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Swedish Healthcare Reimagined: The Hospital at Home Approach

Master’s thesis in Management and Economics of Innovation

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Abstract

This thesis explores the "Hospital at Home" (HaH) model as a strategic innovation to address the increasing pressures on the Swedish healthcare system due to aging populations and demographic shifts. The HaH model, which provides advanced medical care in patients' homes, offers a potential solution to enhance healthcare efficiency and quality. This study evaluates the feasibility and structure of integrating the HaH model into Sweden's unique healthcare landscape, focusing on patient selection, technological integration, and regulatory challenges. A literature review, case studies, and interviews with healthcare professionals, decision-makers, and medtech industry representatives provide the basis for the research. The findings indicate that HaH can reduce healthcare costs, improve patient outcomes, and enhance patient satisfaction. However, successful implementation in Sweden requires systemic flexibility, technological readiness, and collaborative efforts across regional healthcare entities. This research contributes to the debate on innovative healthcare delivery models and provides practical insights for policymakers and healthcare providers.

Keywords: Hospital at Home, Swedish healthcare, healthcare innovation, patient care, healthcare efficiency, patient satisfaction.

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1 Introduction

This chapter provides the background for the research conducted in this thesis and introduces the concept Hospital at Home. It outlines the challenges faced by healthcare systems and also a background on how the Swedish healthcare system is structured.

1.1 Hospital at Home

Aging populations and changed demographics in western countries are resulting in increasing pressures on healthcare systems. To deal with the increasing demand, healthcare organizations are searching for alternative innovative solutions which may increase effectiveness and quality. One innovative model which has seen growing attention in the last years is the “Hospital at Home” (HaH) model which involves healthcare organizations providing advanced care in the patient’s home. Several studies have been conducted world-wide, assessing performance of the model in different contexts and for treatment of various diseases reporting promising results.

Shepperd and Iliffe (2005) describes HaH as a service which healthcare organizations can offer that includes healthcare professionals giving active treatment for a limited time of a condition that would otherwise require acute care at a hospital. Patel and West (2021) describes how the term was first introduced in the US at the John Hopkins University in 1995.

Carollo (2018) and Arnold (2021) describe how the model first was developed by an MD at John’s Hopkins University, Bruce Leff, as a response to a particular patient of his. The patient had to be admitted to the hospital several times yearly as he finally refused to be admitted stating the many inconveniences and indignities of hospital stays. Some patients also refused to get admitted as they argued that the visits only made them sicker, e.g. due to admission-related infections, which were fears that may not have been unfounded (Carollo, 2018). To solve the problem, Leff together with his mentors, John Burton and William Greenough III, gathered all necessary machines and hospital equipment and started providing care in the comfort of patients’ own homes (Arnold, 2021). The positive experiences led to Leff and his colleagues piloting the HaH concept in 1996, which also showed promising results in terms of the patient satisfaction, length of care and lower costs (Leff et al., 1999). Since then, the model has been used (as shown in e.g González-Ramallo et al., 2017) and the concept has been studied by several scholars in various contexts and for patients with different illnesses (Leong et al., 2021).

In recent years, changes in attitudes and capabilities in relation to using technology, and technological development have boosted interest in and increased the potential of the model.

Ko et al. (2022) describes that the Covid-19 pandemic increased utilization of HaH programs. Existing programs such as a HaH unit connected to Hospital Clinic in Barcelona, for example, could effectively and safely treat some types of Covid-19 patients, offering an alternative to the overcrowded medical facilities during the peak of the pandemic (Pericàs et al., 2020).

The expansion of internet access and the availability of higher internet speeds have improved the feasibility of remote healthcare delivery. Additionally, there has been an increase in the willingness to utilize telehealth, as evidenced by Sin et al. (2020). The pandemic also accelerated the adoption of virtual consultations (U.S. Department of Health and Human Services, 2023). Advancements in portable medical technology and the entrance of the Internet of Things (which refers to the interconnected network of devices that communicate and share data), have also presented new opportunities in making use of technology in the home (Mohamad Jawad et al., 2022). Together, these various circumstances and developments have favorably changed the landscape for HaH.

The implementation of the HaH model needs careful patient selection. Ensuring that patients live within a specified distance to emergency facilities and have a stable home environment with caregiver support is important. This setup is essential for maintaining the safety and effectiveness, as the importance of environmental and familial factors in the success of HaH interventions is emphasized. Studies also indicate that the re-admission rate increases with the HaH model. Furthermore, the potential for HaH to reduce costs and relieve pressure on hospital resources is significant. (Vale et al., 2020).

1.2 Background on the Swedish Healthcare System

SCB (2024) predicts significant changes in the Swedish demography in the coming years. The oldest group in the population will increase drastically, at the same time as the group consisting of people within working age will constitute a smaller part of the population. Alemayehu and Warner (2004) describes substantial differences in healthcare costs in older age-groups compared to younger age-groups. For example, for people surviving to the age of 85, about one third of their total lifetime healthcare expenditures will come in their remaining years alive (Alemayehu & Warner, 2004). The rate of hospital admissions per person is also the highest for people over the age of 85 (Tillmann et al., 2021). As people age above 50, they cost exponentially more in healthcare expenditure. For example, a person over 85 costs about three times as much as a person in the 65-74 age range (Alemayehu & Warner, 2004).

In Sweden, where the healthcare system is publicly funded and therefore supported mainly by the population within working-age (20-64), the predicted demographic changes pose a two-fold problem. Firstly, as the working age constitutes a smaller part of the population, there will be less resources supporting the healthcare system. Secondly, there will be a drastic increase in demand for healthcare in the future. To deal with the growing pressures posed on the Swedish healthcare system, there is a need to become more efficient. The implementation and integration of HaH in the Swedish healthcare system could prove to be one part of the solution to the future challenges of Swedish healthcare. But first, the feasibility of implementing such a model in the Swedish context, and with the Swedish conditions needs to be thoroughly assessed.

The Swedish healthcare system is somewhat unique, primarily funded through taxes. In 2021, 84.8% of Swedish healthcare was funded through taxes, a larger proportion compared to Australia (65.2%), Switzerland (30.1%), and The Netherlands (0.0%) (Lundbäck, 2022). This taxation is mainly regional and municipal. Relevant to the implementation of HaH in Sweden is the relatively low number of hospital beds per capita (2.0 per 1000 inhabitants) compared to Denmark (2.5), the USA (2.8), and Germany (7.8) (OECD, 2024). However, Sweden compensates with a shorter Hospital Length of Stay (5.4 days) compared to the USA (5.9) and Germany (7.4), partially explaining how the Swedish healthcare system deals with fewer hospital beds (OECD, 2024). Life expectancy at birth is growing annually in Sweden, except for 2020, and the older population is increasing rapidly, making the need for hospital beds more crucial.

Sweden is divided into 21 regions and 290 municipalities (Regeringen, n.d.). Each region runs its hospitals and is largely self-governing, following guidelines from the government (Lundbäck, 2022). The Swedish Association of Local Authorities and Regions (SALAR) is responsible for cooperation between regions and municipalities, adhering to governmental guidelines. Significant changes in the healthcare system cannot be implemented by a single region without centralized legislative changes. By 2010, 98% of Swedish healthcare institutions were public, with only 2% being private profit-making institutions (Lundbäck, 2022). One notable exception is St. Görans Sjukhus in Stockholm, the only privately owned hospital, owned by Capio (Capio S:t Görans Sjukhus, n.d.).

Sweden's healthcare system performs well compared to the European Union (EU) average. In 2021, the nation's health expenditure was 11.2% of its Gross Domestic Product (GDP), slightly higher than the EU average of 11.0%. This higher investment is evident in the densities of healthcare professionals, with Sweden having 4.3 doctors and 10.7 nurses per 1,000 population, surpassing the EU averages of 4.1 doctors and 8.5 nurses (OECD, 2023).

Despite these advantages, Sweden faces challenges in integrating advanced practice nurses into primary care. As of 2022, there were only about 35 advanced practice nurses throughout the country, trained at the master's degree level to address the shortage of General Practitioners (GPs) (OECD, 2023). The limited number of these roles, along with vague job descriptions and low wage supplements compared to regular nurses, poses significant barriers (OECD, 2023). The National Health Competence Council has advocated for regulating this role to facilitate broader implementation, recognizing the need for clear educational pathways and professional responsibilities to resolve these issues (OECD, 2023).

During the pandemic, telehealth services emerged as a solution to maintain or improve access to care in Sweden. By early 2021, nearly 47% of Swedish adults reported having participated in at least one teleconsultation since the pandemic began, up from 30% in the summer of

2020 (OECD, 2023). Despite this sharp rise, teleconsultations represented only about 18% of all GP primary care consultations in 2020. These virtual consultations served not only to replace in-person visits but also spurred additional healthcare consumption, potentially increasing demand for lower-value care and raising overall costs for regions despite the lower average cost per consultation (OECD, 2023). Since 2015, when digital healthcare providers were permitted to offer services across all 21 regions, the use of teleconsultations has been climbing. In addition to regulatory changes, Sweden is investing EUR 3.8 million to develop e-health services and applications, part of the EU Cohesion Policy 2021-27 programming, with approximately 40% of the funding provided by the EU (OECD, 2023). According to the OECD (2020), Sweden performs relatively well compared to other OECD countries in terms of internet access and speed.

The Swedish reimbursement system for specialized care includes fixed reimbursement, action-based reimbursement, DRG-based reimbursement, episode reimbursement, value-based reimbursement, and target-related reimbursement (SKR, 2022). Fixed reimbursement is often used for public healthcare providers to ensure stability and is not linked to performance. Action-based reimbursement encourages productivity, with payments made per visit or based on Diagnosis Related Groups (DRG). Episode-based reimbursement covers all treatments within a specific care event, promoting comprehensive care planning. Value-based care links reimbursement to patient outcomes, focusing on delivering high-value care. Performance-related payments reward healthcare providers for achieving specific quality and efficiency targets, improving overall care quality (SKR, 2022).

The most common forms of reimbursement in Sweden involve some form of action-based reimbursement, with visit-reimbursement being the most common in some regions' care choices for specialized somatic care (SKR, 2022). This system is used by five regions. Episode-based payments are used by three regions, although some episodes in the price list cover only one care contact, potentially perceived as visit-based reimbursement. Value-based reimbursement is used sparingly, covering care choices in spinal surgery and hip and knee replacement surgery. Some regions use a combination of grants and measure-based reimbursement. Stockholm and Västra Götaland have different reimbursement structures than just grants for specialized inpatient care. Stockholm uses 54% fixed and 40% DRG-based reimbursement and 6% target-related reimbursement, while Västra Götaland uses a 50/50 split between fixed and DRG-based reimbursement (SKR, 2022).

1.3 Problem Formulation

As the aging population in Sweden grows and the working-age population decreases, the current healthcare system faces increasing pressure and potential inefficiencies. With a publicly funded healthcare system that already operates with fewer hospital beds per capita compared to other developed countries, Sweden must find innovative solutions to manage the rising demand for healthcare services effectively. The HaH model, which has shown promising results in various global contexts, presents a potential strategy for relieving these pressures. At the same time, advancements in technology and cultural acceptance towards telemedicine have improved the conditions for the model. In addition, the pandemic taught us that more things, including healthcare, can be done from home. However, the feasibility and optimal structure of implementing such a model in Sweden's unique healthcare landscape remain uncertain.

1.4 Purpose

The aim of the study is to draw on research of prominent HaH programs and interviews with experts in the field, combined with information about the Swedish context to assess the feasibility and structure of a HaH program in Sweden.

1.5 Research questions

Research Question 1: *How can the HaH model be adapted to the specific needs and structure of the Swedish healthcare system to improve patient outcomes and efficiency?*

Research Question 2: *What lessons can be learned, from successful international cases and experts in the field, about the challenges and strategies needed to implement HaH?*

2 Literature overview

This literature review summarizes prior research on the HaH model, highlighting its development, implementation, and outcomes across various contexts. By examining existing studies, the aim is to provide an understanding of HaH's effectiveness, challenges, and potential benefits, setting the foundation for assessing its feasibility and structure within the Swedish healthcare system.

2.1 Definition of HaH

John's Hopkins defines HaH, in Leff et al. (2022), as the delivery of acute hospital-level care to patients in their own homes as a substitute for traditional hospital care. This care model is episodic, providing comprehensive responsibility for the care episode, and includes continuous medical, nursing, paramedical, therapy, laboratory, radiology, and pharmacy services available 24 hours a day. HaH is distinct from other home-based services, because it provides acute hospital-level care in the home, including comprehensive medical, nursing, paramedical, therapy, laboratory, radiology, and pharmacy services, as a direct substitute for traditional hospital care. Unlike other home-based care models, HaH is responsible for the entire episode of acute care and continuous care for acutely ill patients, which sets it apart from services like personal home care, skilled home health care, and home hospice. The focus is on providing high-quality, safe, and effective care for selected acutely ill patients, leveraging the full spectrum of hospital services within the home environment.

The UK Hospital at Home Society on the other hand, defines HaH as an acute clinical service that delivers hospital-level care, including staff, equipment, and medical interventions, to patients in their homes. This model substitutes for inpatient hospital care, adhering to regulatory and governance standards, and is directed by specialist physicians. It provides comprehensive care, including diagnostics and therapeutics. It is not outpatient care, chronic disease management, or virtual care. The focus is on managing acute illnesses with defined inclusion criteria, ensuring patient and family-centered care through multidisciplinary teams (Hospital at Home Society, n.d.).

While each version of HaH can have its own definition, these definitions highlight the most common criteria. Both Johns Hopkins and the UK Hospital at Home Society emphasize delivering care at home instead of traditional inpatient care, providing comprehensive and continuous services. Johns Hopkins focuses on a wide range of services, while the UK definition emphasizes regulatory adherence, specialist physician direction, and multidisciplinary team involvement.

2.2 Key components of HaH

The success of HaH programs depends on several important parts. These include choosing the right patients, having teams from different medical fields work together, making regular visits, monitoring patients' health, providing a variety of medical treatments at home, and understanding which patients are best suited for this type of care. Each of these elements are important for making HaH work well.

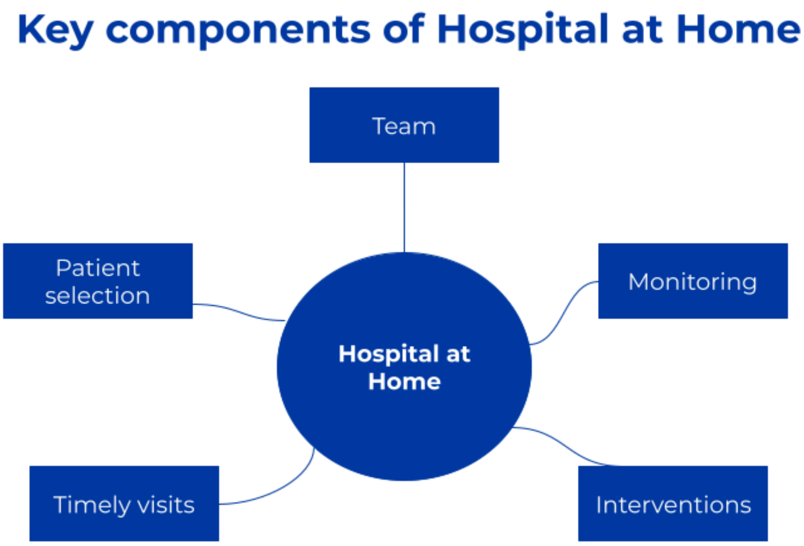

Figure 1. Key components of the Hospital at Home model, derived by the literature review figure made by authors

2.2.1 Patient Selection

A crucial part of implementing a successful HaH program is the selection of the right patients. Patient selection is especially critical for HaH programs compared to traditional inpatient care due to unique characteristics of HaH care, such as the increased presence in the patient's home and the limited access to immediate supervision by physicians. Initially, he patient selection process takes place at various places, in some cases, primary care physicians refer patients from the community (Sheppherd et al., 2009), in other programs patients the referrals are performed by specialists from the emergency departments or inpatient care (Klein et al., 2016). In some cases, the physicians making the referrals base their assessment on explicit criteria, in other cases, it is based on the judgment of the physician. Section 2.3 outlines examples of inclusion criteria that are used, as well as some common characteristics of the patients admitted to HaH care.

2.2.2 Multidisciplinary teams

HaH care is characterized by multidisciplinary teams which treat the patients. Paul III (2013) and Chen et al. (2024) describes that the composition of these teams differ between implementations. Chen et al. (2024) examined 11 HaH programs in the UK and found that differed both in which hours and how many hours a day they operated and what professions operated during what hours. Paul III (2013) suggests that nurses often provide a majority of the care in HaH programs. HaH teams also include physicians, from which fields are dependent on the specific structure and offering of the specific program. Physicians in many clinical fields have the competence to deliver HaH. Fields that are closely related and of direct relevance to HaH usually include general practice, emergency medicine, geriatrics and general hospital medicine according to Paul III (2013).

2.2.3 Timely visits

The number and form of visits varies between HaH programs. Gorbenko et al. (2022) investigates 14 HaH care programs in the US, and their opinions and experiences working under the Centers for Medicare & Medicaid Services' Acute Hospital Care at Home (AHCaH) waiver program which required at least one in-person or remote visit daily by a physician and at least two in-person visits by a nurse daily to get reimbursed. The authors found that leaders from the programs varied in their perception of the 2 in-person visit requirement with some fulfilling the requirement even before the waiver and others considering 2 in-person visits unnecessary, especially if patients were already monitored remotely.

Conley et al. (2022) reflects on the opportunities and challenges in using telemedicine to "visit" patients. Performing care visits remotely have the advantage of the caregiver not having to travel to the patient physically. This increases the number of visits the caregiver could provide in a day. The authors mention that lack of digital literacy within the target population of HaH as a challenge, it is therefore recommended to create an application that is simple and easy to use. Conley et al. (2022) also note that the patient needs a strong and reliable network connection to effectively, securely and efficiently make use of remote visits.

2.2.4 Monitoring

Conely et al. (2022) describe that HaH programs require monitoring of patients' vital signs to be able to deliver hospital-level care. The authors describe that the frequency of reporting of the vital signs differ between patients and programs, ranging from continuous monitoring to occasional monitoring of vital signs by team members when visiting. It is argued that increased acuity levels often require more frequent monitoring, but that the monitoring should be tailored to the specific needs of the patient. There are several devices and technologies that could be utilized, and many different parameters that could be measured in the home. This includes both e.g vital sign monitoring as well as continuous monitoring of potential falls. Conely et al. (2022) suggest that there is no silver bullet offering that suits all patients, neither is there as of 2022 to the authors knowledge no technology that offers accurate and reliable monitoring of all vitals signs in one. The authors also suggest that there have been problems with false alarms which have led to extra work for the multidisciplinary team.

According to Whitehead and Conley (2023) remote patient monitoring (RPM) isn't widely used for HaH programs, even though it has many potential benefits. The authors suggest that additional use of RPM could increase patient safety, broaden patient eligibility criteria and decrease costs.

2.2.5 Interventions

Different HaH programs are able to provide different interventions in the home. Mooney et al. (2021) for example were able to offer oxygen therapy, medication titration and administrations of IV fluids among other interventions. Hecimovic et al., (2020) analyzes the admissions to HaH care in South West of Sydney, based on the characteristics of treatment. They found that the majority of indications for HaH admission were treated with intravenous (IV) medications, accounting for 78% (n = 5552) of all cases, followed by 11% treated with post-op drain, 5% with rehab in the home and 4% with bridging anticoagulant therapy. There are many services that could be provided in the home, and new innovations such as portable x-rays expands the range of services that could be provided in the home (Sahlgrenska Universitetssjukhuset, 2022). Ten Haken et al. (2018) conducted a review on the research on advanced medical technologies used in the home and found that most research had been conducted on technologies for respiratory support, dialysis and oxygen therapy. The authors also found that there has been a rapid increase in production of research on the subject of advanced medical technologies used in the home recently.

2.3 Patient characteristics

The type of patients that are suitable to treat in HaH programs varies between programs, however there are some conditions that often characterize patients admitted to HaH care. In some cases, explicit criteria have been developed to assess suitability for admission. This section explores the various selection criteria that are used to assess patient eligibility, and some common diagnoses which are often treated in HaH programs.

Farfan-Portet et al. (2015) describe four screening processes from different countries noting that the admission process usually doesn't require specific pathologies. Instead, a key requirement is often medical stability. The screening processes also include an assessment of social, clinical, and environmental elements. For example, Paulson et al. (2023) describe an assessment process used by the Mayo Clinic's Advanced Care at Home program in Wisconsin and Florida which includes a screening tool (see Appendix for screening tool), covering a range of questions about the patient's social and clinical stability, e.g. questions about patient's home environment and the availability of an informal caregiver to participate if needed. Presence and participation of an informal caregiver is often, but not always, expressed as a requirement for HaH eligibility. According to Nogués et al. (2021), patient eligibility may depend on living with a caregiver or in a setting such as a nursing home where there is access to a caregiver. Further, as effective communication between the patient and the HaH unit is of great importance, proficiency in the language spoken by the healthcare providers may also serve as a selection criterion.

In some cases, there are stated geographical eligibility criteria that have to be met. Nogués et al. (2021) for example states that participants must live in certain specified geographic reference areas. Other geographic-related requirements can be found in the joint HaH program between Medoma and the privately owned Swedish hospital S:t Görans hospital and the HaH program for hematological patients in Madrid that according to Ström (2023) and Gómez‑Centurión et al. (2022) both required patients to live within a 30-minute car drive from the hospital in charge of their respective program.

2.3.1 Common diagnoses and corresponding result

HaH has proven useful for several patient segments, spanning various illnesses and conditions. Some scholars, (e.g. Leong et al. 2021; Shepperd et al. 2016) divide HaH programs into two main types of programs - "Early supported discharge" (ESD) programs and "Admission avoidance" (AA) programs. ESD programs aim to reduce the time spent in the hospital and accelerate the move towards care in the home. AA programs instead aim to avoid inpatient hospitalization altogether and admit the patient into HaH care directly.

Overall, Leong et al. (2021) suggests both AA and ESD shows promising outcomes compared to traditional inpatient care. Gonçalves-Bradley et al. (2017) found that ESD made no difference in patient health outcomes, probably decreased length of stay (i.e. amount of time receiving hospital-level care), increased patient satisfaction, decreased risk of institutional admission, and led to similar costs, compared to traditional inpatient care. Shepperd et al. (2016) found no differences in health outcomes or readmissions to hospital, reduction in risk of admission to institutional care, increased patient satisfaction, and some evidence of cost reductions when comparing AA to traditional care. Comparing AA and ESD, Leong et al. (2021) concluded that it may be preferable to prioritize AA over ESD, as the study showed better performance in terms of health outcomes and cost. However, the authors also note that the strength of the recommendation is low due to potential heterogeneity among the comparisons.

2.3.1.1 Early supported discharge

Gonçalves-Bradley et al. (2017) conducted a broad literature review, determining the effectiveness of ESD HaH programs. 11 of the trials analyzed recruited stroke patients, eight trials recruited older patients with a mix of conditions (two of them included stroke patients), five trials recruited patients with chronic obstructive pulmonary disease (COPD) and eight trials analyzed ESD programs following surgery.

Stroke

Gonçalves-Bradley et al. (2017) suggest that the efficiency of care is similar to that of traditional care of stroke patients in most key metrics, such as mortality rate, functional status (described by Higgins & Green (2008) as the ability to perform tasks that are valued such as maintaining the home or go to work), living in an institutional setting at follow-up and caregiver outcomes. Langhorne et al. (2005) on the other hand show a small reduction of mortality or dependency equivalent for patients in ESD programs compared to patients in traditional inpatient care. Langhorne et al. (2005) also noted that the greatest benefits of ESD HaH were seen in stroke patients with mild to moderate disability. Gonçalves-Bradley et al. (2017) suggest there is low-certainty evidence suggesting that HaH may lead to an increased patient satisfaction compared to inpatient care. Length of stay was also reduced by HaH. Notably, there were no significant differences in healthcare costs between the two treatment programs. 2 studies, Mayo et al. (2000) and Anderson et al. (2000) both suggest that the healthcare costs were lower for the HaH program, however when community costs were taken into account, the total costs were similar to traditional care. Lastly, Gonçalves-Bradley et al. (2017) also found evidence suggesting that patients from HaH programs has a lower risk of living in an institutional setting 6 month after discharge, which is in line with Langhorne et al. (2005) that suggest ESD programs tends to reduce institutional admissions.

Geriatric care

According to Gonçalves-Bradley et al. (2017), ESD programs for older patients with a mix of conditions also showed similar results compared to traditional inpatient care. However, compared to traditional inpatient care, HaH programs showed a higher risk of readmission, lower risk of living in an institutional setting 1 year after discharge, a slight increase in patient satisfaction and a reduction in length of stay.

Chronic Obstructive Pulmonary Disease

Gonçalves-Bradley et al. (2017) makes less generalizable statements about COPD patients, however suggest that there is little or no difference in mortality rates between HaH programs and traditional care and decreased risks of readmission for HaH patients. Cotton et al. (2000) conducted a randomized trial using ESD for COPD patients, resulting in reduced inpatient stay and similar readmission rates compared to traditional inpatient care.

Surgery

Gonçalves-Bradley et al. (2017) analyzed the effects of ESD programs on patients recovering from elective surgery. The analysis included 2 studies with participants with hernia and varicose veins, 1 with coronary artery bypass grafting, 1 with knee replacement and 2 with hip fracture. The authors found that there was little or no difference in mortality and hospital readmission between HaH and traditional inpatient care, however both with low evidence. The authors also mention a potential increase in patient satisfaction for ESD HaH programs, however with low evidence. Lastly, there was moderate evidence suggesting length of stay is shorter for ESD HaH patients.

2.3.1.2 Admission avoidance

Leong et al. (2021) describes that AA programs could directly involve admission into HaH programs based on referrals from a general practitioner, or through HaH admission straight from the emergency room without inpatient care. Shepperd et al. (2016) conducted a review similar to Gonçalves-Bradley et al. (2017) but assessed the efficiency of AA programs instead of ESD programs. Shepperd et al. (2016) analyzed three trials with COPD patients, two trials with clinically stable patients recovering from a moderately severe stroke and six trials with patients who had an acute medical condition but were mainly elderly.

Chronic Obstructive Pulmonary Disease

Neither of the three studies analyzed by Shepperd et al. (2016) focusing on COPD patients showed any significant results (at 95% confidence interval) in regards to mortality, functional status, clinical outcomes, place of residence at follow-up (e.g living in residential care compared to at home), patient satisfaction, caregiver satisfaction and length of stay. Ricauda et al. (2008) however showed a significant decrease in readmissions after 6 months (42% for AA compared to 87% of traditional inpatient care patients, P-value = .001). Davies et al. (2000) did on the contrary not see any significant differences in regards to readmissions. Ricauda et al. (2008) also found that AA programs resulted in improved quality of life (as measured using the Nottingham Health Profile) and less depressions. Lastly, Nicholson et al. (2001) compared the cost per episode between treatment through AA programs compared to traditional inpatient care, and found that the cost per episode was $745 and $2543 respectively resulting in a difference with P-value < .01. Ricauda et al. (2008) however does not show any significant cost differences.

Stroke

Shepperd et al. (2016) analyzed three articles revolving around two studies that compared AA programs with traditional inpatient care for stroke patients. Neither study showed any significant differences between care models in regard to mortality, functional status or place of residence at follow-up. Ricauda et al. (2004) found that stroke patients in AA programs had significantly better depression scores compared to patients treated at the hospital (P<.001). The length of treatment was also measured in Ricauda et al. (2004) where the authors found that the length of treatment was significantly longer (at P<.001) for the group treated in the home compared to the group treated in the hospital. Regarding cost of treatment, Ricauda et al. (2005), the same study, suggests that the total cost of treatment is similar for both the AA program and the traditional treatment. However, Ricauda et al. (2005) suggests that the cost of treating a patient per day is significantly higher for traditional inpatient care, but as it requires a shorter length of treatment, the total costs are similar. Patel et al. (2004) which analyzed the same study as Kalra (2000) instead suggests that treatment AA programs are less costly than traditional care at the hospital when excluding costs for informal care (from informal caregiver, e.g. partner or child). When including informal costs however, the total costs were very similar and there was no significant difference in either efficiency (quality per cost unit) or total cost (i.e. including estimated costs for informal care).

Geriatric care

The studies which assessed patients that were mainly elderly and with different diagnoses, found no significant results in terms of mortality, readmission at follow-up, quality of life/health status and GP satisfaction. Caplan et al. (2005) suggested a greater improvement in terms of functional status within the HaH-treated group, (greater increase in "Instrumental activities of daily living" score, P = 0.037). Tibaldi et al. (2004) found significant evidence that AA led to less sleeping disorders, agitation and feeding disorders compared to inpatient care. Board (2000) analyzed the same study as Caplan et al. (1999) and found that both patient and (informal) carer, such as partner, satisfaction were significantly higher in the HaH program. Wilson et al. (1999) on the other hand saw no significant difference in terms of patient satisfaction between the two treatment methods. Wilson et al. (1999) also found that the total days of care was significantly lower for the HaH group, which was also true when readmissions were taken into account. Lastly Board et al. (2000) showed significantly lower total episode costs when treating patients in the HaH program. Wilson et al. (1999) saw lower costs per day in the HaH programs, but as the costs for the whole episode was examined, there were no significant differences in cost between the treatment types.

Decompensated chronic heart failure

Two studies focused on patients with decompensated chronic heart failure. The studies found no significant results regarding mortality, readmission at follow-up, functional status, cognitive function and depression and place of residence at follow-up.

Tibaldi et al. (2009) found a significant increase in quality of life (measured by change in Nottingham Health Profile score) in favor of AA HaH care. Mendoza et al. (2009) on the other hand did not find any significant differences between treatment methods in terms of impact on neither physical nor mental health even if their results also tended to favor HaH with P = 0.47 and P = 0.47 respectively. Both Mendoza et al. (2009) and Tibaldi et al. (2009) found the length of treatment to be significantly longer for the AA HaH program, however Mendoza (2009) also found the total treatment cost per episode to be significantly lower for the HaH program compared to the traditional treatment.

2.4 Financial Impacts of Hospital at Home

The HaH model has significant financial implications, offering potential cost savings and economic benefits. The following sections explore the various dimensions of these financial impacts, including costs, reimbursement models, and material expenditures related to technological investments.

2.4.1 Cost Savings and Economic Benefits

Research conducted by Frick et al. (2009) highlighted the financial advantages of HaH care for patients suffering from COPD, demonstrating a reduction in the direct costs associated with curing these patients and a significant decrease in laboratory costs when compared to those incurred through conventional hospital care. The cost-savings of HaH care is further supported by Cryer et al. (2012) who reported that the HaH model developed by Johns Hopkins University School of Medicine managed to cut costs by 19%.

A review by Shepperd et al. (2008) reinforces the position of HaH care as a cost-effective alternative to traditional hospitalization. The review emphasized the role of admission avoidance in achieving cost-effectiveness, suggesting that by admission avoidance the healthcare system can relieve the financial burden associated with inpatient care. According to Gonzales-Ramallo et al. (2017), patients treated under the OPAT model experienced a recovery success rate of 91.5%, with cost per day reduced by 81% compared to hospitalization.

2.4.2 Alternative reimbursement models

The Centers for Medicare & Medicaid Services (CMS) Acute Hospital Care at Home waiver, as discussed by Gorbenko et al., (2023), exemplifies a shift towards recognizing and financially supporting HaH models. This waiver, introduced to expand hospital capacity during the COVID-19 crisis, allowed for full hospital-level DRG-reimbursement for HaH care. This move addressed a significant barrier to HaH implementation, which historically was the lack of a direct, fee-for-service Medicare reimbursement model.

In contrast, Achanta et al. (2021) proposes a structured framework for changing the reimbursement system for HaH models, focusing on cost, quality, and equity. It argues for incorporating quality measurement improvements similar to those used for home health agencies, including equity- and risk-adjusted metrics for outcomes. This approach aims to quantify the quality of care provided in the home setting and emphasizes the broader definitions of value, including societal and personal aspects. Such a comprehensive framework suggests moving beyond simplistic cost-based models towards reimbursement strategies that reflect the multifaceted benefits of HaH care.

Taylor and Golding (2021) further complicate the discussion on reimbursement models. This article suggests that HaH can lead to significant healthcare savings, primarily through the reduction of costs associated with traditional inpatient care. However, it also cautions that the overall impact on healthcare spending will highly depend on the implementation strategy, particularly whether HaH services are used as a substitute for inpatient care or result in additive, potentially unnecessary utilization.

2.4.3 Expenditures on material and technology

Karolinska Sjukhuset reports the results from a pilot study of HaH care, and provides a discussion of the costs and challenges of introducing remote monitoring in healthcare. It points out that costs for new technologies include technical hardware, service and support, human resources for consultation, monitoring supervision, patient contact, instruction, training, equipment management, data management, documentation and reporting (Vinnova, 2020). In addition, vendor costs and in-house costs are mentioned. The report emphasizes the need for additional data to determine cost-effectiveness and develop reimbursement models that can include these new cost items in healthcare financial planning.

Similarly, Skåne Universitetssjukhus reports on initial expenditures related to technology updates. The report mentions that a platform for self-monitoring needs to be developed by a second party, which will lead to costs related to development and procurement (Borgström, 2023). Further, they report use of near-patient blood analyses, ultrasound, ECG, and bladder scans, among others. This technology enables diagnoses and treatments at a hospital level to be carried out in the patient's home. The final report states that the HaH model is more cost-effective compared to traditional care, where a disposable HaH bed costs half as much compared to a hospital bed in inpatient care (Borgström, 2023).

2.5 Patient and family engagement

Training for family members includes instructions on basic care procedures, how to handle emergencies, and daily medical tasks they can perform to help their relatives (Leff et al., 2022). Johns Hopkins HaH program places a strong emphasis on educational support for patients and families, which is tailored to help them manage complex health conditions at home confidently (Leff et al., 2022). These educational initiatives cover a range of topics from medication management to recognizing potential complications. Feedback mechanisms are established that actively incorporate inputs from both patients and their families into the ongoing care regime. Regular satisfaction surveys, follow-up calls, and meetings with care coordinators are standard practice, ensuring that any concerns are addressed and that the care plan remains adaptive to the patient’s needs (Leff et al., 2006).

3 Methodology

The methodology section outlines the overall approach and specific methods used in this research to explore the HaH model. This section will discuss the research strategy, methods employed, and measures taken to ensure the quality and reliability of the findings.

3.1 Research Strategy

According to Bell et al. (2019) a research strategy refers to the general direction that guides the execution of business research. It includes the overarching approach that drives the choice of research methods, data collection, and analysis techniques. Broadly, research strategies can be classified into two main types: quantitative and qualitative research.

Quantitative research is a research strategy that highlights quantification in the collection and analysis of data. This strategy typically involves a deductive approach, where the emphasis is on testing theories. According to Bell et al. (2019), quantitative research uses measurable data to identify patterns and test hypotheses, using structured methods such as surveys, experiments, and statistical analysis.

Qualitative research, on the other hand, focuses on words and images rather than quantification. It often adopts an inductive approach, focusing on generating theories from the data. Bell et al. (2019) further note that qualitative research collects detailed data through methods such as interviews, focus groups, and participant observation. This strategy emphasizes the subjective experiences and meanings attributed by individuals, viewing social reality as a constantly shifting construct shaped by human interactions.

Qualitative research methods are particularly preferable in contexts where the research aims to explore complex phenomena, understand underlying meanings, and generate new theories. According to Bell et al. (2019), qualitative methods are prominent in exploratory research, where little is known about a phenomenon, helping to explore and understand the depth and complexity of the issue. They provide rich descriptions and insights into the context, culture, and environment in which a phenomenon occurs, allowing for a comprehensive understanding. Capturing the perspectives, experiences, and meanings that individuals attach to their actions and social worlds is another area where qualitative research is ideal. Additionally, when the goal is to develop new theories or frameworks, qualitative methods facilitate the inductive process of theory building from the ground up. In studying phenomena that are dynamic and evolving, qualitative research offers flexibility and adaptability in capturing these changes over time.

For this thesis, qualitative research methods are particularly suitable given the nature of the research objectives and the context of the study on the HaH model. The research aims to look into the nuanced experiences and perceptions of experts in the HaH model. The complex and dynamic nature of the HaH phenomena, involving diverse stakeholders and innovative healthcare delivery methods, requires a method that allows for flexibility and in-depth exploration. Qualitative methods will enable the gathering of detailed insights into the participants' perspectives and experiences, which are crucial for understanding the underlying meanings and contextual factors influencing their actions in the HaH setting. According to Bell et al. (2019), qualitative research is particularly effective in exploring areas where little prior research exists, helping to generate new theories and frameworks that can provide a deeper understanding of the research problem. This is especially relevant for the HaH model, which is still a developing area with significant potential for new insights and theoretical contributions.

Moreover, the study involves examining processes and changes over time within the HaH model, which qualitative methods are well-equipped to capture. The inductive approach of qualitative research will allow the development of theories grounded in the data, providing a rich and comprehensive account of the phenomena under study. By using qualitative methods, the research can remain adaptable to emerging patterns and insights, ultimately contributing to a more thorough and nuanced understanding of the HaH model in the Swedish healthcare context (Bell et al., 2019).

3.2 Research Methods

In the field of business research, the choice of research methods is important to effectively address research questions and achieve research objectives. According to Bell et al. (2019), research methods include the techniques and procedures used to gather and analyze data. These methods are key in guiding researchers through the systematic process of investigating complex business phenomena and ensuring that the findings are credible.

The selection of appropriate research methods depends on several factors, including the nature of the research question, the research objectives, and the type of data required. Bell et al. (2019) emphasize that a clear understanding of different research methods enables researchers to make informed decisions that enhance the quality and reliability of their studies. This section outlines the specific methods employed in this study, namely the literature review, interviews, case study, and workshop, and explains why these methods were chosen in the context of the HaH model research. Each method contributes to the overall research design, allowing for a multidimensional exploration of the research topic. This integrated approach aligns with the recommendations of Bell et al. (2019) for conducting rigorous business research that can yield valuable insights and contribute to the development of new theories and practices within the field.

3.2.1 Literature review

A literature review is a critical and comprehensive summary of existing knowledge on a particular topic. It involves systematically searching, evaluating, and synthesizing previous research to provide a coherent backdrop for the current study. According to Bell et al. (2019), a literature review serves several important purposes: it situates the research within the existing body of knowledge, identifies gaps in the literature, and helps refine research questions by highlighting what is already known and what remains to be explored.

The literature review is a fundamental component of the research process for several reasons. First, it provides a context for the research by outlining the background and development of the topic. This helps in understanding the evolution of ideas and theories related to the research question (Bell et al., 2019). Second, by reviewing existing studies, researchers can identify gaps in the current knowledge base and potential areas for further investigation. This ensures that the new research will contribute original insights to the field. Additionally, conducting a thorough literature review helps in avoiding unnecessary duplication of effort by ensuring that the research builds on, rather than replicates, previous studies. Moreover, a literature review aids in refining and clarifying research questions by providing a clearer understanding of what has been studied and what questions remain unanswered.

For this thesis, focusing on the HaH model, a literature review is particularly valuable. The HaH model is an evolving area, and a comprehensive literature review helps to establish a solid foundation of existing knowledge, including definitions and empirical findings related to the model. The literature review can capture the complexity and nuances of this model by synthesizing diverse perspectives and findings from multiple studies.

Bell et al. (2019) emphasize that a well-conducted literature review is essential for ensuring relevance of the research. It provides a comprehensive understanding of the topic, supports the formulation of research questions, and informs the overall research design. For this study on the HaH model, the literature review will play an important role in framing the research, guiding the methodological approach, and ensuring that our findings contribute meaningfully to the field of healthcare delivery.

3.2.2 Interviews

Interviews, particularly semi-structured interviews, offer a powerful method for gathering in-depth qualitative data. This approach allows for a flexible yet guided exploration of participants' insights, experiences, and perspectives. According to Bell et al. (2019), interviews are especially useful in capturing the richness of human experiences and the complexities of social phenomena, making them an ideal method for research on nuanced and dynamic topics such as the HaH model.

The semi-structured interviews conducted for this study were designed to complement the literature review by providing firsthand information from individuals directly involved with or affected by the HaH model. These interviews were recorded and transcribed to ensure accuracy and facilitate detailed analysis. The participants were selected through a purposive sampling method ensuring that the selected participants had direct and relevant experience with the HaH model. By focusing on individuals from these four key groups, the study was able to gather diverse and comprehensive data that enriches the understanding of the HaH model from multiple angles. The interviewees were categorized into three main groups: healthcare professionals, decision-makers and medtech industry representatives. Each group provided unique insights that collectively offered a comprehensive understanding of the HaH model. In addition, one interview was conducted with one of the founders of the concept HaH, that is categorized into a separate, distinct category.

Healthcare personnel, including hospital staff, doctors, and nurses, were interviewed to understand their perspectives on patient care within the HaH model. Their insights focused on the practical challenges and benefits of delivering care at home, highlighting operational aspects and the impact on patient outcomes.

Decision-makers provided valuable information on the strategic and policy implications of integrating the HaH model into the Swedish healthcare system. Their perspectives shed light on funding models, regulatory considerations, and the broader healthcare landscape's readiness for this model.

Medtech industry representatives, who supply the necessary equipment and technological solutions for HaH, were also interviewed. These discussions centered on the technological requirements and innovation challenges associated with supporting home healthcare. The insights from this group were crucial in understanding the role of technology in enabling and enhancing the HaH model.

Bell et al. (2019) emphasize the importance of interviews in qualitative research for their ability to dig into participants' subjective experiences and uncover the underlying meanings of their actions and beliefs. This method's flexibility allows researchers to adapt questions based on the flow of conversation, facilitating deeper exploration of complex topics. The semi-structured format, in particular, balances the need for consistency across interviews with the flexibility to search for more detailed responses as necessary.

A list of the interviewees is provided in a table at the end of this section.

Table 1: Healthcare professionals

Name	**Position**
Katharina Borgström	Project Manager, Acute Care at Home, Skåne University Hospital
Jared Conley	Assistant Professor at Harvard Medical School and emergency physician at Mass General Hospital
Kristina Groth	Responsible Innovation Leader, Home Care Project at Karolinska University Hospital
Linn Kennedy	Head of Section and Area Manager in Internal Medicine, Skåne University Hospital

Gunilla Wahlström	Head of Operations for Medicine and Infection, Capio S:t Görans Hospital

Table 2: Decision Makers

Name	**Position**
Jean-Luc af Geijerstam	Director General, Swedish Agency for Health and Care Services Analysis
Anna Nergårdh	Led the investigation for "Coordinated development for good and close care" (2017-2021), independent consultant
Göran Stiernstedt	Former special investigator for the investigation “Effective Care”

Table 3: Medtech Industry

Name	**Position**
Jesper Olsson	Expert in digitalisation, Swedish Medtech
Philip Smith	Medical Doctor &,Clinical Implementation Manager, Medoma

Table 4: Founder of HaH

Bruce Leff	Professor of Medicine Division of Geriatric Medicine Johns Hopkins University School of Medicine

3.2.3 Case study

Case studies are a suitable research method for gaining an in-depth understanding of complex phenomena within their real-life context. According to Bell et al. (2019), case studies are particularly effective when the research aims to explore contemporary issues where the boundaries between the phenomenon and the context are not clearly evident. This method allows for a detailed examination of specific instances, enabling researchers to capture the richness and intricacies of the subject matter. For this thesis, case studies of well-documented HaH programs were conducted to uncover the challenges, key success factors, and other critical characteristics that can inform the development of a similar model in Sweden.

The primary goal of these case studies is to dive into specific examples of HaH implementations to better understand their processes, outcomes, and the contextual factors that influence their success. By conducting interviews and reviewing relevant literature, the study aims to draw comprehensive insights from detailed statements of pioneering programs that can be adapted to the Swedish healthcare. This method provides a rich, contextualized understanding of how HaH programs operate, the challenges they face, and the strategies they use to overcome these challenges. By examining multiple case studies from different contexts, this research aims to capture a broad spectrum of experiences and lessons learned. This approach helps to identify common factors that contribute to the success of HaH programs. At the same time, it reveals how different contexts and conditions can shape the implementation and outcomes of HaH programs.

The insights gained from these case studies are needed for guiding the development of a tailored HaH model for Sweden. They provide a detailed understanding of the practicalities involved in implementing HaH, from initial planning and pilot trials to scaling and sustaining the program. This knowledge helps to ensure that the Swedish HaH model is based on real-world experience and is designed to address the specific needs and conditions of the Swedish healthcare system.

A list of the interviewees for the cases is provided in a table at the end of this section.

Table 5: Case Interviews

Name	**Position**	**Case**
Katharina Borgström	Project Manager, Acute Care at Home, Skåne University Hospital	Skåne University Hospital
David Nicolás Ocejo	Hospital at Home Medical Coordinator, Hospital Clínic de Barcelona	Hospital clínic de Barcelona
Linn Kennedy	Head of Section and Area Manager in Internal Medicine, Skåne University Hospital	Skåne University Hospital
Stephanie Ko	Consultant, Division of Advanced Internal Medicine, Department of Medicine, National University Hospital in Singapore	NUHS@Home, Singapore

3.2.4 Workshop

Workshops are an effective research method for engaging participants and validating models through interactive and participatory approaches (Bell et al., 2019). They are particularly suitable for gathering qualitative data from participants with practical experience in the subject matter. According to Bell et al. (2019), workshops are advantageous in several ways. They create a space for participants to actively engage and contribute to the research process, which is especially important for validating models where practical insights and experiences are crucial. Additionally, workshops help balance power dynamics by involving diverse participants, ensuring that less dominant voices are heard.

The workshop for this research was structured with two primary objectives: validating a model categorizing crucial aspects of the HaH concept and gathering experiences and insights from healthcare professionals. This approach allowed for an interactive platform where participants could share their practical experiences and insights. By engaging experienced doctors and healthcare professionals, the workshop provided a collaborative environment to assess whether the proposed categories covered the necessary aspects of HaH. This validation process helped to ensure the model's resilience and applicability in real-world scenarios.

A list of the workshop participants is provided in a table below.

Table 6: Workshop Participants

Name	**Position**
Sofia Billgren	Health and Care Coordinator, Section Leader, Community Care Team Östra Sjukhuset
Fredrik Hansson	Development Manager, Sahlgrenska University Hospital
Anna-Karin Ringqvist	Business Developer, Sahlgrenska University Hospital
Maria Taranger	Senior Physician, Area Manager, Sahlgrenska University Hospital

3.3 Research Quality

Ensuring the quality of research is needed to achieve reliable and valid findings that can be trusted and built upon. According to Bell et al. (2019), the quality of research can be evaluated through reliability, validity, and trustworthiness, which are particularly important in qualitative research.

Reliability in qualitative research refers to the consistency and dependability of the research process and findings. Bell et al. (2019) highlight that ensuring reliability involves maintaining consistency in the data collection and analysis procedures, which can be achieved through documentation and replication of methods. In this thesis, the reliability of the research is upheld by documentation of the research methods, including the semi-structured interviews, case studies, and workshops. Each method's procedures are outlined, ensuring that they can be replicated by other researchers. The use of audio recordings and transcriptions of interviews further ensures reliability by providing a transparent and consistent data collection process.

Validity, particularly internal validity, refers to the accuracy and truthfulness of the findings. Bell et al. (2019) says that internal validity in qualitative research can be achieved through techniques such as respondent validation and triangulation. Respondent validation involves sharing the findings with participants to ensure that the researchers' interpretations accurately reflect the participants' views. In this thesis, internal validity is enhanced through the triangulation of data from multiple sources, including literature reviews, interviews with different experts, and case studies of HaH implementations. This approach allows for cross-verification of findings, increasing the accuracy of the results. Additionally, participants were given the opportunity to review and confirm the accuracy of the interpretations made, and the quotes taken from their transcript, ensuring that the findings accurately represent their experiences and perspectives.

External validity, or transferability, refers to the extent to which the research findings can be generalized to other contexts. Bell et al. (2019) note that qualitative research should provide sufficient contextual information to allow readers to determine the applicability of the findings to other settings. This thesis enhances transferability by offering descriptions of the HaH model in different contexts, including various healthcare systems and cultural settings. The inclusion of diverse case studies provides a comprehensive understanding of the factors influencing the success and challenges of the HaH model, thereby facilitating the transferability of insights to the Swedish healthcare context.

Trustworthiness is a concept used to evaluate qualitative research and includes credibility, transferability, dependability, and confirmability. Credibility, similar to internal validity, is achieved in this thesis through prolonged engagement with the subject matter and thorough data triangulation. Transferability is addressed by providing detailed contextual descriptions. Dependability is ensured by reporting on all research activities, so that the study can be replicated and findings verified. Confirmability involves ensuring that the findings are shaped by the participants' responses rather than the researcher’s biases or preconceptions. This is facilitated by continuously seeking feedback from the examiner and verifying perceptions with participants.

The thesis aims to comply with the standards of reliability, validity, and trustworthiness as outlined by Bell et al. (2019). The documentation of methods, triangulation of data, respondent validation, and detailed contextual descriptions all contribute to the research's overall quality. By aligning with these criteria, the research provides a credible, reliable, and transferable narrative of the HaH model, offering valuable insights for the development and implementation of this model in Sweden.

4 Four Voices on Hospital at Home

This chapter aims to present key findings from the interviews. The section is divided into four parts, each presenting insights from a different perspective. The first three are voices from healthcare personnel, decision-makers and the medtech industry. The fourth section is based on a complementary interview with one of the founders of the concept HaH, Bruce Leff. Every section brings up the most relevant aspects of HaH for each perspective, that was mentioned during the interviews.

4.1 Healthcare professionals

The integration of HaH relies heavily on the acceptance and adaptation by healthcare professionals. Their viewpoints shed light on the practical implications and potential benefits of this approach within the healthcare landscape. By understanding their experiences and concerns, we can better navigate the operational challenges and capitalize on the opportunities that HaH presents.

4.1.1 Definition

Among the respondents, there seemed to be a similar view of what HaH means. Gunilla Wahlström described it as, *"This is like hospital care, acute inpatient care at home."* She also clarified, *"because today we already have basic home care in Sweden and ASIH and they are other care levels."* referring to a Swedish care form that deals with more chronic conditions and often a lower magnitude of care during the course of the disease. Linn Kennedy described the essence of the model to be *"The hospital resources and the ability to provide equivalent care at home".* Minor differences and ambiguity in the definitions were mentioned, e.g., as described by Kristina Groth, *"HaH is a term that might not be entirely clearly defined."* Kristina further elaborated, "*When we first looked at the term and how it was defined or what type of care was included in Australia, we saw that much of what they did was similar to what we do in our ASIH services in Stockholm, where we provide healthcare at home. We refer to what we do as hospital care at home, which is a step up in the level of care. Today, many think of more advanced care at home when they hear Hospital at Home. For example, at Karolinska, when we say Hospital at Home, we mean hospital-level care at home, specialist level, and highly specialized level care."*

The overarching theme was a shared and mutual understanding that HaH models are distinct from other home-based care models. An illustrative explanation of the concept is provided here:

"Acute inpatient level care provided in the comfort and convenience of the patient's home. So this care model involves patients with acute illnesses that generally need daily IV medications, daily labs, and daily visits by clinicians. It is to be differentiated from home health care or home-based product care in that regard. Again, these are patients that would be admitted to the hospital." - Jared Conley

4.1.2 Benefits

The perceptions shared by the interviewees on the benefits of the HaH model revealed a spectrum of observed advantages, emphasizing the model's impact from their professional viewpoints. One of the commonly noted benefits pertains to patient safety and the reduction of medical complications, as encapsulated by a direct quote from Gunilla Wahlström, *"We see less complications and fewer and fewer healthcare injuries"* This observation suggests a belief in the inherent safety and potential for improved clinical outcomes within the HaH setting.

Interviewees also highlighted significant clinical benefits of HaH. Katharina Borgström detailed the advantages, explaining how being in a familiar environment reduces the risk of falls, improves nutrition and sleep, and enhances cognitive function and patient involvement in their care.

"*If you are in your own home, you have a significantly lower risk of falls. In fact, we haven't had any fall injuries during the two years of this project. You eat better, as you get to eat the food you are used to and like, and you move around more because you simply have to take care of things yourself. There's no service staff in the home, so the patients manage these tasks on their own. And then you sleep better in your own bed, which is quite important. You also become less confused. Many elderly patients with multiple illnesses become confused when they are moved to the hospital. You also become much more involved in your care, which is quite important. And you maintain your functional level to a greater extent.*" - Katharina Borgström

Additionally, the comfort and psychological benefits of being treated in one's own home environment were frequently mentioned. Katharina Borgström noted, *"Patients are very satisfied [...] and 98% answered that they felt safe in their home environment"*. Gunilla Wahlström highlighted, *"For the patient, there are so many advantages"* indicating a perceived improvement in patient satisfaction and well-being when care is provided at home. These perceptions align with the view that HaH can offer a more patient-centric approach, emphasizing the value of familiar surroundings during recovery.

The flexibility that HaH provides for both patients and healthcare providers, allowing for more personalized care and efficient use of resources was also mentioned.

"HaH offers significant flexibility, allowing us to personalize care more precisely to the patient's actual health needs and make better use of healthcare resources. This flexibility can lead to improved patient outcomes and higher satisfaction levels."- Jared Conley

The economic aspect of HaH was also a point of discussion among the interviewees, who frequently referenced the model's cost-effectiveness compared to traditional hospital care. Katharina Borgström illustrated the financial benefits by stating, *"And the care, all this at about half the cost compared to inpatient care, which is incredible"* suggesting HaH has a potential to deliver care more efficiently. Jared Conley also highlighted the economic advantages, noting, *"By reducing the need to increase hospital beds for our aging populations, we can allocate societal resources more effectively and better address healthcare affordability."*

Interviewees also reflected on the role of HaH in fostering patient engagement and empowerment, noting the model's capacity to involve patients more directly in their care. Katharina Borgström mentioned, *"You also become much more involved in your care, and that is quite important"* emphasizing the importance of patient participation. Linn Kennedy highlighted the person-centered nature of HaH, stating, *"Being able to use this care model ensures some kind of person-centered care. It becomes so easy to work in a person-centered way when you are in someone's home, and it is also very appealing to many employees."* The notion of patient empowerment and active participation is also captured by Gunilla Wahlström, *"But what the patients say is that they are active in their illness in a completely different way. They get involved and understand and listen and participate."*

4.1.3 Challenges

A commonly mentioned challenge is the difficulty of integrating the HaH model within the existing healthcare regulatory and systemic frameworks. This concern is exemplified by the observation by Katharina Borgström, *"Because in Sweden there is only outpatient care and inpatient care. This is actually a bit in between"* pointing to the struggle of categorizing HaH within traditional healthcare classifications. This sentiment was widely shared among respondents, underscoring a systemic rigidity that complicates the implementation of innovative care models like HaH. This reflects a consensus on the need for systemic flexibility and innovation to accommodate models like HaH, which do not fit neatly into existing categories of care. A quote that captures and illustrates the type of challenges that can occur as the result of regulations that are not adapted to HaH.

"Setting up this care, we had to prolong all our hospital routines into the patients home. We had to consider small things as well as bigger i.e. cloths, drugs and logistic." - Gunilla Wahlström

Technological integration and the readiness of both patients and healthcare professionals to adapt to digital health tools represented another shared concern. Gunilla Wahlström highlighted the importance of patient involvement, stating, *"patients also have to be involved themselves and be willing and able to handle this digital equipment above all"* emphasizing the potential for technology to either enable or hinder the effectiveness of HaH. This underscored a common understanding of technology's dual role as both a facilitator and a barrier to HaH.

Culture was a common topic of discussion, in several ways. One of the significant challenges is the cultural shift within the healthcare profession. As Katharina Borgström pointed out, "*The difficult part is the cultural change internally. How do we get our own profession, the doctors and the nurses to join us? How do we get them on board? Sometimes they don't want to let go of their patients. Sometimes I think there might be a lack of trust that the patients will be as well taken care of.*" Linn Kennedy shared a similar view, stating, *"The challenges are about changing a culture where we are used to what is. When do we need to be in the hospital? How do we ensure that we make it easier for everyone to be included in the team?"* However, there is optimism for steady improvement. As Jared Conley noted, *"Over time, physicians, nurses, etcetera, will become aware of the supporting evidence for hospital at home, and further evidence will be generated in the near future to show it is safe for increasing patient populations. Then culture will adapt to this new model of care, accelerated by patient demand."*

Conversely, other respondents point to the importance of patient selection and the appropriateness of HaH for certain patient populations as a critical area of focus. The nuanced discussion around patient eligibility, as Linn Kennedy noted, *"It cannot replace everything. Not all patients should be cared for at home"* brings to light views on the scope and applicability of HaH.

4.1.4 Patient selection

In the discussions about patient selection for HaH in Sweden, a consensus emerges on several key criteria that are considered vital across interviews. The willingness of patients and their families to participate in HaH care is highlighted as fundamental, with Linn Kennedy emphasizing the importance of this consent: *"We have set three inclusion criteria that we have landed on, which are really about the patient wanting to be cared for at home. And by patient we really also mean family members."* Additionally, the practicality of administering care within the patient's home environment is acknowledged as an important factor, stressing the need for a suitable setting to support HaH services. Linn Kennedy notes, *"We have talked about the fact that it should be possible to care for the patient at home and there we exclude quite a few where it is not possible."*

Differences in approach become evident when examining how healthcare professionals consider the medical suitability of patients for HaH care. Gunilla Wahlström mentions moving beyond a fixed list of diagnoses to a more individualized assessment of patient needs, indicating a departure from a diagnosis-focused model to one that evaluates the overall benefits to the patient, *"We had a long list of diagnoses to include. After a week, we had to throw the list away and start again from scratch."*. Katharina Borgström introduces operational considerations into the patient selection process, specifying the capacity of care interventions per patient as a limiting factor: *"So three care interventions per day is what we can handle in this team."*

The iterative process of refining patient selection criteria was acknowledged as a significant theme across discussions. As healthcare professionals gain more experience with HaH, their approach to determining patient eligibility evolves to better meet individual patient needs and the operational capabilities of the healthcare system. This adaptive approach was showcased by the reflection by Kristina Groth, *"We will miss some and we will take in too many too. But in the end we will learn"* highlighting the ongoing learning and adjustment required to optimize patient selection for HaH.

4.1.5 The Swedish context

The Swedish context, with its advanced digital healthcare infrastructure and strict regulatory environment, also plays a crucial role in shaping the implementation of HaH. Interviewees discuss the importance of leveraging technology to support HaH while navigating the regulations that govern patient data and privacy. Linn Kennedy mentioned, *"In Sweden, there is a lot connected to personal data, cloud solutions, unclear legal ground or how we should interpret this."* This reflects the double challenge of making use of digital tools to improve HaH's effectiveness and at the same time comply with Sweden's high healthcare standards and privacy laws. Kristina Groth highlights the need for political and institutional support: *"it is very much about getting politicians and officials on board who understand the need to adapt regulations and laws to enable digital solutions in healthcare."*

In discussing the implementation of HaH programs in Sweden, all Swedish respondents underscored the critical role of collaboration, regional integration, and the engagement of various healthcare entities. Kristina Groth points out the significance of considering the broader healthcare ecosystem within a region, stating, *"I came up with another element in a strategy and that is to not just look at a single hospital, but to look at a whole ecosystem in the region. Since we have regional care, there is an interaction with home care and HaH care. You have to look at the whole region. I think we should look more nationally as well, because patients move across different regions."*

This reasoning is further developed in highlighting the importance of participatory development, emphasizing, *"I think it is important that the different organizations participate in the development. I think it is an important part of a strategy to not try to push down a finished concept and say 'here, now you go' without themselves being involved in the creation process"*

Similarly, Katharina Borgström added, *"I think you have to work a lot with collaboration. In Region Skåne, we have a whole structure for regional collaboration [...] I think that builds trust. Which is necessary if we are to move forward"* reinforcing the notion of structured collaboration as a foundational element.

Additionally, the dialogue underscored the necessity of inter-regional communication and political engagement, with Gunilla Wahlström noting, *"A good contact with the involved Region is necessary. But I also think we will come to a point in healthcare where the Regions collaborate more. Interestingly, the politicians are very positive and interested in this type of care"*

These shared views highlight a consensus on the need for a systemic, inclusive approach to healthcare innovation, where collaboration, stakeholder engagement, and a willingness to navigate regulatory complexities are important for the advancement of HaH models in Sweden.

4.2 Decision-makers

The implementation of HaH in the Swedish healthcare system requires efforts and decisions at the highest level. Decision-makers handle everything from policy development and financing to ensuring quality standards and patient safety. Their perspectives are needed to understand the strategies to integrate HaH into Swedish healthcare, a challenge that requires careful planning and coordination. A key aspect of integrating HaH involves understanding the unique healthcare landscape of Sweden. As Jean-Luc af Geijerstam points out, *"Sweden has a strong bias towards hospitals. To achieve successful HaH, a strong primary care system is needed"* This emphasis on hospital care necessitates a strong primary care system to support HaH, highlighting a critical need to strengthen this.

Moreover, Göran Stiernstedt emphasizes the cultural challenge in shifting from a hospital-centric model to a more home-based care approach, noting, *"The difficult part is that we are extremely hospital-focused. We are brought up that way. It is somewhat unique to Sweden. The sense of security is found in the hospital and the emergency department is the security."* This rooted reliance on hospitals for healthcare indicates that significant efforts will be needed to build trust in HaH models among both patients and healthcare professionals.

4.2.1 Implementation Challenges

Despite enthusiasm for HaH, decision-makers expressed concern about significant structural and financial barriers. Jean-Luc af Geijerstam emphasizes addressing these obstacles, stating, *"There are formal, structural, and financial barriers in various forms. One must also be attentive to what the patients actually want and need, so that we do not force patients into new forms just because it suits many"*.

Another key point was that HaH should be seen rather as a complement to the hospitals, instead of a replacement, and must be implemented sensibly, especially for patients with acute illnesses. Anna Nergårdh adds, *"I don't think hospitals can be replaced by HaH. I see it as a stage of acute illness where it is much better for the patient to be at home, and the significant advantages outweigh the alternatives"*.

Focus is also put on the collaboration between different roles and levels to seamlessly implement this model. Anna Nergårdh pushes this view by saying that "*it places great demands on interprofessional collaboration. And it places great demands on those who usually work with the most acute phase of care and those who work with the more intermediate or rehabilitation process, they must now work simultaneously"*

She continued to elaborate on the importance of getting every part of the system working together: *"One must understand that when implementing new approaches or methods, it is very much about whether everyone involved in the system at all levels thinks this is a good idea or not"*.

4.2.2 Cost Effectiveness and Reimbursement

Discussions on the cost-effectiveness of HaH emphasized potential savings compared to traditional hospital care. HaH can reduce the need for expensive hospital beds, presenting an opportunity to save money and improve patient experiences. However, accurately calculating these costs to get an overall picture of savings, considering all variables, is challenging.

"What determines whether it is profitable or not? That is a very difficult question. In the end, I believe it often comes down to the fact that there is a demand for some kind of economic calculation that shows this is profitable." -Göran Stiernstedt

"Of course, the costs have potential. However, I believe this is easily exaggerated. Healthcare is not particularly good at calculating costs. It becomes a unit price and does not take marginal effects into account." -Göran Stiernstedt

A significant obstacle to HaH implementation is current reimbursement models designed for traditional hospital care. These models do not account for HaH's unique aspects and benefits, leading to financing challenges. Changes in definitions of outpatient and inpatient care are necessary to enable adequate funding for HaH.

"There are different ways to approach this. With the current definitions of outpatient and inpatient care, round-the-clock care beds are by definition inpatient care. This is because the levels of care in primary and specialized care do not allow for round-the-clock beds. The problem is that if we start changing those definitions and say it's okay to have round-the-clock beds at the primary care level, it complicates things for municipal health care services, which we do not want. So, it doesn't work. Either we review the entire concept of outpatient and inpatient care, which is a huge undertaking, or we specifically look at HaH within inpatient care and develop a solution for that type of care. I am quite sure it could be done." -Anna Nergårdh

4.2.3 Patient-Centered Care

A recurring theme in discussions with decision-makers was the recognition of HaH as a valuable model from both the patient's and the healthcare system's perspectives. Interviewees highlighted HaH's potential to improve the environment for the patients, for example by reducing the risk of infectious diseases. Göran Stiernstedt mentioned, *"Hospitals are a dangerous place. As an infectious disease physician, I can vouch for that. The risk of injuries can also exist at home. But, for example, the risk of resistant bacteria is much greater in a healthcare facility"*.

"For me, it is a way to capture something important related to the development of healthcare, focusing on the patient's needs rather than the structure and organization of healthcare. Traditionally, healthcare has been based on patients receiving what is available. Here, the attempt is to conceptually make a shift of this view." -Jean-Luc af Geijerstam

Patient-centered care within the HaH concept emphasizes tailoring care services to meet individual patient needs and preferences. Jean-Luc af Geijerstam pointed out the necessity for flexibility and adaptation in HaH models to meet unique patient situations. He stated, *"It should be patients who want this and are capable of making decisions, or at least in some way through relatives if they can represent the patient's views. But it should be patients who can and want home healthcare"*. Göran Stiernstedt described how *"you feel more involved in the care. And that is an advantage. We know that patients who are more involved in their own care simply get better results"*. Decision-makers emphasize strategies promoting patient and family engagement. This includes training healthcare personnel in patient-centered care and developing communication strategies that facilitate open dialogue between caregivers, patients, and relatives.

4.2.4 Technology and Innovation

The importance of integrating advanced monitoring systems and digital communication platforms is something that is highlighted. These technological solutions can enhance the quality and safety of care and also improve efficiency and coordination among healthcare professionals. Göran Stiernstedt pointed out the potential of technology to improve home care: *"The new aspect that has emerged in the past five to ten years is the increased use of* *technology. The idea itself is not new, but technological advancements have made it possible to monitor multiple patients simultaneously and keep track of their health parameters more efficiently."* Moreover, digital communication platforms enable real-time consultations between patients and healthcare providers, ensuring timely interventions and reducing the need for physical visits to healthcare facilities. Stiernstedt elaborates on this by noting, *"When you are hospitalized, you press a button and someone comes. Now, you press a tablet and someone appears on the screen."*

Ensuring the compatibility and security of patient-generated data with existing healthcare systems is a complex issue that requires careful consideration. Decision-makers stress the importance of maintaining high-quality standards and safety protocols for all technological solutions used in HaH. For instance, Anna Nergårdh points out the necessity of robust data protection measures to protect patient information while leveraging technology for healthcare delivery.

"Before we can integrate, say, an Apple Watch, into the Hospital at Home concept, there are many steps to take. We need to ensure that medical devices are approved by the healthcare system. We are missing a lot in terms of self-care and self-monitoring because we do not use data that people, not even patients, collect themselves. It's challenging to balance the benefits of collected data with the requirements for evidence-based methods and CE-marked equipment. Apple Watch does not meet these requirements today. Quickly integrating other types of devices than those we currently use in healthcare could lead to political issues about data accessibility and ownership. We must convince decision-makers and the public that hospital care at home maintains the same quality standards as in hospitals. The question of how we integrate patient- or person-generated data into our systems is larger and must be addressed step by step." -Anna Nergårdh

4.3 Medtech-Industry

The medtech industry plays an important role in the development and implementation of the HaH model. Their work involves the development of monitoring systems and other technologies that are critical for the effective operation of HaH. These technological solutions must also meet strict regulatory requirements. Their contributions range from technical development to solving logistical and regulatory challenges, making their perspective essential in the development of HaH.

"We need to intensify the use of technology in healthcare. We need to automate in various ways and empower individuals and their relatives to be capable and confident in doing more themselves without needing assistance from healthcare personnel. This is a reason for wanting to move care closer to the home." -Jesper Olsson

4.3.1 Technology and Innovation

A central aspect of the medtech industry's contribution to the HaH model is the development of advanced technological solutions. These solutions include everything from monitoring systems to specialized equipment for treatments. This requires comprehensive integration of various technologies. It is important that all medical equipment and digital platforms are compatible and can be used safely and effectively at home. Ensuring that new technology meets all necessary standards and requirements is challenging, but essential for guaranteeing patient safety.

"All types of apps that are used, as well as IV devices and EKG machines, and even medical record systems, belong to the category of products that need CE marking. Essentially, everything used in healthcare, such as IV lines and needles, needs CE marking. This limits how quickly innovations can be put into practice" -Jesper Olsson

Representatives from the medtech industry said that the continuous development and improvement of medical technologies used within the HaH model is important when scaling up HaH. Philip Smith talks about the development of Medomas' own platform, explaining, *"We have developed our own coverage platform during the time we have been running this department. We started by using an existing coverage platform, but we saw limitations with it, especially when considering scaling up, which is our ambition."* He continues, *"It's not efficient to maintain this form of care if all hospitals only have six care places each. The major benefits are seen when leveraging synergies and collaborating within or across regions, municipalities, and regions."*

Furthermore, the Medtech industry's role extends to solving logistical challenges associated with HaH. Philip Smith highlights the importance of logistics, noting, *"If you go to a patient in a hospital room, it's not a big deal if you've forgotten a type of needle or a compressor to dry blood after pricking someone. But if you don't have it in the car and not in the patient's home, and you need to drive back 30 minutes to the hospital, it becomes very inefficient care."*

4.3.2 Resource Efficiency

Representatives from the medtech-industry were also highlighting the opportunity of resource-efficiency with HaH. Philip Smith explains: *"Having the right technical conditions is crucial for utilizing resource efficiency and saving money on personnel."* An important aspect of resource efficiency is also the possibility of reducing healthcare-related complications and readmissions. Philip Smith states that *"There has been a lower rate of healthcare-related complications and readmissions compared to traditional inpatient care. This also results in savings for both the hospital and society."*

Philip Smith also highlights the economic and organizational aspects of implementing HaH: *"The most challenging issue for us is that it has to be cheaper, but no one really knows the current costs."*

Another critical factor for the HaH model is preparedness. By developing and implementing this model, the healthcare system can become more flexible and better equipped to handle crisis situations. Jesper Olsson highlights this perspective: *"Hospitals have suddenly become targets in war. [...] This means that in a war situation, we must be able to move care from hospitals to other places, such as people's homes."*

4.3.3 Patient and Caregiver Perspectives

The patient and caregiver perspective was also discussed in the interviews with representatives from the medtech-industry. Philip Smith highlights the patient experience: *"HaH patients are generally more satisfied with their care than inpatient care patients. This is due to several factors, both practical, for example eating and sleeping better, and emotional, by simply feeling safer in their home environment accompanied by their loved ones. HaH patients also feel more engaged and informed in their care."* Patients often experience fewer complications in HaH compared to traditional inpatient care. The familiar environment can reduce stress and anxiety, which positively impacts recovery. Jesper Olsson underscores this point: *"It is better to be at home and it is safer. Infection risks are reduced, and there are not enough beds in hospitals."*

The perspective of caregivers is also something that representatives from the medtech industry highlights as important to consider. Their involvement is essential for HaH, but there is a risk that the responsibility is shifted from the patient to their relatives, making their burden too heavy. Philip Smith shares insights on caregiver involvement: *“The involvement of caregivers and patient engagement are much greater compared to the ten years I worked in physical wards."* By focusing on the patient and caregiver perspectives, the HaH model can be further refined to address their needs and improve overall satisfaction and efficiency.

4.4 Leading the Way in Hospital at Home: Dr. Bruce Leff's Insights

In the exploration of the HaH model, Dr. Bruce Leff's expertise provides valuable insights. A pioneering geriatrician and health services researcher at Johns Hopkins University School of Medicine, Dr. Leff has played an important role in the development of HaH, transitioning from early minimal technology to the sophisticated, tech-integrated care systems seen today. His extensive experience and innovative vision offer valuable understanding of the evolution, implementation, and optimization of HaH programs.

4.4.1 Remote Patient Monitoring and Eligibility

The integration of technology into the HaH model has evolved considerably since its inception. Early implementations lacked sophisticated technology, relying on paper-based systems and basic communication tools.*"When I first did hospital at home in our small series*

I had a cell phone but it wasn't even like one of those big bricks. I literally carried it on my back" Today, advanced remote monitoring and telemedicine technologies sometimes enable real-time patient assessments and continuous monitoring.

Remote patient monitoring has significantly broadened the eligibility for HaH programs. *"The technology has helped to improve that as well, and the remote patient monitoring has helped to broaden the spectrum and be able to take care of people who are more acutely ill"* Dr. Leff emphasizes that the choice of monitoring—whether through virtual meetings, in-person tests or intermittent remote monitoring—depends on the patients' needs and acuity levels. In most cases, intermittent monitoring is sufficient to manage patient care effectively at home.

4.4.2 Suitable Hospitals for HaH

Implementing HaH requires hospitals to solve specific problems and articulate clear goals. Dr. Leff outlines several reasons that justify the shift to HaH:

- Operating above capacity with no available beds.
- High patient volume and inadequate well-being management.
- Economic viability through the right mix of patients.
- A culture of embracing change and innovation.
- Availability of necessary assets within the healthcare system.
- Commitment to the HaH model.
- Geographic and patient density considerations.
- Willingness and ability to invest in HaH infrastructure.

4.4.3 Efficiency and Operational Considerations

Dr. Leff concluded that the efficiency of HaH models are dependent on what Key Performance Indexes (KPIs) are used. He suggested that more caregivers per patient is likely needed for HaH, compared to traditional inpatient care. This is due to the fact that a caregiver cannot be responsible for as many patients in HaH, compared to what they can in traditional inpatient care. In that regard, HaH could be considered inefficient. *"It depends a little bit on your definition of efficiency right?"* If instead whole episodes are taken into account, or the reduced care required due to hospital acquired infections, HaH is likely to be efficient.

4.4.4 Admission avoidance and Early supported discharge

When considering the implementation of HaH programs, hospitals often decide between focusing on admission avoidance or early supported discharge (i.e. completing hospitalization at home). Dr. Leff explained that the decision largely depends on the goals of the hospital.

"It depends on what the goals of the hospital are. Is transferring and completing hospitalization at home easier to pull off? Absolutely. Because usually you have some advanced warning of that patient being admitted to the HaH bed." This means that for HaH models focused around completing hospitalization at home, hospitals have the advantage of

planning and coordinating the transition of a patient from the hospital to their home. For instance, a patient with severe heart failure might initially be too ill for HaH but can be transferred home after a few days of stabilization in the hospital. *"You know on Tuesday night that they're going to be able to go back home on Wednesday morning. You have that time to get everything coordinated. Set up. All done."* This advanced notice makes it easier to implement all necessary elements for home care.

On the other hand, admission avoidance, or substitution, involves managing patients directly from the emergency department without admitting them to the hospital. *"Someone comes to the emergency department and then you have to snap your fingers or flip a switch and get all of that done."*. This approach can be more challenging because it requires rapid coordination and implementation of home care services. However, Dr. Leff believes this model is particularly beneficial for patients. *"Personally I think that's the best for the patient[...] to help them avoid the inpatient environment altogether."*

Dr. Leff noted that many healthcare systems start with early supported discharge to fine-tune their processes before transitioning to admission avoidance. *"What we've seen, a number of times, is that systems or hospitals will start off with the transfer model. Get their processes down really well and then move and start to concentrate on substitution."*

4.4.5 Financial and Reimbursement Models

Dr. Leff suggested that shared benefits based on performance could be a viable reimbursement model. The economic break-point for HaH programs is typically an average daily census of 20-25 patients, though this can vary depending on the context. *"I think the number that's being tossed around is when you can get to an average daily census of about 20 to 25 on average, that's when things really start to make sense".* - Bruce Leff

Regarding reimbursement models, Dr. Leff argues that while the cost of care during the acute care episode is not significantly lower than traditional care, the real savings of HaH lie in other areas. These include reduced post-acute utilization, fewer readmissions, and a decreased need to send patients to rehabilitation centers. *"Recognizing that the real savings of hospital at home comes in the reduction of post-acute utilization[...] Reduction in readmissions, reduction in the need to send people at the end of a hospital stay from the hospital to a rehabilitation facility. Those are very costly things and HaH cuts those things down tremendously.”*. He therefore proposes a DRG model which provides similar reimbursement for the acute episode as compared to traditional inpatient care, and then sharing the benefits of the reduction in readmission etc that comes with HaH between provider and payer. He also mentions the need to have quality measures in place.

One of the most significant challenges in implementing HaH programs is managing change within healthcare organizations. Dr. Leff emphasizes that *"The biggest issue is really change management. Payment helps people learn, you know, better payment models help leaders ride the backward bicycle a little better. But it still takes a lot. You know, people do what they do and they're comfortable doing it and it's very hard to get people to rewire things even when* *money is on the table".* Effective change management involves not only adopting new technologies and practices but also ensuring that healthcare professionals are adequately trained and motivated. *"I think one key element in terms of training is to train doctors who are taking care of hospital at home patients and what it means to do care in the home"* Dr. Leff adds.

In summary, Dr. Leff's insights highlight the potential of HaH programs to address capacity issues, improve patient care, and improve hospital efficiency. Successful implementation depends on commitment to the careform, careful planning, patient selection, monitoring strategies, and a supportive organizational culture.

5 Exploring Hospital at Home: Global Case Studies

The aim of the case studies is to go deeper into some well documented HaH cases. By doing this, the understanding of challenges and key success factors can increase. In addition, to get a better understanding of how the teams are composed and other important characteristics of the cases, it can facilitate the construction of the Swedish HaH model.

Table 7, summary of the cases made by authors

Case	History	Distinctive feature(s)
Johns Hopkins University School of Medicine	Johns Hopkins pioneered the HaH concept in 1995, successfully scaling it through pilot trials and national studies. Has since mostly focused on helping other instituitions develop programs.	Johns Hopkins developed guidelines for HaH implementation, focusing on system readiness, physician capability, innovation, and resource alignment.
Skåne Universtiy Hospital Malmö	Initiated in 2020 following the successful outcomes of a previous, less comprehensive home-based care program called the "ÄMMA"- project.	Illustrates HaH in the Swedish context. Physicians rotates between the team and departments in the hospital.
Hospital Clínic de Barcelona	Early adopter of the HaH model, initiated in 1996 at Hospital Clínic de Barcelona, now supported by regional initiatives. Increased the number of hospital beds from 12-72 between 2015 and 2022.	Has specifically dedicated full-time staff and makes use of relatively primitive technology.
National University Hospital Singapore	The NUHS@Home program, initiated in late 2020, was inspired by successful HaH models in the United States. Focused specifically on Covid-19 patientes during the pandemic.	Unique cultural and family structures illsustrates the need to adapt HaH programs to local conditions.

5.1 Johns Hopkins University School of Medicine

Johns Hopkins is where the concept of HaH started. This case describes the process of initiating the first HaH program and its subsequent scaling. The case study draws on articles and information from Johns Hopkins' website, providing a detailed account of the program's development.

5.1.1 Background

The concept of HaH was pioneered at Johns Hopkins as a solution to provide hospital-level care in the comfort and familiarity of a patient's home. Constructed in 1995 by Dr. John Burton of the Johns Hopkins School of Medicine and Dr. Donna Regenstreif of The John A. Hartford Foundation, the program aimed to establish a new model of care that could effectively manage acute illnesses outside traditional hospital settings. The foundational groundwork for HaH was laid out through a study led by Dr. Bruce Leff, which focused on developing medical eligibility criteria and a basic clinical model suitable for home care. The team designed the study and measurement methodology to ensure the program's viability and effectiveness from both a medical and operational perspective (Johns Hopkins, n.d.).

In 1996, a pilot trial consisting of 17 patients was initiated to explore the feasibility, safety, and cost-effectiveness of the HaH model. This early exploration proved successful, demonstrating the practicality of such a program and its potential to reduce costs significantly, compared to traditional hospital care. The positive outcomes of the pilot facilitated the expansion of the program and further validation through a National Demonstration and Evaluation Study conducted between 2000 and 2002 (Leff et al., 1999). The results showed that HaH met disease-specific quality standards and demonstrated a reduction in the average length of stay and overall costs by a third compared to inpatient care. Moreover, patients in the HaH program were less likely to experience delirium, required fewer sedatives, and had decreased needs for chemical restraints. The program also led to higher satisfaction rates among both patients and family members, with reported reductions in family member stress and quicker recovery in patients' ability to perform daily tasks (Johns Hopkins, n.d.).

In 2010, a significant evolution of the model was trialed through a public/private partnership that introduced home-based care by nurses with physician consultation facilitated via advanced telemedicine technology. This modified approach continued to emphasize the importance of accessibility and patient-centered care in the HaH model. In 2014, Mount Sinai Medical Center received an Innovation Challenge Grant to further develop the HaH model in a fee-for-service Medicare setting. This initiative aimed to refine the model and gather data to support the development of a 30-day bundled payment for HaH care, marking another step forward in the program's journey towards widespread adoption and standardization (Johns Hopkins, n.d.).

5.1.2 Supporting Other Institutions in Adopting HaH

Recognizing that the implementation of such a transformative model can be a complex and challenging task for many institutions, Johns Hopkins has committed to assisting other healthcare organizations in exploring whether HaH is suitable for their systems. For institutions interested in this care model, Johns Hopkins provides guidance on several critical considerations:

System readiness involves ensuring that the health system is prepared to handle changes in care delivery models, including assessing existing hospital capacity issues and home health-care capabilities. Physician readiness requires determining whether there are physicians within the system who are both interested and capable of managing patient care in the home environment. An innovative outlook is essential, evaluating whether the institution is generally forward-thinking in its approach to healthcare and constantly seeks to innovate and improve care delivery. Finally, the alignment of resources is crucial, including the alignment of payment structures, provider incentives, and organizational goals to successfully implement and sustain a HaH program (Johns Hopkins, n.d.).

Johns Hopkins advises healthcare organizations to consider these elements as foundational to determining the appropriateness of HaH for their settings. By providing a framework for evaluation and implementation, Johns Hopkins fosters an environment where other institutions can learn from their experience, adapt the model to their specific needs, and successfully integrate HaH into their service offerings (Johns Hopkins, n.d.).

The program itself is structured to ensure comprehensive care, extending from the initial patient assessment in emergency settings through to daily medical evaluations at home. Care pathways are carefully designed to include all necessary diagnostics and treatments that can be administered at home, with provisions for transporting patients to hospital facilities for procedures that require more complex equipment. This approach ensures that patients receive continuous, high-quality care throughout their treatment period, mirroring the level of care one would expect in a traditional hospital setting but within the more comforting and familiar home environment. By outlining these processes and providing robust support to other institutions, Johns Hopkins enhances the reach and effectiveness of the HaH model (Johns Hopkins, n.d.).

5.2 Skåne University Hospital Malmö

A Swedish HaH project which has drawn on insights both from previous programs around the world but also experiences in working with home care in other forms. Illustrates the unique possibilities and challenges of implementing HaH in Sweden.

5.2.1 Background

The project ÄMMA aimed to enhance patient comfort and safety by minimizing hospital-related risks, including infections and disorientation. Additionally, it sought to optimize the use of medical resources and improve cost-effectiveness. (Stavenow et al., 2014). The project focused on implementing a mobile acute care team capable of treating elderly patients in their homes. The purpose of the project was to increase the comfort and safety of patients by reducing the risks of staying at the hospital such as infections and disorientation, and at the same more efficiently make use of medical resources and improve cost efficiency (Stavenow et al., 2014).

The ÄMMA team consisted of healthcare professionals including doctors and nurses from both hospital and primary care, social workers, and physiotherapists, who worked together to provide fast assessment and treatment at home (Stavenow et al., 2014). They tried to treat acute incidents efficiently, preventing the escalation of health issues that typically lead to hospital admissions. The project focused on medical care, but also the development of practices that could be integrated into the regular community and primary care (Stavenow et al., 2014). It was not a HaH project, as its scope and services were primarily targeted at providing immediate medical attention and minor interventions in the home, rather than more extensive and complete hospital-level care. The project involved primary care interventions that were integrated with municipal health services, which is different from the HaH model that typically provides more complex medical treatments that are at the same level as those available in a hospital (Stavenow et al., 2014).

Given the success of the ÄMMA project in demonstrating the feasibility and benefits of medical care at home, there was a recognized opportunity to expand the concept further. This led to the development of a full HaH program in Malmö. In late 2020, resources were granted to create a 2-year HaH project, assessing the feasibility of implementing HaH models in the Swedish context. The HaH model was developed to provide a broader range of hospital-level treatments at home, such as more complex diagnostics and intensive treatments for acute conditions that would normally require inpatient care. This progression was also driven by the need to further reduce hospital admissions, particularly for conditions that could be effectively cared for at home with the right medical expertise and equipment (Borgström, 2023).

Borgström (2023) describes that the project's aims revolved around improving patient and caregiver involvement and satisfaction, improving the safety and accessibility of care, and optimizing healthcare resources. The project also focused on reducing hospital readmissions and the length of care, decreasing the amount of infections acquired at the hospital and effectively integrating hospital-level home care with primary and community care systems to facilitate good patient transitions and increased cooperation among healthcare providers (Borgström, 2023).

5.2.2 Organisation

Borgström (2023) describes that the HaH project was initially developed to have 7 hospital beds, and to look after these beds, a team was recruited. 5 full time nurses were employed for the project. This was enough to staff the 7 beds 07.15-22.00 weekdays with nurses. Also daytime, 2 specialist doctors were also rotated into the team from the internal medicine department and the infection clinic, one from each. Responsibility of the patients fell under one of the two doctors, and having a doctor from each department facilitated closer connection to both departments. During daytime on weekends, the team was staffed with a specialist doctor from internal medicine. Evenings, until 21.30, the team was staffed by an assistant doctor. Lastly, during night times, the standby duty at the hospital’s emergency department was supported to always have one doctor available on the phone if needed. Additionally, a curator and an occupational therapist was available daytime during the weekdays. Administrative support was also available daytime during weekdays. The administrative support helped register visits to comply with the requirements of the form of care, which was "outpatient care". As the team increased the number of hospital beds from 7 to 14 beds, the number of nurses needed to be doubled. Additional staffing of doctors was also required, however not doubled (Borgström, 2023).

5.2.3 Patient selection

According to Borgström (2023), the HaH project selects patients based on key criteria aimed at ensuring that HaH care is appropriate and beneficial for the individuals involved. Explicitly, the following three inclusion criterias was developed:

- "The patient wants to be cared in their home" Borgström (2023, p.22)
- "Specialized care in the home is possible" Borgström (2023, p.22)
- "The care is beneficial for the patient" Borgström (2023, p.22)

The eligibility also depends on the number of interventions required. The team could not manage over three interventions at the same patient each day efficiently, and the patients requiring over three interventions a day are therefore excluded. Examples of appropriate patients include those with conditions that initially require specialized treatments, such as intravenous medications, but are expected to transition to simpler forms of therapy, like oral medications. These patients may also require diagnostic tests within a few days to determine subsequent treatment steps, which can be effectively managed at home, including monitoring of treatment progress (Borgström, 2023).

Borgström (2023) describes that the project made use of both ESD and AA and admitted patients from both the ER and inpatient care. As the project has continued to develop, the project now tries to avoid transportation of potential patients to the ER all together, and admit patients through an assessment in the home. According to Borgström (2023), at first, the project primarily involved patients from specific medical departments, but it later expanded to include patients from various other departments as the team's expertise grew.

The criteria for inclusion have been designed to allow patients who prefer home care to receive it, provided it is both feasible and advantageous. Primary care physicians typically assess these patients to determine if specialized home care is appropriate. If the patient is deemed unsuitable for the program, the program facilitates an admission straight to the relevant department of the hospital (Borgström, 2023)

Various infections, such as pneumonia, make out over half of the patients receiving the care in the program. However, the team also treats more chronic conditions such as COPD and heart failure where the patients are relatively stable, and other less common conditions, where the team deem their competence appropriate Borgström (2023).

5.2.4 Remote monitoring

The project in Skåne incorporates patient monitoring through a combination of manual reports and automated digital tools to effectively track patient health data over time. Initially, the project uses the itACiH system for both daily planning and patient self-monitoring. Borgström (2023) however also notes that there was a public procurement for a self-monitoring platform in the beginning of the project. Borgström (2023) describes that the procurement was won by Siemens but was appealed twice, postponing the development of the platform and limiting the ability to make use of self-monitoring in the project.

Borgström (2023) describes that data about the patients are transferred to the team in various ways. Some data, such as weight measured by digital scales could be directly sent through bluetooth. In other cases, the data has to be manually added to the system by the patient. In some cases, the patient does not have the ability to add the data, and could then get help to do so by either an informal caregiver or staff. Examples of what can be monitored are vital parameters and oxygen saturation (Borgström, 2023).

According to Borgström (2023), the itACiH system also allows for patients to add additional information about their health and communicate and plan consultations with the team. Some examples of additional information that could be added and sent to the team are questionnaires about the patients well-being and pictures.

5.2.5 Challenges

The project faced challenges in the implementation and integration of monitoring equipment (Borgström, 2023). Initially, the use of certain remote monitoring technologies was limited by the available systems within the region. Linn Kennedy states, “*Initially, we could use Itacihs remote monitoring, and now we use Siemens' own monitoring that Region Skåne has procured. So we have to use the parameters that we can get through that system. Today, the systems dictate what we can use and not the other way around".* The project relied on systems that were procured by the Region Skåne, which decided what parameters could be monitored and how. This reliance often limited the project's ability to adapt or expand its monitoring capabilities based on emerging needs or technological advances. However, when asked, both staff and patients felt confident in the technology according to Borgström (2023).

The integration of monitoring technologies with existing healthcare IT systems posed a challenge.There were mentions of having to use multiple IT systems simultaneously, complicating daily operations and data management. Linn Kennedy mentions the lack of integration, "*Our team works with four different IT systems for the same patient every day"*. The project's team also had to navigate the complexities of interfacing new monitoring tools with legacy systems, which sometimes limited functionality or required workarounds due to regulation (Borgström, 2023).

Managing patient data and compliance with privacy regulations was a challenge, especially when integrating new technologies. The project had to be aware of legal and regulatory frameworks governing patient data, which sometimes restricted the use of cloud-based solutions or the integration of certain technologies that could enhance patient monitoring and care. Linn Kennedy highlighted this issue, stating, "*It takes a long time to get technology into healthcare [...] In Sweden, it is often related to personal data, cloud solutions, unclear legal grounds, or how we should interpret this.*"

The project also encountered challenges related to existing healthcare frameworks and regulations. These constraints were often not suited to fit new healthcare models such as HaH. Regulatory classifications and procedural requirements often required modifications to fit the structure of HaH care. The following quote captures the type of challenges that could occur:

"*Not all regulations and frameworks are designed for close care and care in the home. When you think about medication management, we have had to struggle quite a bit to establish routines that we could work with [...] In Sweden, there is only outpatient care and inpatient care. This form of care is actually a bit in between. But if you call this inpatient care, then the patient cannot retain their social services if they have primary home care. This care model is defined as outpatient care. It is really a middle ground, but there are only two categories*."
-Katharina Borgström

Recruitment of personnel, especially nurses poses a challenge in scaling up the operations (Borgström, 2023). Borgström (2023) mentions that initially, the project faced difficulties in hiring nurses, but the situation improved over time. L. Kennedy (personal communication, March 25, 2024) also explained that the project has been relatively successful in recruiting nurses, especially experienced ones, compared to the traditional inpatient care department.

5.2.6 Reimbursement

According to L. Kennedy (personal communication, March 25, 2024), the HaH project in Skåne is currently grant-funded which she argues increases the project's room for action and flexibility. However, to facilitate greater adoption of HaH, she argues that a broader more cohesive strategy would be beneficial. Deciding which form of care the type of project belongs to, and a decision about reimbursement could incentivise more healthcare providers to offer similar types of care. She however also notes that the reimbursement should not be too low per patient, as that risks incentivising health care providers to focus on groups that may need too simple interventions for HaH, and should thus actually be in primary care instead.

5.2.7 Outcomes

Table 8: made by authors, based on data from Borgström (2023)

Category	Metric	Value
Patient Feedback	Patients reported that digital tools contributed to a sense of security	96% yes
	Patients reported that digital tools were easy to use	95% yes
	Were your current care and treatment needs met during the care period?	98% yes
	Would you recommend home care to someone in a similar situation?	99% yes
	As a relative, did you feel safe with the care provided?	99.9% yes
	Did you feel safe during your care period at home?	98% yes
Clinical and Resource Utilization	Average length of stay within HaH	5.3 days
	Median length of stay within HaH	4.0 days
	Average length of stay for inpatient care in Internal Medicine	5.1 days
	Average length of stay for inpatient care in Infection	5.3 days
	Total patients cared for within HaH	716
	Total care days	3,771
	Number of home visits	6,688
	Number of remote visits	508
Health Outcomes and Safety	Readmissions within 30 days	0.13
	Readmissions per period (2021-06-15 to 2023-03-31)	1-6 days: 31; 7-13 days: 20; 14-20 days: 23; 21-30 days: 21
	Percentage of healthcare-associated infections within HaH	0
	Number of incidents related to the care model	9
	Number of Lex Maria cases related to the care model	0

Lastly, Borgström (2023) describes that the project set up direct admissions to hospital care without patients needing to go through the emergency department 58 times during the project period. The project also increased the number of patients it could care for at home. It started with 12 patients per month in June 2021 and grew to 52 patients by March 2023. Compared to the regional average for similar departments the rehospitalization rate was shorter for HaH. Similarly, both median and average “Length of Stay”, i.e. the length of treatment, including both care in the home and at the hospital, were comparable with those of traditional inpatient care (Borgström, 2023).

5.3 Hospital Clínic de Barcelona

This case describes processes and key success factors of a HaH program in Barcelona, Spain. The program has been long running and has had time to refine their processes, and has also together with other programs in the region been praised for its practices by OECD. Information is partly based on an interview with David Nicolás, Medical Doctor at Hospital Clinic of Barcelona, who has worked with the model for a long time.

5.3.1 Background

The HaH model in Catalonia, particularly in Barcelona, has a well-documented history of integration and success within the regional healthcare system. As outlined by González-Colom et al. (2024), Catalonia, a region in Northeast Spain with approximately 7.7

million citizens, adopted HaH during the 2011-2015 regional Health Plan under the administration of the Catalan Health Service. This early adoption was strategically supported by a reimbursement scheme that used patient-refined diagnosis-related groups (APR-DRG) to facilitate widespread implementation across hospitals. The effectiveness of this approach led to Catalonia being recognized as a Best Practices site for HaH in the Joint Action on the implementation of digitally enabled integrated person-centered care (JADE-CARE), a European Union initiative in collaboration with the OECD aimed at enhancing the assessment and transferability of innovative healthcare services.

At the Hospital Clinic in Barcelona, a public tertiary teaching hospital with 750 hospital beds, serving 560,000 people, a HaH unit was established in 1996 and has since treated approximately 1,200 patients annually, with an average stay of seven days (Pericàs et al., 2020). Pericàs et al. (2020) describe the comprehensive care provided during HaH admissions, which includes daily medical and nurse visits via in-person, phone, or video calls, supported by a 24-hour call center. The unit is equipped to perform routine tests and administer treatments at home, with protocols in place for transferring patients to the hospital when necessary. According to (Hospital Clínic de Barcelona, 2022), the Hospital Clinic in Barcelona has been expanding the capacity of its Transversal Home Hospitalization Unit called HDOM, from 12 to 72 beds in the past seven years, now positioning it as the largest unit of its kind in Catalonia.

5.3.2 Patient selection

D. Nicolás (personal communication, March 7, 2024) describes that the admission criteria is quite broad and flexible and not defined by any specific conditions. He describes "*I think there is not just one type of patient[...] I think it's more about what kind of patients you can't take home*." emphasizing that the type of care is not for any narrow patient groups, but rather is effective for many different pathologies during the right conditions.

Both D. Nicolás (personal communication, March 7, 2024) and Hospital Clínic de Barcelona (n.d.-a) however mention the occurrence of some specific inclusion criterias. According to Hospital Clínic de Barcelona (n.d.-a) patients must live together with someone, and the patient must also sign an informed consent document. Additionally, the patient must live within a specific part of Barcelona. However, there is an emphasis on that these criteria should be individually assessed. Deviation from both these criteria could be possible when it's deemed acceptable. Another inclusion criteria regards to the home environment, it must fulfill some environmental and hygienic standards and the patient should have access to either a cellphone or a telephone through a landline.

D. Nicolás (personal communication, March 7, 2024) and Hospital Clínic de Barcelona. (n.d.-b) highlight that Hospital Clínic admits patients who are evaluated in the Emergency Department and are deemed suitable for HaH as well as those already admitted who have stabilized enough to continue their recovery at home. This also extends to patients seen in outpatient settings, such as clinics or primary care, who need hospital-level admission but can appropriately receive it in their home environment. D. Nicolás (personal communication, March 7, 2024) further clarified that the Hospital Clinic thus has both AA and ESD patients.

According to Hospital Clínic de Barcelona (n.d.-a), in the process of transferring patients to HaH care, the Hospital Clínic team starts by conducting the evaluation to determine the suitability of the HaH service for each patient. This decision-making process involves careful coordination with the patient and their family, making sure that all parties are informed and agreeable to the plan. Once a patient is deemed a good candidate for HaH, a detailed plan is crafted, which includes the arrangement of necessary medical equipment and the management of their ongoing treatment. If accepting HaH services, the patient is carefully transported to their home via ambulance, equipped with a treatment plan and direct contact information for the HaH team. This ensures continuation of care, where the patient receives an initial call on arrival to address any immediate concerns and inform them of upcoming home visits. The HaH team remains accessible through a direct dial phone service, providing regular medical and nursing visits, conducting necessary tests at home, and facilitating hospital transport for tests that cannot be performed in the home setting. The discharge process from HaH also involves collaboration with primary and community care teams to ensure a good transition and continued care.

5.3.3 Organization

Many people are involved in the HaH process. The physicians in charge of a specific patient are responsible for an initial assessment of whether a patient is suitable for HaH. In ESD, this responsibility may fall on physicians within the inpatient care, for AA, this reference could be done either by a GP in the primary care, or a physician at the ER. D. Nicolás (personal communication, March 7, 2024) highlights the importance of collaborating closely with the physicians providing the initial assessment and evaluation of suitability for HaH. He for example emphasizes, "*in primary care you need to be sure that they know how to identify which patients are good candidates to be admitted".*

This initiative is according to Hospital Clínic de Barcelona. (n.d.-b) supported by multidisciplinary teams, combining exceeding 50 professionals, designed to extend hospital-level care to the comfort of a patient's home. Central to the teams are an internal medicine physician with a decade of experience in various critical wards and 4 full-time and 1 part-time registered nurses. Notably, 70% of these nurses not only hold additional master's degrees but all of them also bring over 15 years of frontline experience in the Intensive Care Unit or Emergency Room. The program is further supported by two part-time administrative officers and a PhD, registered nurse coordinator, all with specialized training. Each person within the team also had to undergo a minimum of three months of training within the unit. The team additionally also has its own administrative staff, hospital pharmacist and social worker (Hospital Clínic de Barcelona., n.d.-b).

Furthermore, D. Nicolás (personal communication, March 7, 2024) explains that in his unit, each doctor is responsible for 12 patients, something he deems is a reasonable ratio to be able to provide care of good quality. He continues by describing the daily operations of the team. Each doctor makes around 4-6 visits every day to patients, and most patients are visited by a doctor every 2 or 3 days. D. Nicolás (personal communication, March 7, 2024) explains that an assessment is made everyday to decide on who the doctor should visit that day. Everyday, each patient is also visited by a nurse that performs some intervention or provides an assessment of the patient's well-being.

Staffing is a key challenge in HaH programs. D. Nicolás (personal communication, March 7, 2024) points out that it's important for HaH units to have their own dedicated staff, instead of sharing staff with emergency rooms or hospital wards. This helps the team focus better on HaH care (D. Nicolás, personal communication, March 7, 2024).

5.3.4 Interventions & Monitoring

In addition to the daily routines described by D. Nicolás (personal communication, March 7, 2024), Hernandez et al. (2024) outline further provisions for patient care utilizing modern technology. Healthcare providers can access patient records remotely, which allows them to monitor and manage patient care effectively from a distance. Patients can receive various treatments at home, such as blood tests, microbiology tests, clinical ultrasound, electrocardiograms, many intravenous and nebulized treatments, and oxygen therapy. The study also describes established pathways for transferring patients back to the hospital for additional tests that cannot be performed at home, and for emergency responses if a patient's condition worsens.

Commenting on the current technological implementations in HaH, D. Nicolás (personal communication, March 7, 2024) questions the practicality and necessity of some high-tech solutions. He gives an example: "*For example, I don't need to measure the continuous temperature of my patients at home because this is something that wouldn't do for a patient in a ward so.*". Instead, D. Nicolás (personal communication, March 7, 2024) argues for a more tailored technology use that addresses real-world needs, such as the ability to measure vital signs like blood pressure, respiratory rate, and heart rate at significant times throughout the day. He notes the absence of integrated solutions from large tech companies, which often sell platforms and devices without a holistic approach to meet these specific needs.

D. Nicolás suggests that the future of hospital-at-home programs should lean towards creating customized, low-tech solutions that are both affordable and reliable for routine monitoring. These solutions should be adaptable to both patients receiving HaH care, but also other forms of home care including those with chronic conditions who need regular but not continuous monitoring. There is a need for more tools and technologies that meet the practical needs in the daily operations.

D. Nicolás (personal communication, March 7, 2024) also mentions exploring the use of video calls to replace some in-person visits. This approach is being tested to see if it can help doctors manage their time more effectively, allowing them to focus on urgent tasks (D. Nicolás, personal communication, March 7, 2024). Using video calls could make the program more efficient without lowering the quality of care.

5.3.5 Outcomes

Table 9: made by authors, based on data from Hernández et al. (2018)

Category	Metric	Value
Clinical and Resource Utilization	Number of discharges	4,165
	Hospital stay, days (Median, P25-P75)	1 (0–3)
	Home stay, days (Median, P25-P75)	6 (5–7)
	In-hospital + Home, days (Median, P25-P75)	7 (6–10)
	Number of Physician visits, m ± SD	1 ± 0.5
	Number of nurse visits, m ± SD	7 ± 3
	Number of phone calls to the patient, m ± SD	2 ± 1
	Emergency Room visits, n (%)	68 (2)
	In-Hospital re-admissions, n (%)	201 (5)
Health Outcomes and Safety	Emergency Room visits, n (%) (30 days after HH/ED discharge)	311 (7)
	Hospital admissions, n (%) (30 days after HH/ED discharge)	461 (11)
	Mortality during episode, n (%)	12 (0.3)
	Mortality during 30 days post discharge, n (%)	94 (2)
	Primary care, n (%) (Transitional Care after HH/ED discharge)	3,527 (85)
	Palliative care, n (%) (Transitional Care after HH/ED discharge)	226 (5)

5.4 NUHS@Home - Singapore

This case details the NUHS@Home program's initiation and expansion, drawing on insights from Stephanie Ko, a consultant in the Division of Advanced Internal Medicine at the National University Hospital System (NUHS) in Singapore. Inspired by effective HaH models in the United States, NUHS@Home started in late 2020 and quickly grew.

5.4.1 Background

Stephanie Ko mentions that the NUHS@Home program was developed to offer patients an alternative to traditional inpatient care (S.Ko, personal communication, March 21, 2024). This approach was driven by the increasing demand for hospital beds and the need to enhance the quality of care while reducing the risk of hospital-acquired infections. By providing hospital-level care in a patient's home, NUHS aims to utilize the advancements in medical technology and telehealth to ensure effective management and monitoring of patient health.

Stephanie Ko explains that the inspiration for the HaH model came from her experiences in the United States, where she observed the effectiveness of such programs during her studies. Motivated to replicate this success, NUHS@Home started as a small pilot in late 2020 and expanded rapidly despite challenges posed by the COVID-19 pandemic. She elaborates, *"I first got interested in HaH when I learned about the care model while I was doing a master's in the US back in, I think, 2016, 2017, when they were just starting it."* (S.Ko, personal communication, March 21, 2024).

Central to the NUHS@Home program is a multidisciplinary team composed of doctors, nurses, and allied health professionals who deliver comprehensive care remotely and through home visits. The services provided under this program include remote vital signs monitoring, intravenous infusions, laboratory investigations, and regular home visits supplemented by virtual consultations (NUHS, 2024).

Patients suitable for this program include those with conditions like cellulitis, urinary tract infections, pneumonia, and even COVID-19 infections among individuals with a reduced immune system. The inclusion criteria focus on ensuring that patients are clinically stable and have a supportive home environment that complements the treatment plan. According to Stephanie Ko, the program initially focused on COVID-19 patients during the Delta wave. She states, *"Our program pivoted to take care of only COVID patients who needed hospitalization and hospitalized them at home instead."* (S.Ko, personal communication, March 21, 2024).

The process begins with a referral from a doctor either at the emergency department or from selected hospital wards within the NUHS. Patients are assessed for suitability by the NUHS@Home team based on specific medical and environmental criteria. Once deemed eligible, patients are enrolled and can receive comprehensive medical care in their homes. Daily reviews and remote vital signs monitoring are conducted virtually, with provisions for additional home visits if necessary. This system allows patients to receive personalized and maintain close contact with their healthcare providers, ensuring that any change in their condition is addressed (NUHS, 2024).

Stephanie Ko highlights the need for systemic support, such as appropriate funding models and policies, to ensure the sustainability and expansion of the program. She emphasizes, *"We had to work together with some of the other hospitals to come together to apply for what we call a sandbox funding. It's very similar to the CMS waiver in the US, where for a time-limited period, the government mimics typical inpatient reimbursement for HaH while gathering experience and data."* She also emphasizes the program's future potential to expand significantly, with plans to scale up to 100 beds per cluster by 2025, reflecting a commitment to broadening the reach and impact of HaH care in Singapore (S.Ko, personal communication, March 21, 2024).

The NUHS@Home program is supported by Singapore's Ministry of Health. Patients treated by NUHS@Home are considered hospital patients. Singapore citizens and permanent residents can use government subsidies like MediSave, MediShield, MediFund as well as personal insurance to manage costs. This structured approach to funding ensures that the program remains accessible and affordable to a broad segment of the population (NUHS, 2024). Adding further context from Ko et al. (2023), the introduction of virtual wards has shown to be well-accepted, with patients appreciating the safety and effectiveness of receiving care at home. Many participants expressed that they found the virtual ward to be safer than the hospital setting, especially due to reduced exposure to infections and a more personalized level of care, which they deemed as "just right" for their needs.

5.4.2 Cultural Perceptions and Healthcare Decisions

In Singapore, deeply rooted cultural norms contribute to healthcare decisions, favoring in-hospital care for its perceived safety and comprehensiveness. This preference is embedded in a societal norm that values the structure and security of hospital settings over newer models like HaH. However, as the NUHS@Home program evolves, there's a growing recognition of its benefits, prompting a gradual shift in public perception. Programs like NUHS@Home are increasingly seen as alternatives, offering safe and effective care in the patients' homes. This shift is supported by educational outreach that highlights the program's personalized care approach, helping to reduce family concerns about the safety and effectiveness of HaH. (S. Ko, personal communication, March 21, 2024).

Ko et al. (2023) further underscored the importance of cultural competence in patient care, highlighting how understanding and integrating cultural values into care plans enhance patient and family acceptance of HaH services. This integration helps bridge the gap between traditional healthcare expectations and the HaH model, fostering a smoother transition for patients and their families.

Singapore's family structure is predominantly multi-generational, with extended families often living under one roof (Ko et al., 2022). This setup can provide a robust support system essential for the HaH model. Yet, it also presents challenges, such as potential caregiver burden and the logistical complexities of integrating professional medical care within a home setting. Families often express concerns about the responsibilities of home care, fearing the physical and emotional demands it places on them. Ko et al. (2022) highlights how familial obligations and the physical layout of homes can impact the implementation and acceptance of HaH services, suggesting that these factors need to be carefully considered in program planning and patient selection. Stephanie Ko notes the challenge in altering the traditional mindset that views hospitals as the safest place for care. She emphasizes, *"We are always taught that hospitals are really safe and we should keep patients in hospital until they're better."* She also emphasizes the need for continued education and training for families to build their confidence in managing care at home, which is crucial for reducing perceived burdens and enhancing program uptake (S. Ko, personal communication, March 21, 2024).

5.4.3 Patient Selection Criteria

A key element is the patient selection process. According to Ko et al. (2022), the criteria include both inclusion and exclusion parameters. Adults aged 21 and over who are Singapore citizens or permanent residents within designated service areas are eligible, ensuring the program can manage its resources effectively while maintaining close proximity to patients. Candidates must be clinically stable enough to receive care at home and have a home environment favorable to the planned medical care. This includes access to necessary facilities such as a bed, phone, and refrigerator, as well as a supportive environment for medical care. Additionally, most patients had an informal caregiver who assisted with caregiving duties, but the presence of such a caregiver was not a requirement for patient selection.

Equally important are the exclusion criteria, which help mitigate potential risks associated with delivering care outside a controlled hospital environment. Patients requiring immediate access to emergency services are excluded to ensure the program does not compromise on care quality or patient safety. Those with conditions requiring isolation, such as acute psychosis or suicidal intent, patients on supplemental oxygen, those with a history of severe medical complications, or behavioral issues, and those needing parenteral controlled drugs are carefully screened out to maintain the safety of both healthcare providers and patients. Moreover, patients anticipated to require intensive rehabilitation exceeding two weeks, or those with a history of violence towards healthcare workers, are excluded to ensure the program's operational integrity.

5.4.4 Key Performance Indicators

Table 10, made by authors, based on data from Ko et al. (2022)

Category	Metric	Value
Patient Feedback	Spent less time lying down at home	83%
	Walked around more at home	66%
	Mean rating for overall experience	9.0/10
	Recommend experience to others	94%
	Better sleep quality at home	79%
	Would opt for HaH care again if cost lower than hospital	97.5%
	Would opt for HaH care again if cost similar to hospital	55.6%
	Would opt for HaH care again if cost more expensive than hospital	16.4%
	Overall patient satisfaction	High
Clinical and Resource Utilization	Total bed days in HaH	582 bed days
	Median length of stay prior to HaH transfer (days)	2 days
	Bed capacity	3 beds
	Weekend admissions	No
	Overall bed occupancy rate	49.1%
Health Outcomes and Safety	Rate of escalation to acute hospital	6.5%
	Failure to respond to IV antibiotics	2 patients
	Fall requiring rehabilitation	1 patient
	Anaphylaxis	1 patient
	First onset seizure	1 patient
	Hypotensive episode	1 patient
	Desaturation	1 patient
	30-day readmission rate	15.7%
	Patients requiring hospital admissions, n (%)	2,003 (8.08)
	Patients requiring emergency room visits, n (%)	4,109 (16.62)
	Inpatient mortality rate	1.8%
	Died during HaH treatment	1 patient
	End-of-life patient died at home	1 patient
	Died after escalation to hospital	1 patient
	30-day mortality rate	3.7%
	Improvement from 0.45 to 0.58 after 14 days	0.45 to 0.58
	Inpatient falls	1 (0.9%)
	Adverse drug reactions	1 (0.9%)

6 Concluding Discussion

This section focuses on summarizing and putting together the information collected from the literature overview, four voices and the selected cases, to discuss how to implement th HaH in the Swedish Healthcare system.

6.1 Components

In revising the literature and when talking to interviewees, key components capturing the essence of the HaH model emerged. The components highlight various aspects of HaH programs and cover different questions which need to be addressed when developing a HaH program. The choice of how to structure each component is not an easy task and should be taken after careful consideration. Several factors should influence the decision.

Understanding the specific goals and aims the HaH program is developed to fulfill is critical, as different program structures have certain strengths and weaknesses. Are the objectives to reduce hospital acquired infections, free up hospital beds, or improve the efficiency of care? Defining clear goals will help in designing a program that meets the desired outcomes. For instance, if the primary aim is to reduce hospital acquired infections, the program structure could focus on AA to mitigate the risk. On the other hand, if freeing up hospital beds is the main objective, the program might focus on developing broad patient selection criteria and operations that benefit from economies of scale, such as virtual consultations, and therefore promote a large uptake of patients to the program.

Another factor that influences the decisions regarding the components is the resources and capabilities of the organization implementing the HaH program. This includes not only financial resources but also e.g. the availability of trained healthcare professionals, technological infrastructure, and logistical support. A thorough assessment of the existing resources can help identify gaps and areas that need enhancement. For example, if there is a shortage of trained nurses, the program might need to invest in additional training or hire more staff. If this is not possible, the organization could opt for structures that maximize the ratio of patients cared for per caregiver, through e.g. primarily using virtual consultations. Similarly, if the technological infrastructure is lacking, investments in remote monitoring systems could be useful, or deciding on more narrow selection criterias regarding medical stability, and only admit very stable patients that do not require continuous monitoring.

The unique environment and conditions where the HaH program is to be implemented influence the choices. Specific conditions within countries, regions, or communities, such as cultural norms could pose barriers to specific choices. For example, in some countries, people may be more open to using digital tools, and make use of technology in healthcare, such as virtual consultations. This could make that choice more viable in those countries. Other countries may lack reliable internet infrastructure which would make virtual consultations less viable.

Lastly, the components should not be decided in isolation. They are deeply intertwined, and choices regarding one component should influence the decision of the other components as well. It is crucial that the structural decisions of a HaH program are taken from a holistic perspective. If for example a program is developed to deal with specific pathologies, what values are measured, and at what frequency should be decided according to what is relevant for the specific pathology.

Table 11: made by authors, key components to consider

Key components and aspects to consider

Hospital/implementational level	**Patient selection**	• Where are the patients found? • Who assesses the patient? • What criterias are used?	• Emergency room, Inpatient • General practitioner, nurse • Pathologies, stability criteria
	Team structure	• What proficiencies are part of the team? • To what capacity should they work in the team?	• Nurses, GPs, coordination • Full-time, rotating
	Technology/ Monitoring	• What is monitored? • At what frequency? • From where? • Where do the visits take place?	• Vital signs, how the patient feels • Few times per day, intermittent, continuous • Remotely, at home • Virtual, in the home
	Organization	• Where do the visits take place? • What determines when to visit? • What interventions are done in the home? • How often?	• Virtual, in the home • Least number of visits, when needed • Intravenous antibiotics, oxygen therapy • No predefined limit, predefined limit
Decision-maker/policy level	**Reimbursement**	• Are the current reimbursement systems customized for HaH? • How can they be changed to facilitate HaH?	• Subsidies • Definitions of inpatient and outpatient care

6.2 Patient selection

The choice of patient selection strategy should take several factors into account, including the desired objectives and the context and conditions of the implemented project. As mentioned by OECD (2024), Sweden currently has an aging population and a relatively low number of hospital beds per capita. The relatively high value of freeing up hospital beds through implementation of HaH could therefore point in the direction of broad patient criteria, as it could have a greater relieving effect on the rest of the Swedish health care system. The use of broad inclusion criteria as mentioned by L. Kennedy (2024, personal communication) as a successfactor in the Skåne case, further highlights the suitability to the Swedish context. It could also be the case that broad inclusion criteria is especially suitable as there already are teams which can perform some interventions such as the ÄMMA team in Skåne. This could be the case as those teams may reduce the pool of potential patients, as the need for traditional “inpatient interventions” in the home are already performed. In that case, choosing broader criteria to increase the potential patient pool would be especially beneficial for regions already having teams performing advanced care in the home.

Other choices regard social and clinical inclusion criterias such as presence of a caregiver. In Barcelona, the patient must have an informal caregiver at home. The caregiver must also be willing to participate. Having this as a requirement in Sweden could potentially lead to better patient outcomes, as there is an informal caregiver at home that could help with everyday tasks, or in case of an emergency. On the other hand, it may limit the pool of patients drastically, as a large part of the Swedish population that would be suitable for HaH is living alone. Also, excluding based on home environment can be argued to go against the aim of Swedish healthcare to provide equal care. Instead choosing to only include clinically stable patients, as done by the Mayo Clinic according to Paulson et al. (2023), Singapore among others, may mitigate a stated need to have an informal caregiver present as there is low risk of deterioration. The Skåne case may provide a good guideline, primarily focusing on the needs of the patient, and therefore only requiring a present caregiver when needed.

Choosing between ESD and AA, or both, is impacted by several aspects. There are arguments to be made for both systems. Starting with AA, Sweden has an aging population, which leads to more frail patients in the health care systems. Old and frail patients are at an especially high risk of conducting hospital-acquired infections. As AA removes the admission altogether, this mitigates the risk of infection. This points to a particular value of including AA in a potential HaH program. Secondly, Skåne is currently trying to include more AA in their HaH programs, suggesting that they see a benefit of using the mode in the Swedish context. Thirdly, as suggested by Leong et al. (2021), it can be beneficial to prioritize AA as it, according to their study, can offer greater cost reductions and patient outcomes.

On the other hand, there are also arguments to be made to choose ESD. The project in Skåne is clear evidence that the mode has actually performed well in the Swedish context. It may also be easier to start with patients where the hospital has a clear picture of the patient’s clinical stability and values. Targeting patients already in the hospital also give further time to evaluate the suitability for HaH admission, and does not require as fast evaluation as AA. Additionally, ESD could require less involvement and facilitation from people outside the team, as e.g. GPs in the emergency room don’t have to be engaged in screening for HaH eligibility.

Also, there is the possibility to make use of both ESD and AA at the same time, which would increase the pool of eligible patients. Given Sweden’s relatively low number of hospital beds per capita mentioned by (OECD, 2024), this could be a good choice, as a larger number of people could be treated at their home. An increased pool of eligible patients could be beneficial both for larger and smaller HaH programs. As mentioned by (Leff, personal communication, May 7, 2024), a HaH program requires a minimum number of patients to become beneficial. For hospitals located in rural areas, using both ESD and AA could enable them to start HaH programs, as the dual screening makes the pool meet the size requirements. Larger HaH programs, especially those in larger cities, can likely meet demand thresholds which makes it economical to organize more functional and thereby become more efficient. By increasing the patient pool, using both ESD and AA would help reach these thresholds. Starting with ESD, as it does not require any additional education of GPs to screen for HaH eligibility, and then expand to also include AA as the PoC is finished, is one method. This method was used by the HaH project in Skåne, and could act as an example of how to work initially.

Similarly, as mentioned in several cases, including Skåne, an initial method could be to firstly determine which patient that actually would benefit from staying at home, and which interventions that could safely be performed in the patient's own home. The decision should then take into account the specific resources, capabilities, and aims of the specific hospital investigating the feasibility of HaH. For example, different regions may be better suited for HaH, as they contain a greater concentration of the old population or people living in close proximity to the hospital. Due to the low concentration of inhabitants in some parts of Sweden, HaH may not be suitable to cover all areas. This can be a challenge due to the aim of Swedish healthcare of offering equal care to its population, especially within regions.

Another inclusion criteria which was mentioned by health care personnel was that the patient must be able to manage and understand the digital equipment required to treat the patient. In the Skåne case, they mentioned that the patients had the alternative to get help with the digital equipment from the hospital personnel. Complete lack of capability can however pose a challenge, if the patient isn't able to make use of the technology in the long run and therefore repeatedly requires support. However, as mentioned in OECD (2023), a large part of the Swedish population already has experienced having digital contact with the healthcare system, with a sharp increase during the Covid-19 pandemic. Even though this probably mostly is among the younger population, it can also indicate a culture that is open to adapting digital solutions, and a population that is technologically competent.

6.3 Team structure

Team composition and competences

As mentioned by Chen et al. (2024), the multidisciplinary teams that treat the patients vary in terms of composition. Paul III (2013), suggested that HaH teams often rely heavily on nurses, something that has also been seen in both the Skåne and the Barcelona case, which had a high ratio of nurses compared to other roles. Given the relatively high number of nurses per capita compared to other OECD countries, leaning towards a high ratio of nurses within the teams teams might be suitable in Sweden.

Furthermore, the multidisciplinary teams also include different kinds of physicians. The specific proficiencies and specialities among them vary, but physicians from internal medicine are present and highlighted in both the Skåne and the Barcelona case. As mentioned in the Skåne case, the connection to departments relevant for HaH such as internal medicine was considered a successfactor. Including physicians with ties to departments that are closely related to the HaH program, (such as internal medicine and the ER) might be useful. Given the demographic in Sweden, with many older patients, including geriatricians could also be an option to adjust the team according to the Swedish conditions.

Full time or rotating staff

Employing full-time staff, as seen in the Barcelona case, offers consistency in patient care and allows staff to develop deeper relationships and familiarity with each other, and their patients' conditions, which can enhance the quality of care and patient satisfaction. This approach ensures that staff are fully integrated into the HaH ecosystem, promoting a stable and focused care environment. Conversely, the Skåne project utilizes a rotating staff model, which provides flexibility and a broad range of connection to the HaH team. Rotating staff can bring diverse clinical perspectives and specialties into the HaH program, potentially increasing the quality of interdisciplinary care and enabling the program to handle a wider variety of patient conditions. It is argued in Borgström (2023) that rotating staff also makes sure that the unit maintains close ties to departments which are closely tied to the HaH program. Additionally, this model can prevent burnout among healthcare professionals by varying their work environments and responsibilities, which might contribute to higher job satisfaction and retention rates. Each staffing strategy presents distinct benefits that can be tailored to meet the specific needs and objectives of the HaH program.

6.4 Technology/monitoring

The development of technology has been an important factor in the enabling of HaH programs. Both representatives from the medtech industry and other stakeholders see technology, especially monitoring systems, as an enabler to implement an effective HaH program. Different programs make use of different technologies, and the sophistication of the technologies varies widely.

Monitoring

Monitoring is a hot topic of discussion within the HaH community. Some programs make use of more advanced technologies for monitoring such as continuous remote monitoring of e.g. vital parameters and fall-alarms. Other programs such as Barcelona and Skåne rely on less advanced intermittent monitoring. Whitehead and Conley (2023) describes decreased costs as a benefit of using RPM, which likely is connected to the fewer healthcare personnel visits related to vital sign testing. However, the initial investment in tools for RPM is likely significantly higher than a few testing-related visits. An initially large investment to later decrease marginal costs related to monitoring could be a viable option in Sweden for three reasons.

Firstly, the predicted increasing demand for healthcare in the future suggests that Sweden could reap benefits from a monitoring system that promotes lower marginal costs instead of focusing on low investment costs. Secondly, Sweden's internet is relatively good, which is mentioned to be crucial for RPM. Thirdly, investing in RPM could make up a part of the investment in development of E-health related to the EU Cohesion Policy (2021-27). As is pointed out in the Singapore-case, enrollment in a HaH program could put a burden on the informal caregiver that is required in their program. Making use of more advanced monitoring technology might mitigate the need for the presence of an informal caregiver to alert if there is a deterioration and the burden that the responsibility results in. This can broaden the eligibility criteria in Sweden, and be in line with the aim of Swedish healthcare to promote equal care.

On the contrary, there are other arguments pointing towards more low-tech solutions to monitor patients. Skåne and Barcelona are both programs which have not used advanced RPM, but still managed to show successful results compared to traditional inpatient care. Additionally, the Skåne case provides a clear example that HaH in Sweden does not require continuous RPM to be beneficial in the Swedish context. Another aspect is that Swedish healthcare hasn't integrated HaH neither nationally nor on any large scale yet. Starting out with more traditional monitoring may be a good starting point, and as programs show good performance and a PoC on a larger scale in Sweden, more advanced monitoring could be implemented.

Virtual visits

When designing a HaH program, the suitability of incorporating virtual visits should be considered. Conley et al. (2022) highlights the opportunities and benefits of conducting virtual visits and the Barcelona program is currently trying to integrate it into their organization. In many ways, the Swedish conditions are suitable to make use of such digital tools. Sweden has a broadly developed internet program, providing fast internet almost nationwide. On the same note, the digital literacy in Sweden is high and a large portion of the Swedish population already have experience in virtual consultations. Virtual visits could also enable HaH programs to cover larger areas as the inefficiency of covering large geographical distances are reduced.

There are also risks and challenges in relying on virtual visits. A large part of the patient group treated with HaH care is older people, which usually are less digitally literate. Another aspect is that patients and people in general may see the use of virtual visits as means to decrease costs, and therefore oppose it. Patients may also feel less cared for. Lastly, if there is not enough infrastructure to immediately be able to substitute remote visits with connection problems, it could risk the quality of care of the patient.

Integration & ease of use

Regarding technology, one key aspect is the ease of use. Conely et al.(2022) describe the need for digital literacy among the patients. Similarly, the healthcare personnel working with HaH programs shared the view that readiness in using technology is important in a HaH program. The healthcare personnel mentions the importance of both the patients as well as the healthcare personnel being capable of dealing with the technology. The united view on the importance of understanding the technology highlights the significance of creating technology that is easy to use.

On a similar note, as described by healthcare personnel, integration between different technology providers have been a challenge. It is described that there are many different systems that don't integrate well with each other. If every region and municipality choose to buy its own technology, there are great risks that they won't be able to communicate. Lack of integration leads to many problems, both that healthcare personnel may not have access to useful information that comes from another system, and the high risk of duplication of work by healthcare personnel, e.g. related to record keeping.

Taking a look towards the future, it is likely that people will become digitally literare.As more people are getting used to technology in their lives, it’s reasonable to believe that this will make HaH get even more favorable conditions in the future.

6.5 Organization

Daily visit, impacted by continuous monitoring and technology

In the Skåne case, the team visits the patient solely based on what is deemed appropriate by the care team. This enables the HaH team to exclusively focus on which patients are deemed a priority, and thus where the HaH team would be the most useful. In the US, reimbursements and their requirements are key drivers in choosing how to set up visits. There, there must be a specified number of visits per day to get reimbursed, which sometimes nudges programs to structure their visits around this waiver, as mentioned by Gorbenko et al. (2023). Setting a lower limit of how often patients are visited could have political benefits and disarm opposition towards the HaH care form, as it may make it look less like a saving measure. Another benefit is that it has a reassuring effect on the patient that it feels cared for. The Barcelona case could be considered a middle ground, as every patient is visited at least daily, but with the responsible physician prioritizing who the physician should visit every day.

In the Skåne case, K. Borgström (personal communication, February 9, 2024) mentions that there has been some criticism among physicians towards HaH, as they argue that HaH does not admit the most difficult patients. Even though that is a claim that could be considered correct in some ways, such as they only admit patients which are clinically stable, there is an argument to be made that having a lower number of required visits could potentially allow for more flexibility and targeted care according to patient needs. This could be particularly beneficial in regions like Skåne where geographical distances and resource allocation pose significant challenges. By not setting a strict minimum number of visits, the HaH program can use its resources more efficiently, focusing on patients who need more intensive care on any given day while still monitoring stable patients remotely.

Furthermore, this approach aligns with the overall goal of HaH to deliver patient-centered care. It enables the care team to adapt their schedules based on the real-time health status of patients, rather than adhering to rigid visit quotas that may not necessarily reflect patient needs. This flexibility can lead to higher quality care and better outcomes, as the care provided is more responsive to changes in patient conditions.

The criticism regarding HaH not admitting the most difficult patients could be addressed by clearly communicating the goals and limitations of the HaH model. It is important to underscore that HaH is designed to provide an alternative to inpatient care for those who are clinically stable and can safely receive treatment at home, rather than serving as a direct substitute for all types of inpatient care. This distinction helps set realistic expectations and demonstrates that HaH is a complement to traditional care models, designed to enhance the healthcare system's efficiency and reach.

Incorporating strategies from successful models like Barcelona, where daily visits are combined with prioritizing, could also be advantageous. This ensures all patients receive the attention they need while allowing flexibility for the care team to focus on more critical cases as necessary. Balancing these elements—flexibility, targeted care, and ensuring sufficient contact—could help mitigate some of the criticisms faced by HaH programs and improve acceptance and satisfaction among healthcare providers and patients.

The Skåne project was initiated following the success of a previous initiative, where a mobile team (ÄMMA) was established to provide simpler forms of care directly in patients' homes. The ÄMMA team is considered a primary care team, and sometimes provides its patients with similar interventions to HaH units, although at a lower frequency. Borgström (2023) highlights the close ties between the projects as a successfactor. Presence and experience of such primary care teams in the area could be of great benefit in implementing a HaH project. Drawing on the experiences of the primary care team and collaborating in daily operations can give a HaH project a headstart in the development. At the same time, since some of the interventions are similar, it may be the case that the primary team sometimes takes care of patients otherwise eligible for HaH care. However, these patients may come from a demand that is induced by the presence of the HaH teams, as they may not require the specialized interventions as frequently. The presence of a mobile primary care team in the location where a HaH unit is developed requires additional coordination so that the teams don't counteract each other, but can if correctly aligned give a head start to the HaH project and improve operations through complementary services.

The presence of a primary care team that could perform some interventions in combination with the patient selection affects the number of staff required in the HaH team. If the HaH program only includes relatively stable patients, it is possible that the primary care team could be responsible for the interventions at some times during e.g. the night. In that way, collaboration between the two units could result in efficiency gains.

The Swedish healthcare personnel highlight the importance of collaborating both within the region, as well as between regions. The healthcare personnel emphasize a need to have a holistic perspective on the regional activities, including HaH programs. There are many benefits to gain by not only focusing on specific hospitals, but what is best for the region as a whole. In practice, such as in the case of Skåne, it is important to anchor decisions and make sure a strategy is aligned with the region. This also aligns with one of the successfactors in Barcelona, which was the regional Health Plan that supported the implementation of a HaH program.

The healthcare personnel also mentions collaborating more between regions and requests a national strategy for HaH. This could be useful due to both potential benefits in resource allocation and standardization of care. Coordinating across regions would allow for better utilization of healthcare resources, ensuring that all areas have access to necessary equipment and personnel. A national strategy could establish guidelines and protocols for best practices in the Swedish context. Collaboration in buying equipment also strengthens the buyer-leverage and may decrease prices. The presence of a national plan which supported implementation of a HaH project highlights the method's past success.

Additionally, collaboration between regions could support the development of patient monitoring and support systems. For instance, integrating digital health tools across regions would make sure that patients receive consistent care, regardless of their location.

6.6 Reimbursement

During the interviews with different stakeholders, many of them emphasized the importance of getting the whole system to work together. New healthcare models like HaH need incentives on a higher level to change the way healthcare professionals and patients see it. Having a reimbursement system that promotes the HaH model will help the implementation, exemplified by the temporary sandbox funding used in Singapore. This system eased the implementation by making the HaH model reimbursed as typical inpatient care, although the definition was not fully in place. This led to the NUHS@Home project could start up quickly and gather experience and data about the model, without having to worry about the definition of HaH and how it would be reimbursed.

Another more permanent intervention is discussed by decision-makers, where a change of definition of inpatient and outpatient care is proposed, to easier fit the HaH model into the Swedish healthcare system. Anna Nergårdh emphasizes this, who also suggests developing a whole new reimbursement system specifically for HaH. This is also strengthened by Katharina Borgström, who discusses the problematic nature of HaH fitting somewhere in the middle of how inpatient and outpatient care is defined.

The Swedish healthcare system is mainly reimbursed by a mix of fixed and action based reimbursement. Fixed reimbursement provides a reliable financial base, crucial for the initial investments required for HaH infrastructure and technology. This financial predictability allows for the steady development and maintenance of the HaH system. The Grant-funded system used in Skåne has also shown to be encouraging flexibility by getting a bundled payment to use where needed. However, without performance-based incentives, there may be little drive for providers to enhance efficiency or improve the quality of care, potentially hinder innovation and the pursuit of better patient outcomes.

Conversely, action-based reimbursement introduces a performance element that encourages frequent patient interactions and timely responses. This can be particularly beneficial for HaH programs, ensuring that patient needs are met. However, the emphasis on quantity over quality can lead to unnecessary treatments or visits, increasing costs without necessarily improving patient health outcomes. This focus on maximizing reimbursable actions could undermine the patient-centered and cost-effective nature of HaH, as providers might prioritize the volume of services over their effectiveness and necessity.

The common influence of fixed and action-based DRG reimbursement models creates a balance of financial stability and performance incentives. However, to ensure the successful implementation of HaH, it is essential to address the risk of convenience in fixed reimbursement and of quantity-driven care in action-based reimbursement. This balance will require careful management and possible integration of additional performance-based incentives to foster innovation and maintain high standards of patient-centered care in home settings.

International Comparisons

As seen in the US, the CMS acute hospital waiver exemplified a successful shift towards supporting HaH models. This waiver allowed for full hospital level fee-for-service reimbursement which addressed a significant barrier to the HaH implementation. However, a fee-for-service system is more suitable in countries with private funded healthcare, and a waiver like this is rarely introduced without a large anomaly, like the pandemic. Also, the Swedish SALAR plays a crucial role in coordinating efforts between regions and municipalities while adhering to governmental guidelines. However, substantial changes in the healthcare system, particularly those related to reimbursement models, cannot be implemented by individual regions alone since they require centralized legislative changes at the governmental level.

Another example of how to improve the reimbursement system is to use the suggestions by Achanta et al. (2021). By implementing a reimbursement system that is more value based, the incentives for treating patients at home can increase. However, this change of strategy builds on that the measures that the reimbursement is based on aligns more with the advantages of treating patients at home, to promote this model. This value-based approach will focus on more than the medical outcomes, and also take factors such as societal and personal values. As previously mentioned, a turnaround like this requires changes on a governmental level, which might be slow to implement. But, by changing the definition of value in the medical environment, incentives for HaH might increase.

In Singapore, subsidies towards permanent residents are used to help cover the costs of HaH. By applying these, the incentives for patients to choose HaH care increases. However, this is not directly applicable in the Swedish context, since the healthcare is not paid by the residents privately. But, this can potentially be used as an inspiration for the government to subsidize healthcare providers, to make it less costly for them to implement this new care model. As seen in Barcelona, the reimbursement for HaH services was initially lower than for regular inpatient care, leading to savings in the healthcare system. While this is positive for the funding of the public healthcare system, lower reimbursement for healthcare providers is a risk, making them reluctant to implement HaH due to lack of financial incentives.

7 Professional Insights and Model Validation

During the interviews and literature review, a model was developed to categorize crucial aspects connected to the HaH concept. A workshop was designed with two primary objectives: validating the model using defined categories and gathering experience and insights from healthcare professionals.

Validation of the Model Using Defined Categories: The workshop aimed to validate a structured model consisting of specific categories crucial to the implementation and operation of home healthcare. These categories included patient selection criteria, healthcare team/personnel, technology and monitoring, organization and reimbursement systems. The discussion focused on validating this model, to understand if it includes all the relevant aspects or not. Quality control and development was also one of the categories included, however it was agreed that this category was out of the scope of the thesis, and therefore added to future research.

Gathering Experience and Insights: By involving experienced doctors and healthcare professionals who have previously worked in home healthcare settings, the workshop provided a platform for these experts to discuss and provide feedback on the proposed categories. Their insights were invaluable for deepening the understanding of practical challenges and opportunities in HaH. This exchange helped refine the model by integrating real-world experiences and expert opinions, further tailoring it to meet the actual needs and complexities of home-based care.

7.1 Model Validation

The workshop participants agreed that the proposed categories comprehensively covered the necessary aspects of the HaH model. They found the categories highly relevant, as evidenced by their ease in discussing and elaborating on each one. This alignment between the model and the participants' practical experiences confirmed the model's resilience and applicability. The discussions facilitated a validation process and strengthened the model with practical insights, thereby improving its applicability and effectiveness in real-world scenarios.

During the workshop, participants discussed the criteria and selection of patients suitable for HaH. The conversation highlighted that many treatments traditionally performed in hospitals could be managed at home, such as administering certain medications without significant complications. Patient stability and safety were emphasized, with a focus on selecting medically stable patients who can manage without continuous supervision, ensuring both patient safety and the program's feasibility. Additionally, geographical and logistical considerations were discussed, noting the impact of distance and living conditions on the effectiveness of home care, particularly in remote areas. Effective communication between the patient, care team, and relatives was seen as important, alongside practical examples of successful home care implementations that avoided hospital admissions, demonstrating home care's potential to reduce hospital stays.

The workshop also explored the configurations of healthcare teams for HaH, highlighting key considerations in team composition and continuity. Emphasizing the importance of diverse professional skills, the discussion underscored the need for doctors, nurses, and other specialists like physiotherapists or pharmacists based on patient needs. Continuity within the team was highlighted for building patient trust and comfort. The concept of rotating staff between hospital and home care settings was proposed to enrich team experience and adaptability. Continuous training and professional development were recognized as essential, with regular case reviews suggested to ensure ongoing learning and care improvement. Operational efficiency, including resource allocation for routine versus urgent care and empowering healthcare providers with decision-making autonomy, was stressed. Effective interdisciplinary communication and support from central hospital units were considered vital for timely specialist advice and decision-making.

The discussion on technology and monitoring for HaH underscored critical technological needs and operational insights. Reliable, high-speed connectivity, particularly direct links to hospital networks, was emphasized to ensure secure and efficient access to patient data. The need for integrated monitoring systems that communicate seamlessly with hospital electronic health records was discussed, aiming to simplify monitoring and reduce errors. Portable and reliable monitoring equipment for vital signs was identified as necessary for guiding patient care without frequent hospital visits. Participants discussed the scope of patient responsibility in monitoring, stressing the importance of patient education and clear guidelines. Systems with alert features for out-of-range values were considered crucial for prioritizing care. Practical challenges, such as the safety and accuracy of portable medical devices, were addressed, indicating the need for rigorous testing. Regulatory and logistical challenges were acknowledged, with a call for collaboration between hospital teams and community providers to ensure effective patient care within regulatory frameworks.

8 Conclusion

Adapting the HaH model to the specific needs and structure of the Swedish healthcare system to improve patient outcomes and efficiency appears to involve a multifaceted approach. Given the aging population and relatively low number of hospital beds per capita, implementing broad patient selection criteria could be beneficial. However, these criteria must be carefully balanced with practical considerations, such as the availability of informal caregivers and the clinical stability of patients.

A multidisciplinary team has many benefits, with a range of healthcare professionals who can address diverse medical and social needs. The inclusion of physicians, nurses, pharmacists, and social workers could ensure comprehensive care. Flexibility in staffing, whether through full-time or rotating staff, can be adapted to local contexts to ensure continuity of care and the inclusion of diverse clinical expertise.

Advanced RPM systems can reduce the need for frequent physical visits, though initial investment costs need to be considered. Virtual visits and digital literacy among patients and healthcare providers are also important factors. Ensuring ease of use and system integration is likely to be vital to avoid duplication of efforts and to streamline care delivery.

Organizational aspects, such as the frequency of visits, should be flexible to respond to patient needs rather than adhering to strict schedules. This patient-centered approach could enhance care quality and address criticisms about the level of care provided. Collaboration with existing primary care teams might offer additional support and improve efficiency.

Reimbursement systems that align with the goals of HaH are also worth considering. A mix of fixed and action-based reimbursement, with performance-based incentives, provides financial stability while encouraging high-quality, efficient care. Lessons from international examples, such as value-based reimbursement models and subsidies, could offer valuable insights for potential adaptations in the Swedish context.

Overall, the successful adaptation of the HaH model in Sweden seems to require a comprehensive strategy that includes broad patient selection criteria, a multidisciplinary team, appropriate use of technology, flexible organization, and supportive reimbursement systems. By addressing these components thoughtfully, HaH has the potential to improve patient outcomes and efficiency in the Swedish healthcare system.

9 Future Research

Several areas require further investigation to improve understanding and implementation of this healthcare model.

Long-term Studies on Patient Outcomes
Future research should focus on long-term studies to assess the long-term outcomes of patients participating in HaH programs. While this study provides insights into the feasibility and short-term benefits, understanding the long-term health, psychological, and social impacts on patients is important.

Impact on Healthcare Workforce
Investigating the impact of HaH programs on the healthcare workforce is another important area for future research. Studies should examine how shifting to a home-based care model affects healthcare providers, including workload, job satisfaction, and professional development. Understanding these dynamics can inform workforce training programs and support mechanisms needed to ensure the sustainability of HaH programs.

Technological Innovations and Their Effectiveness
As technology plays a critical role in the success of HaH programs, future research should explore the effectiveness of various technological solutions in enhancing patient care. This includes examining remote patient monitoring systems, virtual visit platforms, and other digital health tools. Comparative studies could identify the most effective technologies and best practices for integrating these tools into the HaH model.

Policy and Regulatory Frameworks
Investigating the impact of different policy and regulatory frameworks on the implementation of HaH programs can provide insights for policymakers. Comparative studies across countries with different healthcare systems can highlight effective policies and regulatory practices that support the growth of HaH programs.

Development and Quality Control
Future research should also focus on the development and quality control of HaH programs. This includes creating standardized protocols for patient care, monitoring, and evaluation to ensure high-quality care across different regions. Studies should investigate the most effective methods for continuous quality improvement and how to best implement these practices in the HaH context.

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Appendix. Mayo Clinic's screening tool

Clinical Stability Screen

Must be NO:	Yes	No	Comment
Low diagnostic certainty requiring advanced diagnostics that cannot be performed in the home If yes, select reason (if "other", select and describe): ☐ Active live telemetry monitoring ☐ Advanced imaging required (CT, MRI, nuclear stress) ☐ Cardiac catheterization required ☐ EGD/Colonoscopy required ☐ Lab monitoring not amenable to home (troponin, >q12 labs) ☐ Other______________________________________			
Higher acuity medical services may be required making admission to home clinically unsafe If yes, select reason (if "other", select and describe): ☐ Intensive care unit required (i.e. vitals checked >q4hr, BG checked >q2hr, active drip titration etc.) ☐ Intubation risk elevated (i.e. history of intubation for respiratory conditions) ☐ New tracheostomy or mechanical ventilation required ☐ Vasopressor risk elevated (i.e. reasonable risk of fluid refractory hypotension) ☐ Unstable arrhythmias ☐ Elevated risk of respiratory compromise increasing risk of needing support with noninvasive positive pressure ventilation or intubation ☐ Home IV access limitations ☐ Other____ __			
Specific services required that cannot be Provided in the Home If yes, select reason (if "other", select and describe): ☐ Risk for inability to obtain IV access ☐ Daily involvement of in person specialty consultation ☐ Blood transfusions likely to be needed (i.e. active GI bleed) ☐ Hemodialysis likely to be required (i.e. already on HD or newly anuric/severe ATN)			

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☐ Respiratory isolation/airborne precautions (high TB concern) ☐ Pain such that would require adjustment of opiates or need for IV therapy ☐ Chronic need for 24/7 care that is currently not in place in the home setting ☐ Other_______________________________________			
Surgical/IR procedure required that cannot be performed in the home If yes, select reason (if "other", select and describe): ☐ Surgical consultation required or high risk of being required ☐ Intraabdominal abscess requiring drainage (an example) ☐ Percutaneous nephrostomy tube placement (an example) ☐ Thoracentesis for parapneumonic effusion (an example) ☐ Significant surgical wound debridement ☐ Other____ __			
Clinical partnership with patient and family untenable to safely care for patient If yes, select reason (if "other", select and describe): ☐ Severe altered mental status unable to be managed safely at home with family and home health aide (an example) ☐ Active substance abuse (an example) ☐ History of or high risk of noncompliance with primary treatment plan ☐ Other____ __			
Is the patient currently on hospice or have a life expectancy of <= 6 mo.?			

Social Stability Screening Tool

Patient Name: ____________________ Patient DOB: ___________ Program: _______________ Date of Screen: _______

Complete for ALL Programs

Must be YES:	Yes	No	N/A	Comment
Does the patient have a home recovery environment?				
Is the patient's home recovery environment in an eligible geography?				
Does the patient's home have water, electricity, bathroom, heat/ac, refrigerator?				
Does the patient feel safe at home?				
Are family/caregivers willing to participate, as needed, while the patient participates in the MH program?				
Is there a person in the home (patient or other) willing/able to take vital signs and answer phone calls?				
Is the patient willing to put pets in a secure area while MH affiliated staff are in the home?				
Is patient willing/able to participate in the MH program (this includes MH affiliated staff entering the home, and MH home equipment set-up in the home)?				
Is the patient/patient's HCP willing/able to sign consent?				

Informative Questions:	Yes	No	N/A	Comment
Does the patient have internet at home and a cell phone?				
Does the patient live in a stand-alone house or in a community setting? *Options: house, apartment, other*				
What floor does the patient live on?				
How many steps are there to enter the home?				
Is there an elevator at the home?				
Are there stairs within the home? *If yes-how many?*				
Does the patient live alone?				
Is there anyone who assists the patient with day to day life? *If yes-describe*				
Does the patient currently have any home services?				
Is the patient likely to require >4 hrs. of HHA support to fill ADL needs?				
Does the patient have mild, or greater, cognitive impairment?				
Has the patient experienced a fall within the last 6 mo.? *If yes, explain:*				
Is the patient homebound?				
Is the NIDA Quick Screen positive for the patient? *(see below for NIDA Quick Screen; if positive- explain)*				

Social Stability Screening Tool

Patient Name: ____________________ Patient DOB: ___________ Program: _______________ Date of Screen: _______

Is the NIDA Quick Screen positive for the anyone living in the patient's home? *(see below for NIDA Quick Screen; if positive- explain)*				
Is the patient's primary language English? *If no, what is the patient's primary language?*				

Must be NO:	**Yes**	**No**	**N/A**	**Comment**
Are there any behavioral diagnosis that would limit patient participation in the MH program?				
Does the patient require 1:1 aid with feeding or daily speech therapy?				
Does the patient require 1:1 aid with toileting and lack home assistance?				
Is the patient or caregiver unable to call for help or push the emergency help device?				
Is there active smoking in the home and need for home Oxygen?				
Are there unsecured firearms in the home?				
Does the patient exhibit any signs of neglect suggestive of an unsafe home?				
Is the patient deaf?				

NIDA Quick Screen: In the past year, how many times have you used the following….						
Alcohol (for men, 5 or more drinks in a day; for women, 4 or more drinks in a day)	Never	Once or Twice	Monthly	Weekly	Almost Daily or Daily	Comment
Tobacco Products						
Prescription Drugs for Nonmedical Reasons						
Illegal Drugs (if in a state where marijuana is legal, specifically ask re: marijuana use)						

Social Stability Screening Tool

Patient Name: ___________________ Patient DOB: __________ Program: _______________ Date of Screen: _______

Complete for SNF Substitution Program ONLY

Must be YES:	Yes	No	N/A	Comment
Has the patient been recommended for discharge to SNF?				
Are the patient/caregivers aware that HHA support provided by the MH program is temporary?				
Does the patient's home have sufficient space/appropriate condition for rehab needs?				
Are caregivers willing to aid the patient w/ADLs during the patient's time in the MH program and post d/c from the MH program (if needed)?				

Must be NO:	Yes	No	N/A	Comment
Has the patient been previously recommended for long-term care?				
Does the patient live at a SNF/SAR/LTAC?				
Does the patient no longer prefer to live at home after the hospital/SNF stay?				
Has the patient required a 1:1 sitter in the last 48 hours?				
Has PT deemed the patient to be either a maximum assist or two assists in any functional category?				

Complete for ALL Programs

Must be YES:	Yes	No	N/A	Comment
Did the patient pass this screen?				

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