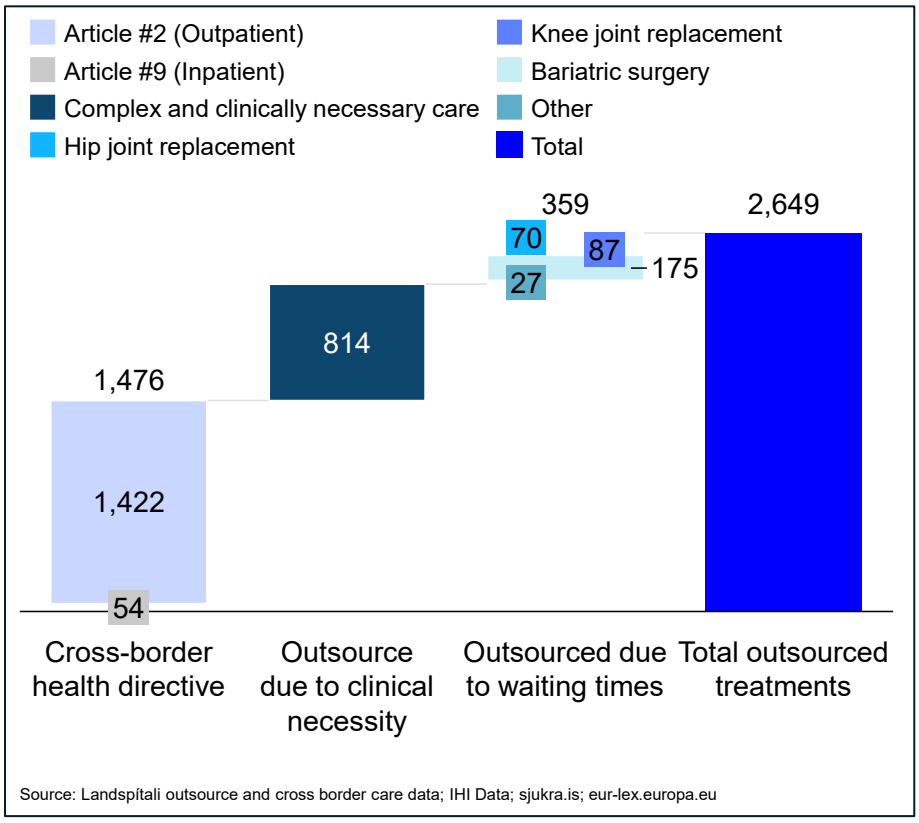
[98] The only out-of-country treatment category not included here falls under the cross-border directive's Article 12, which includes only necessary treatments for Icelandic residents who are travelling abroad, e.g., for accidents that require acute care.

- Finally, it quantifies the potential impact of sending patients abroad on Landspítali and the Icelandic healthcare system.

5.5.2 Categories of out-of-country treatments

Medical treatments for people living in Iceland are performed abroad in one of three situations: due to patients deciding to use the pre-established cross-border health directive within the European Economic Area (EEA), because waiting times are too long for a specific treatment in Iceland, or due to clinical necessity (i.e., when a complex treatments are not provided in Iceland because they require high volumes and specific expertise to be provided safely). From 2018 to 2020, the more common reason was due to the cross-border directive, amounting to 1,476 treatments in total, compared to 814 treatments due to clinical necessity and 359 due to too-long waiting times.

Exhibit 49. Number of treatments distributed out of Iceland from 2018 to 2020.



5.5.2.1 The cross-border health directive

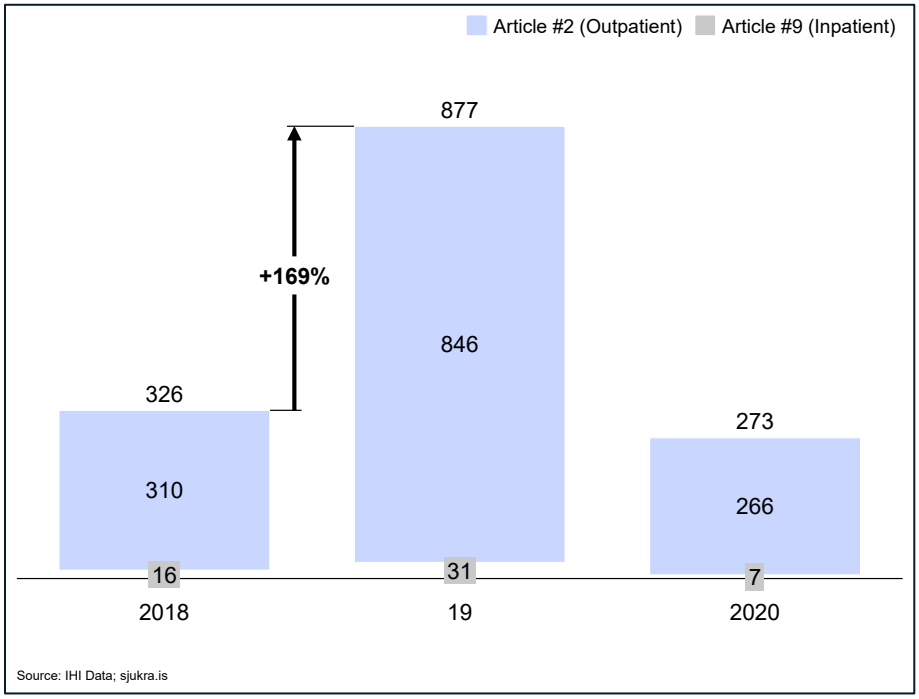
The cross-border health directive is a directive established between EEA members, with the purpose of giving residents within the EEA the right to receive medical care in other EEA countries. Individuals can receive out-of-country treatment for all types of treatments that are also provided in their home countries – however, EEA members can individually decide whether other types of treatments (i.e., treatments not provided within that country) are

deemed suitable for their citizens to apply for to have performed abroad, or if these treatments should be blocked from the directive.[99]

In Iceland, IHI is responsible for approving applications for receiving treatment abroad, and for reimbursement to the patient. Outsourced treatments under this directive can be divided into two groups: Article 2 for outpatient visits that do not require overnight stays, and Article 9 for inpatient treatments that require overnight stays. Icelandic patients can apply for care individually to private or public healthcare providers in other EEA countries. For Article 2 outpatient visits without the need for overnight stays, patients do not need pre-approval from IHI. For Article 9 inpatient treatments that require overnight stays, patients must submit an application to IHI for approval. IHI will reimburse the treatment cost if the cost is lower than or the same as in Iceland for a similar treatment. If the treatment is more expensive, patients must pay the extra amount individually. Patients must also pay for additional expenses themselves, e.g., travel and accommodation.

Article 2 treatments account for a significant majority of out-of-country treatments under this directive, as they do not require pre-approval from IHI. For Article 9 treatments, only between 20 to 30% of applications get approved. Overall, the number of cross-border treatments increased significantly between 2018 and 2019, with a noticeable dip in 2020, likely due to the Covid-19 pandemic.[100]

Exhibit 50. Number of EEA directive cross-border healthcare treatments by type from 2018 to 2020.



Short term, the directive does not incur additional costs for the Icelandic healthcare system, as the treatment reimbursement will at most match the cost of an equivalent treatment in Iceland. Long term, however, there might be a negative impact on scale benefits (both economical and in terms of quality of care) and expertise retention, as higher volumes of

[99] European Union, 'Europaparlamentets och rådets direktiv 2011/24/EU av den 9 mars 2011 om tillämpningen av patienträttigheter vid gränsöverskridande hälso- och sjukvård', *Official Journal of the European Union,* Series L 88, Volume 54, 4 April 2011, pp. 45–65, http://data.europa.eu/eli/dir/2011/24/oj.

[100] The Covid-19 pandemic restricted availability of care and travel, which reduced the number of cross-border healthcare treatments.

treatments may be performed out-of-country. As explained in the 'Centralization and decentralization of complex care' chapter, patient safety and quality of care typically have a positive correlation with the volume of procedures a hospital performs per year.[101, 102, 103] If the amount of treatments performed abroad were to increase significantly, the overall volume of treatments would go down in Iceland, which could impact patient safety. Furthermore, the directive can potentially provide an advantage to patients who can afford the additional costs related to out-of-country care, as they are able to bypass waiting lists for certain treatments by applying for care abroad.

Directly changing this out-of-country treatment category is not straightforward, as it is up to each individual patient to decide whether to seek treatment outside of Iceland under this directive. If a further increase in volume were to become an issue, indirect approaches would need to be utilized to reduce out-of-country treatments – e.g., marketing of the high quality and skill level of Icelandic orthopaedic surgeons.

5.5.2.2 Clinical necessity and too-long waiting times

Icelandic patients also sometimes receive out-of-country treatments due to clinical necessity, mainly because some highly unique and complex treatments are not provided in Iceland. This is partly due to too-low volumes, which can impact patient safety, but also due to a lack of specific expertise and equipment needed to provide such treatments. In addition, if necessary medical treatment is not provided within a certain time limit (that is justified by medical examination of the patient's health status), i.e., waiting times are too long, a patient may also be able to seek treatment out-of-country.

As opposed to the process for the cross-border health directive, physicians will in these cases apply for out-of-country care on behalf of the patient. A committee at IHI processes and evaluates the application, and all expenses, including logistics, are be covered by IHI.

For patients treated abroad due to too-long waiting times, hip and knee joint replacement accounted for the majority of the total cases before 2019, but have decreased since. Overall, the number of treatments performed abroad within the 'too-long waiting times' category increased by ~60% between 2018 and 2019, with a dip in 2020 due to the Covid-19 pandemic. An increase in bariatric surgery in 2019 drove the overall increase, which can partly be attributed to a newly established Swedish clinic lead by an Icelandic physician that specializes in this type of treatment. In addition, there was likely increased demand that could not be met by Iceland's current capacity.

There is a potential to insource some of these treatments by increasing capacity in Iceland – e.g., of bariatric surgery, where the overall amount of patients treated abroad can be significantly reduced, potentially resulting in cost benefits, given the extra costs associated with logistics when patients are treated out-of-country (as all costs are covered by IHI).

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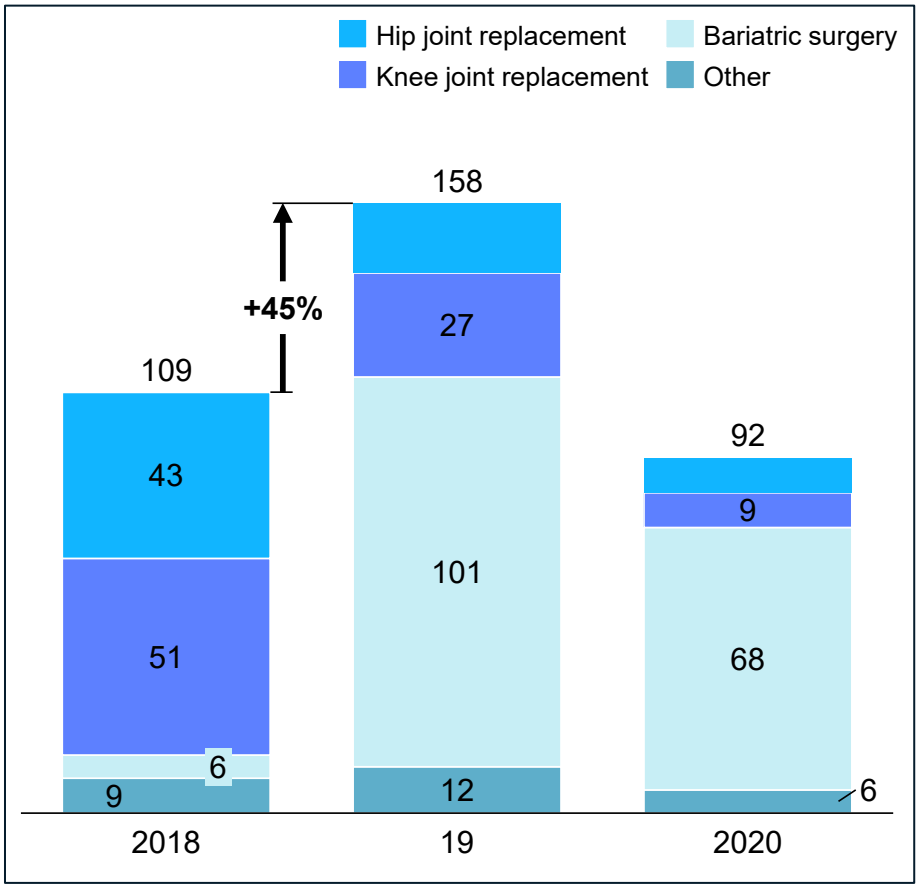
[101] M. M. Chowdhury et al., 'A systematic review of the impact of volume of surgery and specialization on patient outcome', *The British Journal of Surgery,* 2007, Volume 94, Number 2, pp. 145–161, https://doi.org/10.1002/bjs.5714.

[102] Y.-L. Nguyen et al., 'The volume–outcome relationship in critical care: A systematic review and meta-analysis', *Chest*, 2015, Volume 148, Number 1, pp. 79–92, https://doi.org/10.1378/chest.14-2195.

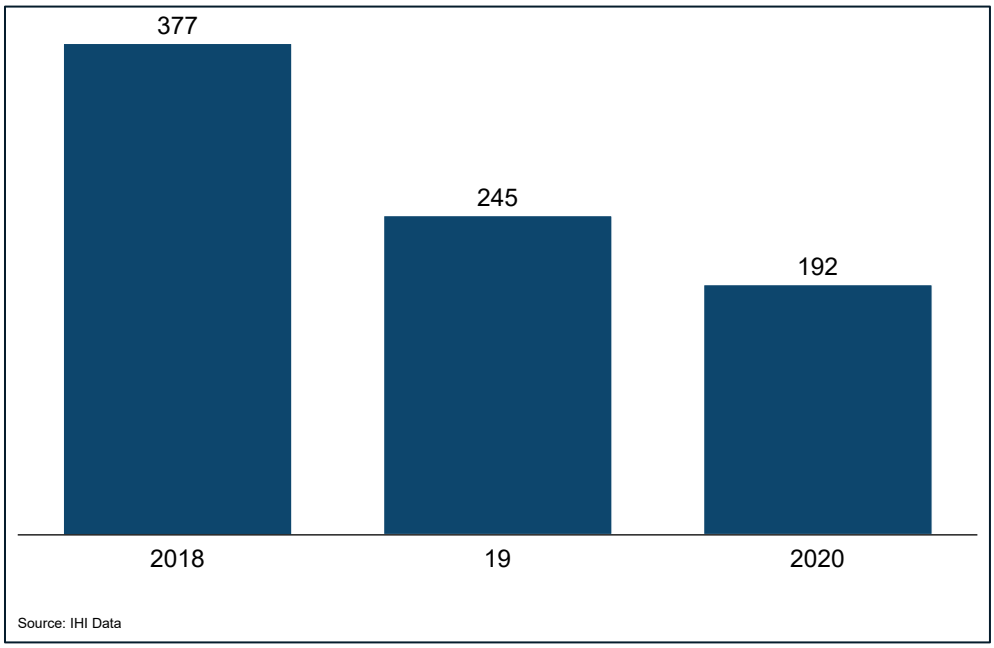
[103] H. Kaneko et al., 'Impact of hospital volume on clinical outcomes of hospitalized heart failure patients: Analysis of a nationwide database including 447,818 patients with heart failure', *BMC Cardiovascular Disorders*, 2021, Volume 21, Number 49, https://doi.org/10.1186/s12872-021-01863-4.

Exhibit 51. Number and type of outsourced treatments due to too-long waiting lists from 2018 to 2020.



For patients treated out-of-country due to clinical necessity, the number of treatments has fallen since 2018, due to both the Covid-19 pandemic since 2020, but also due to Iceland acquiring a new PET scanner in 2019 and insourcing some of the treatments previously handled abroad. In total, 814 clinically necessary treatments were performed out-of-country between 2018 and 2020.

Exhibit 52. Number of treatments performed out-of-country due to clinical necessity from 2018 to 2020.



As outlined in the 'Centralization and decentralization of complex care' chapter, due to the small scale of the Icelandic healthcare system, complex procedures occur in very small volumes – making it difficult for Iceland to maintain the necessary expertise and capabilities required to ensure the highest possible levels of patient safety.[104, 105, 106] By instead outsourcing these types of complex and rare treatments, quality of care may be improved, and patient safety preserved. Of the 814 clinically necessary treatments distributed abroad from 2018 to 2020, more than 350 different types of diseases were treated, including ~40 types of malignant neoplasms[107] – highlighting the uniqueness and high variety of the out-of-country treatments.

Overly complex and low-volume treatments at Landspítali should continue to be identified and evaluated in terms of whether patient safety would be increased by outsourcing them. As an example, ~8 kidney transplants are carried out yearly at Landspítali, which is below minimum clinical threshold volumes[108] and may result in higher risk for patients. However, in certain cases, offering the treatment in Iceland by utilizing visiting physicians from abroad may counteract the potential risk increase, while increasing access to care. This may be a better option than outsourcing treatments that are not considered too time-critical.

Additionally, monitoring and deciding whether certain out-of-country treatments should be done in Iceland is equally important, e.g., due to an increase in expertise, an increased volume of a specific disease, or scientific advancements. In order to ensure the right decisions are made in both insourcing and outsourcing out of country a structured process for making these decisions is vital; this is discussed in the following sections.

5.5.3 Current decision-making process for out-of-country treatments

Currently, there is no formalized and structured process for referring patients abroad. On a health system level, there is no clearly defined strategic direction or evaluation process regarding which clinical services Landspítali should develop internally and which services it should distribute out-of-country for the long term. Furthermore, multiple interviews with senior stakeholders in the Icelandic healthcare system[109] highlighted that choosing to insource one specific treatment is most often the result of years of analysis, planning, back-and-forth discussion, and pressure from external stakeholders. The interviews[109] also strongly suggest that there exists a lack of structure regarding limited follow-up, measurement, and overview of trends and outcomes of out-of-country clinical services. This negatively impacts Landspítali's ability to form a long-term strategy, as it is not clear which clinical services benefit from being outsourced out-of-country, nor which hospitals result in the best quality of care for different treatments.

'It has occurred that a patient was sent abroad for a treatment that could have been made available at Landspítali, had a more formal process been in place.'

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[104] M. M. Chowdhury et al., 'A systematic review of the impact of volume of surgery and specialization on patient outcome', *The British Journal of Surgery,* 2007, Volume 94, Number 2, pp. 145–161, https://doi.org/10.1002/bjs.5714

[105] Y.-L. Nguyen et al., 'The volume–outcome relationship in critical care: A systematic review and meta-analysis', *Chest*, 2015, Volume 148, Number 1, pp. 79–92, https://doi.org/10.1378/chest.14-2195.

[106] H. Kaneko et al., 'Impact of hospital volume on clinical outcomes of hospitalized heart failure patients: Analysis of a nationwide database including 447,818 patients with heart failure', *BMC Cardiovascular Disorders*, 2021, Volume 21, Number 49, https://doi.org/10.1186/s12872-021-01863-4.

[107] From Landspítali data on cross-border healthcare treatments.

[108] D. A. Axelrod et al., 'Association of center volume with outcome after liver and kidney transplantation', *American Journal of Transplantation*, 2004, Volume 4, Number 6, pp. 920–927, https://doi.org/10.1111/j.1600-6143.2004.00462.x.

[109] Interviews conducted on this topic with stakeholders from IHI, Landspítali, and the Ministry of Health.

– **Manager at IHI**

'I don't think there is any systematic discussion regarding insourcing of treatments; it is mostly individual doctors who decide whether or not to insource treatments.'

– Manager at the Ministry of Health

On a patient level, there is also a lack of a structured process or framework for out-of-country treatments. It is up to physicians to determine whether a patient should be referred abroad. Most often, the decision will be based on whether Iceland has the necessary resources (e.g., capabilities, equipment), but can also be related to too-long waiting times (e.g., for bariatric surgery).

For a limited set of care types, the referral process and the process for determining the receiving hospital are standardized. For example, there are pre-established contracts for referrals to Lund University Hospital for paediatric cardiothoracic surgery. However, for other types of care, the referral process is considered unstructured – both in terms of where the patient is referred to and the overall decision to treat a patient out-of-country.

'We should aim to contract with specific hospitals for referral of our patients instead of leaving that choice entirely up to the referring physician in each case.'

– Manager at IHI

On occasion, physicians refer patients to hospitals they have a personal connection to, which can result in varying quality of care for the same treatment. In theory, two patients with identical conditions could be moved to two different hospitals abroad, with one patient receiving better care as a result. Furthermore, patients might receive treatment abroad that requires long-term follow-up treatment, which Iceland is unable to provide.

'Landspítali could benefit from a clearer process in relation to decision making of referring patients abroad, partly to be able to identify gaps in their services which might be feasible to fill, and also to be prepared to provide follow-up care for the patients sent abroad.'

– Manager at IHI

5.5.4 Key evaluation criteria to consider for out-of-country treatments

Developing a structured and holistic framework is necessary when shifting complex care out of the country, and could be a potential solution to some of the issues outlined above. The key evaluation criteria for successfully shifting complex care within healthcare systems, outlined in the 'Centralization and decentralization of complex care' chapter, is relevant here as well and can again be seen in Exhibit 53 below – however, the framework should be further detailed out and adapted to fit the context of out-of-country treatments.

- Quality of care and patient safety should, as always, be top priority and the first evaluation criteria – e.g., out-of-country treatments should be strongly considered if the quality of care can be increased and risks reduced, as described in this chapter.
- Long-term impact on resources (e.g., expertise and talent retention) should be considered next. By moving certain patients abroad, volumes will decrease in Iceland, which can, in the longer term, impact the quality of certain treatments and might cause physicians with that specific expertise to migrate elsewhere. At the same time, however,

this may free up resources that can be utilized elsewhere. These considerations need to be weighed against each other.

- Access to care can be impacted both positively and negatively for patients, and also needs to be considered. Additional travelling and logistics are required but can allow for broader and more timely access to treatment.
- Finally, the financial aspects of out-of-country treatments should be analysed – especially when determining which treatments to insource and outsource for the long term. The costs associated with distributing patients abroad need to be weighed against the costs of developing capabilities for specific types of treatment and acquiring the relevant equipment.

The framework also needs to be adapted to fit the unique context of Iceland. For instance, given that Iceland is an island, the sustainability aspect of shifting patients abroad may need to be considered to a larger degree, as patients will need to be transported long distances. As another example, given the relatively small size of Iceland, a broader range of treatments could be considered for out-of-country outsourcing when compared to larger nations that have the scale to develop more capabilities internally.

Exhibit 53. Key evaluation criteria for successfully shifting complex care out-of-country.

Criteria	Quality of care	Resources	Access to care	Financials
Description	Impact to the **effectiveness**, **quality** and **safety** of the care the patient receives, as well as the overall **patient experience**	**Availability of, and impact on resources**, incl. beds, equipment and staff	Accessibility of the care for the patient, including **travel time** and distance required, as well as **access to specialists** and urgent care	Investigate **costs per treatment** compared to start-up costs of expanding the amounts of treatment offered in Iceland
Example questions to answer	*Will this option lead to patients receiving better quality of care?* *Will this option reduce / increase risks?* *How will this option impact the overall patient experience?*	*How will moving treatments out of country impact our ability to retain talent and expertise?* *Will we enhance efficiency of staff?* *Can we utilize the gained capacity for something else?*	*Impact of time to access for a patient? Both in terms of travel time and reduced waiting time?* *Will it be easier to access a broad range of relevant specialists?*	*Does it make financial sense to invest in start-up costs related to offering new types of treatments on a country level?* *How will outsourcing treatments impact long-term scale benefits?*

Source: The 'shifting of care' framework, developed and used by McKinsey for other healthcare system restructuring projects

5.5.5 Conclusions and impact on Landspítali

5.5.5.1 Key conclusions

Iceland currently shifts patients out of the country due to one of three reasons – with limited potential to impact the number of patients for some of these categories:

1. **Lack of clinical capabilities for certain treatments.** The Icelandic healthcare system should continually review whether insourcing select complex treatments may be an overall benefit to the system, but given its small scale, there will likely always be treatments that are too unique for Iceland to develop capabilities internally.
2. **Receiving care abroad under a cross-border directive.** There is little to be done to impact this category – this directive allows individual patients to decide whether they want to receive care abroad.

3. **Too-long waiting lists.** Iceland has the potential to increase capacity and insource additional treatments – potentially reducing the number of patients receiving treatment abroad for this reason.

The Icelandic healthcare system currently lacks a structured process for making out-of-country treatment decisions.[110] This can potentially result in increased patient risk and hinder long-term strategic planning. Formalizing a framework based on key evaluation criteria[111] to help guide decision making regarding which treatments should ideally be provided abroad (and where) and which treatments Iceland should consider for insourcing could bring significant benefits for Iceland.

5.5.5.2 Main 2040 scenario – most likely impact on Landspítali

Given that Landspítali is limited in its ability to impact most out-of-country treatment categories, the levels of out-of-country outsourcing will likely remain relatively similar – apart from treatments within the waiting list category.

The number of clinically necessary treatments outsourced is assumed to remain at a similar level going forward. While there are discussions to insource additional treatments within this category, e.g., stereotactic radiotherapy for brain tumours, pre-implantation genetic diagnosis, gender reassignment surgeries, hyperthermic intraperitoneal chemotherapy surgeries for patients with abdominal tumours, and Nuss surgeries, the discussions are still in the early stages. Furthermore, this would only affect a small number of treatments, and is therefore not expected to have a substantial impact on Landspítali's resource needs. Even in a more extreme and highly unlikely scenario (due to the arguments outlined in this chapter), e.g., if over 30% of treatments within this category were insourced by 2040, the potential insourcing of these treatments would still have a negligible effect on Landspítali as a whole. With technological advancements and more complex treatments becoming available, it is also likely that new treatments may be outsourced in the future to safeguard patient safety. All in all, it is likely that there might be shifts in *which* treatments are insourced or outsourced within this category, but the overall number of treatments is expected to remain stable. As such, no potential changes within this category are reflected in the main 2040 scenario.

For treatments sought abroad under the cross-border directive, no relative change other than the baseline demographic and non-demographic changes will be reflected in the main 2040 scenario, as the number of outsourced treatments is expected to remain stable. This is mainly because there is not much that the Icelandic healthcare system can do to impact this treatment category – it is up to every individual to decide whether they want to seek care abroad under this directive.

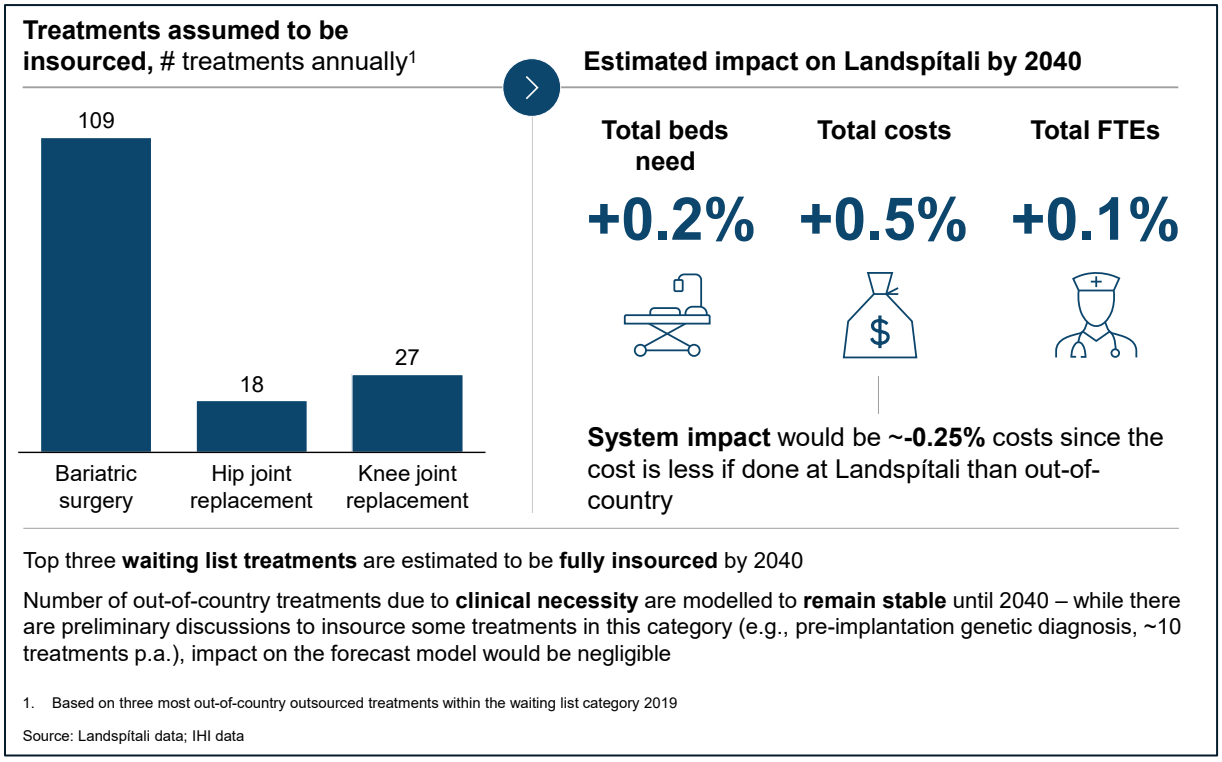
Treatments currently outsourced out-of-country because waiting lists are too long in Iceland are the most likely to shift in the coming years, as the capabilities to provide these treatments in Iceland already exist – what is lacking is the capacity. The 2030 health policy states the aim of ensuring sufficient capacity to reduce waiting lists to within contracted limits with care providers. As such, the main 2040 scenario will include the impact of insourcing the three most commonly outsourced treatments in the waiting list category – bariatric surgery, knee replacements, and hip joint replacements – amounting to ~154 treatments annually.

[110] There are a few exceptions – some decisions follow a more structured decision-making process, e.g., long-term contracts between Iceland and European hospitals for certain transplant procedures.

[111] Key criteria include quality of care, resources, accessibility to care, and financials.

The impact of insourcing these three treatments is highlighted Exhibit 54. Insourcing would have a relatively small impact on Landspítali, given the small volume of treatments – it would result in just ~0.2% additional beds needed, ~0.5% increased costs, and ~0.1% additional FTEs required. But as the total cost per treatment is lower at Landspítali than abroad, total system costs would go down by ~0.2% following this shift. The surgical services division would be impacted the most by this decision, with costs increasing by ~2.5%, FTE need increasing by ~1.3%, and the need for beds increasing by 1.7% by 2040.

Exhibit 54. Modelling output of insourcing the three most commonly outsourced treatments due to too-long waiting lists, as included in the main 2040 scenario.



Given the relatively small impact stemming from this strategic choice, further insourcing of treatments could be seen more as a strategic decision than an impact driver. The more significant impact potential related to out-of-country treatments is likely related to the decision-making process of outsourcing. By implementing a structured process that objectively evaluates key criteria for when to insource or outsource a treatment, patient safety can be improved, and long-term strategic planning alleviated.

5.6 Funding and focus on research and education

5.6.1 Introduction

Medical research and education, together with patient care, form the core of a university hospital's activities. Sufficient funding and support for medical research and education result in tangible benefits for the institution and broader society. Landspítali currently has comparable funding levels for education, but its research funding and ranking in terms of normalized citation impact have declined over the years. This chapter presents a fact base on the role and future vision for medical education and research in Iceland, and benchmarks Landspítali's current funding levels with comparable healthcare institutes. Furthermore, the

funding process is explored and the potential benefits of improving that process and increasing funding levels for medical research and education are discussed.

This chapter is divided into three sections:

1. A brief overview of medical education at Landspítali is presented, including benchmarking spending against other university hospitals.
2. A similar overview of medical research at Landspítali is presented, with the addition of exploring potential improvement areas in the funding process.
3. The potential benefits of adjusting the levels of research and educational funding are discussed further.
4. Lastly, the potential funding for medical research and education in Iceland by 2040 will be quantified and its impact discussed.

It is important to note that of Landspítali's current funding, there is no funding earmarked for research or education. Thus, Landspítali is required to internally allocate some of its operational block funding towards research and educational activities. As such, the numbers presented here are internal estimates conducted by a team within Landspítali working on enhancing transparency on actual spending and funding on these activities within the hospital.

5.6.2 Medical education

Strong medical education is a prerequisite for maintaining an adequate medical staffing pipeline within a healthcare system and maintaining quality of care for patients. Landspítali provides the majority of all medical vocational training and specialization for healthcare professionals in Iceland. Although the 2030 health policy states the aim of SAK taking a larger role as a teaching hospital in the coming decade, Landspítali's role within medical education will likely continue to be predominant.

Landspítali understands the importance of its role as the key medical educator in Iceland, as is apparent in its defined vision, e.g., of becoming an attractive educational institution and ensuring the education it provides is in line with the nation's needs. The Icelandic healthcare system and Landspítali also understand that staffing in health services is and will continue to be a challenge. This is especially true in the Icelandic context, where many medical professionals choose or are required to at least partly finalize their education abroad, leading to some staying abroad indefinitely. As such – and as argued in Iceland's 2030 health policy – there is a need to continuously ensure sufficient funding for Landspítali's educational role.

It is worth noting that postgraduate specialization in Iceland is limited, with full postgraduate education offered in only a handful of specialties. This is why many Icelandic medical students are required to study abroad. Considering the size of the Icelandic healthcare system, this is not surprising. However, as presented in a report published by the Ministry of Health in 2020,[112] the scope of postgraduate offerings in Iceland has been expanding somewhat in recent years (e.g., a full emergency medicine specialization is now offered), and opportunities for further expansion exist. Further expansion may result in certain benefits for the Icelandic healthcare system, e.g., facilitating sufficient staffing across specialties, and reducing the share of clinical staff lost to hospitals and practices abroad. As further

[112] Ministry of Health, 'Sérfræðinám lækna og framtíðarmönnun, skýsla starfshóps', May 2020

expansion would require increased education funding and significant administrative effort, a cost–benefit trade-off would need to be conducted.

5.6.2.1 Medical education spending

Before looking ahead, it is essential to review the current funding of education at Landspítali. In total, Landspítali has ~1,700 enrolled students, of which the majority are medical and nursing students. The student population has grown by an average of 3.7% per year in the last decade. As displayed in 55, Landspítali spends ~2.4%[113] of its total spending on medical education. Landspítali's spend of ~ISK 1.3 million per year per undergraduate medical student[114] is in line with university hospitals in neighbouring countries, with Finland and Sweden spending ~ISK 1.5 million per year and ~ISK 1.2 million per year, respectively. The spending per postgraduate student is higher at Landspítali (~ISK 3.2 million per year[115]) than in the benchmarked countries (~ISK 1.5 million per year in Finland, and ~ISK 2.3 million per year in the United Kingdom), as seen in Exhibit 56.

These benchmarks indicate that, at least currently, Landspítali's medical education funding needs are being met. As the demand for healthcare in Iceland continues to grow, and thus the need for a continuous pipeline of well-educated clinical professionals, it is likely wise to review these funding levels often to ensure sufficient funding for Landspítali's educational role. Additionally, if the Icelandic healthcare system decides to further expand the scope of its postgraduate offering, the current funding allocated for education at Landspítali (~2.4% of total spend) may need to be revised accordingly. This funding should also ideally be earmarked for education rather than competing with the patient care budget, as discussed further below.

[113] Based on internal estimates made directly by Landspítali.

[114] Based on internal estimates made directly by Landspítali.

[115] Based on internal estimates made directly by Landspítali.

Exhibit 55. Landspítali's education cost breakdown in 2020.

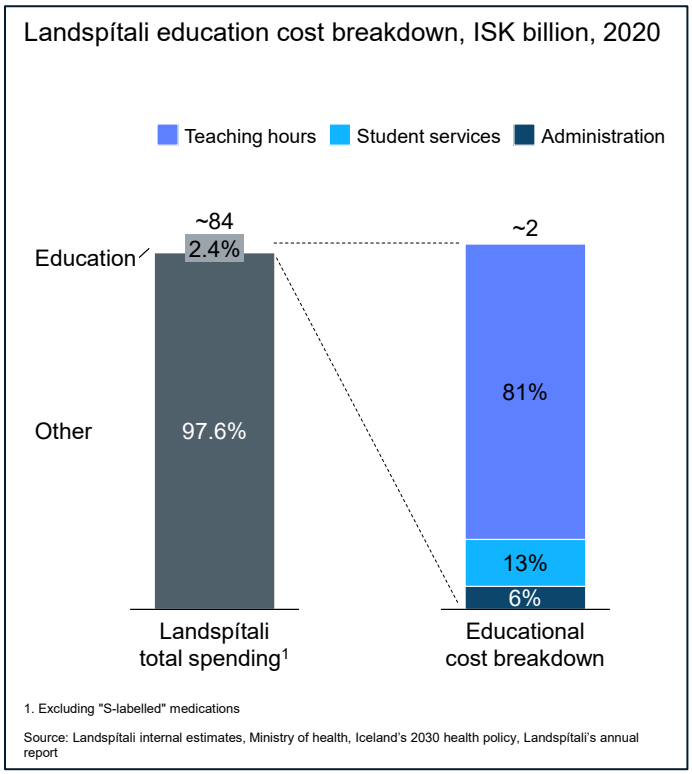
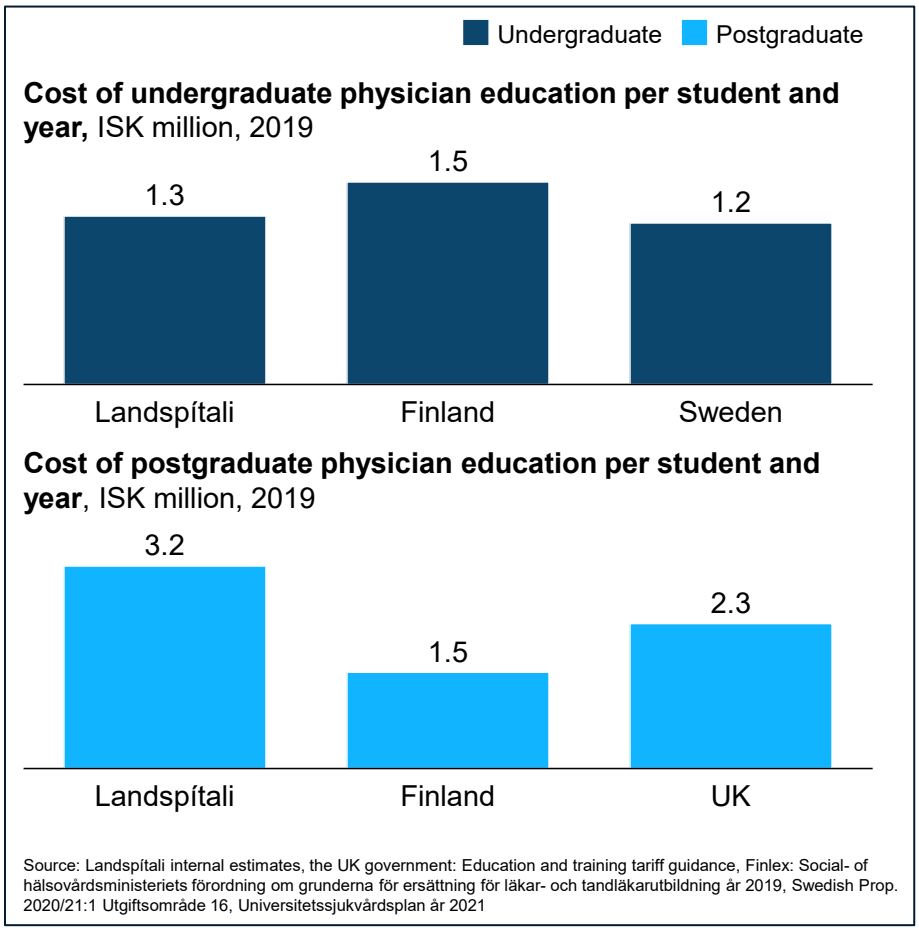


Exhibit 56. The total cost of medical education per student.



5.6.3 Medical research

Medical research plays a vital role in advancing healthcare services and the continuous education of clinical professionals. Consequently, research is an integral part of university hospitals' operations and their ability to provide quality care. Furthermore, a strong research environment at a university hospital can help attract and retain highly skilled clinical workers, which in today's globalized environment is even more imperative in the Icelandic context.

'*Research is an important recruiting tool for Landspítali.'*

– Senior physician at Landspítali

Medical research in Iceland is conducted at Landspítali, the University of Iceland, deCODE genetics, and other research institutions (e.g., the Icelandic Heart Association).[116] Although deCODE, the University of Iceland, and the Icelandic Heart Association are prominent in medical research in Iceland, and effective collaboration between these institutions and Landspítali is beneficial to the overall medical research field in Iceland, the focus here will be on Landspítali, in accordance with the scope of this report.

Landspítali's stated future vision within research is for its quality and funding to be comparable to other Nordic university hospitals. The 2030 health policy echoes this, stating that medical research should be comparable in quality and volume to research elsewhere and that clinical staff shall have the opportunity to engage in research. However, the current structure of and funding for research at Landspítali is likely not well adapted to achieve these goals.

5.6.3.1 Medical research spending and outcomes

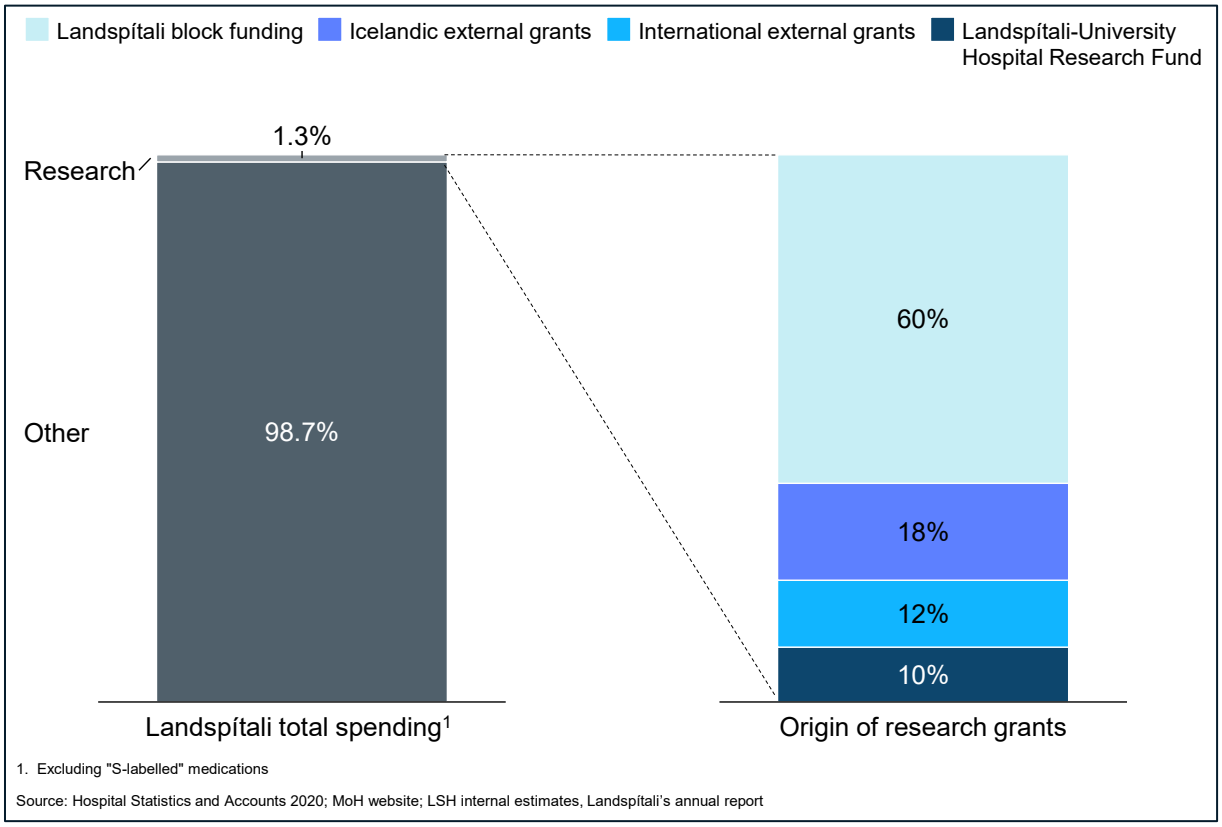
As is often the case for university hospitals, funding for research at Landspítali comes from various sources. These can be seen in Exhibit 57, and include domestic and international contributions (private donations and external research funds, totalling ~30% of research spend at Landspítali), the Landspítali research fund (~10%), and funds taken directly from Landspítali's block funding (~60%[117]). The total research spend at Landspítali is equal to ~1.3% of its overall spending.[118]

[116] Medical research is also conducted to a smaller degree at SAK.

[117] Based on internal estimates made directly by Landspítali, with estimated research spend in 2020 being ~ISK 770 million.

[118] Landspítali spends ~0.9% of its total spend on research (~0.8% from block funding and ~0.1% from the Landspítali University Hospital Research Fund). However, accounting for external grants, the total research funding at Landspítali equates to ~1.3% of total spend.

Exhibit 57. Landspítali's cost and research funding breakdown for 2020.



1. Excluding "S-labelled" medications

Source: Hospital Statistics and Accounts 2020; MoH website; LSH internal estimates, Landspítali's annual report

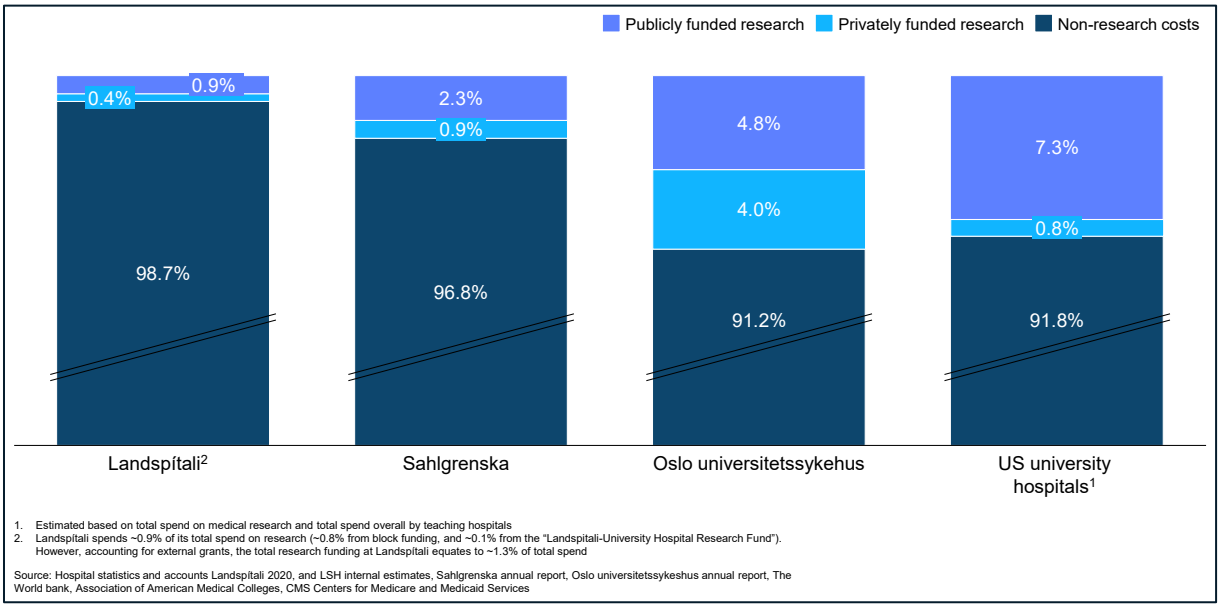
This ~1.3% share of total spending at Landspítali is considerably lower than other Nordic and US university hospitals, where medical research accounts for between 3 to 9% of their total spending, as seen in Exhibit 58. According to interviews with Landspítali and other key stakeholders in the Icelandic healthcare system, this comparatively low level of research spending at Landspítali is relatively new.[119] The financial crisis of 2008 struck the Icelandic economy particularly hard, and as a result, public spending on healthcare was reduced from ISK 153 billion in 2008 to ISK 134 billion in 2012, and rose slowly from there. As clinical demand on Landspítali did not decline in the same manner, the hospital was required to increase productivity and cut down on some auxiliary activities, including research. Physicians interviewed at Landspítali argue that these effects are still felt today.

'When the hospital became financially strapped, research was a key area [that] Landspítali cut. We cannot back-calculate this, since research funding is not earmarked, but physicians at Landspítali do not get the same research capacity today as they used to.'

– Former physician at Landspítali

[119] Interviews conducted with stakeholders from Landspítali, IHI, the University of Iceland, and the Ministry of Health.

Exhibit 58. Breakdown of research financing as a percentage of costs for Nordic and US university hospitals.



1. Estimated based on total spend on medical research and total spend overall by teaching hospitals
2. Landspítali spends ~0.9% of its total spend on research (~0.8% from block funding, and ~0.1% from the "Landspitali-University Hospital Research Fund"). However, accounting for external grants, the total research funding at Landspítali equates to ~1.3% of total spend

Source: Hospital statistics and accounts Landspítali 2020, and LSH internal estimates, Sahlgrenska annual report, Oslo universitetssykeshus annual report, The World bank, Association of American Medical Colleges, CMS Centers for Medicare and Medicaid Services

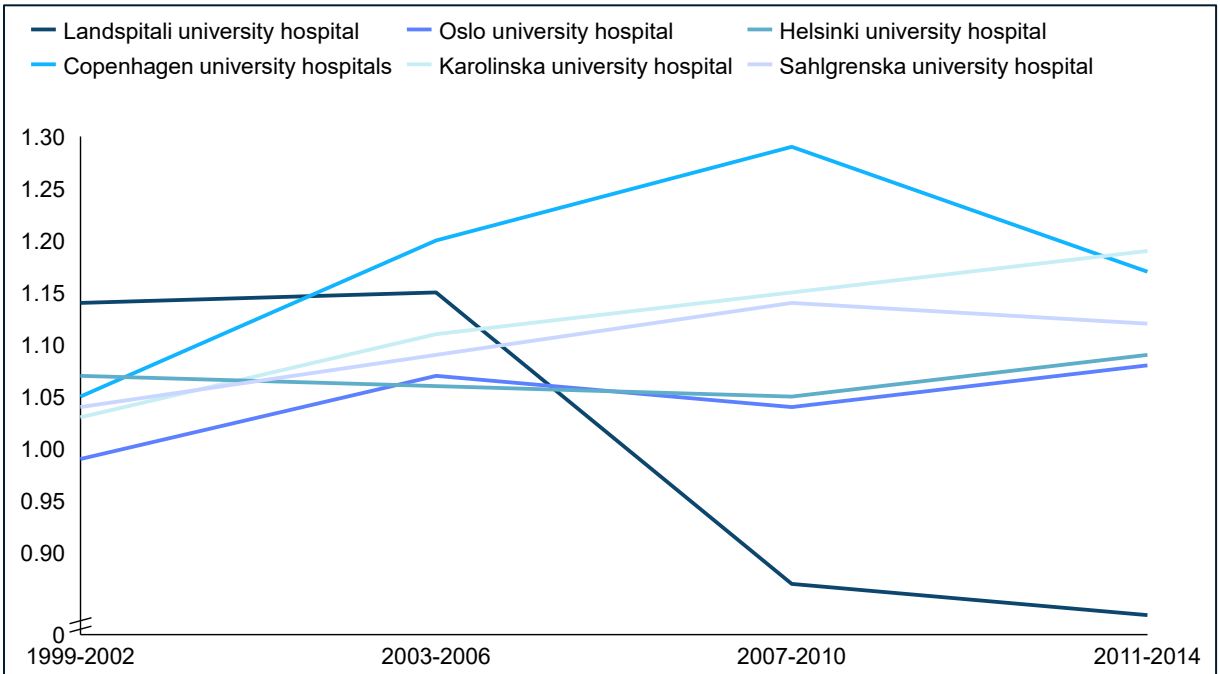
These cuts in research funding at Landspítali may be the cause of the decline in research outcomes in the past decade. Before the 2008 financial crisis, Landspítali was the frontrunner among Nordic university hospitals in research outcomes, as measured by normalized citation impact – shown in Exhibit 59. In the years following the crisis, Landspítali had dropped to the bottom of the list of benchmarked Nordic university hospitals.

If Landspítali is to realize the healthcare system's stated future vision to provide medical research of comparable quality and volume as other international university hospitals, its comparatively low funding level may need to be revised.

'The scientific work should be on a comparable level to other Nordic university hospitals; one prerequisite should be staff receiving time and facility to pursue scientific activities side by side with other duties.'

– The 2030 health policy

Exhibit 59. Normalized citation impact rates for university hospitals in the Nordics from 1999 to 2014.



Source: Comparing research at Nordic higher education institutions using bibliometric indicators, covering the years 1999-2014, 2017, The World University Rankings, World University Rankings in Clinical and health

5.6.3.2 Lack of a funding structure

'The funding level is not the only issue. The funding structure needs to be strengthened – the research funds should be earmarked for research to ensure physician time for research is protected.'

– Senior physician at Landspítali

To enable researchers at a university hospital to pursue their work and unlock quality research outcomes, increasing funding levels alone is likely insufficient. A structured funding process is also a key enabler. Today, apart from a few projects funded through external grants, Landspítali does not receive earmarked research funding from the payor. Thus, it needs to allocate funding from the general block funding received each year. This internal funding allocation at Landspítali is currently not planned – the funding amount is not decided on internally at the start of a year, but rather calculated at the end of the year based on estimates of research time allocation for clinical staff.

This likely leads to a few issues for research activities within the hospital. First, Landspítali receives no indication from the payor regarding to what degree research should be funded and focused on. Second, it likely leads to conflicts between funding for clinical care and research, putting research spending at risk of cuts when the hospital becomes financially strained. Third, it makes it difficult for Landspítali to identify and communicate how much funding and time it can afford to allocate its researchers throughout the year.

To address these and other potential shortcomings of the research funding process, it may be helpful to look to other healthcare systems. Exhibit 60 compares the funding approach for research in Sweden to that of Iceland. In Sweden, the government earmarks a share of its annual healthcare budget specifically for research. The Ministry of Social Affairs and the

Swedish Research Council then decide on the key strategic priorities within research, and distribute the funding mostly in line with the aligned strategic direction. Once a research institution (e.g., a university hospital) receives the earmarked research funding, it funds research projects mostly in line with the overarching strategic direction of the healthcare system, but also partly based on its own strategic priorities.

'We need to improve the entire process of how we fund research. We can learn a lot from the Swedish system, which works well with clearly earmarked funding and strategic priorities.'

– Manager at the Ministry of Health

Exhibit 60. Funding approach for medical research in Sweden versus Iceland.

	The Swedish research funding process	How it differs in Iceland
Government	Government decides annually funding of research Increases annually	Research budget is not specifically decided upon as it is part of total healthcare spending
Ministry	Ministry distributes research funds between universities and agencies Decides which research areas should be funded	Landspítali receives a general lump sum each year, of which it has autonomy over to a large degree Limited guidance on priorities
Government agency	Agency funds research in line with government priorities Explicitly asks for research in critical areas	No agency in place for distribution or oversight Council in place to ensure research is in line with ethical standards
University	University funds research which is either: - in line with ministry guidelines - of interest of the university	Landspítali distributes funds internally Lack of clear guideline on research focus and thus spend
Research project	Projects in line with government ambitions get additional funding sources to apply to	Nearly all funding applications are approved - funding per project thus often low

Source: SCB, Swedish government, Strategy working group

The Icelandic healthcare system may benefit from thoroughly reviewing and adopting some elements of the Swedish (or other) funding processes. Earmarked research funding could be a key priority for the system to adopt. It would enhance transparency, prevent inadvertent cuts to research funding, and enable researchers at Landspítali proactivity to dedicate sufficient time to research activities. Setting strategic research priorities to help guide which projects to fund may aid Landspítali at excelling in certain areas where it is already strong.

'We lack prioritization in funding allocation – we follow an egalitarian approach, where all who apply get some funding. This does not produce excellence and leads to most projects being underfunded.'

– Senior physician at Landspítali

It is important to note that some of the findings discussed in this chapter also apply to educational funding at Landspítali – e.g., the lack of earmarked funding and estimated back-calculations. Although the same risk of cuts during financially constrained times is less of a risk for education, as students still require time and focus from their educators, it is likely

beneficial to consider similar process changes to educational funding as those described for research.

5.6.3.3 Potential benefits from increased medical research and education spend

As argued above, funding levels for medical research at Landspítali are lower than at other university hospitals, with outcomes declining, while education spending seems in line with peers. However, there is a clear ambition from the Icelandic healthcare system that research and education spending should be in line with peers, which would entail an increase towards research spending from current levels.[120] This subchapter explores the benefits of such action.

While the exact benefits of increased medical research and education spend are challenging to identify exhaustively, there are three main categories of acknowledged benefits that other systems have experienced. These are improved attraction and retention of talent, enhanced care delivery, and broader economic benefits.

The attraction and retention of talent is, and has been, a challenge for university hospitals in recent years, partly due to a perceived shortage of clinical workers and more global competition for talent. An increase in research spending has been shown to aid in attracting high-performing physicians and nurses by enabling them to conduct research that interests them and further enhances their skills. A systematic review of research cultures in Australian hospitals highlighted this impact, finding a significant association between increased enablement of research for staff, improved satisfaction, and enhanced organizational efficiency. Furthermore, increased research spending may also enable leading senior researchers to attract high-performing trainees, supporting a pipeline of leading clinicians.

'The lack of research funding and focus at Landspítali is clearly losing us talent.'

– Senior physician at Landspítali

Sufficient levels of medical education spending have also been shown to enhance the attraction and retention of clinical staff. A university hospital that offers a large breadth of specialization attracts more students, increasing the pipeline of talent secured at the hospital. Additionally, the higher educational spend may enable the hospital to offer attractive technologies and more innovative procedures, attracting high-skill clinicians.

The attraction and retention of talent may be the key benefit of increased research spending and capacity (and sufficient education spending) in the Icelandic context. Due to its size, it is difficult for Iceland to offer a full breadth of specialization within medical education, leading to many clinical students seeking all or some of their education abroad. In addition, Landspítali is the country's only tertiary university hospital, accentuating the importance for the hospital to ensure strong attraction and retention of talent. Increased research spending may aid in increasing the return rate of physicians specializing abroad and attract and retain research-oriented physicians.

'Many don't return from abroad because they know of the lack of research capacity they would receive at Landspítali. Of those that do return, many turn to the university or deCODE.'

– Manager at the Ministry of Health

[120] Stated in Landspítali's future vision, indicated in the 2030 health policy, and is the consensus from multiple interviews with key stakeholders within the healthcare system.

Care delivery includes benefits in the quality or efficiency of healthcare provided at the university hospital. Increased research spending boosts the ability to conduct clinical trials and real-world evidence studies – increasing the number of innovative treatments and therapies offered to patients. In the United Kingdom, an econometric analysis of increased research spend on musculoskeletal and cardiovascular diseases and cancer found a 25% internal rate of return. Of this 25%, 10 percentage points were realized as health gains and the remaining 15 percentage points as benefits to the broader economy.

Enhanced education spending can result in higher quality and more specialized education, which can increase the expertise and skill set of graduates employed in the healthcare system. An economic evaluation of 1,298 academic hospitals conducted in the United States found a statistically significant association between higher medical education funding, reduced patient mortality, and improved resident performance.

Broader economic benefits may also result from increased spending on medical research. More support for medical research within an economy creates additional attractive jobs in the health and life-sciences sector, enhancing the general economy. Increased research spending may also lead to further innovation within life sciences and new commercial activity and income for the sector.

Finally, with the Covid-19 pandemic still ongoing, it is worth mentioning that enhanced funding for medical research and education is beneficial during demand surges, as it creates a buffer for the healthcare system. With more clinicians being secured within Landspítali to work on research or education at least part-time, additional capacity can be tapped into temporarily during times of crisis like the Covid-19 pandemic.

5.6.4 Conclusions and impact on Landspítali

5.6.4.1 Key conclusions

As Landspítali is a university hospital, medical research and education are core elements of its operations, bringing benefits to other parts of Landspítali and Icelandic society. This chapter discussed current research and education activities at Landspítali, and the benefits of increased spending on such activities, e.g., increased retention and higher quality of care.

It was found that medical education spend at Landspítali per student is in line with neighbouring countries, and as long as the share of total spend (~2.4% today) is maintained, the spend per student is likely to stay in line with benchmarks. In recent years, the scope of Iceland's postgraduate offerings has expanded somewhat, and there are ongoing discussions that further specialized education may be offered in Iceland in the coming years. If this is decided upon, current funding levels for education may need to be revised accordingly. However, as potential additions to the postgraduate offering at Landspítali are still being explored, and the spend per student today is comparable to benchmarks, a shift in funding for education is not assumed in this report, other than maintaining the current relative share of spend.

For medical research, it was found that spending appears to be significantly lower at Landspítali, and its normalized citation impact rating has fallen steadily during the 21st century. As both medical research spending and the normalized citation impact rating have been experiencing a downward trend, this risks a continuing impact on the attractiveness of

Landspítali as an employer and institution – so addressing this should be a matter of consideration.

Furthermore, the research and education funding processes at Landspítali are unstructured and not optimally designed. Healthcare services, research, and education are funded from the same budget, which increases the risk of funding conflicts between them. Additionally, research grants tend to be granted to all applying for them, which risks dilution per grant and may result in underfunding of most research projects.

5.6.4.2 Main 2040 scenario – increased spending on medical research

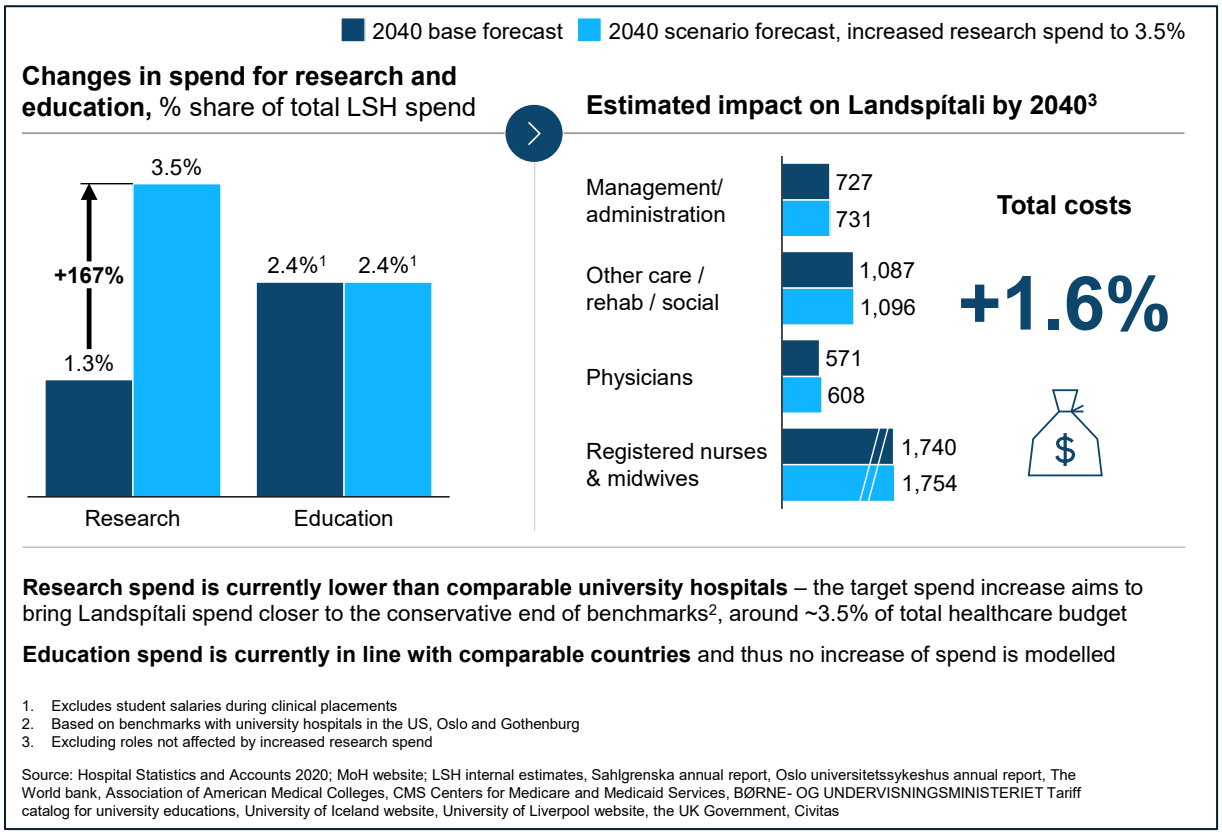
Landspítali and the Icelandic healthcare system share the vision that support for medical research and education, and their quality and outcomes, should be comparable to neighbouring countries. Today, medical research spend is significantly lower at Landspítali than in benchmarked institutions elsewhere. An increase to comparable levels is likely needed if the Icelandic healthcare system is to achieve its vision.

For the coming decades, the exact funding level is hard to pinpoint, but it is likely to fall within the range of benchmarked hospitals – ranging from a roughly 3 to 9% share of Landspítali's total spend. The exact funding level is ultimately a political decision. For the main 2040 scenario, 3.5% of Landspítali's total spend will be included, bringing Landspítali to comparable levels with the low end of the benchmarked range. While seemingly conservative, this would entail almost a threefold increase from current levels. However, to determine the full range of potential future impact, the upper end of the benchmark range (~9% share of Landspítali's total spend) is also modelled in the following subchapter. For education, current levels of spend are in line with neighbouring countries, so a shift in spending is not expected nor modelled.

Although increased research funding is likely to result in tangible benefits for Landspítali and the broader Icelandic healthcare system (e.g., through increased staff retention), this report focuses on future capability, capacity, and financial needs. Thus, the increase in research spending is modelled through its impact on FTEs and costs at Landspítali, as enabling more employees to conduct research would require an increase in clinical staff.

The impact on Landspítali from increasing total research spend to 3.5% of total expenditure is highlighted in Exhibit 61. This would result in an increase of total costs and workforce need, as more time would be spent on conducting research. The total costs would increase by ~1.6 % and the FTE need would increase by ~65 FTEs, of which the majority would be physicians.

Exhibit 61. An increase in research spending to 3.5% as a share of total spend entails a 167% increase, but could generate indirect benefits for the system.

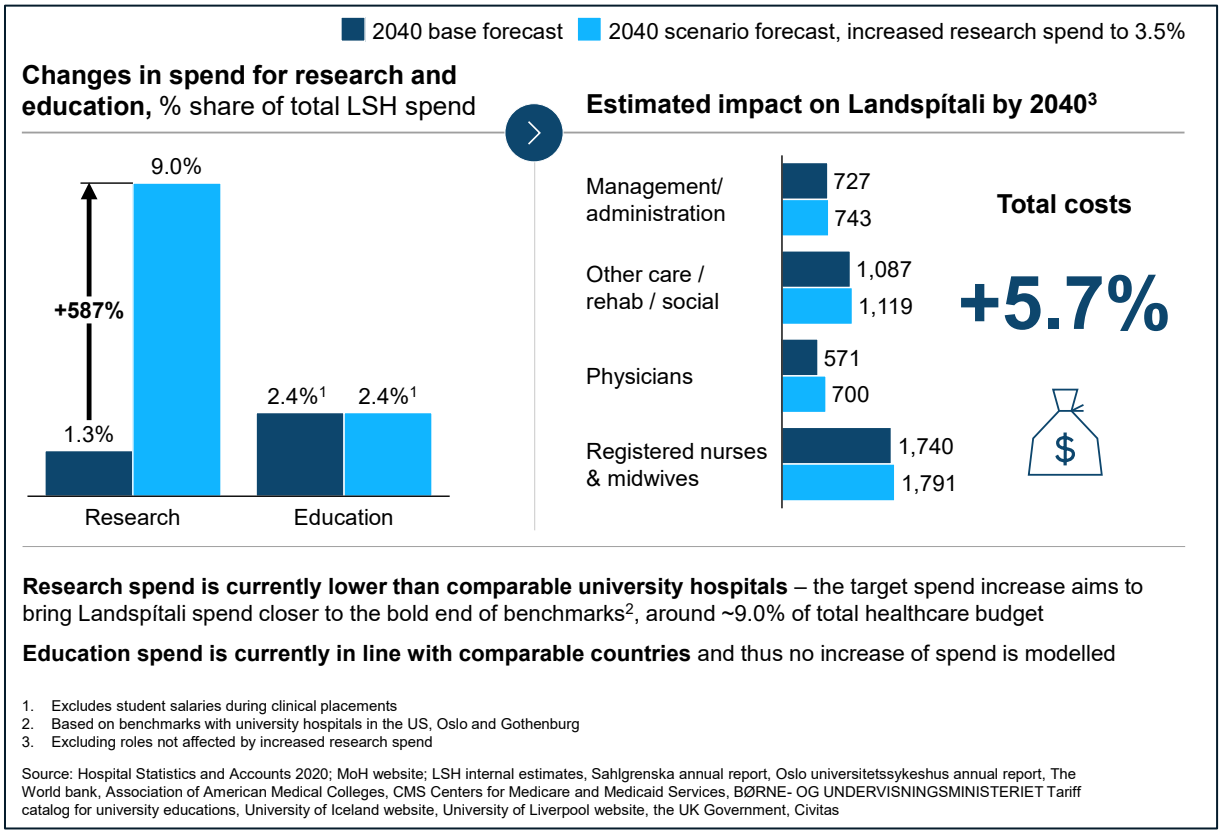


5.6.4.3 The potential range of impact on Landspítali

To highlight the full potential range of impact from increasing research funding, the impact of reaching funding levels comparable to the upper end of the benchmark range (9% of total spend) is modelled and displayed here.

The impact on Landspítali from increasing total research spend to 9% of total expenditure is displayed in Exhibit 62. Similar to the main 2040 scenario, the impact reflected in the model from this is related to cost and workforce increases – with a total cost increase of 5.7% and an increased FTE need of ~229 FTEs, of which the majority would be physicians.

Exhibit 62. An increase in research spend to 9% results in increased cost and FTE need.



5.7 Coordination role of Landspítali

5.7.1 Introduction

To fully understand the role of Landspítali going forward, this report has also examined different types of coordination roles typically seen in healthcare systems, and considered whether they are or might be within the scope of Landspítali's role in the coming decades. The functions discussed in this section are: procurement, centre of excellence, digital infrastructure and guidelines, and placement of care. For each function, an overview is given of how it is currently organized, and then the trade-offs of centralizing it or coordinating these to a larger extent. Finally, it discusses whether Landspítali or another institution in Iceland would be the most suitable owner of the function, and the related impact.

5.7.2 Overview of functions that are often centrally coordinated in healthcare systems

Table 1 outlines four functions that are often deemed to have the most impact when centralized within healthcare systems. These are then analysed more in-depth, in terms of the potential of coordinating them from a centralized body (e.g., Landspítali).

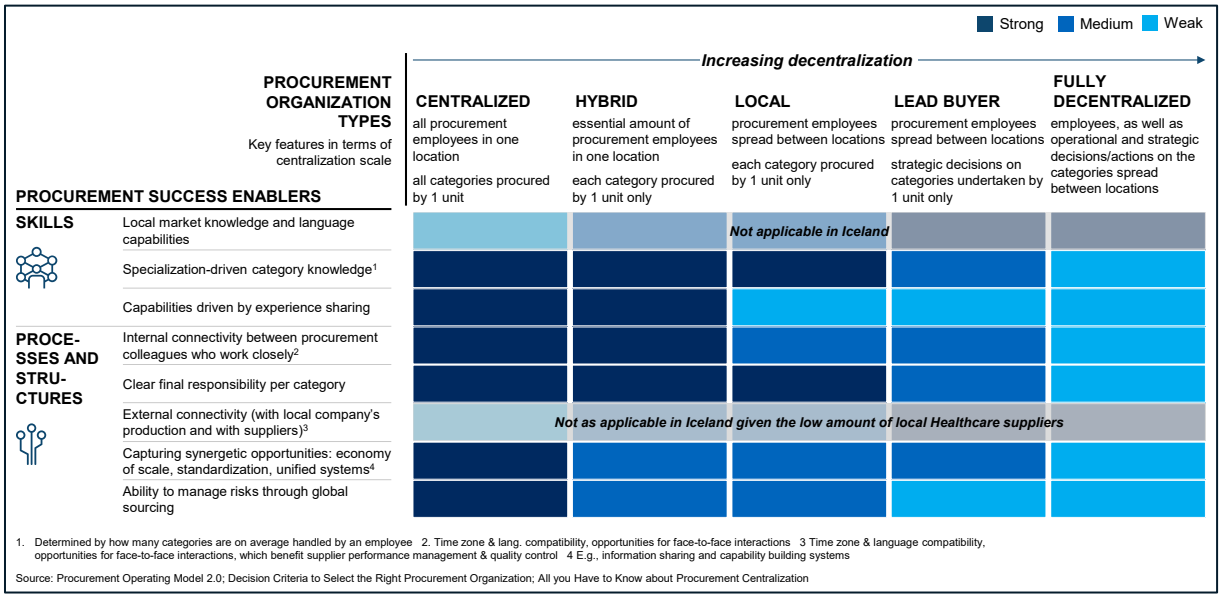
Table 1. Selected functions that could be centrally coordinated in Iceland.

Function	Description	Current situation in Iceland
Procurement	Centrally coordinating all Icelandic healthcare procurement – creating opportunities for scalable benefits and higher quality of procured products	Not centralized
Centre of excellence	Compiling and disseminating best-practice information – ensuring the use of healthcare and operational best practices throughout the healthcare system	Not centralized
Digital infrastructure and guidelines	Coordinating and standardizing the digital infrastructure and capabilities used throughout the Icelandic healthcare system	Centralized at the Directorate of Health
Placement of care	Coordinating body responsible for ensuring patients are distributed to and treated in the optimal healthcare centres based on the capabilities needed for the specific treatment, quality of care, and waiting times	Not centralized

5.7.3 Procurement

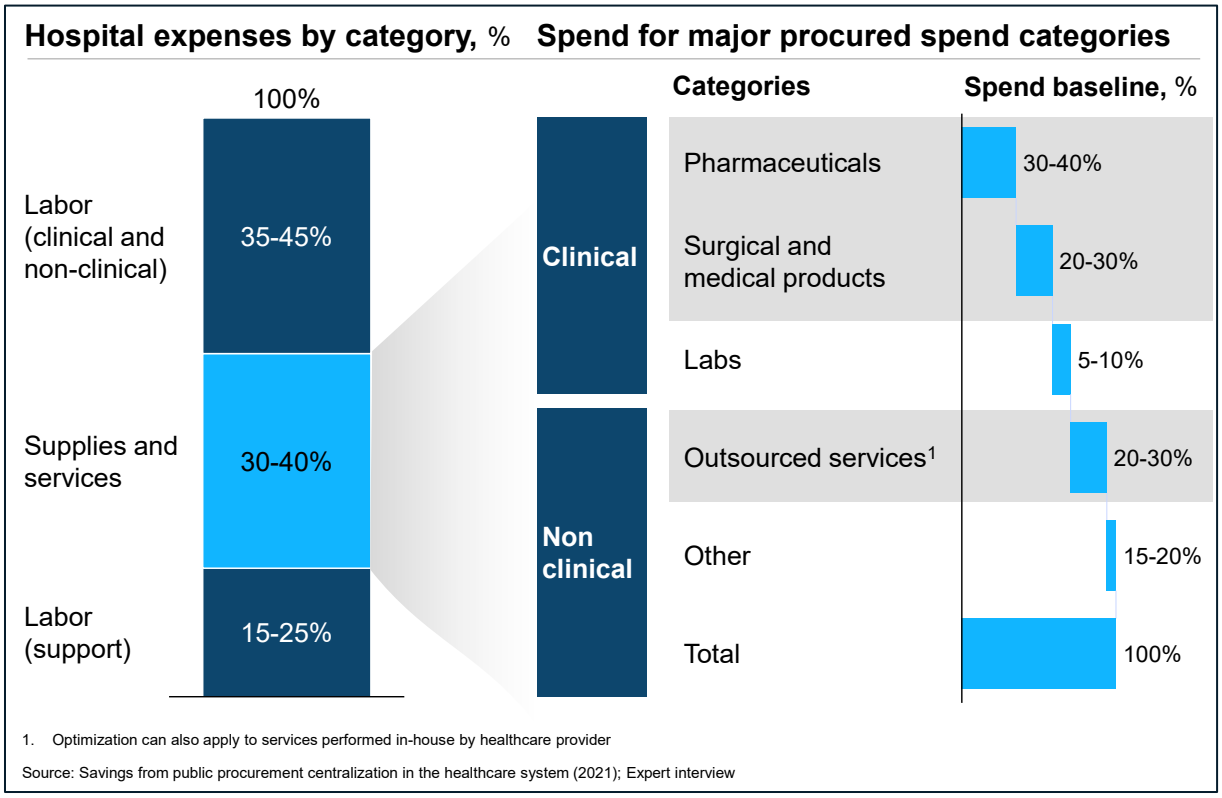
Procurement is one of the functions more commonly coordinated by a central body, as there are often clear benefits to realize. Finding the right balance between centralized and decentralized procurement is critical and depends on several factors, as outlined in Exhibit 63. Based on the framework in Exhibit 63, a fully centralized procurement organization may be the optimal structure for Iceland. The main drawbacks of a fully centralized procurement department are a need for local market knowledge and language capabilities and that it is harder to maintain external connectivity with local suppliers. In the Icelandic context, these factors are not as applicable, given the relatively small scale of the healthcare system.

Exhibit 63. Trade-offs of centrally coordinating procurement.



Supplies and services constitute a significant share of the total expenditure in the healthcare sector; for a typical healthcare provider, external spend makes up ~30 to 40% of total expenditure. Significant savings can be realized by adjusting procurement-related levers – e.g., standardizing products across units, harmonizing prices, consolidating volumes, optimizing product choices (by involving healthcare expertise in the procurement process), and optimizing procurement administration costs.

Exhibit 64. A sample cost breakdown for a healthcare provider.



There is clear evidence of significant savings being realized by adjusting procurement levers through a centrally coordinated procurement body; e.g., the Italian healthcare system

estimated 2 to 8% savings of *total* healthcare expenses by adopting a central purchasing body.[121]

For Iceland, a centrally coordinated procurement unit can create further benefits in addition to cost savings. It can mandate the use of formal procurement frameworks and ensure that procured products are approved, safe, and of high quality, leading to improved quality of care and patient safety.

'It would not only save money but also ensure patient safety. Having a centralized unit to handle procurement would ensure that safety elements follow a concrete and centralized framework.'

– Manager at IHI

Furthermore, a centralized procurement unit can improve national stockpile control – providing an exhaustive overview of current inventory and restocking needs, and whether products could be distributed more efficiently throughout the country. This can help reduce waste and enable better crisis preparation – e.g., ensuring enough respirators for patients with Covid-19.

'It gives us an overview of what is needed, where we may lack, and high-risk areas, such as respirators for Covid-19.'

– Manager at IHI

'[We] need to know what we have and whether we can move it internally before procuring more, which could reduce waste.'

– Physician at Landspítali

There are different options for how to set up a centralized procurement body in Iceland. For example, an external body with the sole responsibility of coordinating procurement could be created, or the function could be incorporated into an existing body. Given the relatively small scale of the Icelandic healthcare system, incorporating the function into an existing body is likely the strongest option. Furthermore, close collaboration with healthcare experts would be beneficial when it comes to ensuring that optimal products are procured. Given Landspítali's position as the largest hospital and procurement body of medical products in Iceland, it is a strong candidate for this role. Interviews with multiple senior stakeholders[122] within the Icelandic healthcare system reinforced this – all those interviewed agreed that centralizing procurement has clear benefits, and Landspítali is the clearest candidate for the role.

If implemented, Landspítali's procurement department will likely need to grow by 20 to 30%[123] to accommodate the increased number of patients and healthcare facilities that the department would be responsible for. Regardless of the increased need for FTEs in procurement, Landspítali will likely realize significant savings and other miscellaneous benefits – as outlined throughout this subchapter.

[121] M. Ferraresi et al., 'Savings from public procurement centralization in the healthcare system', *European Journal of Political Economy*, 2021, Volume 66, https://doi.org/10.1016/j.ejpoleco.2020.101963.

[122] Interviews on this topic conducted with stakeholders from IHI, Landspítali, and the Ministry of Health.

[123] Based on interviews with healthcare and procurement experts.

5.7.4 Centre of excellence

A structured way of organizing knowledge management is essential in any healthcare system and can be implemented in many ways. Knowledge management, in this case, entails documenting, compiling, and disseminating currently available healthcare knowledge and best practices – e.g., the latest knowledge on treatment and diagnosis for known diseases and operational best practices related to resource allocation and patient flow. The setup for such a structure can vary significantly, from decentralized systems where regional committees are responsible for local knowledge management (e.g., the Swedish SPESAK[124] communities) to centralized national bodies responsible for knowledge management and quality assurance (e.g., the Swedish Socialstyrelsen or the US National Center for Complementary and Integrative Health).

In Iceland, there are sporadic instances of such knowledge management structures, e.g., the professional councils set up by the Directorate of Health, a form of decentralized expert groups responsible for different topics. However, there is a lack of governance for overarching knowledge management in the healthcare system – specifically regarding the collaboration, coordination, and responsibility of knowledge management structures, information on the contributors (e.g., medical experts), and the location of specific expertise. Setting up a formal governing body responsible for these questions (and more) could benefit the Icelandic healthcare system. Ideally, such a body has two areas of responsibility:

1. To act as the best-practice centre for knowledge and information by pulling in and synthesizing knowledge on current and developing clinical and operational best practices. This could be done by creating clinical healthcare guidelines, like the ones outlined by the National Center for Complementary and Integrative Health or Socialstyrelsen,[125] and formulating operational best-practice guidelines, e.g., regarding patient flow or resource allocation at healthcare clinics.
2. To disseminate best-practice information and knowledge to healthcare centres, e.g., by publishing monthly papers on the latest developments, creating a national service and information hub for professionals, and arranging conferences and expert panels where knowledge can be shared.

'Knowledge management is immensely important, but there is no culture or structure for that in Iceland currently.'

– Manager at the Ministry of Health

'Even internally at Landspítali, there is no such information centre that is useful. This just shows how far behind we are on this.'

– Senior physician at Landspítali

A structured form of knowledge management can have multiple benefits – most importantly, higher quality of care and improved patient safety. There are also potential effectiveness and efficiency gains from using operational best practices (e.g., related to patient flow) and more effective healthcare treatments. Access to high-quality care can also be improved, as healthcare guidelines are disseminated more effectively to all healthcare facilities in the system. Finally, strategic decision making on a system level can be improved as more

[124] A regional network of medical experts within a specific field, e.g., cancer diseases; Vårdgivareguiden – Specialsakkunnig.

[125] National Center for Complementary and Integrative Health clinical practice guidelines; Socialstyrelsen information and guidance for healthcare and social care; Vårdigvarguiden.

knowledge is readily available and easily accessible – allowing for even more informed decisions.

As there is a need for a coherent knowledge management structure in Iceland, there are a few key questions to focus on regarding *how* to structure and optimally organize this:

1. Is Iceland large enough to benefit from centrally dedicated resources, or is it more sensible to use existing specialist resources through decentralized committees?
2. How should the governance body be structured – should it be a national body outside the provider system or connected to Landspítali or other providers?
3. Where will the expertise come from, and where will it be located – will it be a separate unit and will it be located at Landspítali?
4. Should one unit or separate units be responsible for specialist and primary care?

As the questions above suggest, multiple structures could be used in the Icelandic healthcare system – ranging from fully centralized to fully decentralized, as shown in Table 2. The boundaries between the sample structures are not binary and should be viewed as a scale ranging from centralized to decentralized.

Table 2. Examples of structures for a centre of excellence in Iceland.

Degree of centralization	Description and examples of responsibilities
Fully centralized	A centralized unit that is responsible for gathering knowledge and best-practice information, documenting it, and disseminating it to the healthcare system across all healthcare specialties. The unit is also responsible for governing knowledge management structures and centralizing expertise. If not overseen by the Directorate of Health, the unit is additionally responsible for coordinating with the Directorate of Health regarding healthcare knowledge management.
Hybrid	Decentralized committees consisting of medical experts[126] within different medical disciplines, like the SPESAK communities in Sweden, regularly convene to discuss best practices and the latest knowledge related to their specialties. A separate centralized unit is responsible for the overarching governance of knowledge management within the healthcare system and defining the coordination of the different committees and their mandates. Another centralized unit with dedicated employees may be responsible for pulling in information from the decentralized committees and disseminating it throughout the healthcare system.

[126] Likely only dedicating part of their time to these committees.

Degree of centralization	Description and examples of responsibilities
Fully decentralized	Completely decentralized and independent committees within specialist medical disciplines discuss and document best practices and knowledge, e.g., regarding new treatment options from academia, and disseminate this to relevant healthcare centres across the country. No centralized governing body is responsible for information codification and dissemination – each committee is responsible for this independently.

Iceland currently has instances of knowledge management structures, as mentioned above (e.g., councils at the Directorate of Health). The healthcare system could likely see benefits from further coordinating responsibility for healthcare-related knowledge management. The impact on Landspítali of implementing a coordinated centre of excellence would depend on the chosen governance structure. If Landspítali were chosen to lead the governance of this entity, the impact on resource needs at the hospital would be larger (i.e., more staff required). However, a knowledge management structure is typically not centralized with a single care provider. This has been corroborated with senior stakeholders[127] involved in reviewing this report, among who the consensus was that the governance of this function would most naturally be located outside of Landspítali, e.g., at the Ministry of Health or the Directorate of Health. However, Landspítali would be one of the core contributors of expertise, and thus a hybrid model could work best in the Icelandic context.

5.7.5 Digital infrastructure and guidelines

A centralized unit responsible for the overarching digital infrastructure of the healthcare system in Iceland can help the system drive digitization. It could create a system with an efficient innovation environment, standardized data sharing and exchange processes, and clear governance for data definitions, protection, and gathering. It would also provide a homogenous cloud infrastructure where digital tools could be developed and accessed throughout the healthcare system. These areas of responsibility and sample key questions that such a unit should solve are outlined in Table 3.

Table 3. Description of potential areas of responsibility for a digital infrastructure and guidelines unit, and sample key questions.

Topic	Description	Key questions
Structure for an efficient innovation system	Setting up the structure and system with clearly defined testing and validation processes that promote frictionless innovation with quick turnaround while also being compatible with	How to structure an environment that enables quick and efficient testing (e.g., ethical trials) of innovations?

[127] Interviews on this topic conducted with stakeholders from IHI, Landspítali, and the Ministry of Health.

Topic	Description	Key questions
	data, privacy, and ethics guidelines	How to set up a financial model that promotes innovation? Which processes are required to make it easy to produce innovations?
Healthcare cloud infrastructure and tools	Setting up and managing the cloud infrastructure that makes applications and digital use cases accessible throughout the healthcare system Defining the national infrastructure for running and maintaining applications Being responsible for the production of artificial intelligence models and utilization of advanced analytics throughout the healthcare system	Should we create a multi-cloud or one national cloud? Should the cloud be private or public? What standards to adopt (e.g., design patterns and security)? Which tools and templates to develop to enable faster cloud adoption throughout the system? How should artificial intelligence models be implemented to optimally utilize advanced analytics?
Standards for data sharing and exchange	Defining and setting up standards and blueprints for data sharing and exchange Clearly outlining the national platform for how medical data is saved and shared, and creating application programming interfaces that serve data to this system – ensuring that each localized facility can connect to this platform	What standards to use, e.g., patient journal data (electronic health records) and production data? Who sets up and maintains the infrastructure for data sharing? How should data exchange be traced and secured? Which data should be shared, and which standards should be used for this?
Governance for data definitions, protection, and gathering	Outlining the overall governance structure for data	What standards to use for various data types, including DRGs, production data, and financial data?

Topic	Description	Key questions
	Setting standards for data infrastructure on a national level Clearly defining data protection procedures	How should anonymized test results be shared and stored, e.g., from MRI scans? How is input from the medical board regarding definitions incorporated?

A department under the Directorate of Health – the National Centre for eHealth – is currently responsible for centrally coordinating digital infrastructure throughout the Icelandic healthcare system, and is centrally managing all of Iceland's main digital platforms – e.g., Heilsuvera and Hekla. As it stands, most of the digital topics outlined in Table 3 are centrally coordinated by the National Centre for eHealth to a varying degree, with some minor exceptions. Table 4 outlines how the National Centre for eHealth works with the four topics described in Table 3.

From a governance and mandate perspective, a central and neutral body is likely required. However, investments in digital infrastructure are both sizeable and require deep digital capabilities. As Landspítali has a unique position in the Icelandic healthcare system as the most significant care provider and owner of the most extensive digital infrastructure – despite not owning digital infrastructure from a governance perspective – it will be the most important stakeholder and could take on the role of developing and maintaining significant portions of the national digital infrastructure. Decisions around this should be made and planning done for each major digital capability, involving senior technology leaders to ensure sound decisions from a data engineering and architecture perspective.

Table 4. Overview of how the Directorate of Health's National Centre for eHealth manages Iceland's digital infrastructure.

Topic	Managed by the National Centre for eHealth	Currently not managed by the National Centre for eHealth
Structure for an efficient innovation system	Promoting digital innovation, e.g., by hosting hackathons, organizing special meetups, and setting up a testing environment for developers to access Hekla and Heilsuvera	Promoting innovation through predefined processes Aiding in setting up financial models that enable and promote innovation
Healthcare cloud infrastructure and tools	Developing and implementing digital tools, platforms, and cloud infrastructure, most often by contracting external vendors Developing tools either done by pushing out new technologies, often due to a request from the	Responsibility for the usage and development of advanced analytics

Topic	Managed by the National Centre for eHealth	Currently not managed by the National Centre for eHealth
	Ministry of Health, or by involving superusers[128] from local healthcare centres and letting technologies be pulled in and implemented locally Mandating the implementation (if needed) of tools or platforms if there is resistance from local healthcare centres[129] Partly running or planning artificial intelligence projects, providing data mining support, and performing automatic data gathering for the Directorate of Health Being the responsible national contact point for cross-border data exchange	
Standards for data sharing and exchange	Defining the standards for data sharing and exchange, coding systems (e.g., ICD-10) Ensuring that local facilities, e.g., Landspítali, individually procure and install electronic health record modules from vendors	Mandating local healthcare facilities to be ported into the national electronic health record and patient portal (Heilsuvera) (however, all hospitals and primary healthcare clinics are connected, as are a majority of other healthcare facilities)
Governance for data definitions, protection, and gathering	Surveillance of the usage and sharing of data, and ensuring data governance practices are adhered to throughout the healthcare system Aid in defining processes for data protection and setting up the national structure for data infrastructure	

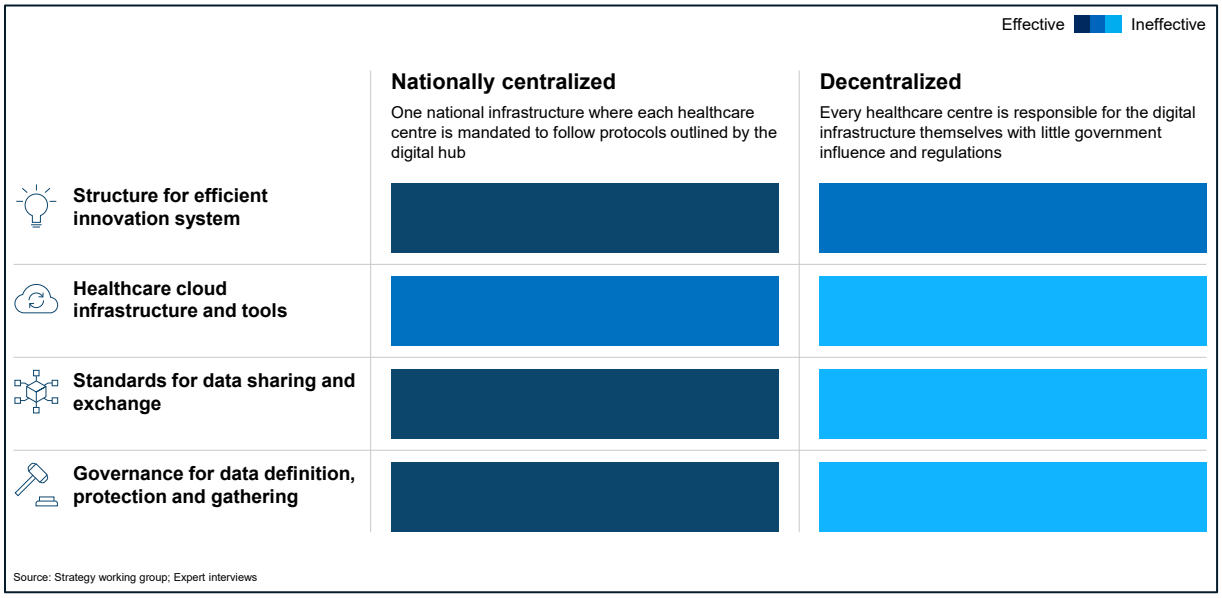
[128] A person from a local health centre who has a profound understanding of internal processes and is responsible for knowledge management.

[129] By going through the Ministry of Health.

When organizing a unit responsible for digital infrastructure and guidelines, the structure can vary in terms of the centralization of its responsibility. The degree of centralization can range from fully centralized, where the national digital infrastructure is centrally coordinated and each healthcare centre follows protocols outlined by a central unit, to fully decentralized, where each healthcare centre is individually responsible for its digital infrastructure, with little government influence and regulation. In addition, a hybrid model is possible. In the hybrid model, some elements are defined and coordinated centrally (e.g., cloud platform procurement, data governance structures, or standards for data sharing and exchange), while others are implemented on a decentralized or local level (e.g., tools and applications, the use of advanced analytics, or electronic health record systems).

Iceland's digital healthcare infrastructure is almost fully centralized through the National Centre for eHealth under the Directorate of Health (outlined in Table 4). Through numerous interviews with senior stakeholders[130] of the Icelandic healthcare system, it was found that there was a general consensus that favours keeping the digital infrastructure centralized under the Directorate of Health. However, some stakeholders noted that the healthcare system could benefit from Landspítali taking on a larger role in this area. The framework depicted in Exhibit 65 presents a high-level comparison of the relative effectiveness of nationally centralized digital infrastructure and guidelines unit versus decentralized infrastructure and guidelines unit.

Exhibit 65. Framework comparing the effectiveness of a centralized versus decentralized digital infrastructure and guidelines unit in the Icelandic context.



5.7.6 Placement of care

The Icelandic healthcare system has no coordinating body responsible for high-level patient distribution and movement decisions, both for patients within Iceland and out-of-country outsourced patients. This could potentially cause inefficiencies, result in suboptimal transfer decisions, and even impact patient safety. There is already a significant amount of patient movement in the system, e.g., moving patients abroad, transporting patients from SAK to Landspítali, moving patients from Landspítali to neighbouring hospitals in the Capital Region of Iceland, moving patients from private care providers to public ones (and vice versa).

[130] Interviews conducted on this topic with stakeholders from IHI, Landspítali, and the Ministry of Health.

Patient movement between hospitals, clinics, and out-of-country is expected to increase if the Icelandic healthcare system aims to become even more dynamic through some of the strategic choices discussed in this report.

To accommodate the large amount of patient movement within the healthcare system, centrally controlled placement of care could benefit Iceland. A placement-of-care coordinating body would be responsible for coordinating the movement and distribution of patients throughout the healthcare system on a holistic level.

This coordinating body could also be responsible for creating clear healthcare pathways that indicate when a patient should move from one level of care to another, and prepare the system for this. Such pathways could clearly define thresholds for when an elderly patient at Landspítali is ready to be transferred to a simpler care setting (e.g., nursing home or home-based care) and ensure sufficient capacity in the system to allow the transfer. Another example could be clearly defined thresholds for when a patient should move from primary, secondary, or tertiary care.

Furthermore, the placement-of-care coordinating body could be responsible for actively distributing patients through the healthcare system on a high level – allowing for capacity optimization on a system level and increased patient safety. These actions could reduce waiting times for specific treatment types (e.g., by shifting patients from SAK to Landspítali, or out-of-country proactively), better access to care, higher utilization rates for all clinics in the system, and a more structured overview of out-of-country treatments. In practice, most cases would be handled by a 'business rule' algorithm, which the coordinating body would be responsible for developing and managing. This rule could be an artificial-intelligence-based algorithm that optimizes the system for the 'simpler' or 'standard' cases – with exceptions for more complex cases that a manual unit would handle.

'There is a huge need for a placement coordinating body. The inflows of care in the system today are volatile, often leading to strain on Landspítali, which could be solved by distributing care more effectively to other facilities for plausible cases.'

– Senior physician at Landspítali

Defining how to set up placement-of-care coordination and where the responsibility should reside is key. There are multiple candidates that would be a natural fit for this responsibility, such as:

1. The Directorate of Health, given that it already has overarching responsibility over the healthcare system
2. IHI, given that it is the buyer of all healthcare in Iceland and responsible for approving transfers abroad

Landspítali – or any other healthcare facility – is likely not the strongest candidate for this position, given the less-holistic overview of the healthcare system it has compared to the Directorate of Health or IHI. However, while Landspítali is not a clear candidate for this role, instituting placement-of-care coordination could impact Landspítali's operations and capacity through the benefits highlighted in this subchapter – regardless of where the responsibility resides.

5.7.7 Conclusions and impact on Landspítali

5.7.7.1 Key conclusions

Four healthcare functions that could potentially benefit from being centrally coordinated by Landspítali were discussed in this chapter: procurement, centre of excellence, digital infrastructure and guidelines, and placement of care. It was found that, currently, only the function related to digital infrastructure and guidelines is centrally coordinated by the Icelandic healthcare system under the Directorate of Health.

While potential benefits of centralization for these functions were identified, Landspítali was only considered a strong candidate for full centralization of procurement, and potentially for taking on a larger role in developing and maintaining portions of the national digital infrastructure. A centralized centre of excellence and placement of care coordination should likely be implemented to help overcome issues with capacity, patient distribution, and knowledge management – however, these functions are likely best centralized by entities such as the Directorate of Health or IHI instead of Landspítali.

5.7.7.2 Main 2040 scenario – most likely impact on Landspítali

Apart from procurement, the functions discussed throughout this chapter are unlikely to be coordinated by Landspítali in the future. As such, even if these functions were created or expanded in the coming decades, their impact on resource needs at Landspítali would likely be minimal. Thus, the main 2040 scenario will *not* reflect the impact of these topics.

Procurement. This is the function most likely to be centrally coordinated by Landspítali in the future, which would have a twofold impact: a) productivity gains in the form of cost reductions on a healthcare system level, and b) increased FTE need at Landspítali. The impact of a) will be discussed in the ‘Operations and procurement best practices’ chapter – with the most likely scenario analysed in the ‘Main 2040 scenario – most likely impact on Landspítali’ subchapter, and the full range of potential effects explored further in the ‘Potential range of impact on Landspítali’ section of that same chapter. The impact of b) is expected to be negligible on Landspítali’s long-term FTE need – Landspítali already has a procurement body, which is not expected to grow enough for the impact to be noticeable (likely a maximum of three to five additional FTEs in total).

Centre of excellence. This will likely not be coordinated by Landspítali, and the impact of additional FTEs required for this function will thus have a negligible impact on Landspítali. However, Landspítali has the largest pool of clinical expertise within the system – as such, part-time contribution to the centre of excellence from selected experts would be needed. However, the impact of this would be negligible in the model, and difficult to estimate before an outline of the potential structure of this entity exists. While there would likely be improvements in areas such as quality of care and productivity gains, these improvements are already reflected in other improvement areas (e.g., operations and procurement best practices, health improvement interventions).

Digital infrastructure and guidelines. This is currently centrally coordinated by the National Centre for eHealth under the Directorate of Health. There are currently no plans to move this function to Landspítali. However, as the most significant care provider and owner of the most extensive digital infrastructure, Landspítali will be the most important stakeholder of the national digital infrastructure, and could take on the role of developing and maintaining

significant portions of it, despite not owning the governance. However, as this is not planned for, the impact of this potential action is not included in the main scenario forecasting.

Placement of care. This role will likely not be coordinated by Landspítali, thus the impact on current or future FTEs at Landspítali is not modelled. If this function is implemented elsewhere in the system, access to care and quality of care may improve, which might bring potential productivity gains to Landspítali. However, as these productivity gains are already reflected through other initiatives included in the model (e.g., operations and procurement best practices, health improvement interventions, shifting out of primary and long-term care), they will not be reflected in the model.

6 Operational improvements and prevention

6.1 Introduction to operational improvements and prevention

In the base 2040 forecast, this report considered the healthcare system without any significant reforms to Lanspítali's role and without executing significant operational improvement and digital transformation programmes. The previous chapter considered the impact of potential strategic choices and shifts of patient responsibility and highlighted long-term care and primary care as especially important. This chapter will outline the types of operational improvement and prevention programmes that could be considered and quantify their potential impact to end at a robust 2040 scenario where key strategic choices and future improvement programmes are factored in.

This chapter provides an overview of the four operational improvements and prevention measures deemed as having the most significant potential impact on the resource requirements of Landspítali in the coming two decades. How these relate to Landspítali is also presented, and the likely impact of these measures is identified and discussed. The aim is to enable a robust view of the likely future development of these measures and the subsequent implications for Landspítali. The main 2040 scenario will include estimates of potential benefits that can be realized and the future development of each measure. However, as these measures are subject to uncertainty, a range of the likely benefits is also provided for each of the measures. The operational improvements and prevention measures covered in this chapter are:

- **Health-improvement interventions:** analyse the potential impact of health interventions (e.g., preventive medicine) on a societal level and discusses how this potentially relates to and impacts Landspítali.
- **Operations and procurement best practices:** provides an overview of potential operations and procurement levers that can be used to realize productivity gains and estimates the future potential impact on Landspítali.
- **Shift to day surgery:** discusses the practice of shifting specific treatments from inpatient theatres to a day surgery setting and analyses the upcoming potential impact of further shifts at Landspítali.
- **Digitization:** outlines digital healthcare solutions and discusses the potential productivity gains that can be realized by implementing these at Landspítali.

6.2 Health-improvement interventions

6.2.1 Introduction

National health-improvement interventions are actions most often taken by central government or public health agencies related to environmental, social, and behavioural, or prevention and health promotion. The base-line forecast of this report already incorporates continued impact in Iceland from these types of interventions in line with what has previously been seen. This section will discuss the additional potential society can realize if it captures the full potential of these types of interventions.

By using an international framework[131] developed to gauge the impact of these types of initiatives, it is estimated that it would theoretically be possible to reduce disease burden by more than 50% in Iceland. Reduced disease burden would result in significantly lower healthcare demand on Landspítali (~30%) and subsequently fewer beds, reduced staff needs, and cost savings – not to mention improved human wellbeing. As implementing health-improvement interventions is complex and requires significant behavioural shifts on a societal level, this report has not factored in the additional impact beyond a continuation of current levels but models the potential impact if Iceland takes on an ambitious agenda in this area.

This chapter is divided into three sections:

1. Firstly, the definition of health-improvement interventions and how they affect disease burden, and subsequently healthcare demand are presented. Three different types of interventions are discussed.
2. Secondly, the theoretical reduction potential of disease burden by health-improvement interventions is explained and quantified.
3. Finally, the potential effects on healthcare demand at Landspítali are discussed and linked to the 2040 forecasting; this includes a hypothetical scenario modelled to gauge the potential impact to Landspítali if 100% of the benefits from health-improvement interventions are realized.

6.2.2 Categories of health-improvement interventions

Health-improvement interventions aim to assess, promote, or improve the health of an individual or a population, including everything from public sanitation programmes to surgical procedures recommended by leading institutions.[132] There is a wide variety of interventions with different characteristics and ease of implementation, ranging from easily implementable interventions, e.g., better vaccine distribution, to more complex topics, e.g., eliminating smoking. In broad terms, interventions can be divided into three categories: environmental, social, and behavioural; prevention and health promotion; and therapeutic.

The base-line forecast of this report already captures all expected impacts from the continuous development within these health-improvement intervention categories based on historical trends. This chapter instead focuses on the additional societal impact that might be realized by implementing health interventions, going beyond historical, continuous efforts.

6.2.2.1 Environmental, social, and behavioural

Environmental, social, and behavioural interventions aim to change the environment and how people go about their daily lives, with the goal of improving their general health. Most of the potential reduction in disease burden within this intervention category stems from social and behavioural interventions, e.g., dietary interventions that result in people consuming healthier food or interventions targeted towards reducing the number of smokers in society. In addition to social and behavioural changes, environmentally-targeted interventions also impact the disease burden, e.g., air pollution control and increased road safety.

[131] 'Prioritizing health: A prescription for prosperity', McKinsey Global Institute, July 2020.

[132] Such as the WHO or national medical associations.

Most of the interventions in this category cannot be implemented by Landspítali directly and are a matter for the Icelandic government, ministries, and agencies. If successfully addressed, Iceland could potentially significantly improve the population's general health by actively pushing for the implementation of relevant health-improvement interventions – ultimately reducing demand on the country's healthcare system and Landspítali.

As an illustrative example, The Amsterdam Healthy Weight Approach is a set of long-term social and behavioural health-improvement interventions targeted to decrease childhood overweight and obesity. It is an ongoing, 20-year programme that uses a range of targeted interventions for different groups, e.g., providing support for caregivers, connecting counselling efforts between medical workers and communities, ensuring healthy school environments, and preventing unhealthy food marketing to children. While the programme is still in an early phase, the overweight and obesity prevalence among children in Amsterdam decreased by 12% for all age groups between 2012 and 2015.[133]

The following three examples could significantly impact the Icelandic healthcare system within environmental, societal, and behavioural interventions. These are all interventions that the Icelandic healthcare system may be actively investing in and working on but also represent considerable potential in further disease reduction if additional achievements are made.

1. Full elimination of smoking, e.g., via tailored programmes per age group in combination with policy initiatives to make it more challenging to start and continue smoking (e.g., accessibility taxation)[134]
2. Comprehensive and regular education on a healthy lifestyle, i.e., education on a healthy diet, exercise, weight control, and substance use
3. Extensive and regular physical activity for most of the population to limit overweight and obesity rates

6.2.2.2 Prevention and health promotion

Prevention and health promotion interventions focus on preventing diseases to improve the population's general health, potentially reducing the incidence of certain diseases, post-treatment morbidity, and complications. On a global scale, the most impactful interventions within this category are the distribution of vaccines, implementing measures that enable safe childbirth, and deploying medicines for chronic diseases.

Landspítali can have a large, direct effect on the interventions within this category, e.g., by performing preventive surgeries. For some interventions, a joint effort from all care providers in the healthcare system is needed to ensure success, e.g., vaccinations, which must be distributed by healthcare centres and clinics close to the patient.

Early screening for atrial fibrillation – a leading cause of ischaemic stroke – is an example of a prevention and health promotion intervention. By screening for atrial fibrillation, patients

[133] United Nations Children's Fund, 'The Amsterdam Healthy Weight Approach: Investing in health urban childhoods: A case study on healthy diets for children', , November 2020, unicef.org.

[134] Impact from elimination of smoking might be more limited in Iceland than elsewhere, as Iceland already has one of the lowest rates of smokers in Europe. However, Iceland does have a sizeable population of alternative tobacco and nicotine product consumers (e.g., mouth tobacco).

who require anticoagulant therapy treatments can be identified and treated early on, ultimately reducing the prevalence of stroke and mortality.[135]

Within prevention and health-promotion interventions, we again present three examples that the Icelandic healthcare system is likely already investing in, but where considerable potential may exist to enable further disease reduction in Iceland.

1. Proactively identifying all or the majority of the population with too high cholesterol levels and getting them on antihypertensives and cholesterol-reduction medicines
2. Annual or biennial screening campaigns for patients, usually over 50 years of age, e.g., by low-dose screening with computer tomography, especially for risk groups, e.g., heavy smokers
3. Active disease and medical management, including active monitoring of complications and comorbidities, to prevent and start treating conditions in an early stage, e.g., diabetes

6.2.2.3 Therapeutic

Therapeutic interventions aim to more effectively treat patients and improve patient outcomes, resulting in benefits such as reduced mortality and post-treatment complications. This could be achieved by providing more effective pharmaceuticals and treatments, e.g., using medications with fewer side effects or performing minor procedures with a higher degree of sophistication as opposed to major surgeries.

Similarly, to prevention and health-promotion interventions, Landspítali can directly affect some therapeutic interventions, e.g., by sourcing and developing better equipment and pharmaceuticals or adapting state-of-the-art equipment and procedures.

Increasing evidence-based treatments for STEMI patients (ST-elevation myocardial infarction) is an example of a therapeutic health intervention. By gradually switching to both new and established evidence-based treatments for STEMI patients, e.g., reperfusion, primary percutaneous coronary intervention, or dual antiplatelet therapy, a range of benefits related to prolonged survival and reduced risk of complications can be realized, including reductions of ~9 percentage points in cardiovascular death and ~6.5 percentage points in myocardial infarction.[136]

Within therapeutic interventions, we again present three examples that the Icelandic healthcare system is likely already investing efforts in, but where large potential may exist to enable further disease reduction in Iceland.

1. Widespread implementation of pain-relief interventions, such as physiotherapy, pharmacological pain management (e.g., NSAIDs),[137] proactive surgical procedures to alleviate pain, etc.
2. Proactive identification and broad use of effective treatments for depression and anxiety disorders, e.g., primary-care-based therapy with medication and psychological therapies, electroconvulsive therapy, and psychosocial interventions

[135] Clinical outcomes in systematic screening for atrial fibrillation (STROKESTOP): a multicentre, parallel group, unmasked, randomized controlled trial, 2021.

[136] Improved outcomes in patients with STEMI during the last 20 years are related to implementation of evidence-based treatments: experiences from the SWEDEHEART registry 1995–2014, 2017.

[137] Non-steroidal anti-inflammatory drugs.

3. Utilization of the latest innovations for treatments of dementia, e.g., treatment with acetylcholinesterase inhibitors or memantine (dependent on disease severity)

6.2.3 The theoretical potential of health improvement interventions

As described previously, IHME's forecast is a core part of the forecast modelling used to define the healthcare trends and changes in Iceland until 2040. It includes multiple factors, e.g., healthcare trends and the impact of new technologies. The IHME forecast captures all the expected impacts from health improvements based on what has been achieved historically – which means a share of the health-improvement interventions is already reflected in the base 2040 forecast. Thus, to achieve additional benefits – as outlined in this chapter – extra efforts beyond what is 'normally' done would be required.

The health improvement interventions[138] discussed in this chapter expand upon the scope of the IHME forecast to include additional aspects not reflected in the data used by IHME. Hence, trends and changes accounted for in the IHME forecast do not overlap with the health improvement interventions, making them mutually exclusive.

6.2.3.1 Reduction in disease burden from interventions

Disease burden is the impact a condition or disease has on quality of life, i.e., the number of healthy life years lost or the gap between current health status and the ideal health status due to the impact of a condition or disease. Disease burden can be measured in disability-adjusted life years (DALYs), which describes the total disease burden on a population level. DALYs consists of two components: years lived with disability[139] and years of life lost.[140] The sum of the two makes up the total DALYs on a population level for each condition. The IHME forecast estimates that by 2040, the total DALYs in Iceland will be ~75,000.

Health-improvement interventions can impact DALYs by reducing either years lived with a disability, years of life lost, or both, e.g., interventions targeted towards reducing obesity can reduce the incidence of heart diseases, mainly impacting years of life lost. The impact from health-improvement interventions on a disease-category level has been estimated through a rigorous analysis[138] and can be adapted to fit the unique context of different nations.[141] Through this, the potential impact on total DALYs following the implementation of existing health interventions can be measured.

Exhibit 66 illustrates the total theoretical reduction in DALYs per intervention category and future health intervention innovations in the Icelandic context. The total theoretical reduction in disease burden through health interventions[142] results in a ~54% DALYs reduction, with existing intervention categories accounting for ~32 percentage points and future innovations for ~17 percentage points.

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[138] 'Prioritizing health: A prescription for prosperity', McKinsey Global Institute, July 2020.

[139] Years lived with disability is calculated as the number of years a patient is estimated to live with a condition multiplied by a weight representing the decrease in quality of life each year multiplied by the incidence of the disease on the population level.

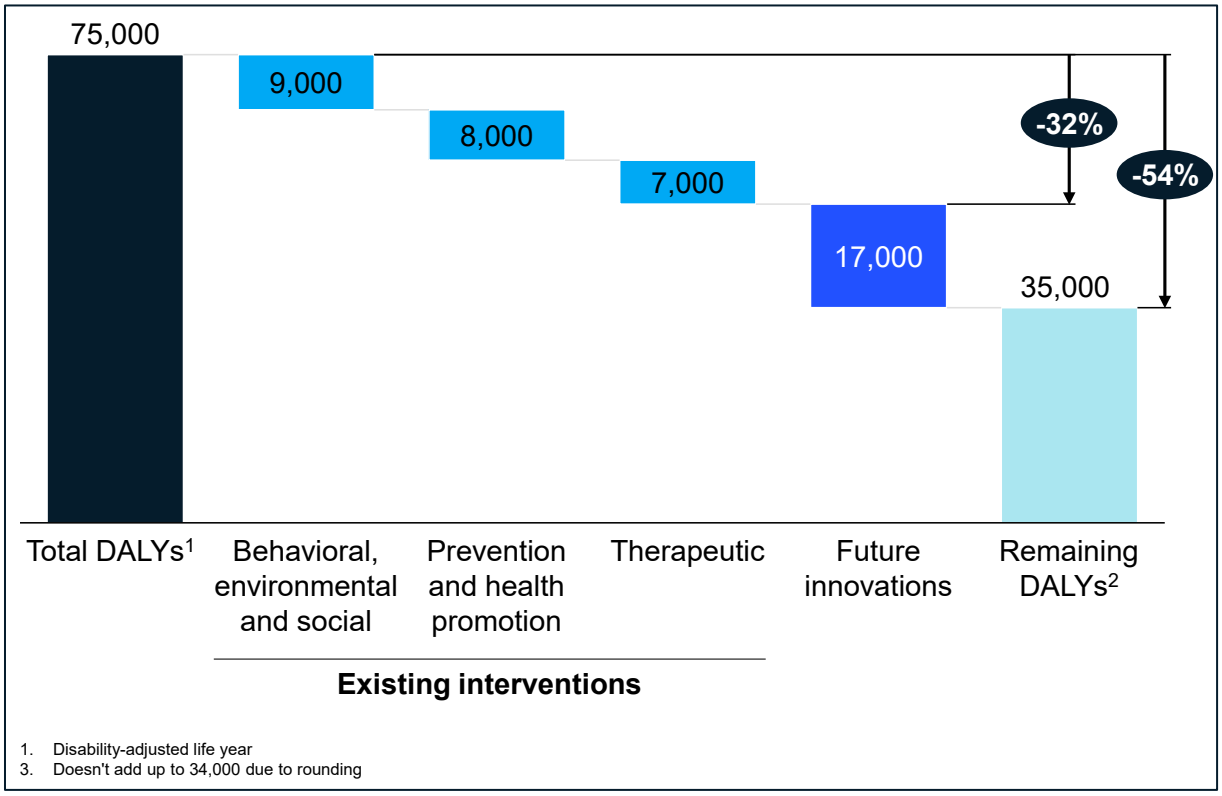
[140] Years of life lost is the decrease in expected number of life years due to the condition multiplied by the incidence rate of the condition.

[141] Interventions that have a significant impact in some countries might have a negligible impact in others – e.g., access to clean water will significantly reduce DALYs in Chad, but not in Iceland. In contrast, interventions such as cancer screenings will have a more significant effect in Iceland; 'Prioritizing health: A prescription for prosperity', McKinsey Global Institute, July 2020.

[142] Through interventions outlined in 'Prioritizing health: A prescription for prosperity', McKinsey Global Institute, July 2020.

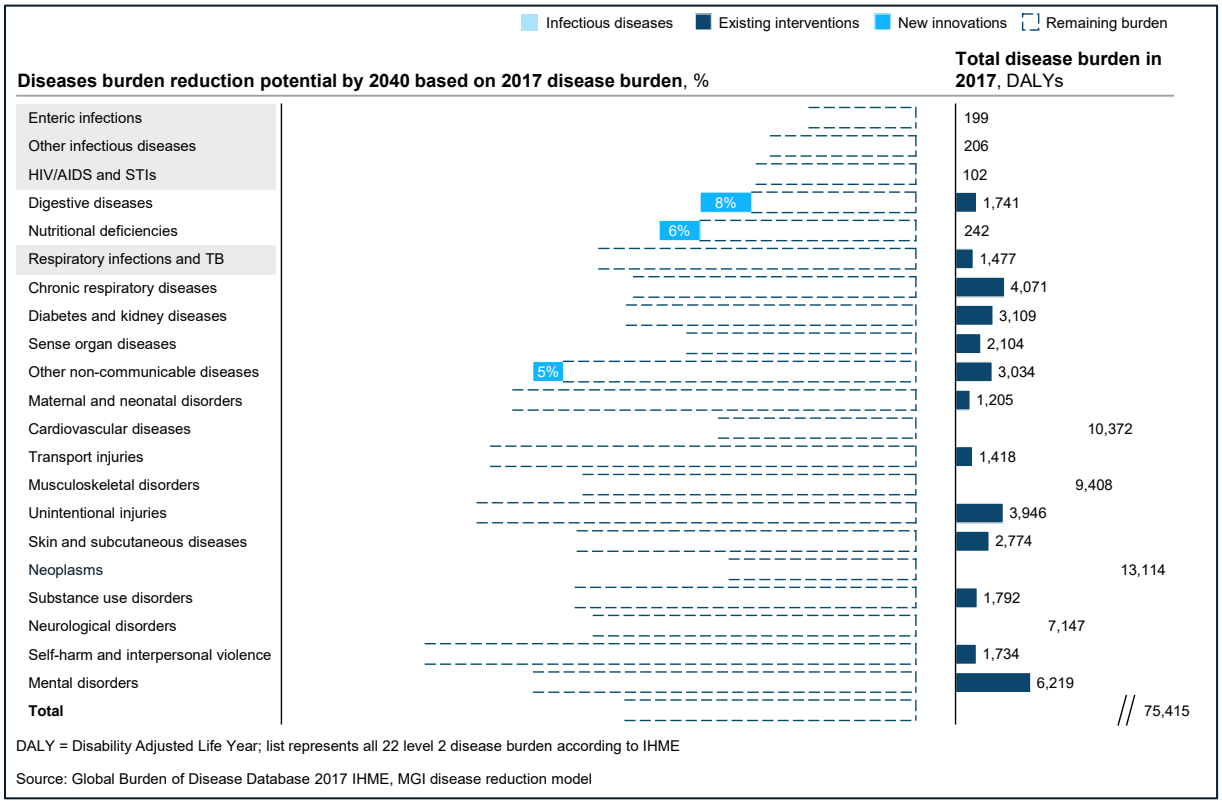
Exhibit 67 provides further details on how interventions might reduce disease burden on a disease category level by utilizing existing and future interventions. As a highly developed country, most of Iceland's disease burden constitutes neoplasms, cardiovascular diseases, and musculoskeletal disorders. Infectious diseases make up a minuscule part of the total disease burden. However, as seen on a disease category level, the largest reduction in disease burden is possible in the disease categories that account for the smallest disease burden.

Exhibit 66. Iceland's estimated DALYs and potential reduction by 2040.



1. Disability-adjusted life year
3. Doesn't add up to 34,000 due to rounding

Exhibit 67. Disease burden reduction potential until 2040 for Iceland.



DALY = Disability Adjusted Life Year; list represents all 22 level 2 disease burden according to IHME

Source: Global Burden of Disease Database 2017 IHME, MGI disease reduction model

6.2.3.2 The link between DALYs and incidence and prevalence rates

As the impact from health-improvement interventions is measured in terms of a decrease in DALYs, it is necessary to understand the relationship between DALYs and incidence and prevalence rates (as used by IHME) to determine how health interventions impact healthcare demand. There is a strong correlation between a reduction in DALYs and a reduction in incidence and prevalence rates on a disease category level. Thus, it is possible to model a link between intervention impact and healthcare demand at Landspítali. Based on this correlation, a 1-percentage-point decrease in DALYs is expected to decrease incidence and prevalence rates by 0.63 percentage points in the same disease group.[143]

Reducing disease burden could decrease incidence and prevalence rates of disease categories, with different types of health interventions likely impacting incidence and prevalence rates in different ways. For non-therapeutic interventions (behavioural, environmental, and social; and prevention and health promotion), incidence and prevalence rates can be reduced through preventive measures, e.g., preventive surgeries to avoid more serious conditions, and improved general health, e.g., by promoting a healthier lifestyle. For therapeutic interventions, incidence and prevalence rates can be decreased by reducing the number of complications following treatments, e.g., performing more minor procedures instead of major surgeries, decreasing the chance of infection.

[143] A linear least square estimator was used to estimate the link between decrease in DALYs and decrease in incidence and prevalence rate.

6.2.3.3 Applicability to Landspítali and Iceland

Looking ahead to 2040, Iceland could be considered a highly relevant nation for implementing new and innovative health-improvement interventions given the small, highly developed, and relatively closed-off system with access to extremely comprehensive genetics data. Iceland could thus benefit significantly by actively analysing and determining which interventions are suitable in the Icelandic context, determining their potential impact, prioritizing them, and finally dedicating investments and efforts towards implementing them on a broad scale. Benefits would be realized through reduced healthcare demand – which can potentially counteract some of the increased healthcare demand-driven demographic changes.

However, as described previously, the maximum potential reduction in disease burden and DALYs is still a highly theoretical scenario of what could be achieved. For Iceland to accomplish the full ~54% reduction in DALYs, successful implementation of all existing interventions and future potential health intervention innovations, as outlined in this chapter, would be required.

6.2.4 Conclusions and impact on Landspítali

6.2.4.1 Key conclusions

Health-improvement interventions aim to assess, promote, or improve the health of an individual or population and include everything from public sanitation programmes to surgical procedures recommended by leading institutions.[144]

With existing and future health interventions, it would, theoretically, be possible to reduce Iceland's disease burden by more than 50%. This reduction would significantly decrease the healthcare demand on Landspítali and, subsequently, fewer beds and FTEs would be required – resulting in cost savings and improved outcomes.

6.2.4.2 The potential range of impact on Landspítali

While the implementation of health interventions can improve the general health of the Icelandic population and thus reduce healthcare demand on Landspítali, significant efforts and societal shifts are required to achieve this, since all expected gains from health interventions are reflected in the base forecast. Because of this, the impact of health improvement interventions is considered above expected levels and excluded from the main 2040 scenario.

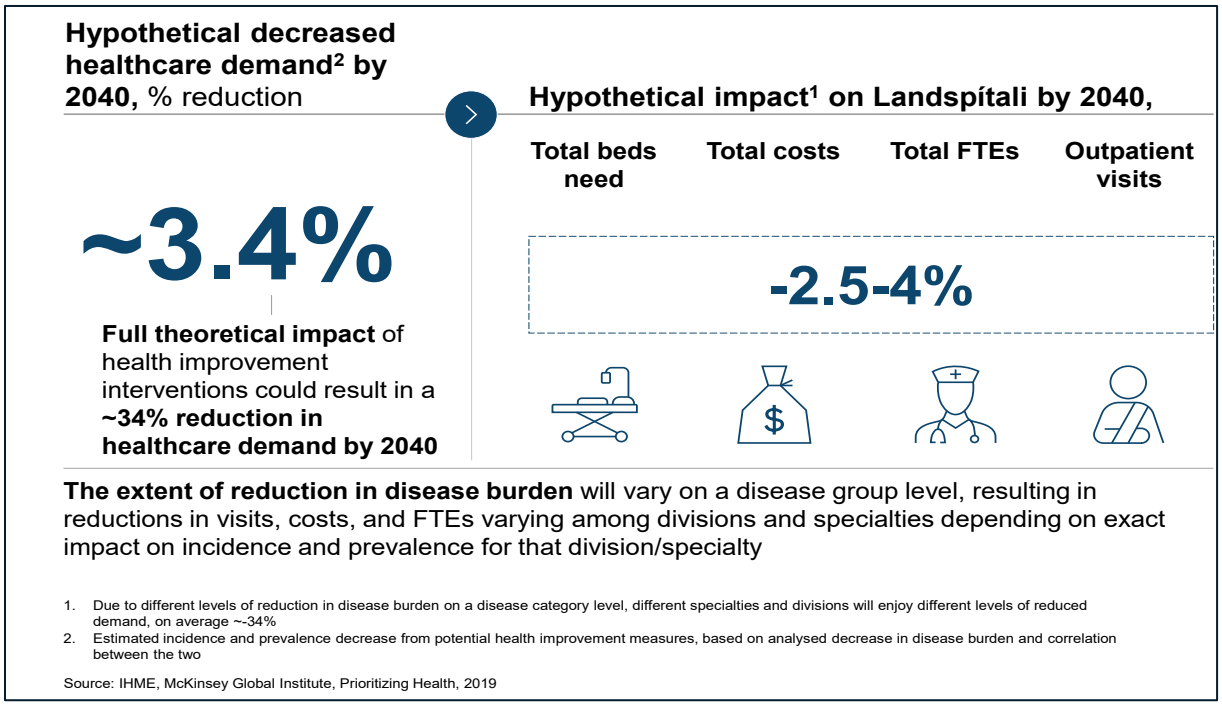
However, to show the full potential range of this initiative and highlight the possible benefits that could be realized if Landspítali and the healthcare system dedicate significant focus and resources towards pushing health-improvement interventions, the full impact is discussed here. The impact highlighted assumes that the highest theoretical potential reduction of DALYs – a ~54% reduction – is achieved by successfully implementing all existing health-improvement interventions and capturing the potential of future health-improvement interventions. A hypothetical example of achieving ~10% of the theoretical potential is also discussed. As Exhibit 67 shows, the reduced disease burden will differ among disease

[144] Such as the WHO or national medical associations.

categories, both in the total amount of DALYs and the percentual reduction of DALYs.[145] The decreased disease burden will reduce incidence and prevalence rates by ~34% on average. Due to the wide variety of impacts on a disease-category level, the impact on total costs and bed and FTE need will vary significantly on a division and specialty level – as some divisions or specialties have different requirements in terms of these metrics. Thus, the full impact will be an interval with an average of 34% but may be higher or lower than 34% for different key metrics depending on specialty or division (25-40% used below). As described throughout this chapter, Landspítali alone has a limited individual impact on implementing most interventions – instead, this would require joint efforts from healthcare providers and governmental agencies.

The full theoretical impact of health-improvement interventions would entail significant benefits – resulting in a 280 to 450 decrease in the total need for beds, ISK 37 billion to 58 billion cost reduction,[146] and a 1,600 to 2,600 reduction in FTE need by 2040. In addition, these effects would likely also apply to the entire Icelandic healthcare system, as most interventions impact all healthcare providers. Again, it is important to note that this is the whole theoretical potential impact and is displayed here to highlight the importance of public health and prevention measures – achieving a large share of this impact should be viewed as highly unlikely. In a hypothetical example – where the Icelandic healthcare system exceeds expectations and captures 10% of the full theoretical impact – a reduction in Landspítali's resource needs would still be significant, as displayed in Exhibit 68. This could result in a 30 to 45 decrease in the total need for beds, ISK 4 billion to 6 billion cost reduction,[147] and a 160 to 260 reduction in FTE need by 2040 compared to the base forecast.

Exhibit 68. A hypothetical example of the impact of the Icelandic healthcare system achieving ~10% of the theoretical potential impact of health-improvement interventions on the 2040 forecast.



[145] Reduction in disease burden is assumed to impact all levels of care equally, e.g., by 54%.

[146] Excluding inflation.

[147] Excluding inflation.

6.3 Operations and procurement best practices

6.3.1 Introduction

Any healthcare system should strive and work towards productivity improvements to meet increasing healthcare demand. By continuously improving operational and procurement-related practices, most healthcare systems could expect ~1 to 2% annual productivity gains, stemming from reduced ALOS for patients, increased workforce efficiency, and direct cost reductions. For Landspítali to successfully face the increased healthcare demand by 2040, annual productivity gains of ~1% will be necessary if significant capability investments are to be avoided.

This chapter first presents an overview of operations and procurement best practices. It discusses the potential productivity impact based on rigorous analysis, using a combination of existing research and expert interviews. Then, the chapter briefly discusses the potential applicability of these findings to the Icelandic context and concludes that Iceland has significant potential to realize these benefits if best practices are adopted.

6.3.2 General productivity gains from operations and procurement best practices

Significant productivity gains are possible in most healthcare settings, e.g., reports indicate that healthcare spending consistently outgrows GDP growth in the United States while productivity levels are poor.[148] As discussed throughout this report, there are multiple ways to realize productivity gains – ranging from using digital technologies to providing care in the optimal healthcare setting.

One of the levers with the highest near-term potential is the adoption of operational and procurement best practices. Currently, most healthcare providers have significant productivity gaps related to a lack of such practices. Nurses, for instance, only spend one-third of their time on core activities (i.e., providing care to patients).[149] By streamlining working processes and reducing time spent on non-core activities, productivity can be improved significantly. Furthermore, physician schedule density in the United States is only ~80%[148] – in a best-practice setting, it can be ~95% without risking burnout.[148] The implementation of more efficient ways of working has been shown to realize productivity gains, e.g., Narayana Health reduced surgery costs by $2,000 per treatment by implementing operational best practices, including standardizing procedures and realizing scale benefits while improving quality (and reducing the mortality rate).[150] Furthermore, throughput was significantly increased while costs were reduced, as processes were streamlined – allowing nurses to provide more than 50% of intravitreal injections at Moorfields Eye Hospital in London.[151]

Multiple operations and procurement levers can realize productivity gains, ranging from refining vendor negotiations to improving patient flow and increasing organizational

[148] N. Sahni; P. Kumar, E. Levine, and S. Singhal, 'The productivity imperative for healthcare delivery in the United States', February 2019, McKinsey & Company.

[149] 'Global growth: Can productivity save the day in an aging world?', McKinsey Global Institute, January 2015.

[150] Wall Street Journal; Deloitte LLP; International Medical Tourism Journal; Narayana Health.

[151] Michellotti et al., 'Transformational change: Nurses substituting for ophthalmologists for intravitreal injections – a quality improvement report', *National Library of Medicine,* 2014, pp. 755–761, https://doi.org/10.2147/OPTH.S59982; DaCosta et al., 'Implementation of a nurse-delivered intravitreal injection service', *Eye*, 2014, pp. 734–740, https://doi.org/10.1038/eye.2014.69.

efficiency. Table 5 provides a non-exhaustive overview of potential operations and procurement levers that can improve productivity.

Table 5. Non-exhaustive examples of operations and procurement levers for productivity improvement.

	Lever	Description and examples[152]
Procurement improvement levers	Vendor negotiation	Leverage negotiation strategies, e.g., vendor consolidation and decreased off-contract spending Adjust vendor contracts to align incentives around value and efficiency Launch parallel requests for proposals for all products and services to challenge the status quo, e.g., through a structured supplier days event
	Optimal product choice and usage	Ensure the lowest cost of ownership by involving healthcare expertise that can help choose optimal products that balance cost and quality Modify clinicians' usage behaviours to change purchasing practices or decrease product usage Standardize products used to gain scale benefits, i.e., instead of using one type of product locally, the same product can be used on a national level
	Outsourcing	Identify non-business essential services that can be outsourced, e.g., auxiliary services such as kitchen duties, cleaning, laundry, and security Identify vendors that match or improve the quality of services delivered without increasing costs
	Centralizing procurement function	Consolidate volume throughout the healthcare system to gain scale benefits and reduce shipping costs Optimize overhead costs associated with procurement Improve stockpile control to reduce safety stock levels and waste (improve knowledge of expiry dates) Define standards and expectations, e.g., use standardized order sets

[152] 'Global growth: Can productivity save the day in an aging world?', McKinsey Global Institute, January 2015; 'Prioritizing health: A prescription for prosperity', McKinsey Global Institute, July 2020; N. Sahni; P. Kumar, E. Levine, and S. Singhal, 'The productivity imperative for healthcare delivery in the United States', February 2019, McKinsey & Company; Expert interviews.

	Lever	Description and examples[152]
Operations improvement levers	Increased organizational efficiency	Simplify and streamline the organizational structure to reduce overhead costs and increase efficiency Standardize administrative processes, such as reporting, and aggregate certain functions, e.g., claims processing and adjudication Become a people-centred organization, e.g., investing more in skilled personnel can result in long-term cost-effectiveness and increased productivity
	Improved internal processes and planning	Increase utilization of physician time, e.g., by increasing schedule density Use process mapping to resolve bottlenecks for different processes, e.g., in the operating room, and clarify task ownership Implement weekly stand-up meetings to plan daily work, review performance, and agree on priorities Streamline and optimize the discharge process, e.g., allow for pre-emptive discharging by ER nurses
	Improved patient flows	Use operations improvement methods, e.g., lean, six sigma, or management engineering, to help optimize patient flow and improve productivity Carry out value-stream mapping on patient flows to identify bottlenecks and develop initiatives to resolve them Implement queuing systems to help prioritize urgent patients Streamline overall patient throughput – better processes enable patients to be treated quicker, thus requiring fewer beds
	Optimal task management	Standardize processes and ways of working to increase efficiency and realize productivity gains, e.g., implement standardized pre-operation checklists and early remote touchpoints with patients (which can reduce cancellations) Optimize specialist staff tasks, e.g., surgeons should focus on operating, not ward rounds

	Lever	Description and examples[152]
		Ensure that healthcare workers are 'operating at the top of their license,' i.e., offload less-complex work to lower-level workers Define clear guidelines and checklists for large patient groups Reduce non-essential work, e.g., repetitive and redundant processes for capturing patient information

While the concrete productivity gains from procurement and operations best practices vary depending on the context of the healthcare provider and which practices are implemented, a rigorous analysis was conducted to estimate the average potential productivity gains across regions. The analysis builds and expands on extensive research consisting of more than 300 academic publications and sources and combines this with several interviews with experts from more than ten countries. This comprehensive and rigorous analysis identified the potential to increase total productivity by between 11 and 22% without compromising healthcare quality in the coming five to ten years. The gains assume that multiple productivity improvement levers are utilized – out of which operational and procurement levers constitute ~9%,[153] even at the 'lowest' level estimated.[154] This translates into a potential productivity gain of ~0.9 to 1.8% per year using operational and procurement best practices, which is in line with estimations by the OECD.[155]

6.3.3 Applicability to Landspítali and Iceland

While there are natural variations across geographies, a vast number of interviews with experts from different countries validate to what degree these findings can be applied in different countries and contexts. These interviews concluded that even for the most operationally efficient countries, e.g., Japan, the impact from operational and procurement-related best practices is still applicable – albeit to a slightly lower degree. Given this, it is highly likely that these productivity gains will apply to both Landspítali and Iceland as a whole.

'Landspítali has a lot of room for improvement on operations; the potential there is huge for them.'

– Member of Landsráð

While the 11 to 22% productivity gains estimate might seem aggressive – a benchmark against other institutions indicates that it is relatively conservative. Depending on where and when estimations were made, some institutions estimate up to 50% productivity gains in the same period. Based on this, there is potential for even further productivity gains in the

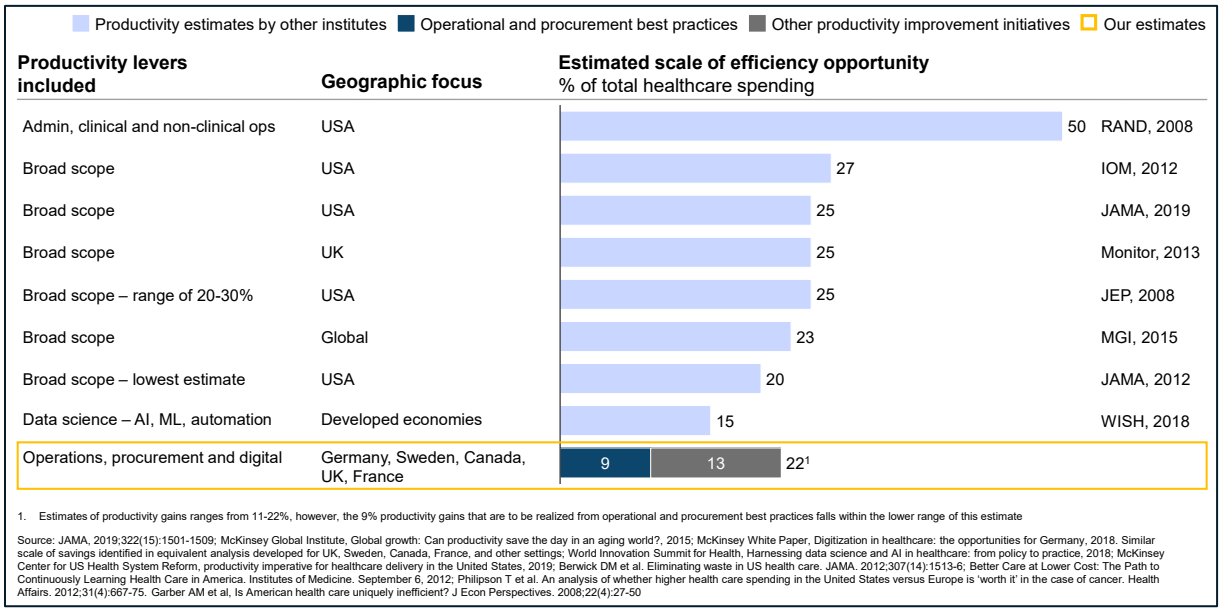
[153] As digitization can be considered an enabler for some of these productivity gains there is potential for overlap when estimating total productivity gains in the 'Digitization' chapter – this potential overlap is accounted for in the gains estimated in the 'Digitization' chapter.

[154] 'Global growth: Can productivity save the day in an aging world?', McKinsey Global Institute, January 2015; 'Prioritizing health: A prescription for prosperity', McKinsey Global Institute, July 2020.

[155] OECD, 'Healthcare systems: Getting more value for money', *OECD Economics Department Policy Notes,* 2010, number 2, oecd.org.

Icelandic context. Exhibit 69 compares the differences between different productivity improvement estimates.

Exhibit 69. Comparison of different productivity improvement estimations made by several institutions.



1. Estimates of productivity gains ranges from 11-22%, however, the 9% productivity gains that are to be realized from operational and procurement best practices falls within the lower range of this estimate

Source: JAMA, 2019;322(15):1501-1509; McKinsey Global Institute, Global growth: Can productivity save the day in an aging world?, 2015; McKinsey White Paper, Digitization in healthcare: the opportunities for Germany, 2018. Similar scale of savings identified in equivalent analysis developed for UK, Sweden, Canada, France, and other settings; World Innovation Summit for Health, Harnessing data science and AI in healthcare: from policy to practice, 2018; McKinsey Center for US Health System Reform, productivity imperative for healthcare delivery in the United States, 2019; Berwick DM et al. Eliminating waste in US health care. JAMA. 2012;307(14):1513-6; Better Care at Lower Cost: The Path to Continuously Learning Health Care in America. Institutes of Medicine. September 6, 2012; Philipson T et al. An analysis of whether higher health care spending in the United States versus Europe is 'worth it' in the case of cancer. Health Affairs. 2012;31(4):667-75. Garber AM et al, Is American health care uniquely inefficient? J Econ Perspectives. 2008;22(4):27-50

Given the relatively small scale of the Icelandic healthcare system compared to other nations, there is potential to be more agile in implementing new ways of working. Additionally, considering the current expansion of Landspítali with the addition of a new hospital building, there is potential to capitalize on the situation and remove some inertia and unwillingness to change among employees. Change resistance typically faced during transformational periods can potentially be avoided to a large extent, making it easier to ensure that new best practices are adopted throughout Landspítali.

'With the new hospital opening up, we have a great opportunity to achieve a lot within operations, which would increase staff efficiency and solve at least part of the issue surrounding the lack of staff.'

– Member of Landsráð

6.3.4 Conclusions and impact on Landspítali

6.3.4.1 Key conclusions

Based on rigorous analysis of current productivity gaps in the healthcare sector, it was found that most healthcare systems can expect between ~1 and 2% in annual productivity gains from implementing best practices in the areas of operations and procurement. While seemingly aspirational, this estimate has been corroborated with multiple experts across various regions and benchmarked against other productivity estimates.

For Landspítali, implementing operations and procurement best practices and subsequently realizing productivity improvements could be necessary to handle increased healthcare demand by 2040 without investing significantly in additional capacity and capabilities. Furthermore, given the small scale of the Icelandic healthcare system and the current

transformational period at Landspítali – due to the Hringbraut project – there are opportunities to take action.

6.3.4.2 Main 2040 scenario – most likely impact on Landspítali

Based on the facts discussed in this chapter, it is reasonable to assume that if Landspítali and the Icelandic healthcare system work towards implementing operations and procurement best practices, e.g., the ones discussed in Table 5, there is potential to realize annual productivity gains in line with the ~0.9 to 1.8% presented in the research.[156] Looking ahead to 2040, the forecast will thus include a range of productivity gain from implementing these practices. The low range of the estimation is conservative, resulting in ~0.9% in total annual productivity gains from operations and procurement, with the more aspirational end of the estimation including the full ~1.8% in annual gains.

The impact of the productivity gains will be split into two categories: procurement and operations best practices. The potential impact of each is based on the share of total Landspítali spend[157] within each category: procurement making up ~27.5% of spend and operations ~72.5%, which translates to ~0.25 to 0.5% in potential productivity gains from procurement and ~0.65 to 1.3% from operations.[158]

Procurement best practices mainly focus on reducing costs, e.g., through vendor negotiations and outsourcing. For the forecasting model, this means that productivity gains from procurement would almost exclusively be realized through direct cost reductions (i.e., not staffing cost reductions).

Operations best practices have a broader impact, including productivity improvements such as more efficient patient flow and faster patient access to treatment. This mainly translates into ALOS reductions and subsequently freed-up beds, which are the main parameters reflected in the forecasting model. However, FTEs[159] and costs are directly connected to ALOS reductions and freed-up beds, and as such, these factors will also be impacted.

Given the current inefficiencies at Landspítali, e.g., higher ALOS than comparable Swedish hospitals (even if outflow issues are overlooked)[160] and productivity decline in recent years,[161] significant productivity gains could be realized. Thus, it could be argued that productivity gains will be closer to the upper end of the range if enough resources and focus is dedicated to the widespread implementation of operational and procurement-related best practices. However, given the historical trends of productivity declines and significant efforts required to turn this around, the conservative end of the range, 0.9%, will be reflected in the main 2040 scenario. The full potential range of impact is presented in the following subchapter.

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[156] 'Global growth: Can productivity save the day in an aging world?', McKinsey Global Institute, January 2015; 'Prioritizing Health', McKinsey Global Institute, 2019.

[157] After excluding capital expenditures (i.e., depreciation) that is not relevant for operations or procurement.

[158] Calculated by multiplying the share of spend with annual productivity gain.

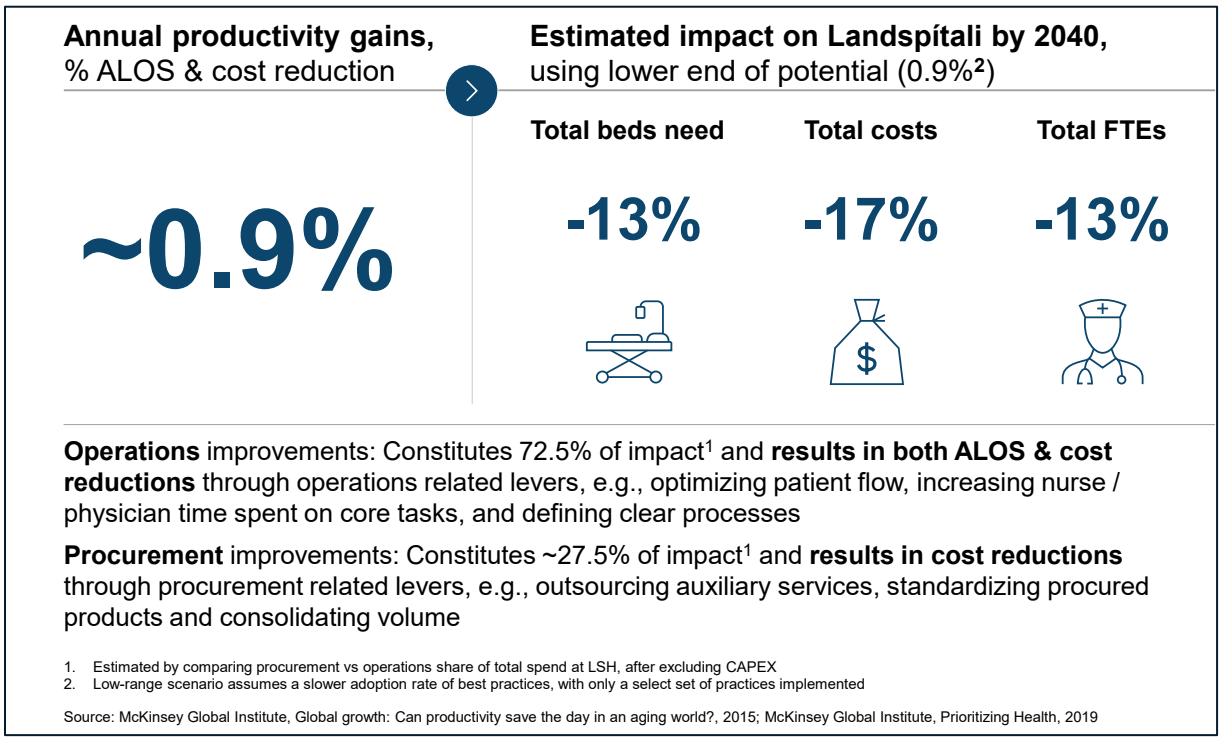
[159] The effect from ALOS reductions is assumed to impact all FTEs equally.

[160] Compared to hospitals in Skåne County using Landspítali capacity and production data and Skåne County capacity and production data.

[161] Between 2015 and 2019, physician productivity declined more rapidly at Landspítali compared to benchmarked hospitals in Skåne County (although, now at comparable levels). The comparison was based on Landspítali capacity and production data and Skåne County capacity and production data.

The impact of this scenario is highlighted in Exhibit 70 and would entail significant benefits for Landspítali: ~13% decrease in total beds needed ~17% cost reduction,[162] and ~13% reduction of workforce need. The impact is expected to be realized equally across divisions and workforce roles.

Exhibit 70. The impact from driving operations and procurement improvements on the 2040 forecast following the lower end of potential productivity gains (0.9%).



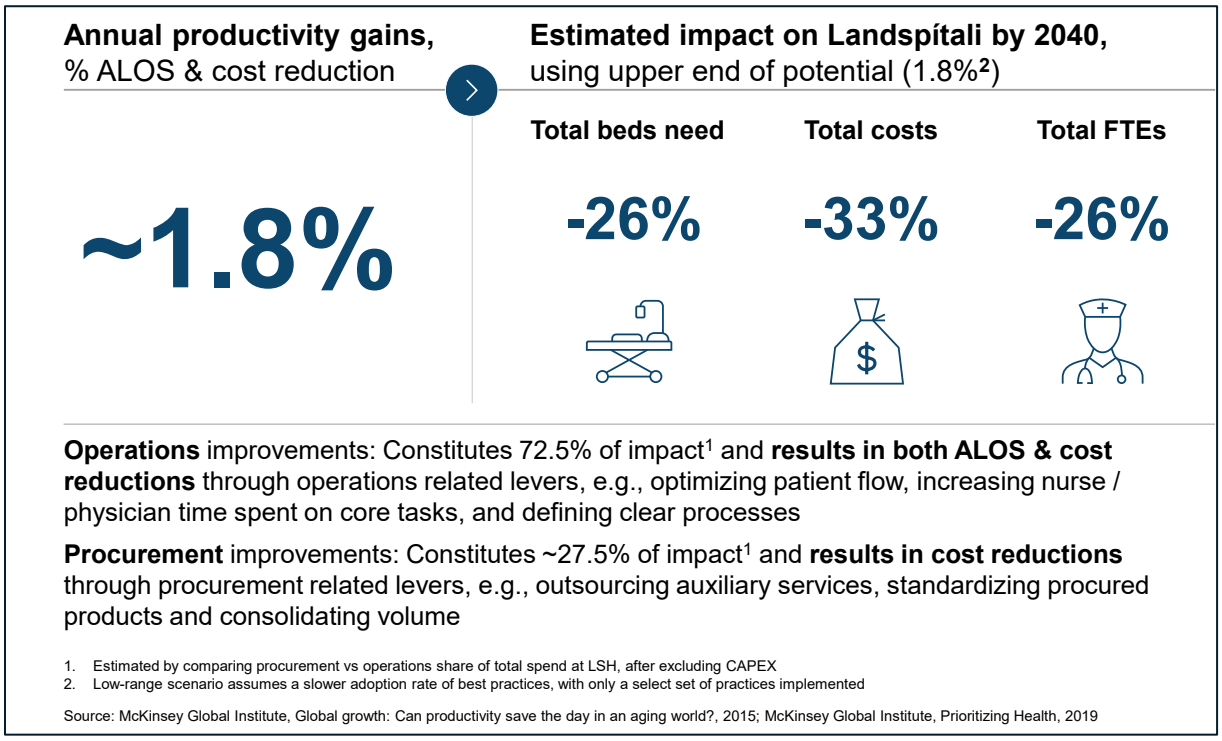
6.3.4.3 The potential range of impact on Landspítali

The 1.8% aspirational end of the productivity gains highlights the full potential impact range of implementing operations and procurement best practices. If Landspítali dedicates focus and resources to rapidly adopting these best practices successfully across the organization, these productivity gains could potentially be realized.

The potential impact of this scenario is highlighted in Exhibit 71. It expands on the benefits detailed in the main 2040 scenario – resulting in an ~26% reduction in need for beds , ~36% cost reduction, and ~26% reduction of workforce need. These gains would significantly impact Landspítali by 2040 and provide flexibility on how to handle the increased healthcare demand.

[162] Cost reduction is less than 18% due to the impact of real wage growth, as procurement initiatives do not impact the number of FTEs and hence not salary costs.

Exhibit 71. The impact of driving operations and procurement improvements on the 2040 forecast, following the upper end of potential productivity gains (1.8%).



6.4 Shift to day surgery

6.4.1 Introduction

Shifting surgery patients from inpatient to day surgery settings can have significant benefits.[163] By increasing the rate of surgeries carried out in day surgery settings, costs and resource utilization can be reduced, and patient outcomes and experiences improved.

This chapter describes the benefits of shifting surgeries to a day surgery setting. It also analyses the historical trend of the share of surgeries performed in the day surgery setting at Landspítali to discern whether such a trend exists, which would indicate the potential to shift further shift potential. The current day surgery shares for high-volume surgeries are then compared to best-in-class benchmarks to identify potential for future improvement.

This chapter is divided into three sections:

1. The topic of shifting surgeries to a day surgery setting and the proven benefits of this
2. The applicability of shifting surgeries to a day surgery setting at Landspítali, and a comparison of day surgery rates at Landspítali made to best-in-class benchmarks
3. An estimate of the impact on Landspítali from shifting surgeries in from inpatient theatres to a day surgery setting

[163] Day surgery setting refers to surgeries that are conducted on an outpatient basis, as opposed to inpatient basis, i.e., the patient enters and leaves the hospital the same day.

6.4.2 Shifting surgeries from inpatient theatres to a day surgery setting

Not all surgeries can or should be shifted to a day surgery setting, which entails that the patient is admitted and discharged on the same day, rather than being required to stay one or more nights for post-operative observation. Some patients may not be eligible due to complications or comorbidities. Even for 'less complex' patients, certain prerequisites (e.g., advanced equipment) must be in place to enable a hospital to achieve this shift. However, with advances in clinical practices and the emergence of new technologies and improved equipment, hospitals have gradually shifted a larger share of surgeries from inpatient theatre to a day surgery setting.

This shift to a day surgery setting can have significant benefits. When patients do not require overnight stays, bed days and clinical staff workloads decrease – resulting in cost reductions. Studies have further shown that overall waiting times for care decline and morbidities and complications decrease, resulting in enhanced quality of care and experience.[164] The Torbay and South Devon NHS Foundation Trust has actively shifted selected inpatient surgeries to a day surgery setting over the past few years, and concrete benefits have already been realized – including:

- 33% increase in productivity for hernia repairs if undertaken within the day surgery unit rather than inpatient theatres
- 47% increase in productivity in moving the hand surgery list from inpatient theatres to the day surgery unit
- 2-hour reduction in total pathway time for a day surgery patient compared to inpatient theatres

'If you are having a surgical procedure, day surgery should be considered as the default option and is suitable in many cases (except complex procedures). Day surgery allows for a quicker recovery with less disruption to you and your home life and also cuts the risk of hospital-acquired infections'

– Academy of Medical Royal Colleges

6.4.3 The opportunity for a further shift to day surgery settings at Landspítali

6.4.3.1 Approach to identifying the potential

To understand whether Landspítali is likely to capture the benefits of shifting more of its surgeries to a day surgery setting, we first need to analyse whether the opportunity exists at the hospital. To do so, historical trends at the hospital are first analysed to see if Landspítali has displayed a shift to a day surgery setting as seen in hospitals elsewhere, which would indicate that Landspítali has the prerequisites (e.g., processes) needed to capture these trends. Then, a comparison needs to be made to best-in-class aspirations on the achievable day surgery share to understand the room for improvement at Landspítali. Since each surgery is different (e.g., requiring different equipment and skills), this needs to be done on a surgical procedure level.

[164] 'National Day Surgery Delivery Pack', British Association of Day Surgery, Centre for Perioperative Care, GIRFT; K. Fehrrman, C. Matthews, M. Stocker, 'Day Surgery in different guises – a comparison of outcomes' *Journal of One-Day Surgery*, 2007, pp. 19, 39–47; G. Warren, et al., 'The benefits of a Dedicated Day Surgery Unit', *Journal of One-Day Surgery*, May 2020.

The Directory of Procedures – published every third year by the British Association of Day Surgery (BADS) – is used to compare Landspítali's current day surgery rates to best-in-class aspirations. BADS is a multidisciplinary organization that works towards increasing the extent to which day surgeries are performed. BADS supports research and quality improvement projects, offers specialist advice and support, and provides education about day surgery. The BADS Directory of Procedures indicates the rate at which certain procedures could be performed in a day surgery setting.[165] These rates are derived by analysing reported practices by leaders in their field, analysing data from Hospital Episode Statistics, and conferring with experts. While some of these rates can be considered aspirational, most are achieved by at least one hospital. Given that BADS is a centre of excellence dedicated to determining the degree to which day surgeries can be performed, it is considered a well-suited benchmark.

The Directory of Procedures covers the surgeries most applicable for a shift to day surgery setting and covers around 200 surgical procedures currently carried out at Landspítali across 11 specialties – accounting for over 25% of all surgery volume at Landspítali. By comparing Landspítali's current surgery rates on a procedure level to the aspirational rate deemed achievable by BADS, a fact-based outlook of the future potential of further shifts to day surgery settings at Landspítali can be identified. However, these results should be considered conservative – even though current best-in-class rates are used, future clinical and technological advancements are likely to increase current best-practice rates even further and, subsequently, impact the potential at Landspítali.

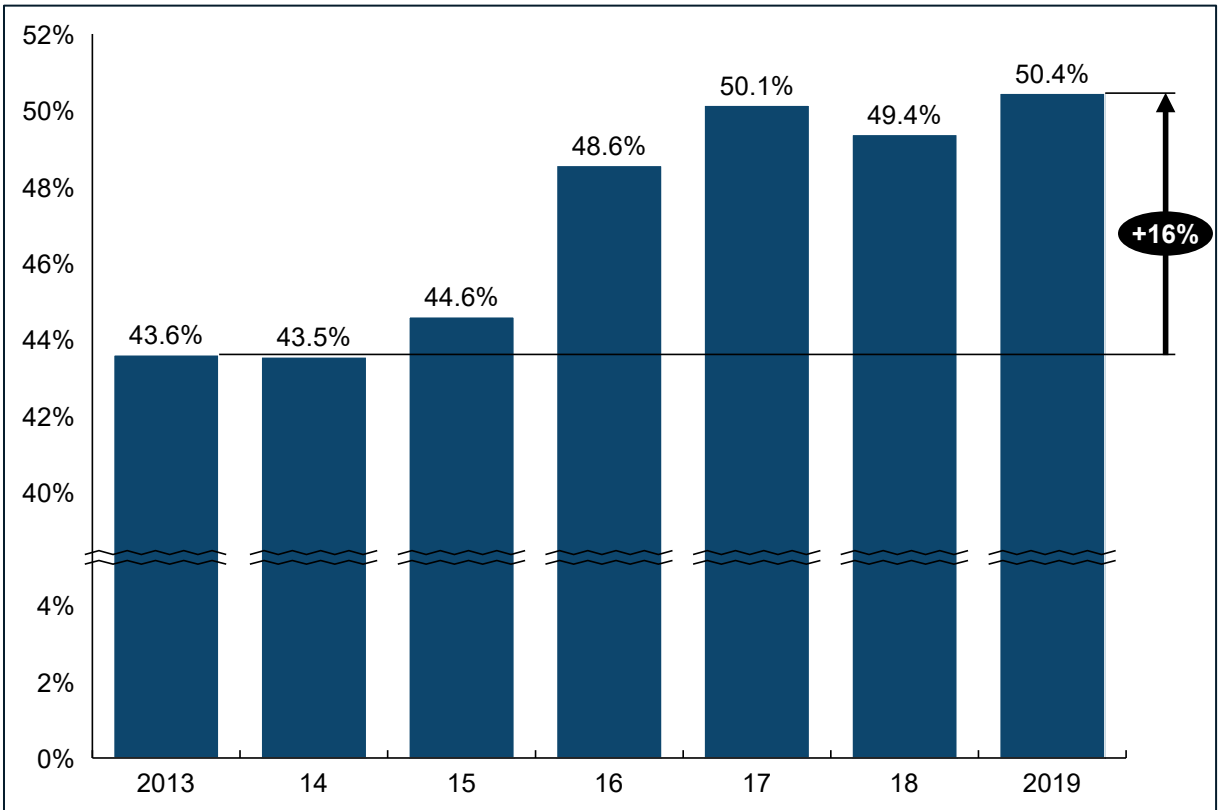
6.4.3.2 Historical development of day surgery rates at Landspítali

Since 2013, Landspítali has overall successfully shifted to an increased day surgery rate[166] – with the share of surgeries performed in a day surgery setting growing by ~1.1 percentage points annually. Exhibit 72 displays the historical trends for day surgery rates on an aggregate level at Landspítali. It can be deduced that the pace at which Landspítali has been shifting towards a day surgery setting has been relatively high since 2013. While this rate will potentially slow down as 'optimal levels' of day surgery rates are reached, the historical trends indicate that Landspítali is likely actively working towards increasing day surgery setting rates, and has established processes to enable a continued shift. Thus, it is not unlikely that Landspítali will continue to increase their day surgery rates where possible in coming years.

[165] British Association of Day Surgery, bads.co.uk, retrieved 1 November 2021.

[166] Landspítali patient data, 2013–2019.

Exhibit 72. Day surgery rate of all surgeries at Landspítali from 2013 to 2019.



Source: National Day Surgery Delivery Pack 2020, British Association of Day Surgery, Centre for Perioperative Care, GIRFT; Torbay and South Devon NHS Foundation Trust

6.4.3.3 Potential for further shifts to a day surgery setting

Landspítali already performs relatively well in terms of day surgery rates, as shown in Exhibit 73.[167] In the exhibit, the day surgery rates for the ten highest volume Landspítali surgeries found in the BADS Directory of Procedures is compared with best-in-class levels as recorded by BADS. Although Landspítali already has high day surgery rates, there is still room for improvement in the near future.

For certain surgeries, the gap to best-in-class BADS levels is minor, indicating that Landspítali likely already has the equipment and processes needed and may continue to increase its rates in the near term. One such surgery is laparoscopic cholecystectomy, with an ~7-percentage-point difference in day surgery rates compared to BADS. By adopting incremental changes in working processes for this surgery alone, ~50 surgeries could potentially be shifted to a day surgery setting annually by reaching BADS levels.

There are other surgical procedures at Landspítali where the day surgery rate is significantly lower at close to 0% compared to BADS levels of over 70%. An example of this is anterior colporrhaphy, as seen in Exhibit 73. This means that for some surgical procedures, Landspítali almost exclusively uses inpatient theatres to treat its patients. In contrast, the same surgical procedure can largely be done in a day surgery setting at select hospitals in

[167] Some of these surgeries are also provided in the private sector. However, the impact of that on the comparison made in this chapter is likely small, due to: a) Landspítali does not actively outsource any of these surgeries to private sector; b) The volume in the private sector of the surgeries compared here is considerably smaller than the volumes at Landspítali; c) The BADS levels are based on best performing hospitals in the United Kingdom, where the private sector is also an alternative.

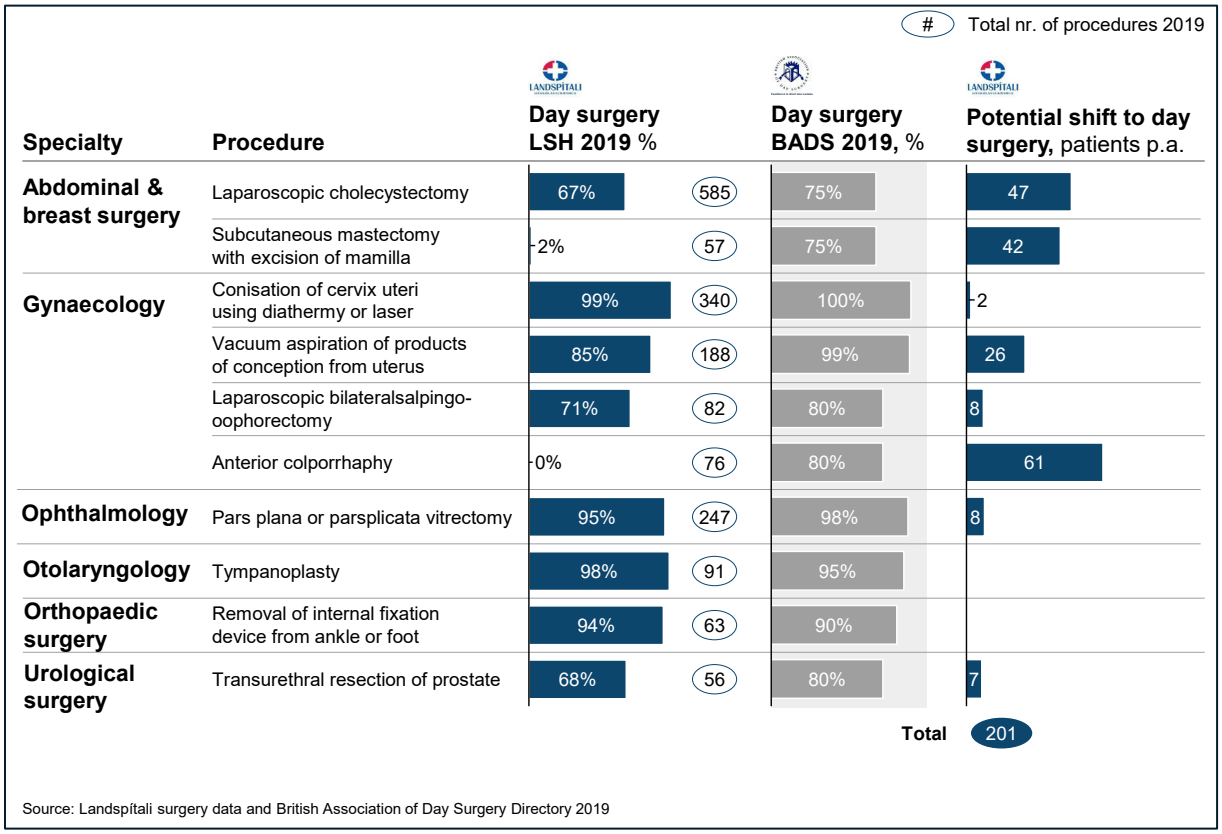
the United Kingdom. These statistics indicate that there may be structural differences in how these surgeries are carried out. For Landspítali to be able to reach best-in-class BADS levels for these surgeries, significant changes to working processes, improved equipment or the adoption of new treatment methods are likely needed. However, this may well be worth the effort, as it would shift a large volume of surgeries to a day surgery setting, with the accompanying benefits to Landspítali and its patients.

There is a clear opportunity for a further shift to a day surgery setting at Landspítali, and the hospital has displayed past capabilities of capturing this opportunity over time. Day surgery rates at Landspítali compared to BADS levels differ significantly between surgeries, which is normal, considering that specialized equipment or innovative treatment methods are often needed to enable the shift to day surgery. If Landspítali were to achieve current best-in-class levels for only the 40 highest volume surgeries[168] at the hospital – defined in the BADS Directory of Procedures – ~540 surgeries could be shifted to a day surgery setting annually (as measured at 2019 levels). This would mean shifting over 3% of all surgeries at Landspítali to a day surgery setting.

Shifting over 3% of all surgeries to a day surgery setting could decrease resource requirements at Landspítali (e.g., bed and staff needs). However, this is probably a conservative estimate of the current potential. Additional surgeries described in the Directory of Procedures were excluded due to low volumes or fluctuations in available data. More importantly, the best-in-class rates of day surgery will likely continue to increase, with advances in clinical practices and the emergence of new technologies and improved equipment. Thus, looking ahead, the potential for shifting surgeries to a day surgery setting at Landspítali in the coming 10 to 20 years is likely even higher than the ~3% captured here, even considering the fact that BADS levels are currently aspirational.

[168] This accounts for ~80% of all surgery volumes at Landspítali among the surgery types described in the BADS Directory of Procedures (excluding paediatrics, since paediatric surgeries are significantly different and have separate benchmarks in the BADS Directory of Procedures).

Exhibit 73. Day surgery rates for ten most common procedures at Landspítali compared to the BADS directory.



Source: Landspítali surgery data and British Association of Day Surgery Directory 2019

6.4.4 Conclusions and impact on Landspítali

6.4.4.1 Key conclusions

By shifting surgeries from inpatient theatres to day surgery, beds can be freed up, waiting times reduced, patient outcome and experience improved, and costs reduced. This chapter described the concept of shifting surgeries to a day surgery setting, presented current best-in-class benchmarks for the rates in which surgeries should be conducted in a day surgery setting, and discussed the potential for Landspítali to shift surgeries to a day surgery setting.

Since 2013, Landspítali has successfully shifted to an increased rate of day surgeries, growing ~1.1 percentage points annually, indicating that processes are in place to enable a continued shift. Reviewing current day surgery rates against best-in-class benchmarks from BADS revealed that Landspítali already performs well, but further opportunity exists to shift additional procedures to a day surgery setting. The comparison to best-in-class benchmarks showed that today, Landspítali has the potential to shift at least an additional ~540 surgeries to a day surgery setting annually (~3% of all surgeries at Landspítali), which could result in tangible benefits.

It was argued that the identified ~3% potential for Landspítali on shift to a day surgery setting is likely conservative, as it does not capture the potential for all surgeries at the hospital. Finally, when looking to the coming 10 to 20 years, Landspítali will likely be able to capture even more than the identified ~3% potential since further advances in clinical practices, equipment, and technology are likely to occur.

6.4.4.2 Main 2040 scenario – reaching BADS levels

Given Landspítali's success in shifting surgical procedures to a day surgery setting in the past decade and the potential that exists even today, it is likely that Landspítali will continue to increase its day surgery ratio. Likely future advancements in clinical practices and technology further corroborate this conclusion, as these would further enable hospitals to improve their day surgery rates. However, determining exactly how far Landspítali will be able to shift to day surgery in the coming 10 to 20 years is difficult, as it depends on technological and treatment innovations.

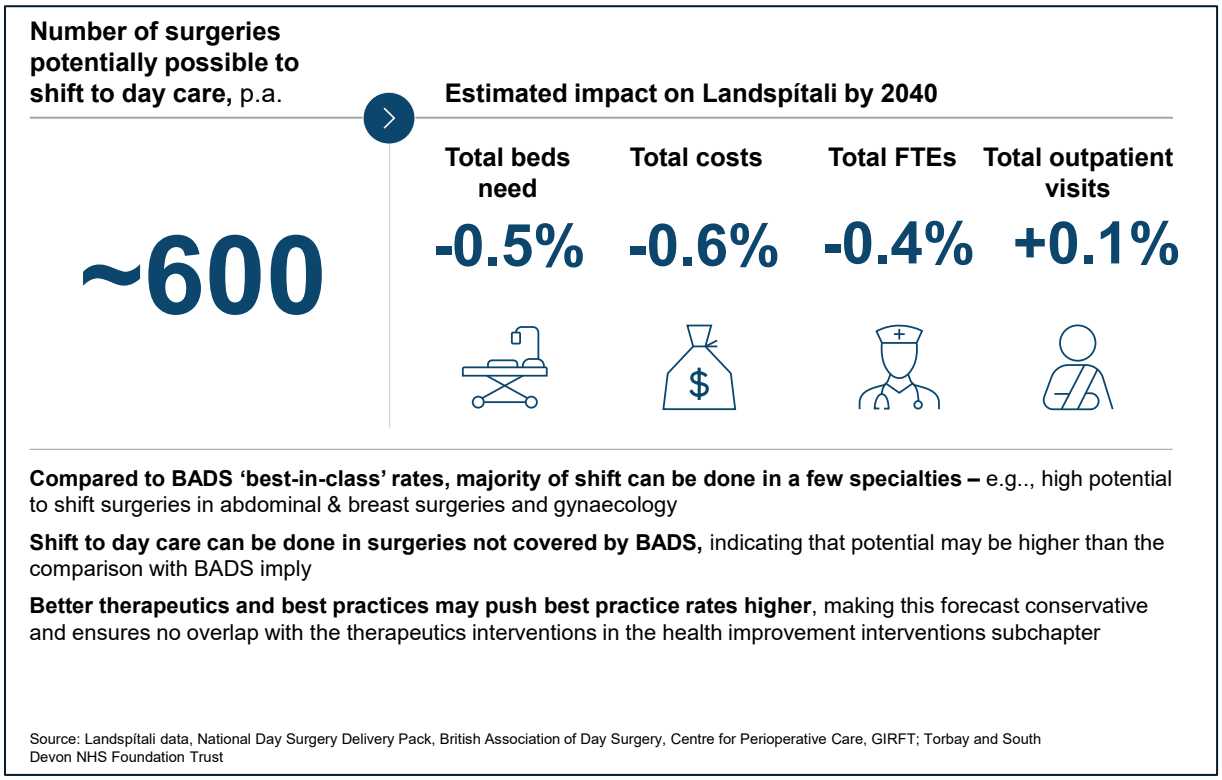
At the same time, capturing at least a conservative estimate of the shift to a day surgery setting is important to enable a more robust view of Landspítali's potential resource needs in the coming years. The conservative approach presented here – and included in the main 2040 scenario for Landspítali – assumes the hospital will at least reach current best-in-class day surgery rates shown in the BADS Directory of Procedures for their high-volume surgical procedures. This includes 40 types of surgeries that account for ~80%[169] of the total volume of all surgeries at Landspítali, among the surgery types described in the BADS Directory of Procedures.[170]

The impact for Landspítali when reaching current best-in-class day surgery rates by BADS is highlighted in Exhibit 74. This relatively conservative estimate would entail a ~0.5% reduction in the total need for beds, a ~0.4% reduction in total FTE requirements, and ~0.6% cost savings for Landspítali by 2040. Additionally, the shift would result in ~0.1% more outpatient visits.

[169] ~20% of surgeries covered by the BADS Directory of Procedures are excluded due to high fluctuations in day surgery rate – i.e., one surgery might have significantly higher or lower day surgery rate from one year to the next due to high variation in types of patients. Furthermore, the excluded surgeries are all low-volume procedures, which enhances the impact of fluctuations.

[170] Excluding paediatrics, since paediatric surgeries are significantly different and have separate benchmarks in the BADS Directory of Procedures.

Exhibit 74. By only reaching current BADS rates, Landspítali would shift ~600 surgeries in 2040 and decrease the need for beds, total costs, and total FTEs.



6.5 Digitization

6.5.1 Introduction

Adopting a wide range of digital solutions can increase productivity within the Icelandic healthcare system by up to ~0.6% per year, depending on the adoption rate, and enable significant productivity improvements in other areas, e.g., operations and procurement, a shift to day surgery, and more. This chapter first presents a broad overview of digital solutions being implemented in other countries and their estimated productivity impact based on comprehensive research. Then, the chapter briefly outlines potential overlaps with other aspects of this report and discusses the implications of adopting these digital healthcare solutions on Iceland and Landspítali – concluding that there are significant productivity gains to realize from digitizing the Icelandic healthcare system further.

6.5.2 Digital solutions in healthcare

Digitizing the healthcare system can contribute to significant benefits in terms of increased productivity, as healthcare services can be provided at a lower cost with improved accessibility and potentially higher quality. Electronic prescriptions, advanced analytics forecasts, e-health services, and electronic health record systems are just a few examples of how digital tools can boost the effectiveness and efficiency of healthcare.[171] As an enabler of many other improvement areas discussed in this report, digitization accounts for one of the most significant increases in productivity going forward.

[171] 'Global growth: Can productivity save the day in an aging world?', McKinsey Global Institute January 2015.

Based on digitization research in both Germany and Switzerland,[172] digital healthcare solutions can broadly be divided into three main categories: digital health, e-health, and enablers – all detailed in Table 6.

Table 6. Overview of digital healthcare solutions that can realize productivity gains.

Category	Subcategory	Digital solution
Digital health	Online Interaction	Teleconsultation
		Remote monitoring of chronic disease patients
		E-triage
	Patient self-care	Chronic disease management tools for: ● Mental health ● Diabetes ● Respiratory diseases ● Cardiovascular diseases
		Medical chatbots
		Disease-prevention tools
		Patient support networks
		Digital diagnostic tools
		Virtual reality for pain management
	Patient self-service	E-booking (electronic appointment system)
E-health	Workflow and automation	Nurse mobile connectivity

[172] S. Hehner, S. Biesdorf, M. Möller, 'Digitizing healthcare - opportunities for Germany', October 2018, McKinsey & Company; M. Hämmerli, et al., 'Digitization in healthcare', September 2021, McKinsey & Company.

Category	Subcategory	Digital solution
		Barcoding medication administration
		RFID tracking
		Vital parameter tracking (eICU)
		Hospital logistics robotics
		Process automation through robots
		E-referrals
	Outcome transparency/decision support	Performance dashboards
		Patient flow management
Enabler	Electronic health records or paperless data	Unified electronic health records or exchange
		E-prescribing
		Intrahospital staff communication
		Clinicians' virtual assistants (artificial intelligence)

These categories contain concrete digital solutions that are expected to realize significant productivity benefits of ~1 to 2% annually in the coming decades.[173] These gains will be realized through several aspects of the healthcare system, including lowering demand (mainly outpatient) by avoiding duplicate examinations, reducing hospital admissions, and minimizing the need for subsequent treatments by improving treatment quality. Productivity gains are also expected from improved efficiencies and reduced infrastructural needs. The largest potential comes from the digital health initiatives, which account for ~50% of total productivity gains of the three main categories. E-health initiatives make up ~30%, and enabler initiatives ~20%.

[173] Based on 11 to 12% estimated productivity gains from a typical adoption rate, ranging from 5 to 15 years; S. Hehner, S. Biesdorf, M. Möller, 'Digitizing healthcare - opportunities for Germany', October 2018, McKinsey & Company; M. Hämmerli, et al., 'Digitization in healthcare', September 2021, McKinsey & Company.

6.5.3 Applicability to Landspítali and Iceland

The productivity gains from the digital solutions outlined in Table 6 are also applicable to the Icelandic context. Depending on the focus, investment, and adoption of rate of these technologies, ~1 to 2% in annual productivity gains can potentially be realized if all solutions are implemented. However, the benefits from digitization efforts are, to a large degree, already captured by other factors mentioned in this report:

1. The base forecasting model uses IHME data, which partly uses historical trends of incident and prevalence rates to forecast future development. Thus, some digital solutions outlined in Table 6 that directly affect incident and prevalence rates are already captured by the base forecast – namely remote monitoring of chronic disease patients and all digital solutions related to patient self-care. These account for ~0.2 to 0.6% of the 1 to 2% in potential annual productivity gains identified and should thus be removed to avoid double counting.
2. Many of the digitization improvement areas mentioned in Table 7 are enablers for other areas of improvement already discussed in this report. An extensive analysis using a significant amount of existing academic research and numerous expert interviews[174] was conducted to estimate the impact already captured by other initiatives. The analysis concludes that around two-thirds of total productivity gains from digitization efforts are potentially realized in other areas, e.g., operations best practices using digital tools, as discussed in the 'Operations and procurement best practices' chapter.

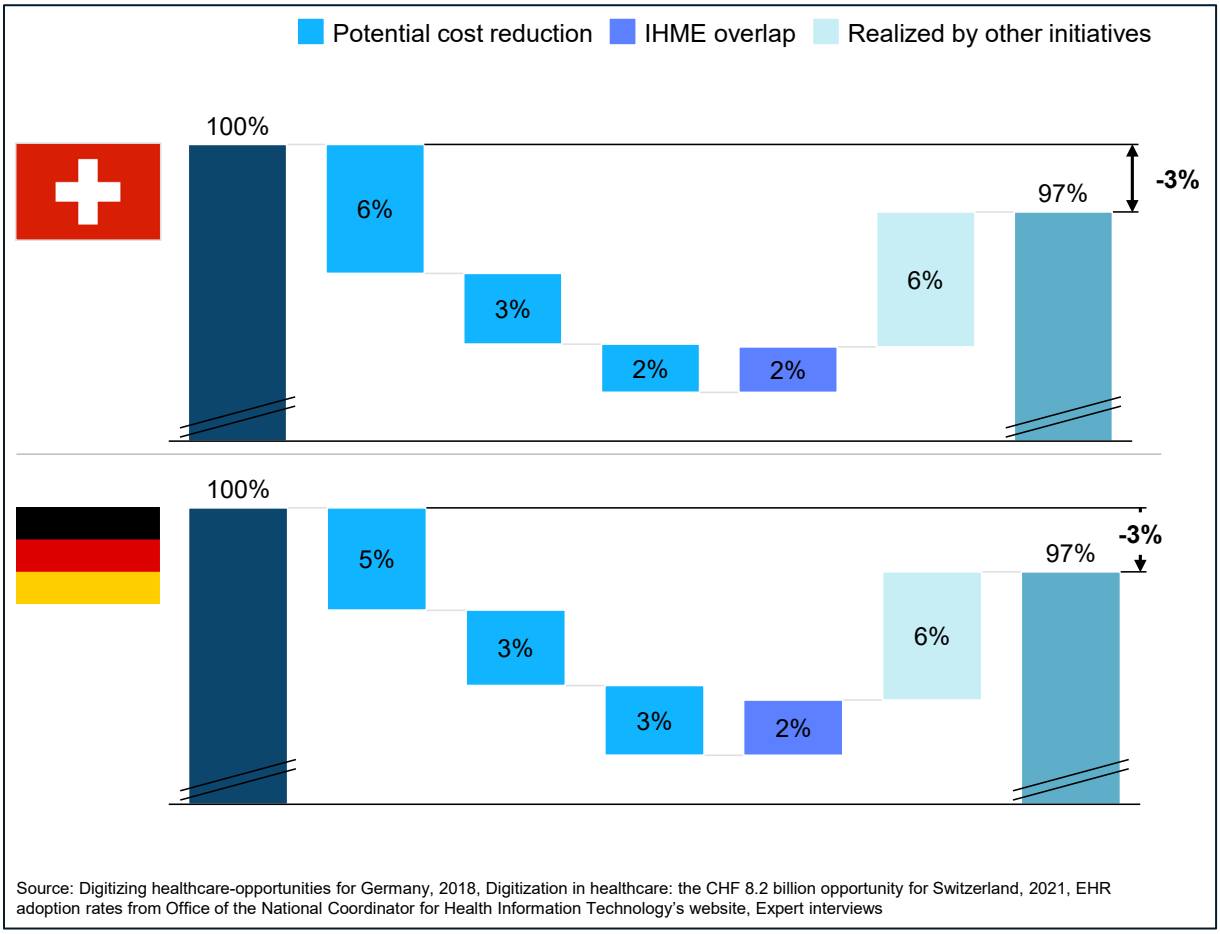
After accounting for the overlap with the IHME forecast and other productivity gains discussed in the report, it is estimated that Landspítali can potentially realize ~0.2 to 0.6% in annual productivity gains from digitization efforts alone – depending on the focus on and investment in adopting these digital solutions.

Productivity gains will mainly be driven by a reduction in care needs (primarily outpatient volumes), improved efficiencies captured through FTE savings, and potentially reduced infrastructure needs. Furthermore, the Icelandic healthcare system overall will also likely experience increased quality and accessibility in addition to decreased costs.

Exhibit 75 provides a simplified overview of the potential productivity gains from the digital solutions in Table 6 when implemented in Germany and Switzerland. It accounts for the potential overlap with IHME and other initiatives to make the productivity gains applicable in the Icelandic context.

[174] 'Global growth: Can productivity save the day in an aging world?', McKinsey Global Institute, January 2015.

Exhibit 75. Total healthcare expenditure and potential digitization cost reduction in Switzerland and Germany – accounting for possible overlaps with IHME forecast and other productivity initiatives.



Source: Digitizing healthcare-opportunities for Germany, 2018, Digitization in healthcare: the CHF 8.2 billion opportunity for Switzerland, 2021, EHR adoption rates from Office of the National Coordinator for Health Information Technology's website, Expert interviews

6.5.4 Conclusions and impact on Landspítali

6.5.4.1 Key conclusions

Using digital healthcare solutions can create significant productivity benefits for any healthcare provider going forward, from enabling new treatment settings through e-health solutions to more effective data handling and sharing through electronic health record systems. By analysing countries currently implementing 30 different digital healthcare solutions, it was found that there is potential to realize ~1 to 2% in annual productivity gains through digitization depending on the adoption rate.

By adopting a range of digital solutions, productivity within the Icelandic healthcare system can be increased by up to ~0.6% per year, depending on the adoption rate. In addition, this will enable significant productivity improvements in other areas, e.g., operations and procurement and the shift to day surgery.

6.5.4.2 Main 2040 scenario – most likely impact on Landspítali

If the Icelandic healthcare system dedicates sufficient effort and resources to implementing and adopting digital healthcare solutions, e.g., those outlined in Table 6, there is potential to realize significant productivity gains. Looking ahead to 2040, the potential gains that can be

realized are in the range of ~0.2 to 0.6% per year, after accounting for possible overlaps with the baseline forecast and other improvement initiatives discussed in this report.

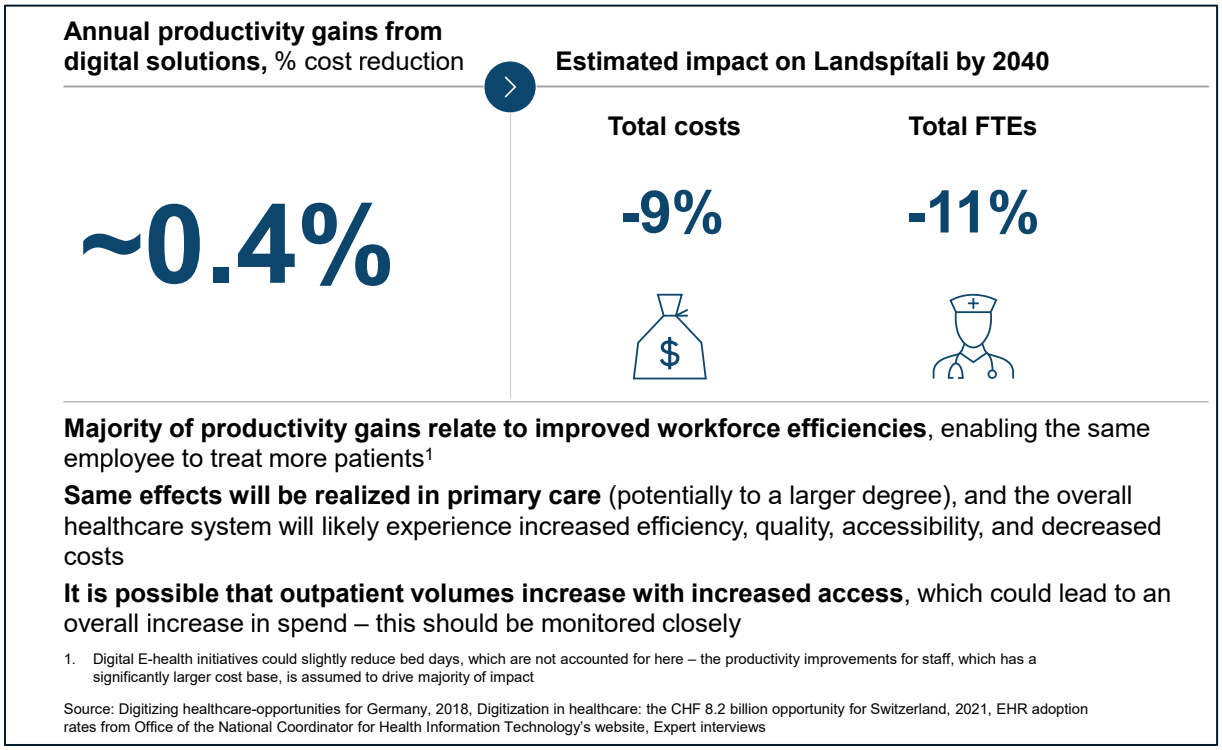
Given the proactive pace at which Iceland has historically adopted new digital healthcare technologies – e.g., Iceland has some of the most mature electronic health record systems in Europe[175] – it is reasonable to assume that Iceland will likely continue to adopt new digital solutions efficiently. As such, Iceland lies closer to the aspirational end of the productivity range of 0.6%. However, given the significant efforts required to achieve this and the fact that some gains may have already been realized before 2019, the mid-point of the estimated range (0.4% in annual gains) is deemed more likely and will be used in the main 2040 scenario.

Digitization efforts will mainly result in increased productivity for staff. The impact on staff is calculated so that the total cost reduction of 0.4% annually is accounted for through decreases in salary volumes. While some digital solutions might reduce the number of bed days, these are excluded due to overlaps with improvement areas discussed in the report (e.g., operations) and are not reflected in the forecast on the impact of digitization. Although these benefits will likely be realized in primary care as well, perhaps to an even larger degree, they will not be included in the forecast, as the main focus is the impact on Landspítali. Finally, through the improved accessibility via teleconsultation, outpatient volumes may increase, i.e., as people seek care for less severe issues as care is more easily accessible. While not included in the model, this should be closely monitored as the potentially increased volume could generate additional costs.

The impact of this scenario is highlighted in Exhibit 76. If captured, digitization improvements would result in an overall cost reduction of ~9% and a total workforce reduction of ~11% for Landspítali by 2040.

[175] G.A. Hardardottir, I.S. Ingason, 'National eHealth Strategy: 2016–2020', Iceland Directorate of Health, January 2016, landlaeknir.is; T. Scliemann, et al., 'eHealth Standardisation in the Nordic Countries', Nordic Council of Ministers, 2019, norden.diva-portal.org.

Exhibit 76. Impact of 0.4% annual productivity gains from digitization initiatives on 2040 forecast, Landspítali.



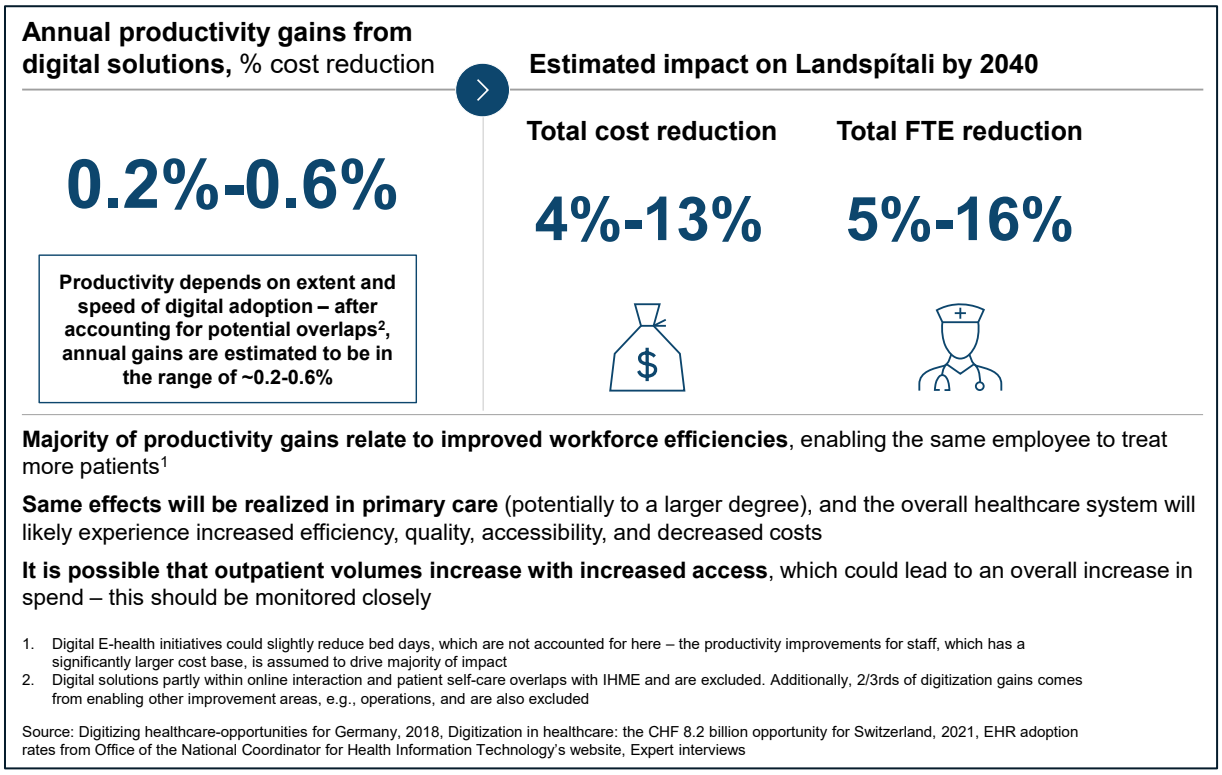
6.5.4.3 The potential range of impact on Landspítali

The lower and upper ends of the productivity range are also modelled to capture the full potential impact of implementing digital health solutions. These figures also highlight what could be achieved if Landspítali decides to dedicate more or less resources and focus on the digitization efforts displayed in this section.

The potential impact on the conservative end of the range – 0.2% in annual gains – is highlighted in Exhibit 77 and would result in less benefits than the main 2040 scenario, i.e., ~4% reduction of overall costs and ~5% reduction of Landspítali's total workforce.

The potential impact on the aspirational end of the range – 0.6% in annual gains – is also highlighted in Exhibit 77 and expands on the benefits in the main 2040 scenario. These additional benefits could total a ~13% reduction of overall costs and ~16% reduction of Landspítali's total workforce.

Exhibit 77. Impact of 0.2 to 0.6% in annual productivity gains from digitization initiatives on 2040 forecast, Landspítali.



7 Landspítali’s future role in the main scenario

This chapter combines the base case forecast with key insights from the fact bases on strategic choices and operational improvement and prevention measures to study Landspítali’s likely future outlook. The first section details the main scenario forecast for key metrics to understand Landspítali’s future needs, and the second section analyses Landspítali´s potential future role.

7.1 Main scenario forecast for 2026, 2030, and 2040

In this section, the main scenario forecast for Landspítali is detailed for 2026, 2030, and 2040. Firstly, a description of the main scenario is provided. Secondly, an overview is given on the steps to determine the main scenario and when the strategic choices and improvement measures are expected to occur. Lastly, the main scenario forecast – for the key outputs of outpatient visits, bed needs, operating room needs, workforce need, and costs – is presented for 2026, 2030, and 2040.

7.1.1 Description of the main scenario

The main scenario details the most probable scenario for Landspítali based on making strategic choices in line with what has been gathered from discussions with experts and stakeholders in the Icelandic healthcare system and achieving a realistic level of operational improvements and preventions. This would entail driving successful initiatives connected to:

1. Shifting out a significant portion of long-term care from Landspítali
2. Shifting out primary care from Landspítali
3. Insourcing select out-of-country treatments to Landspítali
4. Increasing research funding and focus of Landspítali
5. Achieving operations and procurement improvements at Landspítali
6. Shifting surgeries from inpatient care to day surgery at Landspítali
7. Achieving digitization improvements at Landspítali

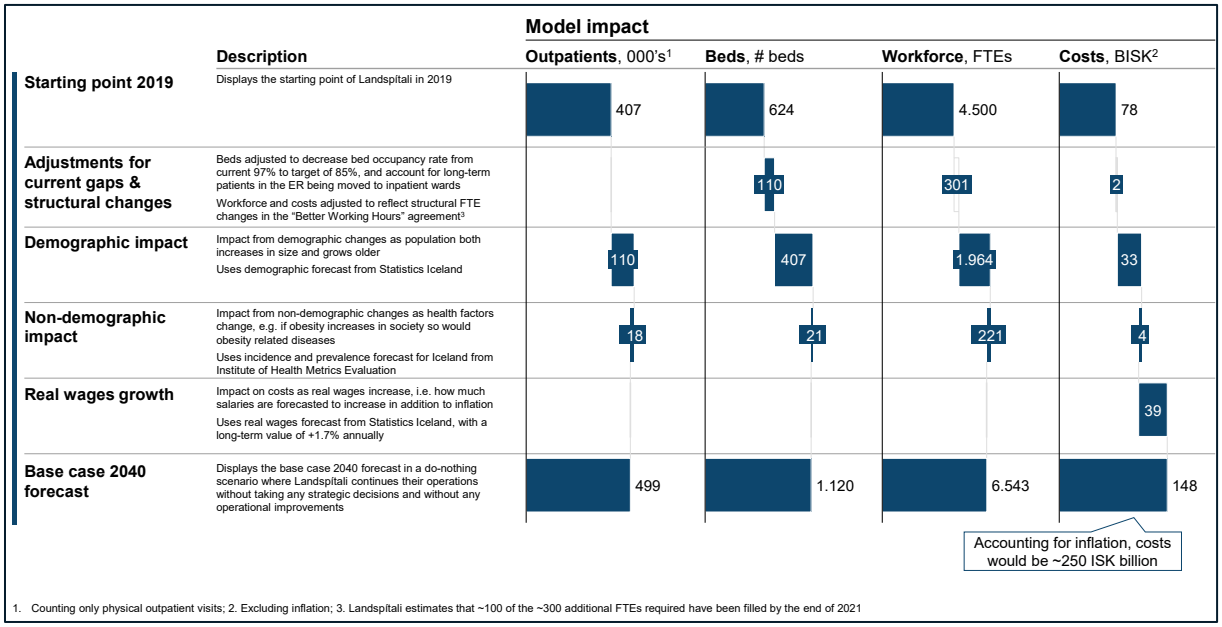
The main scenario is described for 2026 to understand the situation when the new hospital building, Hringbraut, is open, and for 2030 and 2040 to gauge how Landspítali’s demand and needs are expected to evolve in the longer term.

7.1.2 Overview of steps to determine the main scenario

To determine the main scenario, first the base case forecast is modelled, and then the impact of each strategic decision and operational improvement and intervention is considered. This section describes each step in this process, the modelled impact on outpatient visits until 2040, and the beds, workforce, and cost requirements. Outpatient visits are included to ensure outpatient care is covered since this affects the hospital’s needs in terms of what facilities are required, while bed needs cover the inpatient care. Furthermore, the workforce is essential to provide this care, and the costs serve to understand future potential budget needs.

The base case 2040 forecast begins from the starting point in 2019, described in the 'Landspítali's starting point' chapter. It is adjusted for current gaps in beds to reach the target occupancy rate of 85% and also account for moving long-term patients in the ER to inpatient wards. It is further adjusted for the 'Better Working Hours' agreement's structural changes on workforce and salary costs. The impact of demographic, non-demographic, and real wage changes until 2040 is then applied to determine the base case 2040 forecast. This indicates that a significant increase in hospital resource needs is expected, with outpatient visits increasing from 407,00 to 499,000 (+23%), beds from 624 to 1,120 (+79%), the workforce from 4,801 to 6,515 (+36%), and costs, excluding inflation, from ISK 78 billion to 148 billion (+90%). The 'Baseline forecasting of Landspítali's healthcare demand and needs until 2040' chapter gives more details on this forecast.

Exhibit 78. Base case 2040 forecast.

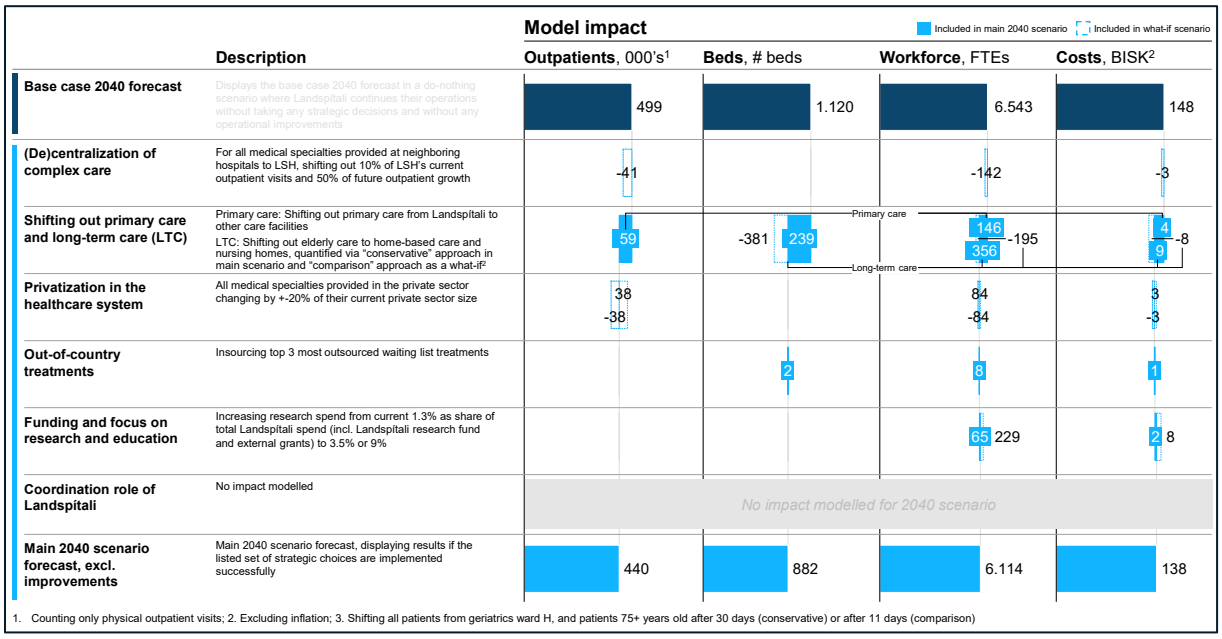


Next, the impact of the six strategic choices detailed in the 'Key strategic choices facing the Icelandic healthcare system' chapter is accounted for to form the main scenario forecast, excluding operational improvements and preventions:

1. Decentralization of complex care is modelled as a what-if scenario where – for all medical specialties provided at neighbouring hospitals – 10% of Landspítali's current outpatient visits and 50% of future outpatient growth is shifted out. This corresponds to a reduction of ~8% of outpatient visits, ~2% of FTEs, and ~2% of costs.
2. Shifting out primary care is included in the main scenario, modelling the impact of moving out primary care from Landspítali to reach benchmark levels amounting to a reduction of ~12% of outpatient visits, ~2% of FTEs, and ~3% of costs. Shifting out long-term care is included in the main scenario using the conservative approach. Here, Geriatric Ward H and all patients over 75 years old are shifted after staying at Landspítali for 30 days. The comparison approach (using a Swedish university hospital as a benchmark), where patients over 75 years old are shifted out after 11 days, is modelled as a what-if scenario. The conservative approach in the main scenario results in a reduction of ~21% of beds, ~5% of FTEs, and ~6% of costs.

3. Privatization is modelled as a what-if scenario, assuming that all medical specialties provided in the private sector change in size by more than –20%, corresponding to either an increase or a reduction of ~8% of outpatient visits, ~1% of FTEs, and ~2% of costs.
4. Insourcing out-of-country treatments is included in the main scenario as insourcing the top three most outsourced waiting list treatments will amount to an increase of ~0.2% of beds, ~0.1% of FTEs, and ~0.5% of costs.
5. Funding and focus on research and education are included in the main scenario to increase research spend from current ~1.3 to 3.5%, corresponding to an increase of ~1% of FTEs and ~2% of costs. Additionally, a what-if scenario is modelled for increasing research spending to ~9%.
6. The coordination role of Landspítali is not included in the model due to the low likelihood of implementation of most of the potential coordination roles and the minimal impact they would have.

Exhibit 79. Strategic choices and potential model impact.

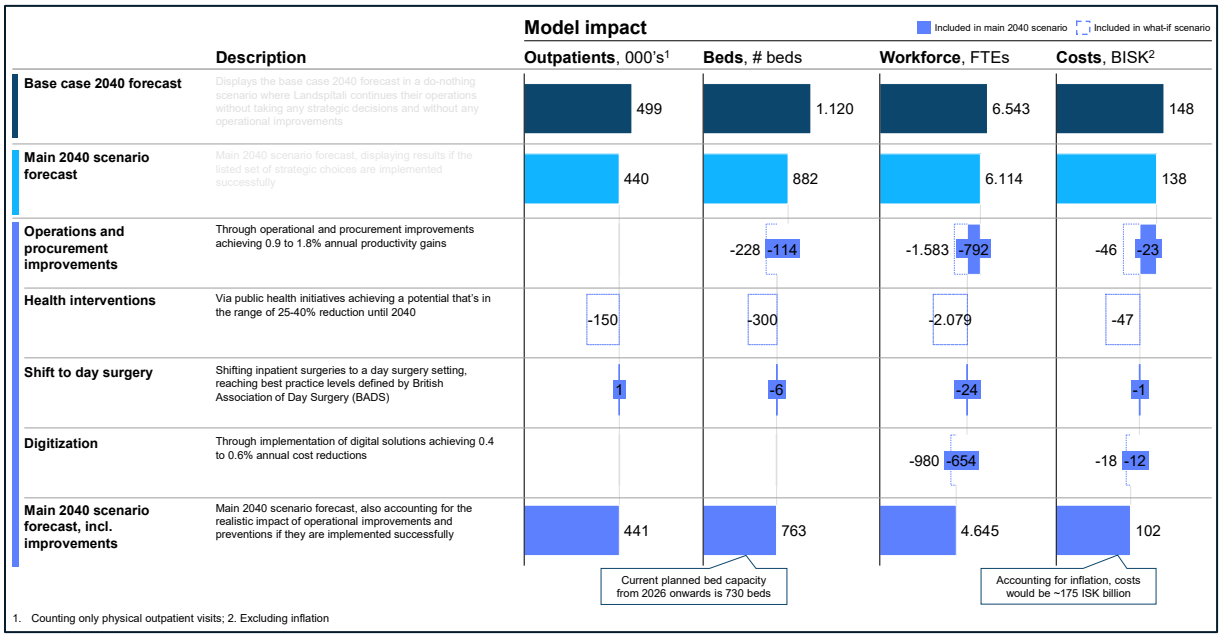


Finally, the impact of the four operational improvements and prevention measures detailed in the 'Operational improvements and prevention' chapter is calculated to form the main scenario forecast:

1. Operations and procurement improvements are included in the main scenario. They are expected to have a 0.9% impact on annual productivity gains, resulting in a reduction of ~13% of beds, ~13% of FTEs and ~17% of costs. Additionally, a what-if scenario is modelled for reaching 1.8% annual productivity gains.
2. Health interventions are modelled as a what-if scenario. The total potential is a ~34% decrease in healthcare demand, corresponding to between ~25 to 40% decrease across outpatient visits, beds, FTEs, and costs.
3. Shift to day surgery is included in the main scenario. If current best-in-class levels, defined by BADS, are reached, this could increase outpatient visits by ~0.1% and decrease beds by ~0.5%, FTEs by ~0.4%, and costs by ~0.6%.

4. Digitization is included in the main scenario to have a 0.4% impact on annual productivity gain, reducing ~11% of FTEs and ~9% of costs.

Exhibit 80. Operational improvement and prevention measures and potential model impact.



7.1.3 Timeline to realize impact from the main scenario initiatives

In the main scenario, the two initiatives on 1) operations and procurement improvements and 2) digitization improvements, have an impact that is assumed to be realized annually. For the remaining five initiatives, it takes time to realize the impact. This becomes relevant when creating the main scenario, especially for 2026. Until 2026, the impact from the following four initiatives is expected to be realized fully:

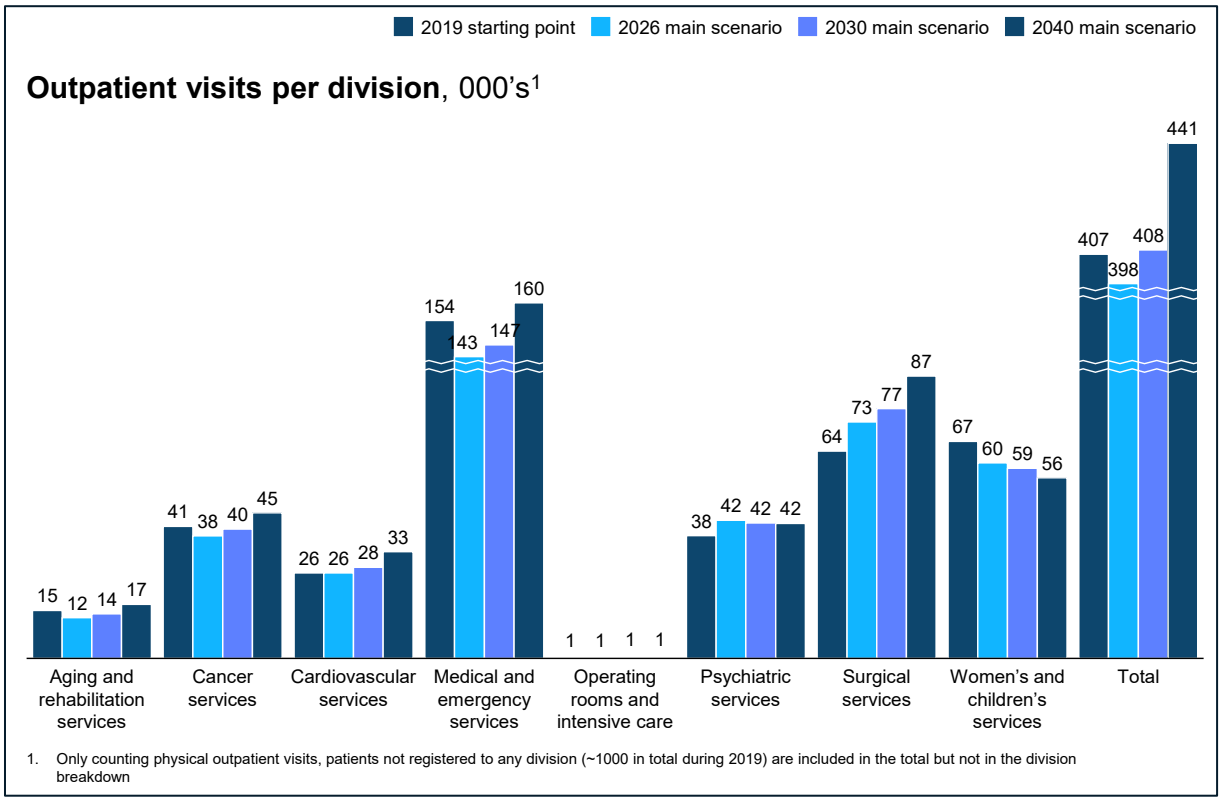
- Shifting out primary care, since activities connected to this are already in progress, though noting that capacities at primary care facilities may need to be expanded.
- Insourcing select out-of-country treatments, since fully insourcing three treatments already performed at Landspítali would not require long lead times. However, a limiting factor could be ensuring sufficient capabilities.
- Increasing research funding and focus, since it is predominantly a strategic choice that needs to be made.
- Shifting inpatient surgeries to day surgery, since Landspítali is already performing well in this field, with data since 2013 displaying a positive trajectory.

However, the initiative on shifting out long-term care is expected to take longer to realize since the capacity needs to be expanded in other parts of the healthcare system (e.g., home-based care) to handle the large patient volumes being shifted out from Landspítali. Assuming activities are commenced regarding this shortly – which discussions with stakeholders in the Icelandic healthcare system indicate there is a desire for – and that they are driven successfully, the full impact is expected to be realized by 2030. For 2026, the impact realized is determined based on how much of the potential of shifting long-term care would need to be achieved to enable handling forecasted demand using planned capacity; this can then guide the potential timeline for shifting out long-term care from Landspítali.

7.1.4 Main scenario forecast on outpatient visits

Outpatient visits are expected to decrease by ~2% in the main scenario until 2026, driven by primary care being shifted from Landspítali, which corresponds to a ~12% decrease in outpatient visits. This would serve to alleviate demand especially in the ER, where outpatient visits would decrease by ~7%, from ~154,000 in 2019 to ~143,000 in 2026. After that, outpatient visits are expected to increase back to around 2019 levels by 2030 before increasing by a further ~8% until 2040. Across divisions, the most significant growths are forecasted for surgical and cardiovascular services, growing by ~36% and ~25%, respectively. In contrast, women's and children's services is the only division expected to decrease in the number of outpatient visits, with a total of about –17%.

Exhibit 81. Outpatient visits per division in the main scenario.



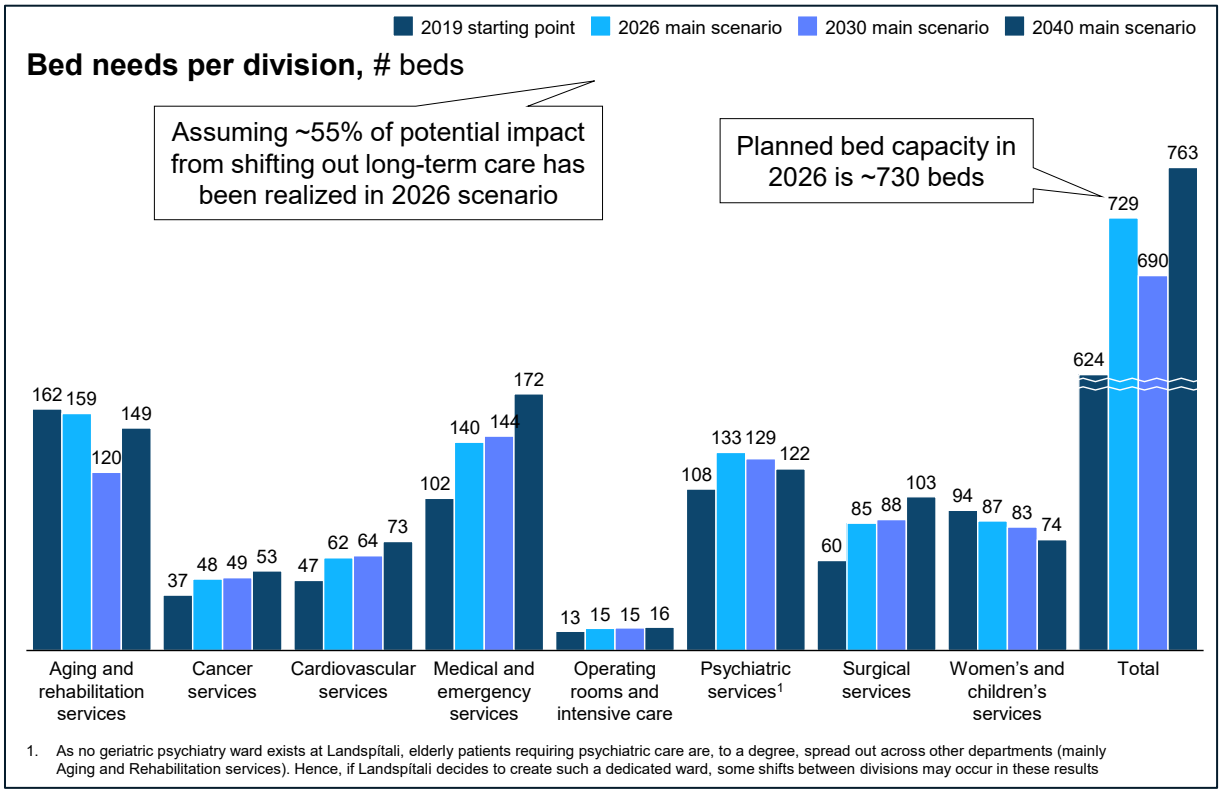
1. Only counting physical outpatient visits, patients not registered to any division (~1000 in total during 2019) are included in the total but not in the division breakdown

7.1.5 Main scenario forecast on the need for beds

In the main scenario, the need for beds is expected to grow significantly, primarily driven by the ambition to move from the current bed occupancy rate of 97% to a target of 85%. When Hringbraut opens, the planned bed capacity is ~730 beds. To handle demand with this planned capacity and reach the bed occupancy rate target, ~55% of the potential impact from shifting out long-term care would need to have been realized by 2026. This would result in a total need for 729 beds by 2026 – a growth of ~17% from the 2019 starting point of 624 beds. As the full impact of shifting out long-term care is realized until 2030, the need for beds is expected to decrease before continuing to increase to 763 beds by 2040. This number is slightly above the currently planned capacity of ~730 beds by 2026. At a division level, the shifting out of long-term care is expected to offset the impact of demographic changes on aging and rehabilitation services, resulting in a decreased need for beds compared to 2019. The largest expected growth of ~70 beds is expected for medical and emergency services in the short term, driven by reducing the high occupancy rates and successfully moving long-

term patients from outpatient ER to inpatient wards. Compared to the expected reduction in outpatient ER visits, this is in line with Landspítali's role of handling more complex emergency cases requiring inpatient settings, while reducing the number of less complex cases that can be handled in outpatient settings or other primary care facilities. As noted in the 'Landspítali's current healthcare production' chapter, there are indicators that psychiatric care for elderly patients is provided in other divisions. If this changes in the future – e.g., through the establishment of a geriatrics department for psychiatric services – it will impact the bed needs per division by increasing the bed needs in psychiatric services while reducing it in aging and rehabilitation services.

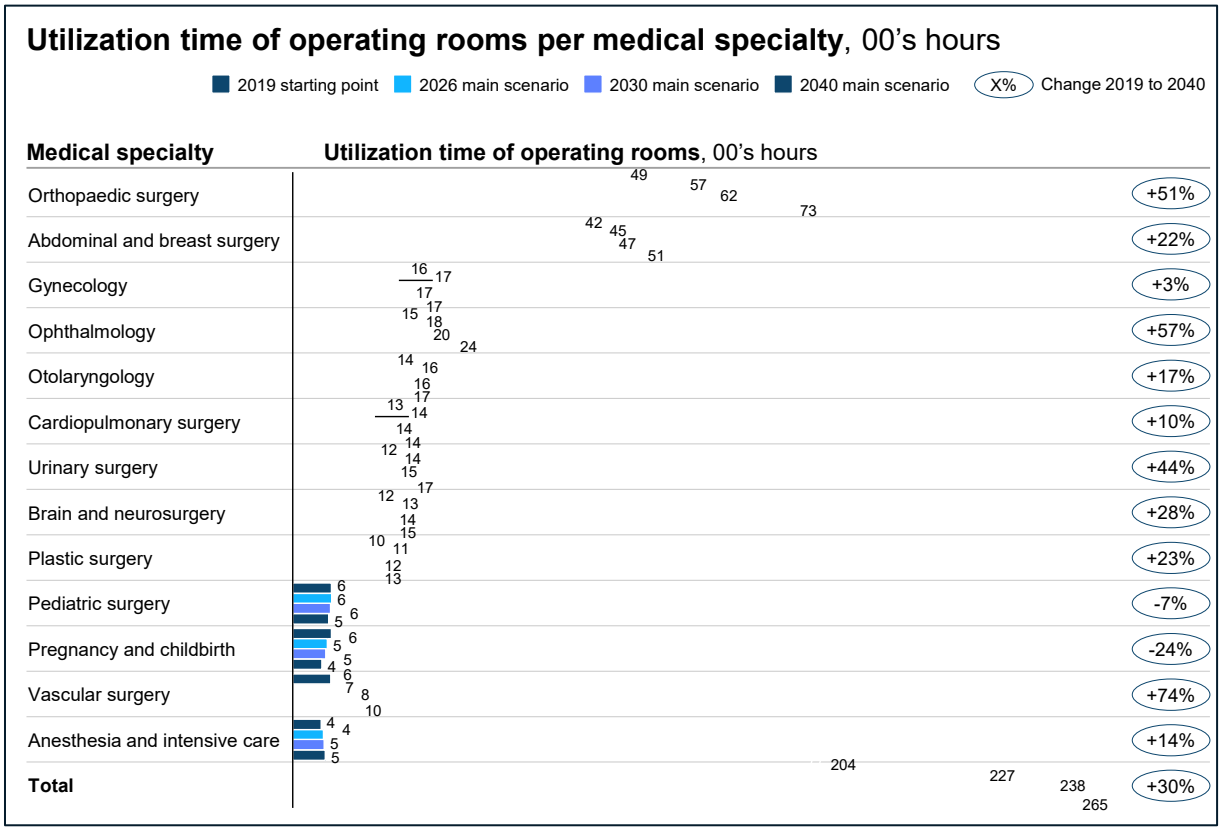
Exhibit 82. The need for beds in each division in the main scenario.



7.1.6 Main scenario forecast on operating room needs

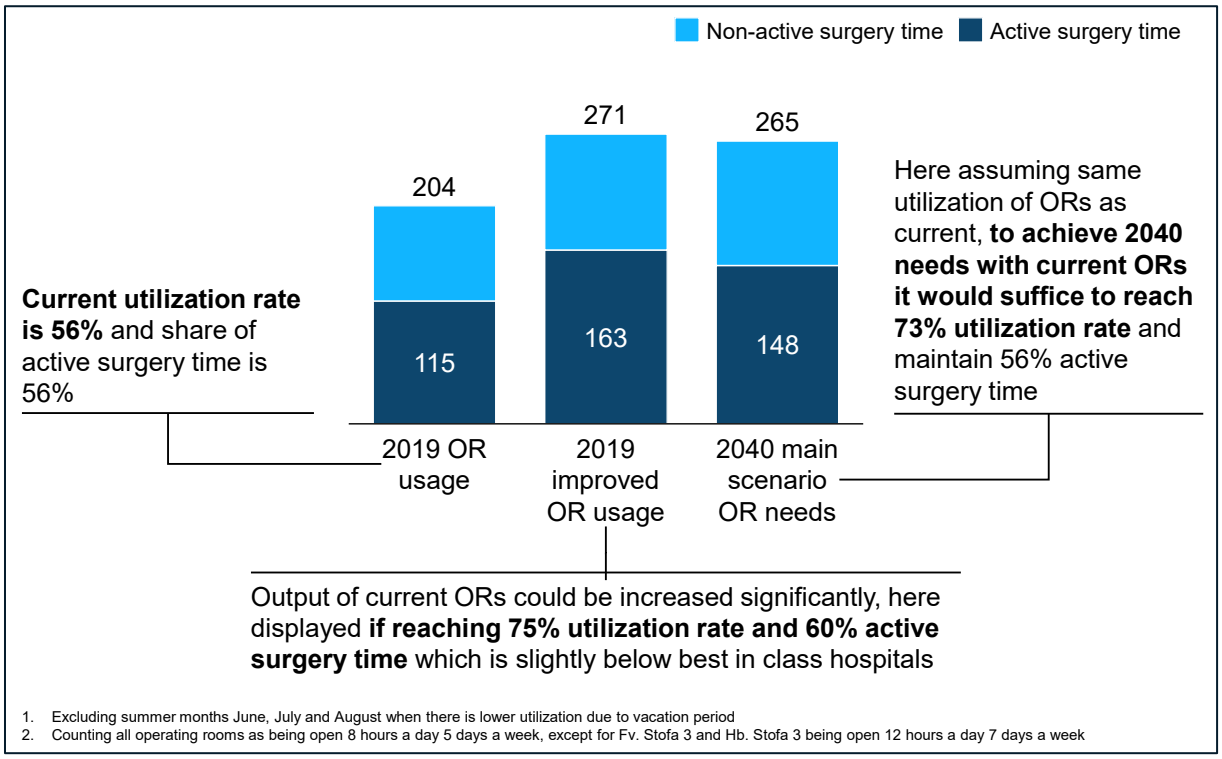
Operating room needs in the main scenario are expected to grow steadily in terms of total utilization time needed, from ~20,400 hours in 2019 to ~26,500 hours in 2040, totalling a growth of +30%. Compared to the base case forecast, a marginal increase is driven primarily by insourcing out-of-country treatments. Across medical specialties, the forecasted change varies greatly, with the most significant percentual increases being vascular surgery (+74%), ophthalmology (+57%), and orthopaedic surgery (+51%), while a decrease is expected for pregnancy and childbirth (–7%).

Exhibit 83. Utilization time of operating rooms per medical specialty in the main scenario.



Comparing this to current operating room capacity potential shows that the increased operating room needs until 2040 could be fully absorbed by existing operating room facilities. This would require improving the utilization rate of operating rooms by increasing the utilization rate from the current 56 to 73% (excluding the summer months June to August when utilization rate is lower due to vacation time). Compared to best-practice rates, this would still be below best-in-class hospitals. Note that this is on the aggregate level. For final operating room planning, there is also the need to ensure the specialization mix of the operating rooms covers the surgical needs of all specialties. Nonetheless, especially with the increased number of operating rooms with the new hospital building Hringbraut, there is likely no need to plan further additional operating rooms.

Exhibit 84. Operating room usage in 2019 and needs in 2040 main scenario, compared with best-practice utilizations and benchmarks.[176, 177, 178]



1. Excluding summer months June, July and August when there is lower utilization due to vacation period
2. Counting all operating rooms as being open 8 hours a day 5 days a week, except for Fv. Stofa 3 and Hb. Stofa 3 being open 12 hours a day 7 days a week

7.1.7 Main scenario forecast on the workforce need

Workforce need in the main scenario are expected to grow until 2026, primarily driven by the structural changes for shift workers introduced with the Better Working Hours agreement. For physicians, the initial growth until 2026 is largely attributed to the increased focus on research in the main scenario. After 2026, the workforce need is expected to decrease slightly, as productivity improvements in operations and digitization are forecasted to outweigh demand growth. The main scenario assumes that the productivity improvements will be successful. On the total level, this would lead to an increase from 4,500 FTEs in 2019 to 4,645 FTEs in 2040. Across roles, the expected change varies, with the other category and nurse assistants growing by +8.3% and +8.1%, respectively. In comparison, junior physicians decrease by –0.8%, mainly because they are excluded from shift workers' Better Working Hours agreement. This assumes no structural changes to the current workforce composition. However, as noted in the 'Analysis of potential current gaps in the workforce' chapter, Landspítali stands out compared to benchmarks in terms of ratios for registered nurses & midwives to nurse assistants, and physicians to medical secretaries.[179]

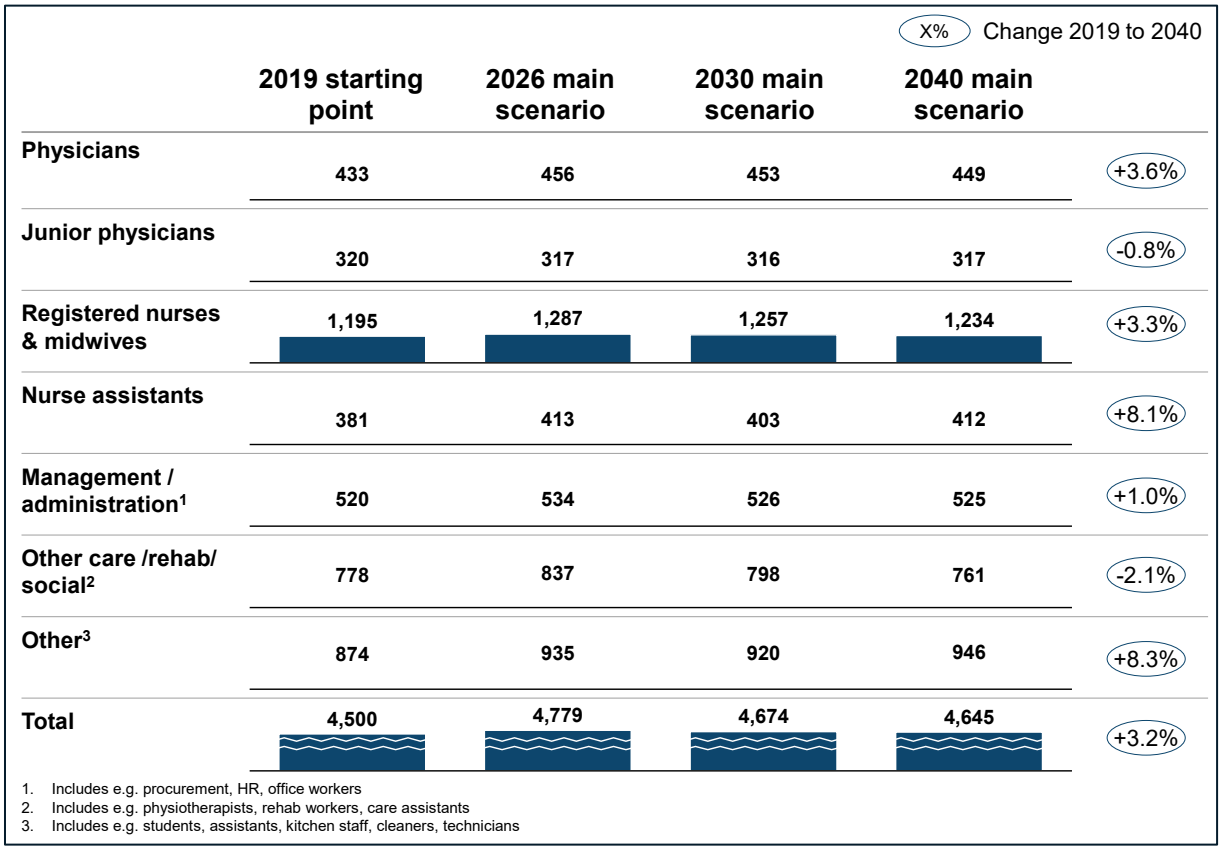
[176] National Health Service, 'Acute sector: Operating theatres', NHS Benchmarking Network Study, 2021, nhsbenchmarking.nhs.uk.

[177] National Health Service, 'Planned Care, Outpatients and Theatres', NHS Benchmarking Network, 2017, https://www.nhsbenchmarking.nhs.uk.

[178] Expert interviews on best-practice rates in the United Kingdom and United States, 2021.

[179] Relative distribution of FTEs across roles could also be affected further by the development and needs of different disease groups. This, since the forecast uses DRG units per organizational unit as basis to determine FTE need, and DRG units of different disease groups may require different workforce compositions.

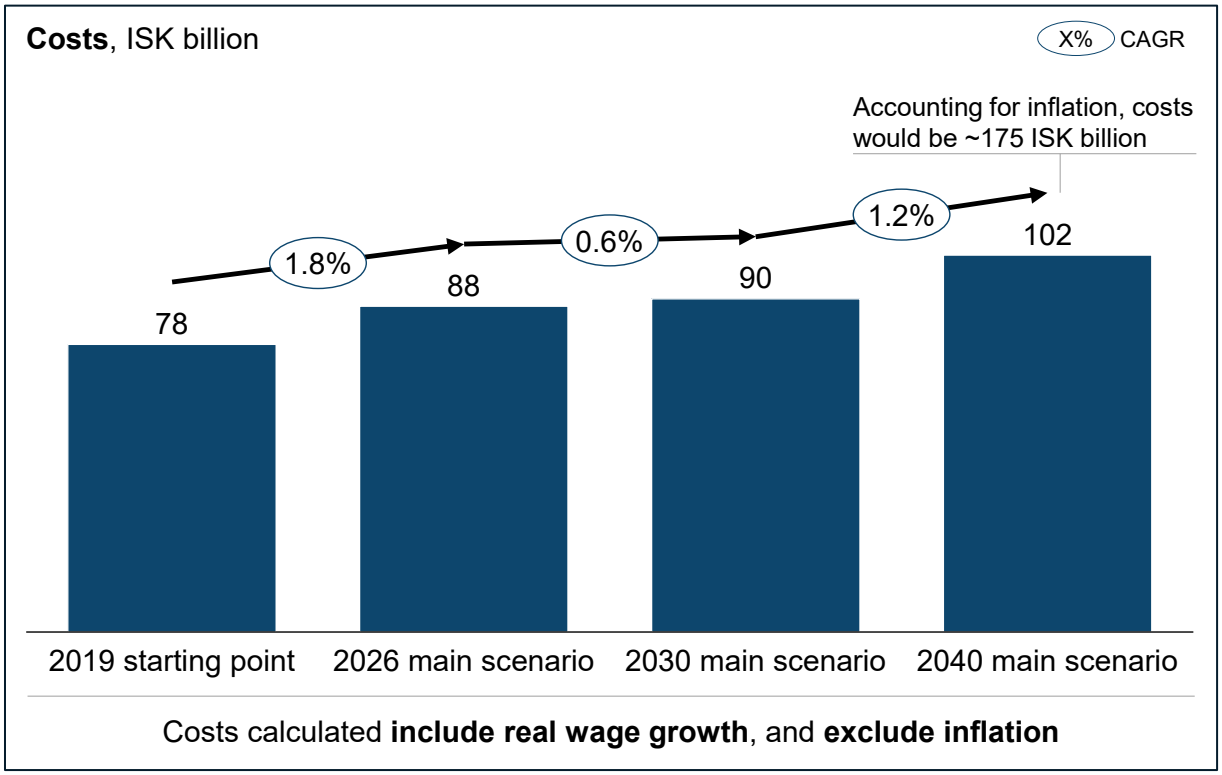
Exhibit 85. Workforce need per role in the main scenario.



7.1.8 Main scenario forecast on costs

Costs in the main scenario are expected to grow the fastest until 2026, primarily driven by high real wage growth (~3% between 2020 and 2022), increased research spending, and increased salary costs due to the Better Working Hours agreement. As long-term care is shifted out fully until 2030 and real wage growth declines, the cost increase is forecasted to slow down. Thereafter, the cost increase is expected to stabilize until 2040, with primarily improvements in operations, procurement, and digitization slowing it. In total, this would amount to a cost increase from ~ISK 78 billion in 2019 to ~ISK 102 billion in 2040, excluding inflation, with the costs being ~ISK 175 billion in 2040 if inflation is accounted for.

Exhibit 86. Costs in the main scenario.



7.2 The future role of Landspítali

7.2.1 Introduction

Landspítali has a significant responsibility in the Icelandic healthcare system as the only university hospital and the main hospital providing complex secondary and tertiary care. At the same time, there are question marks around the boundaries of Landspítali's role – with Landspítali sometimes seeming to take a broader role in the system than would typically be seen in a university hospital, e.g., providing more long-term and primary care. The question marks range from what types of care Landspítali should ideally provide to ideal fund levels for medical research. At the same time, Landspítali and the healthcare system are facing challenges, e.g., higher ALOS than benchmarks, high occupancy rates and outflow issues.

In addition to the challenges outlined above, healthcare demand in Iceland is forecasted to increase steadily until 2040. To address this increased demand, the challenges facing Landspítali need to be tackled and its' role defined in a sustainable and efficient way. The purpose of this report was to provide clarity on the questions mentioned above and help define the potential role of Landspítali in 2040 through a discussion of key strategic choices and operational improvements and prevention measures. Insights from this discussion, in combination with output from the main 2040 scenario, helped define a potential role of Landspítali by 2040, which is presented in this chapter.

7.2.2 The potential role of Landspítali by 2040

Based on the impact from the key strategic choices and the operational improvement and prevention measures discussed in this report, the likely required role of Landspítali in the

Icelandic healthcare system by 2040 is discussed in this subchapter. However, it is important to note that the discussions should not be considered a recommendation for the direction in which Landspítali should move, but rather a likely role for Landspítali in the Icelandic healthcare system by 2040. This likely role can be described in the following way:

- **Landspítali is the main centre for complex secondary and tertiary care in Iceland**

  Landspítali's role as the leading university hospital and provider of complex secondary and tertiary care will have been reinforced in the coming 20-year period, by focusing on specializing and handling all complex secondary and tertiary care that does not require acute care responses. This means that the system monitors and assesses what complex care is provided in the country and where. Predefined frameworks and processes would be used to continuously analyse what care can be moved to or from Landspítali – ensuring maximum quality of care.

- **Landspítali's role in long-term and nursing home care has been significantly reduced**

  The outflow issues for long-term elderly care patients who have shaped Landspítali's role up until 2019 will have been reduced significantly. Other institutions will have been created or strengthened in the healthcare system (e.g., home-based care) – enabling a rapid and efficient outflow for patients who do not require more complex care and allowing Landspítali to dedicate further capabilities towards growing its expertise in core areas.

- **Landspítali's role as a primary care institution has been minimized**

  Most primary care patients that were treated at Landspítali have been shifted to more suitable care settings in the healthcare system – outside of Landspítali's boundaries, to dedicated primary care centres.

- **Landspítali's role and process for coordinating out-of-country complex secondary and tertiary care has been clarified**

  Landspítali will have good, established relationships with international healthcare providers for treating highly complex patients abroad. Furthermore, frameworks and processes evaluating key criteria for when to move patients abroad and where will have been established at Landspítali – ensuring optimal patient distribution and quality of care. Treatments that Landspítali have the capabilities to perform will be fully insourced and treated within the hospital.

- **Landspítali keeps its role as the most important healthcare research and education centre**

  Landspítali will continue educating the majority of the medical workforce with funds on par with current levels and international benchmarks. Furthermore, Landspítali will have reinforced its role as the leading institution, in cooperation with other parts of the establishment (e.g., deCODE and the University of Iceland), for medical research in Iceland through increased funding levels and improved funding processes.

- **Landspítali has established itself as an institution of excellence in operational efficiency and digitalization**

  Landspítali has been able to maintain continuous efficiency improvements and realized productivity gains of 1 to 2% per year, to a large extent driven by innovation and application of digital healthcare solutions and continuous improvement of its' operational

practices. Best-in-class surgery procedures and processes for distributing patients optimally between inpatient theatres to day surgery settings are used.

- **Landspítali plays a central role in procurement for the Icelandic healthcare system**

  A centralized procurement body responsible for procurement across the healthcare system is placed under Landspítali's mandate – resulting in increased stockpile control, higher product quality, and reduced costs on a system level.

In addition to the added roles and responsibilities of Landspítali in the Icelandic healthcare system by 2040, some roles would fall outside of Landspítali's principal mandate:

- **Landspítali would not have the mandate to coordinate knowledge sharing across the healthcare system**

  Landspítali would not be considered the most appropriate role for governing over a system-wide knowledge management function. However, Landspítali experts and researchers will be important participants and contributors – building the foundation of the knowledge base in the system.

- **Landspítali would not be the main coordinating body for placement of care and patient flows**

  Landspítali would likely not have the overarching responsibility for optimizing the distribution of patients across facilities and providers in the system. However, Landspítali will likely have close collaboration processes with the responsible unit – ensuring that capacity is optimized on a system level and that the highest quality of care is adhered to.

- **Landspítali would not be responsible for building out the digital healthcare infrastructure for the country**

  Despite not having a clear mandate to fully coordinate the system-wide digital efforts, Landspítali will own and maintain the largest part of the digital technology in the healthcare system and will be a core partner driving digital excellence for Iceland.

Through the proposed changes to Landspítali's role description, Landspítali and the Icelandic healthcare system should be able to meet the increased healthcare demand by 2040. As described in 'Main scenario forecast for 2026, 2030, and 2040' chapter, the impact of demographic and non-demographic changes to the healthcare system will lead to a significantly increased healthcare demand by 2040 – resulting in an increase of ~80% for beds, ~23% for outpatient visits, ~45% for staff, and ~90% for total costs compared to 2019. By adapting Landspítali's role following the changes described in this chapter, the effects of the increased healthcare demand would only result in an increase of ~22% for beds, ~8% for outpatient visits, ~3% for staff, and ~30% for total costs, by 2040 for Landspítali compared to 2019. While demand will likely increase in other parts of the system and subsequently require increased capacity, e.g., for home-based care, the role changes mean that Landspítali will likely not need significant expansions or investments into additional capacity to successfully deliver its core role and services.